# A47 Blofield to North Burlingham

## EIA Scoping Report

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# 1 Introduction

## 1.1 Purpose of the report

1.1.1 Scoping is an important part of the Environmental Impact Assessment (EIA) process and determines which environmental topics are to be examined during the course of the assessment and reported in the Environmental Statement (ES).

1.1.2 This Scoping Report describes how the EIA will be undertaken, and identifies the technical environmental disciplines that will be considered. Defining the environmental scope is one of the most critical parts of the study, as it sets out the method for the Detailed assessment. This EIA Scoping Report will be submitted to the Planning Inspectorate in order to inform its Scoping Opinion. The Planning Inspectorate may not adopt a Scoping Opinion in response to a request until it has consulted the person who made the request and the consultation bodies or notifies the person making the request that it requires additional information in order to adopt an opinion. The ES will be submitted as part of the application for a Development Consent Order (DCO).

1.1.3 The scope of the EIA may be amended following receipt of the Scoping Opinion or if understanding of environmental conditions change. The final version of this EIA Scoping Report will be issued as a Technical Appendix of the ES. This will provide a full audit trail for the EIA process that is undertaken.

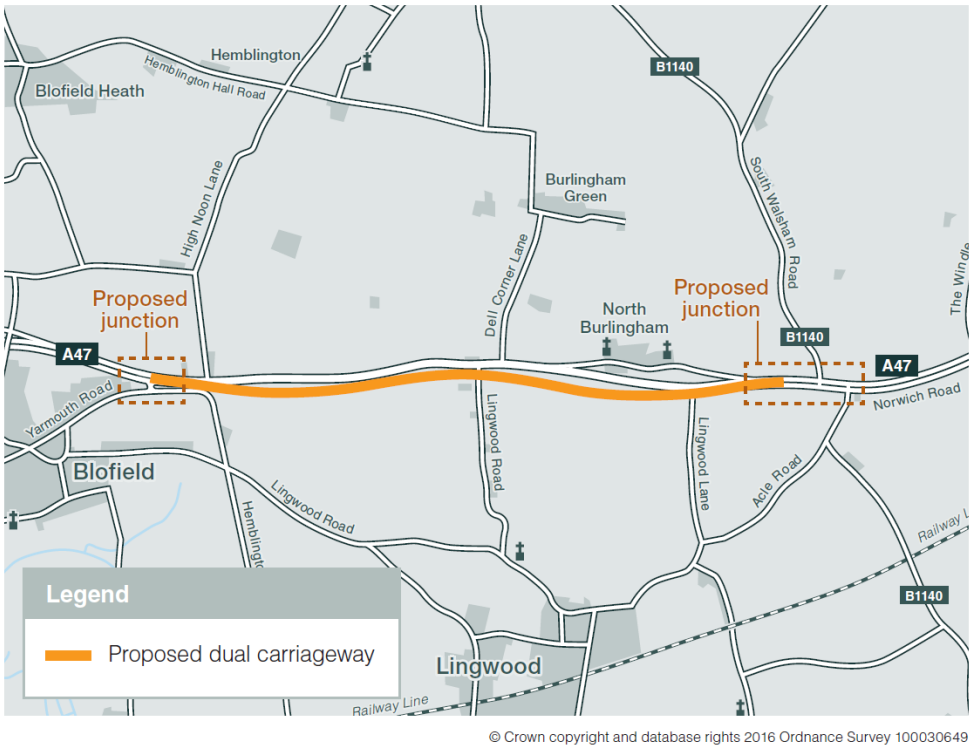
## 1.2 Proposed scheme location

1.2.1 The A47 trunk road forms part of the Strategic Road Network (SRN) and provides for a variety of local, medium and long-distance trips between the A1 and the eastern coastline. The corridor connects the cities of Norwich (population over 210,000) and Peterborough (population over 180,000) and the towns of Wisbech, Kings Lynn, Dereham, Great Yarmouth and Lowestoft.

1.2.2 The proposed A47 Blofield to North Burlingham scheme is located approximately 9 kilometres to the east of Norwich.

1.2.3 The section of single carriageway from Blofield to North Burlingham forms part of the main arterial highway route connecting Norwich and Great Yarmouth (see Figure 1.1).

**Figure 1.1: Proposed Scheme**






## 1.3 Proposed Scheme overview

1.3.1 It is proposed to upgrade the existing 2.6km section of single carriageway between Blofield and North Burlingham to a high quality dual carriageway. A new section of offline dual carriageway with junction improvements will be constructed to the south of the existing carriageway. This scheme will henceforth be referred to as the 'Proposed Scheme'. The DCO site boundary is shown in Appendix A.

## 1.4 Approach to EIA scoping

1.4.1 The main aims of this EIA Scoping Report are as follows:

- To identify and report the baseline conditions of the existing environmental asset.
- To determine which (if any) environmental topics are to be further examined during the EIA and hence reported in the ES.
- To identify all relevant environmental constraints present, as part of an iterative design process thereby ensuring adverse effects can be minimised.
- To identify if there are opportunities for environmental enhancement associated with the site of proposed works that could be incorporated into the design.

1.4.2 The Environmental Constraints identified within this EIA Scoping Report have been mapped and are shown in Appendix B.

1.4.3 This scoping exercise has been completed in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 11 and The Planning Inspectorate (PINS) Advice Note 7, to a Scoping Level for all environmental topics contained within Highways England's Interim Advice Note (IAN) 125/15.

## 1.5 Legislative context and need for Environmental Impact Assessment

1.5.1 The Proposed Scheme is defined as a Nationally Significant Infrastructure Project (NSIP) under Section 14(1)(h) and Section 22 of the Planning Act 2008 (PA 2008) (as amended) by virtue of the fact that:

a) It comprises the construction / alteration of a highway.
b) The highway to be constructed is wholly in England.
c) The Secretary of State will be the highway authority for the highway.
d) The speed limit for any class of vehicle on the highway is to be 50 miles per hour or greater, and the area of development is greater than 12.5 hectares.

1.5.2 In accordance with the legislation, a DCO is therefore required to allow the construction and operation of the Proposed Scheme.

1.5.3 The Proposed Scheme falls under schedule 2, part 10 Infrastructure Projects (f) Construction of roads of The Infrastructure Planning (EIA) Regulations 2017. The threshold at which part 10 (f) schemes need to screen for EIA is where the area of works exceeds 1 hectare (ha). The area of works associated with the Proposed Scheme does exceed 1 ha and Highways England have determined that EIA is required on the basis that there is a potential for significant effects on the environment.

1.5.4 In accordance with Regulation 8(1)(b) of the EIA Regulations, Highways England notifies the Secretary of State for Transport (Secretary of State) that an environmental statement will be submitted with the DCO Application for this project.

1.5.5 The Localism Act 2011, appointed the Planning Inspectorate (the Inspectorate) as the agency responsible for operating the DCO process for NSIPs. In its role, the Inspectorate will examine the application for the Proposed Scheme and then will make a recommendation to the Secretary of State who will make the decision on whether to grant or to refuse the DCO.

1.5.6 In accordance with section 104(2) of the PA 2008, the Secretary of State is required to have regard to the relevant National Policy Statement (NPS), amongst other matters, when deciding whether or not to grant a DCO. The relevant NPS for the Proposed Scheme is the National Networks National Policy Statement (NNNPS) which was designated in January 2015.

1.5.7 Other matters that the Secretary of State would consider important and relevant include national and local planning policy. The National Planning Policy Framework (NPPF) published in March 2012 (Ref 8) is relevant national planning policy.

1.5.8 The layout of the ES will comprise three volumes and a Non-Technical Summary for ease of reading as follows:

- Non-technical Summary
- Volume 1 – main body of the ES
- Volume 2 – Figures
- Volume 3 – Technical Appendices

1.5.9 Volume 1 will provide the main body of the ES, and explain the details of the Proposed Scheme. It will contain the technical chapters documenting the baseline position assessment methodologies and assessment results using qualitative and quantitative data (where applicable). This volume will contain the following chapters:

- Chapter 1 Introduction
- Chapter 2 The Proposed Scheme
- Chapter 3 Consideration of Alternatives
- Chapter 4 Construction and Programme
- Chapter 5 EIA Methodology
- Chapter 6 Air Quality
- Chapter 7 Cultural Heritage
- Chapter 8 Landscape
- Chapter 9 Biodiversity
- Chapter 10 Geology & Soils
- Chapter 11 Materials
- Chapter 12 Noise & Vibration
- Chapter 13 People and Communities
- Chapter 14 Road Drainage & the Water Environment
- Chapter 15 Climate
- Chapter 16 Combined and Cumulative Effects
- Chapter 17 Conclusion

## 1.6 Approach to assessment

1.6.1 The environmental assessment will be undertaken in accordance with the requirements presented in the DMRB, Volume 11, Section 3, Interim Advice Note 125/15 Environmental Assessment Update (IAN 125/15) and Major Project Instruction Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive), for each of the relevant environmental topics:

- Air Quality
- Cultural Heritage
- Landscape
- Biodiversity
- Geology & Soils
- Materials
- Noise & Vibration
- People and Communities
- Road Drainage and the Water Environment
- Climate
- Combined and Cumulative Effects

1.6.2 The output of the environmental assessment is to report the likely significance of environmental effects using established significance criteria, as presented within DMRB Volume 11, Section 2, Part 5. This requires an assessment of the receptor or resource's environmental value (or sensitivity) and the magnitude of change (impacts).

1.6.3 DMRB states that the approach to assigning significance of effect relies on reasoned argument, professional judgement and taking on board the advice and views of appropriate organisations. For some disciplines, predicted effects may be compared with quantitative thresholds and scales in determining significance.

1.6.4 Assigning each effect to one of the five significance categories enables different topic issues to be placed upon the same scale, to assist the decision-making process. These five significance categories are set out in Table 1.1

**Table 1.1 Descriptions of the significance of effect categories**

| Significance Category | Typical Descriptors of Effects |
|---|---|
| Very Large | Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category. |
| Large | These beneficial or adverse effects are very important considerations and are likely to be material in the decision-making process. |
| Moderate | These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a resource or receptor. |
| Slight | These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project. |

| Significance Category | Typical Descriptors of Effects |
|---|---|
| Neutral | No effects or those that are beneath levels of perception, within normal bounds or variation or within the margin of forecasting error. |

Source: DMRB Volume 11, Section 2, Part 5, Table 2.3

1.6.5 The environmental value will be identified for each of the individual topics that have been carried forward from the scoping exercise for further environmental assessment, along with the magnitude of change. In this way, the potential significance of environmental effects will be determined for each relevant environmental topic. Five significance categories can result from the assessment, as defined in Table 1.2.

1.6.6 It is important to note that significance categories are required for positive (beneficial) as well as negative (adverse) effects. The greater the magnitude of impact, the more significant the effect. For example, the consequences of a highly valued environmental resource suffering a major detrimental impact would be a significant adverse effect. Impacts that are Moderate or above (Beneficial or Adverse) will be considered significant.

**Table 1.2 Assessing significance of potential effects**

| | | Magnitude of Potential 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 |

Source: DMRB Volume 11, Section 2, Part 5, Table 2.4

## 1.7 Population and human health

1.7.1 The Infrastructure Planning (EIA) Regulations 2017, transposing the European Directive 2014/52/EU, have introduced the requirement for 'the direct and indirect significant effects of the proposed development on the following factors… population and human health' (Regulation 5(2(a))) to be assessed within EIAs.

1.7.2 There is no consolidated methodology or practice for this topic, however the scope of the assessment is considered to be covered by existing Highways England guidance as set out below. This recognises the specific requirements

of the NNNPS for consideration of health, specifically within paragraphs 4.79-4.82. This will address health by utilising the following guidance:

- Air Quality: HA 207/07, IAN 185/15, IAN 175/13, IAN 174/13, IAN 170/12
- Noise and vibration: HD 213/11, IAN 185/15
- Road Drainage & The Water Environment HD 45/09
- Equestrians, Cyclists, and Community Effects: DMRB Volume 11 Section 3 Part 8

1.7.3 It is considered that these assessments, conducted principally in isolation as is required by their methodologies, will not provide a sufficient analysis of the effects of the Proposed Scheme. To enable such conclusions to be drawn, a qualitative assessment of information collated via the topic assessment listed above will be undertaken and presented within the Cumulative Effects section of the ES.

## 1.8 Major accidents and disasters

1.8.1 The Infrastructure Planning (EIA) Regulations 2017, transposing the European Directive 2014/52/EU, have introduced the requirement for 'expected significant effects arising from the vulnerability of the proposed development to major accidents or disasters that are relevant to that development' (Regulation 5(4)) to be assessed within EIAs.

1.8.2 For the Proposed Scheme, a separate chapter assessing the potential impacts of major accidents and disasters during the construction and operation phase is not required for the following reasons:

- The Proposed Scheme is not considered to have high vulnerability to major accidents or disasters. Whilst the legislation is not explicit, the language of the revised Infrastructure Planning Regulations 2017 is aimed towards hazardous industries or operations (those with a 'high vulnerability' to major accidents).
- The design, construction and operation of the Proposed Scheme must comply with legal requirements, codes and standards, such as:
  - Health and Safety at Work etc. Act 1974 (HSWA)
  - The Management of Health and Safety at Work Regulations (1999)
  - Construction (Design and Management) (CDM) 2015 Regulations
  - The Workplace (Health, Safety and Welfare) Regulations 1992
  - Design Manual for Roads and Bridges (DMRB)
  - IAN 191/16, Safety Governance for Highways England
- The term major accidents and disasters refers to events both within and external to the Proposed Scheme that have the potential to cause significant harm to the environment (including but not limited to populations, biodiversity, land, soil, water, air, material assets and cultural heritage).

1.8.3 The impact of any unplanned events (accidents or disasters) has been considered against the current baseline conditions. The volume and type of traffic using the Proposed Scheme will not change significantly from that using the current road alignment, and therefore it is reasonable to conclude that there is no general increase in risk.

1.8.4 Notwithstanding this conclusion, the following specific issues have been reviewed:

- The potential for construction-related accidents, causing harm to construction workers, are not within the scope of the EIA, unless these could also cause harm to an environmental receptor including members of the public beyond the boundaries of the construction site. Existing legislation around safe working practices and CDM will ensure that such risks are mitigated appropriately without the need for further assessment.
- The potential for extreme weather events, combined with the presence of the Proposed Scheme (for example, the Proposed Scheme affecting flood patterns) will be adequately assessed within the Road Drainage and the Water Environment chapter, the separate Flood Risk Assessment (FRA) and the Climate chapter, without the need for further assessment.
- The potential for other external hazards to impact the Proposed Scheme, such as earthquakes, landslides, mine collapse or sinkholes, will, where relevant, be in compliance with the design requirements of the DMRB and the Geology & Soils chapter and will not require further assessment.
- Accidental spillage of contaminants such as hydrocarbons and their subsequent release into the drainage system will be considered in the Road Drainage and the Water Environment chapter.
- There are no registered control of major accident hazards regulations (COMAH) sites with three miles of the Proposed Scheme and therefore no need to consider any associated risks.
- The safety of the Proposed Scheme will be evaluated through a Road Safety Audit, which will be undertaken during design, at the end of construction and post-construction, to identify road safety problems and to suggest measures to eliminate or mitigate any concerns.

1.8.5 A table will be included in the ES which identifies where this has been considered in respect of relevant technical chapters (e.g. Road Drainage and the Water Environment in respect of flood risk and culvert design).

1.8.6 In summary, the independent assessment of the likely significant environmental effects arising from the vulnerability of the Proposed Scheme to major accident and/or natural disaster is scoped out of this EIA. As justified above, major accidents and disasters will be sufficiently addressed within the scheme design and relevant technical chapters.

## 1.9 Heat and radiation

1.9.1 The Infrastructure Planning (EIA) Regulations 2017, transposing the European Directive 2014/52/EU, have introduced the requirement for 'A description of the likely significant effects of the development on the environment resulting from, inter alia -…heat and radiation' (Schedule 4, Part 5(c)) to be assessed within EIAs.

1.9.2 Due to the nature of the Proposed Scheme as a highway scheme, it is considered unlikely that heat and radiation effects associated with the proposals are likely to arise. Further assessment has therefore been scoped out.

## 1.10 Transboundary screening matrix

1.10.1 Regulation 32 of the Infrastructure Planning (EIA) Regulations 2017 requires planning inspectorate to notify other European Economic Area (EEA) States and publicise an application for development consent if it is of the view that the proposed development is likely to have significant effects on the environment of another EEA Member State, and where relevant to consult with the EEA State affected.

1.10.2 The closest international land boundary is over 175km from Proposed Scheme.

1.10.3 The study areas for the various ES topics define the extent of effects anticipated and are described fully in Chapters 5 to 14 and are summarised below as follows:

- Air Quality: 200m around the works.
- Cultural Heritage: 1km around the works.
- Landscape: 1km around the works.
- Biodiversity: 2km for internationally, nationally and locally designated nature conservation sites; 30km for SACs designated for bat populations; 10km for statutory sites designated for bird interest; 500m for Great Crested Newts, water vole and otter; 50m buffer for other preliminary ecological assessments including Phase 1 habitat survey badger, reptiles, and breeding birds.
- Geology & Soils: limited to the works' footprint but extends to 1km beyond this in order to identify any past pollution incidents which may have affected soil within the works area.
- Materials: determined through professional judgement by the influence of the Proposed Scheme.
- Noise & Vibration: 1km around the works.
- People and Communities: various – see section 12.2.
- Road Drainage and the Water Environment: 1km around the works but extended where there are features that may be affected by pollutants transported downstream.
- Climate: not applicable.

1.10.4 As none of these reach other EEA Member States, no transboundary effects are anticipated and are therefore scoped out of the assessment process.

1.10.5 A Habitats Regulation Assessment (HRA) screening exercise will be undertaken in accordance with Advice Note 10: Habitat Regulation Assessment relevant to nationally significant infrastructure projects (Planning Inspectorate, 2012b). The screening exercise will assess the potential for adverse impacts on European sites and therefore the need for HRA Appropriate Assessment.

## 1.11 Planning policy context

### National policy

1.11.1 The national policy is particularly relevant to developments that will be promoted as a NSIP. When the DCO application for the scheme is to be progressed as an EIA development, an environment assessment will be undertaken in compliance with national policies and regulations and will also consider whether legal duties and obligations set out within the Road Investment Strategy (RIS) and Highways England Licence would be met. A summary of key policies that are included in the NNNPS and in the RIS is provided in Sections 1.11.2 to 1.11.5.

#### *National Networks National Policy Statement*

1.11.2 The NNNPS sets out the need for, and the Government's policies to deliver development of, NSIPs on the national road network in England and sets out the primary basis for making decisions of development consent for NSIPs in England. The Government recognises in the Appraisal of Sustainability accompanying the NNNPS that some developments will have some adverse local impacts on noise, emissions, landscape/visual amenity, biodiversity, cultural heritage and water resources. The significance of these effects and the effectiveness of mitigation is uncertain at the strategic and non-locational specific level of the NNNPS. Therefore, whilst applicants should deliver developments in accordance with Government policy and in an environmentally sensitive way, including considering opportunities to deliver environmental benefits, some adverse local effects of development may remain.

1.11.3 Outside the NSIP regime, Government policy is to bring forward targeted works to address existing environmental problems on the strategic road network (SRN) and improve the performance of the network. This includes reconnecting habitats and ecosystems, enhancing the settings of historic and cultural heritage features, respecting and enhancing landscape character, improving water quality and reducing flood risk, avoiding significant adverse impacts from noise and vibration and addressing areas of poor air quality.

#### *Road Investment Strategy*

1.11.4 In December 2014, the DfT published the RIS for 2015-2020. The RIS sets out the list of schemes that are to be developed by Highways England over the period covered by the RIS.

1.11.5 Highways England, as the strategic highways company and appointed by the Secretary of State must, in exercising its functions and complying with its legal duties and other obligations, act in a manner which it considers best calculated to, among others:

- Minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment.
- Conform to the principles of sustainable development.

**Highways England policy**

***Highways England Licence***

1.11.6 The Highways England Licence document sets out key requirements which must be complied with by the Licence holder as well as statutory guidance. In exercising its functions and complying with its legal duties and obligations, the Licence holder must act in such a manner which it considers best calculated to:

- Ensure the effective operation of the network.
- Ensure the maintenance, resilience, renewal, and replacement of the network.
- Ensure the improvement, enhancement and long-term development of the network.
- Ensure efficiency and value for money.
- Protect and improve the safety of the network.
- Co-operate with other persons or organisations for the purposes of coordinating day-to-day operations and long-term planning.
- Minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment.
- Conform to the principles of sustainable development.

1.11.7 In complying with section 4.2(g) and its general duty under section 5(2) of the Infrastructure Act 2015 to have regard for the environment, the Licence holder must:

- Ensure that protecting and enhancing the environment is embedded into its business decision-making processes and is considered at all levels of operations.
- Ensure the best practicable environmental outcomes across its activities, while working in the context of sustainable development and delivering value for money.
- Consider the cumulative environmental impact of its activities across its network and identify holistic approaches to mitigate such impacts and improve environmental performance.

- Where appropriate, work with others to develop solutions that can provide increased environmental benefits over those that the Licence holder can achieve alone, where this delivers value for money.
- Calculate and consider the carbon impact of road projects and factor carbon into design decisions, and seek to minimise carbon emissions and other greenhouse gases from its operations.
- Adapt its network to operate in a changing climate, including assessing, managing and mitigating the potential risks posed by climate change to the operation, maintenance and improvement of the network.
- Develop approaches to the construction, maintenance and operation of the Licence holder's network that are consistent with the government's plans for a low carbon future.
- Take opportunities to influence road users to reduce the greenhouse gas emissions from their journey choices.

### *Highways England Delivery Plan*

1.11.8 The Highways England Delivery Plan sets out Highways England's long-term plans for the modernisation and renewal of our road network over the 5-year period from 2015-2020. It provides a brief outline of what Highways England have delivered during 2015-2016 and sets out a clear programme of activity for 2016-2017, as well as annual and future commitments. It complements the original Delivery Plan (Highways England Delivery Plan 2015-2020), outlining progress made with this work.

1.11.9 Key performance indicators (KPI) and other Performance Indicators have been set out from the January 2016 Operation Metrics Manual produced in collaboration with DfT and Office of Rail and Road. Environmental KPIs include:

- Number of Noise Important Areas (NIA) mitigated. Highways England aim to mitigate 1,150 NIA through interventions, to reduce the noise exposure of the population within the NIA.
- Delivery of improved biodiversity, as set out in Highways England's Biodiversity Plan. Highways England aim to reduce the net loss of biodiversity by the end of the first Road Period, on an ongoing annual basis.
- Helping cyclists, walkers, and other vulnerable users of the network through a number of new and upgraded crossing. The measure of success is an increase in the number of completed new crossings and upgraded crossings.

1.11.10 Furthermore, a series of ring fenced funds for actions beyond business as usual are available across environmental disciplines, including Cultural Heritage; Landscape; Biodiversity; Road Drainage and Water Environment Geology & Soils. There are also separate funds available for Air Quality; Noise & Vibration People and Communities.

# 2 The Proposed Scheme

## 2.1 The need for the Proposed Scheme

2.1.1 The 2.6km single carriageway section of the A47 from Blofield to North Burlingham acts as a bottleneck resulting in congestion and leading to longer and unreliable journey times. This section of the A47 also has a poor safety record.

2.1.2 There are a number of reasons for these traffic delays. Investigations have highlighted the following issues:

- Difficulty of accessing and crossing the A47
- Standard of the road and junctions
- Traffic levels outgrowing the capacity of the road, causing tailbacks and delays
- Limited opportunities for overtaking slower moving vehicles
- Development in the local area

2.1.3 In developing the Proposed Scheme, Highways England aim to address these issues by providing a high quality dual carriageway link which is intended to improve the traffic flow, reduce journey times on the route and increase the route safety and resilience.

2.1.4 The Proposed Scheme is also intended to support economic growth by making journeys safer and more reliable.

## 2.2 Proposed Scheme objectives

2.2.1 The objectives of the Proposed Scheme are:

- Supporting economic growth
  Contributing to sustainable economic growth by supporting employment and residential development opportunities. The Proposed Scheme aims to reduce congestion-related delay, improve journey time reliability and increase the overall capacity of the A47.
- A safe and serviceable network
  Improving road safety for all road users through being designed to modern highway standards appropriate for a strategic road.
- A more free-flowing network
  An improved route between Blofield and North Burlingham would be more reliable, reduce journey times and provide capacity for future traffic growth. The resilience of the road in coping with incidents such as collisions, breakdowns, maintenance and extreme weather will be improved.
- Improved environment

Protecting the environment by minimising adverse impacts and where possible deliver enhancements by improving the environmental impact of transport on those living along the existing A47 and by minimising the impact of new infrastructure on the natural and built environment.

- An accessible and integrated network
  Ensuring the proposals take into account local communities and access to the road network, providing a safer route between communities for cyclists, walkers, equestrians and other non-motorist groups.
- Value for money
  Ensuring that the Proposed Scheme is affordable and delivers good value for money.

## 2.3 Proposed Scheme location

2.3.1 The Road Investment Strategy (RIS) in 2014, set out its investment to improve journeys on England's motorways and major A roads.

2.3.2 The A47 trunk road forms part of the strategic road network and provides for a variety of local, medium and long-distance trips between the A1 and the east coast. The A47 has a number of congestion hotspots around Norwich, Peterborough and Great Yarmouth.

2.3.3 Highways England are proposing route improvements at key locations **along the A47.** This report details one of the proposed A47 improvement works – the Blofield to North Burlingham scheme.

2.3.4 The Proposed Scheme is located approximately 9km to the east of Norwich and forms part of the main arterial highway route connecting Norwich and Great Yarmouth to the east.

2.3.5 The Proposed Scheme involves the dualling of a single carriageway on a section of the A47 between Blofield and North Burlingham. From east to west, the existing A47 narrows from a dual carriageway to a single carriageway at the eastern outskirts of Blofield returning to a dual carriageway to the south east of the village of North Burlingham.

2.3.6 The area surrounding the Proposed Scheme is generally flat and elevations vary between 10m and 20m above sea level. The dual carriageway reduces to a single carriageway at approximately National Grid References (NGR) TG 34675 09939 and widens into a dual carriageway at approximately NGR 37101 00905. The speed limit along the single carriageway is 50mph. This returns to the national speed limit of 70mph when the road returns to a dual carriageway.

2.3.7 The area surrounding the Proposed Scheme is predominantly rural with arable farming representing the major land use practice. There are few features of interest in the landscape. Fields are large in size with hedgerow or fencing along the boundaries. Woodland is limited, although north of North Burlingham there are locally important areas of plantation and semi-natural woodland.

South of the A47 around the farm at Lingwood Road, community woodland has been planted.

2.3.8 Along the single carriageway between the two villages, footpath kerbing can be found with the provision of dropped kerbs. This footpath leads to a Public Right of Way (PRoW) Burlingham FP1 running north of Main Road to The Green. Opposite where the footway leaves the A47 a PRoW (Burlingham FP3) emerges onto A47 via a field access in the southern verge. Pedestrians walking west on the footway are directed across the A47 towards the Right of Way by a sign.

2.3.9 Blofield and North Burlingham along the route of the A47, lie within the boundaries of Norfolk County Council and Broadland District Council. Housing tends to be concentrated in the villages of Blofield, Lingwood and Acle, although the area surrounding the Proposed Scheme between Blofield and North Burlingham contains a number of domestic properties and businesses along the minor road network. A significant number of these are associated with farms which is the key industry.

2.3.10 The land potentially required temporarily and/or permanently for the construction, operation and maintenance of the Proposed Scheme (hereafter referred to as the DCO site boundary, is shown on Figure A.1 in Appendix A. It is important to note that the current proposed draft DCO site boundary may be subject to change, but currently captures what is thought to be a reasonable worst-case land take.

## 2.4 Proposed Scheme description

2.4.1 The Proposed Scheme will:

- Have a total length of new carriageway of 4.5km, including an upgrade of a 2.6km section of single carriageway to dual carriageway between Blofield and North Burlingham.
- Consist of a site area within the DCO site boundary of 104ha.
- Construct a new section of off-line dual carriageway.
- Provide appropriate junction improvements.

2.4.2 The Proposed Scheme will comprise of the following main features:

- 70mph high quality dual carriageway to current standards.
- Connection to existing A47 dual carriageway at both end points of the scheme (NGR TG 34675 09939 and NGR 37101 00905).
- A new alignment that will closely follow the existing alignment of the A47 as geometric and other constraints permit.
- Where the existing A47 will be unaffected by the dualling, it will become part of the local road network.
- Western junction for accessing the A47 from Yarmouth Road - will permit westbound access only onto the A47.

- Yarmouth Road/Hemblington Road junction - will be realigned with a new link road connecting to the old A47 alignment over a new bridge.
- Eastern Junction – new compact grade separated junction on the new proposed A47 with connection to South Walsham Road and Acle Road.
- Acle Road will be slightly realigned at the northern end to connect onto the new compact grade separated junction.
- An additional new access link will be provided connecting Main Street in North Burlingham to South Walsham Road.

## 2.5 Timescales

2.5.1 Subject to successfully passing through the DCO process, the key timescales for the Proposed Scheme are as follows:

- Start of construction works – 2020
- Estimated duration of construction – 16 months
- Open for traffic – 2021

# 3 Consideration of Alternatives

## 3.1 Alternative options considered

3.1.1 In seeking to resolve the transport problem, eight potential options were developed and assessed to identify their performance against environmental, engineering, transportation and economic criteria so that they could be compared and contrasted to allow the most appropriate options to be taken forward.

3.1.2 Four options were then selected for non-statutory public consultation and further assessment. Assessment was undertaken with regard to environmental impact and engineering suitability. The options were re-numbered for simplicity during Stage 2.

3.1.3 The four options are detailed below.

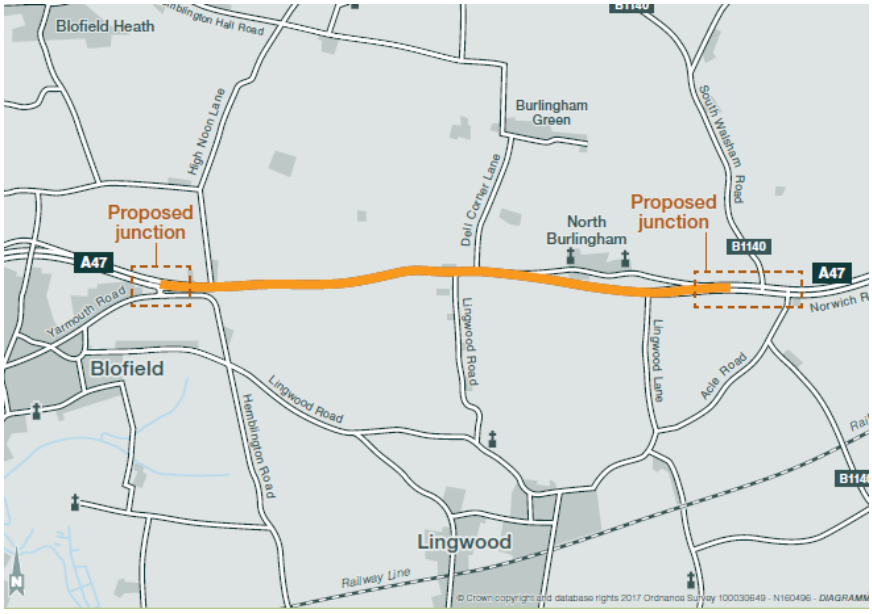
### Option 1

3.1.4 Option 1 is online dualling of the existing A47 between Blofield and North Burlingham.

3.1.5 Option 1 proposes improving the existing single carriageway section by constructing a new section of online dual carriageway with junction improvements. See Figure 3.1

3.1.6 There will be two main junctions situated on the A47 at either end of the scheme and a new local access link road will also be created to the north of the newly dualled A47.

**Figure 3.1 Option 1**



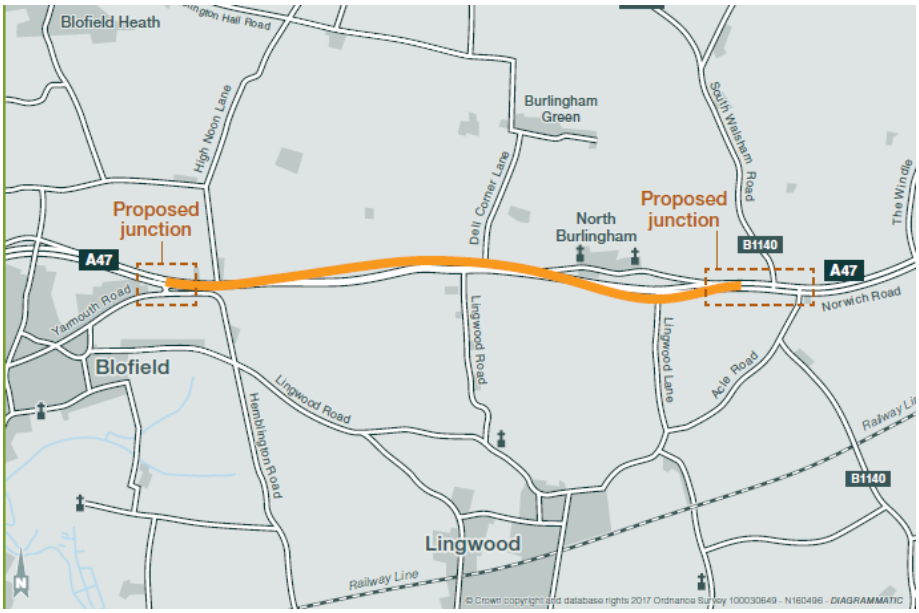
## Option 2

3.1.7 Option 2 is an offline dualling to the north of Blofield and south of North Burlingham with junction improvements.

3.1.8 This option proposes constructing a new offline dual carriageway to the north and to the south of the A47. There will be two main junctions situated on the A47 at either end of the proposed route with new local access roads constructed. See Figure 3.2.

3.1.9 The existing A47 where unaffected by the new dual carriageway would remain as part of the local road network.

**Figure 3.2 Option 2**

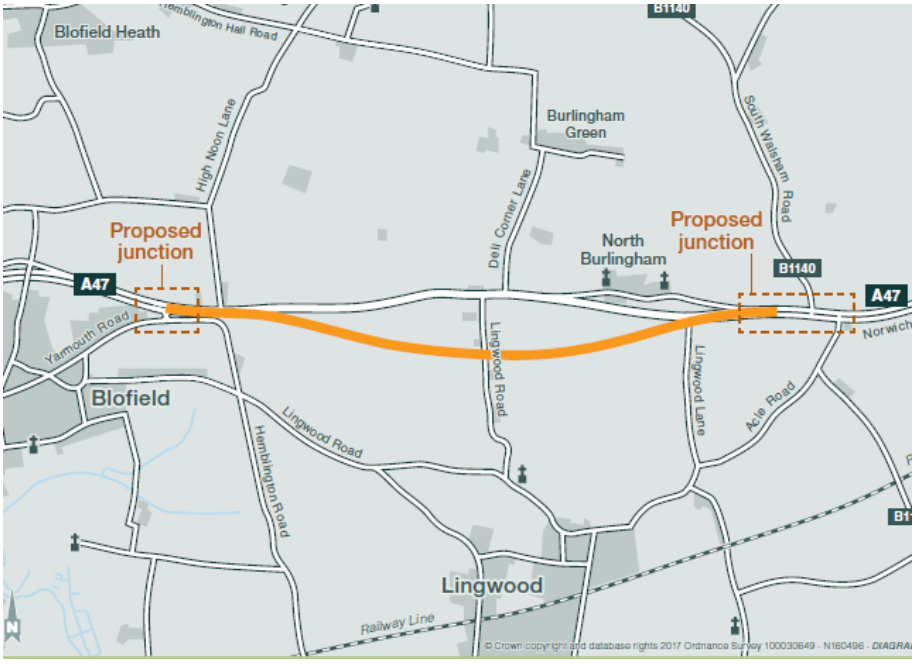



## Option 3

3.1.10 Option 3 is offline dualling to the south of the existing A47. See Figure 3.3.

3.1.11 The proposed route follows an alignment running south of the existing A47 corridor. The existing A47 would remain where unaffected by the new dual carriageway, become part of the local road network.

**Figure 3.3 Option 3**

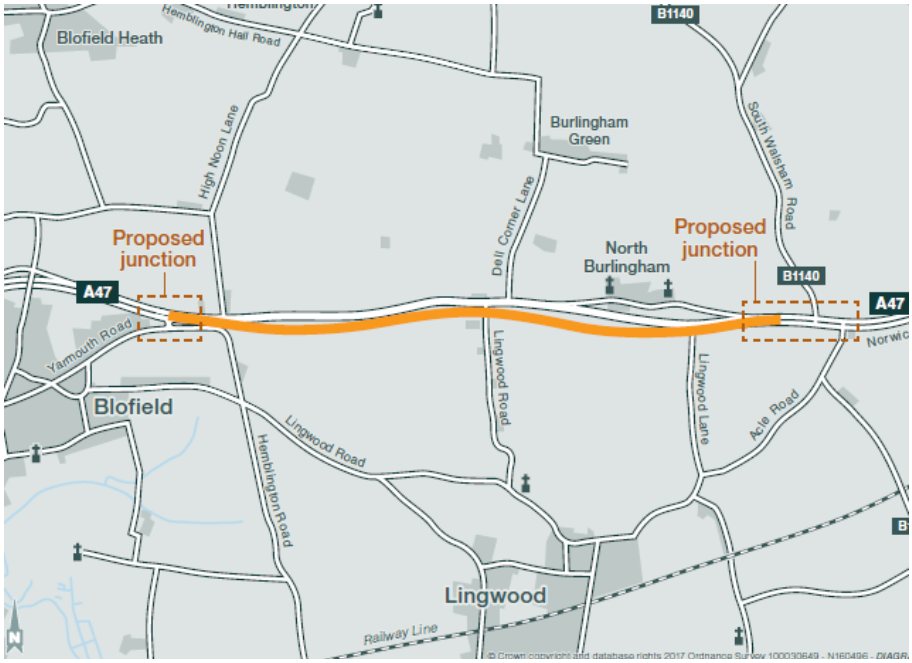



## Option 4

3.1.12 Option 4 is offline dualling to the south with construction of a new section of offline dual carriageway and junction improvements. See Figure 3.4.

3.1.13 The proposed alignment closely follows the existing alignment of the A47 and where the existing A47 is unaffected by the dualling, it will become part of the local road network.

**Figure 3.4 Option 4**



## 3.2 Option taken forward – the Proposed Scheme

3.2.1 Upon review of the non-statutory consultation feedback and route option assessments, the preferred option is Option 4.

3.2.2 It is considered that the preferred option can be built with the least disruption to drivers during construction as the existing road can remain for use by local traffic.

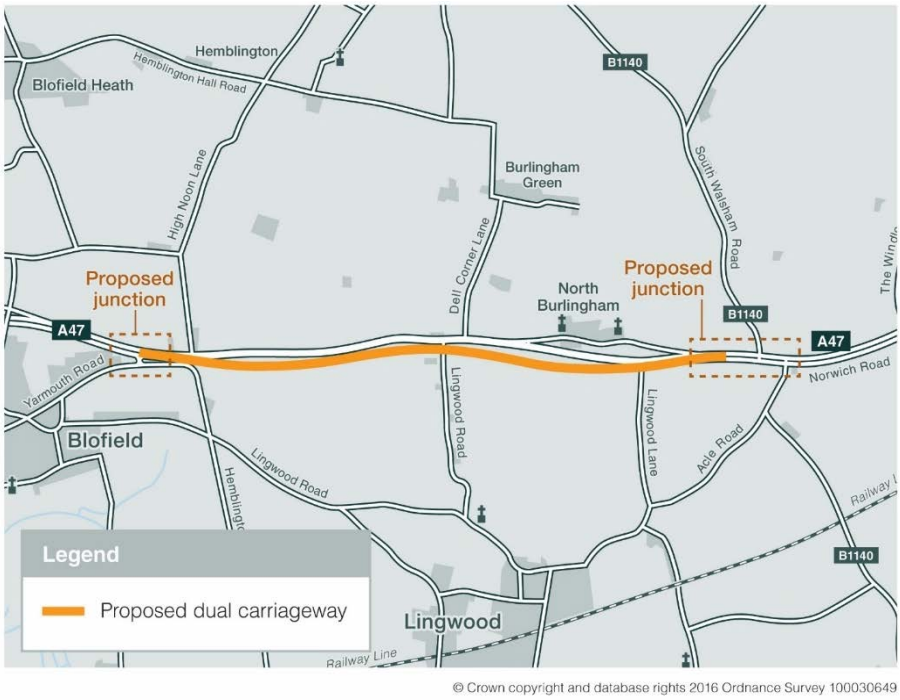
3.2.3 A non-statutory consultation for the scheme was held in March / April 2017 and was attended by the local communities resulting in 441 responses comprising of returned questionnaires, or comments by letter or email. 96% of the responses were supportive of the need to improve the Blofield to North Burlingham route with 4% disagreeing with any improvements but did not comment with any specific reasons, and less than 1% did not answer the question.

3.2.4 Four options were presented for the route which resulted in:

- Option 1: 53% Neutral or in favour
- Option 2: 46% Neutral or in favour
- Option 3: 53% Neutral or in favour
- Option 4: 76% Neutral or in favour

3.2.5 The final design and construction plan will be developed further before statutory consultation.

**Figure 3.4 The Preferred Route – Option 4**



# 4 Consultation

## 4.1 Consultation undertaken to date

4.1.1 An extensive stakeholder mapping exercise was undertaken to identify relevant stakeholders and their key interests. This list was used to inform the participants of a six-week non-statutory public consultation, which was held between 13 March and 21 April 2017.

4.1.2 At all public information exhibition events, members of the Highways England management team, the designers and council officials were available to discuss proposed options with stakeholders.

4.1.3 In addition to the public information exhibitions, public information points were made available throughout the duration of the non-statutory public consultation period. They were selected within the vicinity of the proposals and in nearby neighbourhoods, to ensure that all stakeholders had the opportunity to collect consultation materials if they were unable to attend one of the scheduled consultation events. The following consultation material was available at the public information points:

- Consultation scheme brochure
- Consultation scheme questionnaire and freepost envelope
- Poster detailing public events and scheme website

4.1.4 The Highways England website made the consultation documents available to stakeholders for viewing and downloading, and included the facility to complete and return the questionnaire online. The website was kept up to date with information on all the public consultation events and public information points.

### Engagement with Local Authorities

4.1.5 Local MPs and Councillors were invited to attend a preview of the Public Information Exhibition before it opened to the public. The preview events were held on the 14 March 2017.

### Engagement with Statutory Environmental Bodies

4.1.6 Highways England has not formally engaged with the Statutory Environmental Bodies during the option development period and during the non-statutory public consultation period. Informal consultation has however been undertaken in support of individual technical assessments and this engagement is referenced as appropriate.

### Engagement with landowners

4.1.7 Landowners were engaged as part of the non-statutory public consultation exercise.

### Engagement with local environmental groups

4.1.8 Informal consultation has also been undertaken in support of individual technical assessments and this engagement is referenced as appropriate.

4.1.9 Consultation was undertaken with the following local environmental groups: Canal and River Trust; Norfolk County Recorder; Norfolk Biodiversity Information Service; Norfolk local bat recorder; Norfolk local badger recorder; Norfolk Amphibian and Reptile Group; Local Mammal Group; Norfolk and Norwich Naturalists Society; RSPB (Norfolk and Norwich Groups); Bird Trust for Ornithology; Norfolk Ornithologists Association; Raptor Trust; Norfolk Biodiversity partnership; Norfolk Non-Native Species Initiative; Norfolk Amateur Entomologists Society; Norfolk Moths; Norfolk Flora Group; Norfolk Wildlife Trust; The Barn Owl Trust; Ramblers Association; Sustrans; Cycling UK; East Anglian Cycling Club and the British Horse Society.

4.1.10 Friends of Blofield Church, Friends of North Burlingham Church and St. Peters Church Lingwood were also contacted regarding the Proposed Scheme during previous stages of design development and assessment.

### Engagement with the community

4.1.11 Non-statutory public consultation was undertaken over the period 13 March to 21 April 2017.

4.1.12 The scheme proposals were advertised by way of posters, distributed leaflets and brochures and advertisement in local newspapers and other media sources within the Blofield, North Burlingham and Lingwood areas.

4.1.13 Three public information exhibitions were held on the 29 March, 31 March and 1 April 2017.

### Public Information Exhibition details

4.1.14 In total, 323 people attended the public information exhibitions with a total of 441 responses received (including stakeholders and members of the public).

4.1.15 Information on the proposed scheme options were also made available on the Highways England website www.highways.gov.uk/a47Improvement and distributed to local public libraries and community halls.

## 4.2 Proposed consultation

4.2.1 A consultation strategy has been developed which outlines the organisations who will be consulted, methods through which we will consult and the proposed timeline for the consultation. Consultation required to support individual technical assessments is set out within each technical chapter of this report.

### Engagement with hard to reach groups

4.2.2 It is anticipated that the Proposed Scheme's Equality Impact Assessment will identify the relevant hard to reach groups. Host local authorities will be consulted about identification of relevant groups. Categories identified and contacted include non-motorised users (NMU) groups, ethnic organisations, local Traveller communities', disability groups and groups representing children and the elderly.

# 5 Air Quality

## 5.1 Introduction

5.1.1 This chapter presents the baseline air quality in the vicinity of the Proposed Scheme and describes the proposed approach for the assessment of air quality.

5.1.2 It has been prepared in accordance with the requirements of DMRB Volume 11, Section 2, Part 4 (HA 204/08), DMRB Volume 11, Section 3, Part 1 (HA 207/07), and associated Interim Advice Notes (IAN), namely IANs 170/12v3, 174/13, 175/13 and 185/15. This chapter encompasses two sub-topics, as follows:

- Local air quality – emissions of pollutants that are of concern in relation to human health and ecosystems, at a local level
- Regional air quality – total emissions of pollutants that can disperse over longer distances, affecting both human health and ecosystems

5.1.3 The potential requirement for assessment to either Simple or Detailed level will be identified within this chapter. Where necessary, assessment will be presented within the ES.

## 5.2 Study area

5.2.1 The location of the Proposed Scheme and key environmental constraints located adjacent are shown in Appendices A and B respectively.

5.2.2 The study area for the local air quality assessment covers human health receptors and ecologically Designated Sites within 200m of roads that are expected to be affected by the Proposed Scheme.

5.2.3 Under DMRB Volume 11, Section 3, Part 1(HA 207/07), affected roads are defined where:

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

5.2.4 The local air quality assessment involves estimating the change in pollutant concentrations at sensitive receptors resulting from the operation of the Proposed Scheme. The regional air quality assessment assesses the change in emissions resulting from the Proposed Scheme. This is required as emissions not only affect local air quality, but also have an impact on a regional, national and international scale. Affected roads for the assessment of regional air quality include those that meet the following criteria:

- A change of more than 10% AADT, or
- A change or more than 10% to the number of HDVs, or
- A change in the daily average speed of more than 20km/hr

## 5.3 Existing and baseline knowledge

### Overview

5.3.1 Information on air quality in the UK can be obtained from a variety of sources including Local Authorities, national network monitoring sites and other published sources. For the purpose of this assessment, data has been obtained from the Local Authority (Broadland District Council (BDC)), Department for Environment, Food and Rural Affairs (Defra), and Highways England. The most recent full year of bias adjusted monitoring data available from BDC is for 2015.

### Local Authority review and assessment

5.3.2 There are no Air Quality Management Areas (AQMAs) currently declared by BDC and there are no AQMAs elsewhere that are likely to be affected by the Scheme. The nearest AQMA is the Central Norwich AQMA located approximately 7.7km west of the Proposed Scheme and declared for annual mean $NO_2$ objective.

### Local Authority and Defra monitoring

5.3.3 No automatic monitoring is undertaken by BDC.

5.3.4 BDC currently undertakes non-automatic (diffusion tube) monitoring at 16 sites to assess compliance with the annual mean NO2 air quality objective. Of these sites, one is located considered representative of the study area and the monitored results are presented in Table 5.1.

**Table 5.1 Annual automatic monitoring data for $NO_2$**

| Site ID | Location | Site classification | National Grid Reference | | Annual mean $NO_2$ concentration ($\mu g/m^3$) |
|---|---|---|---|---|---|
| | | | X | Y | 2014[(a)] |
| BN1 | A47 N Burlingham | Kerbside | 636268 | 310000 | 30.8 |

Source: BDC Updating and Screening Assessment 2015
Note: Annual mean objective is 40 $\mu g/m^3$
83% data capture, bias adjusted.
[(a)] Most recent monitoring data available online. An information request will be issued to BDC during the assessment work to retrieve more up to date monitoring data.

### Scheme specific monitoring

5.3.5 An $NO_2$ diffusion tube monitoring survey, commissioned by Highways England, commenced in January 2017. The monitoring consists of four diffusion tubes placed at rural and roadside locations along the proposed route to identify $NO_2$ concentrations. The results of the monitoring are presented in Table 5.2 and show that there are no exceedances of the annual mean $NO_2$ objective along

the proposed route. Currently, only three months of annualised data is available (January to March 2017); however, further monitoring data should be available for the ES.

**Table 5.2 Scheme specific diffusion tube monitoring data for $NO_2$**

| Site ID | Site classification | National Grid reference | | Annualised $NO_2$ (µg/m$^3$) |
|---|---|---|---|---|
| | | X | Y | 2017 |
| A | Roadside | 634378 | 309951 | 19.0 |
| B | Suburban | 633471 | 309508 | 16.1 |
| C | Roadside | 636268 | 309995 | 35.1 |
| D | Roadside | 638611 | 310137 | 25.3 |

## Defra projected background concentrations

5.3.6 In addition to the data above, Defra provides estimates of background pollution concentrations for $NO_X$, $NO_2$ and $PM_{10}$ across the UK for each one kilometre grid square, for every year from 2013 to 2030. Future year projections have been developed on the base year for the background maps, which is currently 2013. The maps include a breakdown of background concentrations by emission source, including road and industrial sources which have been calibrated against 2013 UK monitoring data. This data can be used to provide specific background pollutant concentrations at receptors included within the assessment and to supplement local monitoring data.

5.3.7 Table 5.3 presents the maximum background concentrations for the areas covered by the Proposed Scheme alignment for the year 2016.

**Table 5.3 Defra projected background concentrations for the Proposed Scheme (2016)**

| $NO_x$ | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|
| 15.9 | 11.6 | 18.0 | 11.9 |

Note: The results presented above are taken from the grid squares which have the greatest pollutant concentrations for 2016. Grid squares used = 634500, 309500 for $NO_x$, $NO_2$ and $PM_{10}$ and 635500, 310500 for $PM_{2.5}$

## EU limit value compliance

5.3.8 Defra's Pollution Climate Mapping (PCM) is used to report compliance with the EU limit values and provides $NO_2$ concentrations for a number of roads across the UK for a selection of future years. The most up to date PCM model outputs were released in August 2017, following the release of Defra's Air Quality Action Plan.

5.3.9 Based on projected roadside $NO_2$ concentrations in the current version of the PCM model, there are no PCM links within approximately 50km of the Proposed Scheme exceeding 40µg/m$^3$ for the year of 2017. The PCM link closest to the Proposed Scheme, (on the A1042) is located approximately 6.5km from the Proposed Scheme and has a reported annual mean $NO_2$ concentration in 2017 of 30µg/m$^3$, which is well below the annual mean limit value of 40µg/m$^3$ for $NO_2$

and therefore the Proposed Scheme is unlikely to cause a non-compliance with the Air Quality Directive.

5.3.10 The ES will identify any affected road network (ARN) links that overlap with the PCM model and will assess compliance with the Air Quality Directive in accordance with IAN 175/13.

**Summary**

5.3.11 Local Authority and Scheme Specific monitoring results show no exceedances of the $NO_2$ air quality objective at any of the monitoring locations located close to the Proposed Scheme. In addition, there are no AQMAs located within the vicinity of the Proposed Scheme. There is no monitoring data available for $PM_{10}$ however Table 5.3 indicates that background concentrations are well below the air quality objective in the study area.

## 5.4 Assumptions and limitations

5.4.1 Air quality modelling predictions will be based on the most reasonable, robust and representative methodologies in accordance with best practice guidance. However, there is an inherent level of uncertainty associated with the screening model predictions, including:

- Uncertainties with traffic forecasts
- Uncertainties with vehicle emission predictions
- Uncertainties with background air quality data
- Simplifications made within modelling calculations or post processing of the data that represent atmospheric dispersion or chemical reactions.

5.4.2 In order to best manage these uncertainties, the air quality assessment to be undertaken will be verified using the air quality measurements from the Highways England monitoring survey. The verification process will be undertaken in line with best practice guidance produced by Defra.

## 5.5 Guidance and best practice

5.5.1 The air quality assessment will take account of the best practice guidance provided by the DMRB 207/07, the Defra technical guidance for undertaking air quality assessments (LAQM-TG (16)), and the following IANs published by Highways England:

- IAN 170/12 ‘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’.
- IAN 175/13 ‘Updated advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of

Proposed Scheme Air Quality Action Plans for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA207/07)'.

- IAN 185/15 'Updated traffic, air quality and noise advice on the assessment of traffic data into speed-bands for users of DMRB Volume 11, Section 3 Part 1 Air Quality'.

5.5.2 Further updates to the IANs may be published before work commences on the environmental assessment; the assessment will be undertaken in accordance with the latest IANs available at the time.

5.5.3 Table 5.4 presents the relevant air quality objectives that the Proposed Scheme will be assessed against.

**Table 5.4 Air quality objectives and limit values**

| Pollutant | Averaging Period | Air Quality Objectives and Limit Values | | Attainment Date | |
|---|---|---|---|---|---|
| | | Concentration | Allowance | Air Quality Objectives | EU Limit Values |
| Nitrogen dioxide ($NO_2$) | Annual | 40 µg/m$^3$ | - | 31 December 2005[(a)(b)] | 1 January 2010[(c)] |
| | 1 Hour | 200 µg/m$^3$ | 18 | 31 December 2005[(a)(b)] | 1 January 2010[(c)] |
| Nitrogen Oxides ($NO_X$)[(d)] | Annual | 30 µg/m$^3$ | - | | 31 December 2000[(c)] |
| Particulates ($PM_{10}$) | Annual | 40 µg/m$^3$ | - | 31 December 2004[(a)(b)] | 1 January 2005[(c)] |
| | 24 Hour | 50 µg/m$^3$ | 35 | 31 December 2004[(a)(b)] | 1 January 2005[(c)] |

Notes: (a) Air Quality (England) Regulations 2000 as amended in 2002.
(b) Air Quality Strategy 2007.
(c) EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe and The Air Quality Standards Regulations 2010. Derogations (time extensions) have been agreed by the EU for meeting the $NO_2$ limit values in some zones / agglomerations.
(d) Designated for the protection of vegetation and ecosystems and referred to as the 'critical level' for $NO_x$.

## 5.6 Consultation

5.6.1 Consultation will be undertaken with BDC to discuss the assessment approach and the study area once traffic data for the ES is finalised.

## 5.7 Potential effects, including monitoring and mitigation measures

### Construction

5.7.1 The main risks to sensitive receptors during the construction phase include on-site dust emissions arising from construction activities and vehicle movements. Dust can be mechanically transported (either by wind or re-suspension by

vehicles). It can also arise from wind erosion on material stockpiles, earth moving etc.

5.7.2 These impacts are expected to be restricted to within 200m of construction activities (as stated in DMRB Volume 11, Section 3, Part 1), and will be controlled through appropriate mitigation measures included within the Construction Environmental Management Plan (CEMP) which would be prepared for the Proposed Scheme. Mitigation measures could include minimising the use of dust generating activities, the use of water as a dust suppressant where appropriate, and keeping stockpiles for the shortest time possible.

**Operation**

5.7.3 The operational phase of the Proposed Scheme on local air quality has the potential to effect air quality due to:

- Changes in emissions associated with changes in traffic flows (including composition and speed) on the local road network
- Changes in road layout which may bring road traffic emission sources closer to, or further away from, sensitive receptors

5.7.4 The key pollutants for consideration within the assessment of operation phase local air quality effects are:

- Nitrogen oxides (NOx), including $NO_2$
- Fine particles (particulate matter defined as those less than 10 microns in diameter; PM10)

5.7.5 The key pollutants for consideration within the assessment of operation phase regional air quality effects (if the assessment criteria are met) are:

- Nitrogen oxides (NOx), including nitrogen dioxide ($NO_2$)
- Fine particles (particulate matter defined as those less than 10 microns in diameter; PM10)
- Carbon dioxide ($CO_2$)

5.7.6 No assessment is considered necessary for emissions of any pollutants other than those identified above, as no significant emission sources of these pollutants are introduced or affected by the Proposed Scheme or because concentrations are expected to be well below air quality objectives within the study area.

**Summary**

5.7.7 Table 5.5 provides a summary of the potential construction and operational air quality effects for the Proposed Scheme.

**Table 5.5 Summary of potential air quality effects**

| Potential Construction Effects | Potential Operation Effects |
|---|---|
| Significant direct effects are unlikely with mitigation measures in place | Dependant on traffic impacts which are yet to be determined |

## 5.8 Proposed level and scope of assessment

5.8.1 The scope of assessment during the construction phase will include emissions of $NO_2$ and $PM_{10}$ from construction plant and vehicles, and dust arising from construction activities. A qualitative assessment of construction phase effects will be undertaken.

5.8.2 For the operational stage effects, a Simple Level assessment will be undertaken, once updated traffic modelling data is available. In accordance with DMRB, a Simple Level assessment has been deemed sufficient as no exceedances of the air quality objectives / EU Limit Values have been identified within the vicinity of the Proposed Scheme and the initial assessment as indicated that impacts were not significant in accordance with IAN 174/13.

## 5.9 Proposed methodology including significance

### Construction phase

5.9.1 Key stages of the construction phase and the locations and types of sensitive receptors will be identified in accordance with DMRB 207/07. Appropriate mitigation measures will be identified in accordance Best Practicable Means (BPM) which would be incorporated into the CEMP.

5.9.2 If construction traffic is predicted to last for longer than six months, traffic management measures and the effect of additional construction vehicles will be assessed qualitatively.

### Operational phase

5.9.3 A Simple Level assessment will be undertaken in accordance with the DMRB Volume 11, Section 3, Part 1 (HA 207/07) and associated IANs, and Defra's Local Air Quality Management Technical Guidance (LAQM.TG(16)), which will include:

- An assessment of air quality effects using the DMRB Screening Tool
- Verification of model outputs with local monitoring data
- Prediction of $NO_2$ and $PM_{10}$ concentrations in the 'Base Year' and the opening year 'Do-Minimum' and 'Do-Something' scenarios at sensitive human health receptors and Designated Sites.

5.9.4 For regional air quality impacts, the change in mass emissions that would result from the operation of the Proposed Scheme will be quantified. Emissions with

and without the Proposed Scheme will be compared for opening year and design year (Opening year + 15 years) as well as the base year scenario.

### Determination of significant effects

5.9.5 IAN 174/13 provides advice for evaluating significant local air quality effects for public exposure and designated sites. Evaluation of the significance of local air quality effects will be undertaken in accordance with IAN 174/13, a summary of which is provided here.

5.9.6 Receptors that have a reasonable risk of exceeding an air quality threshold will be assessed in both a Do-Minimum and Do-Something scenario. The difference in pollutant concentration between the two scenarios is used to describe the magnitude of change in accordance with Table 5.6.

**Table 5.6 Magnitude of change criteria**

| Magnitude of Change in Concentration | Value of Change in Annual Average $NO_2$ and $PM_{10}$ |
|---|---|
| Large (>4) | Greater than full MoU value of 10% of the air quality objective (4µg/$m^3$) |
| 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 objective (0.4 µg/$m^3$) |

Notes: MoU = Measure of Uncertainty (10% of the objective)

5.9.7 The number of receptors where changes are greater than imperceptible, and where concentrations exceed the air quality objectives in the Do-Minimum or Do-Something scenario will be compared to the guideline bands presented in Table 5.7.

**Table 5.7 Guideline to number of properties constituting a significant effect**

| Magnitude of Change in Concentration | Number of Receptors With: | |
|---|---|---|
| | Worsening of air quality objective already above objective or creation of a new exceedance | Improvement of an air quality objective already above objective or the removal of an existing exceedance |
| Large (>4) | 1 to 10 | 1 to 10 |
| Medium (>2 to 4) | 10 to 30 | 10 to 30 |
| Small (>0.4 to 2) | 30 to 60 | 30 to 60 |

5.9.8 Table 5.7 presents guideline bands, setting an upper level of likely non-significance and a lower level of likely significance, for the number of receptors affected by the Proposed Scheme. Between these two levels are the ranges where likely significance is more uncertain, therefore professional judgment

would be required. If the Proposed Scheme is above the lower level of likely significance, consideration should be given to all the evidence that may support or detract from the conclusion of a significant effect. The information compiled to complete Table 5.7 will then been used along with the following key criteria to determine the overall evaluation of local air quality significance:

- Is there a risk that environmental standards would be breached?
- Is there a high probability of the effect occurring?
- Would there be a large change in environmental conditions?
- Would the effect continue for a long time?
- Would many people be affected?
- Is there a risk that protected sites, areas, or features would be affected?
- Would it be difficult to avoid, or reduce, or repair, or compensate for the effect?

5.9.9 The Proposed Scheme's compliance with EU limit values will be assessed using IAN 175/13.

## 5.10 Conclusion

5.10.1 A qualitative assessment of receptors within 200m of construction activities will be undertaken and relevant measures to minimise the air quality impact of construction activities will be included in the CEMP.

5.10.2 The operational air quality impacts will be determined through a Simple Level assessment as no exceedances of air quality objectives / EU Limit Values have been identified within the vicinity of the Proposed Scheme and considering the results presented in the previously undertaken air quality assessment. This will be reviewed again once traffic data is available and the ARN for the Proposed Scheme have been determined.

5.10.3 A Simple Level assessment of air quality effects of the Proposed Scheme will be undertaken in accordance with DMRB HA207/07 and associated IANs, and will be presented in the ES.

# 6 Cultural Heritage

## 6.1 Introduction

6.1.1 This chapter provides an overview of the baseline heritage assets in the vicinity of the Proposed Scheme and describes the proposed approach for the assessment of cultural heritage within the study area. For the purpose of this assessment, this includes scheduled monuments, listed buildings, conservation areas, registered battlefields, registered parks and gardens and non-designated features of national, regional or local archaeological, historic or architectural interest and value. These features include archaeological remains, paleoenvironmental deposits, historic buildings, historic open spaces, historic features and the wider historic landscape. Such sites can make an important contribution to the local distinctiveness of an area and its sense of place.

6.1.2 This chapter has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, and DMRB Volume 11, Section 3, Part 2, to a Scoping Level. Assessment will be presented within the ES.

## 6.2 Study area

6.2.1 The study area includes designated and non-designated cultural heritage assets within 1km of the Proposed Scheme. Though no physical impacts to designated assets are anticipated it is considered that a 1km search area for these assets is proportionate as the Proposed Scheme is situated within a largely flat landscape.

6.2.2 In addition, the Zone of Visual Influence (ZVI), which will be produced as part of the Landscape Visual Impact Assessment (LVIA), will be used to identify any designated assets that would be affected by the construction of the Proposed Scheme.

## 6.3 Existing and baseline knowledge

6.3.1 The information presented within this Scoping Report is based on the previous stages of design development and assessment.

6.3.2 Data detailing nationally designated cultural heritage assets in the UK has been obtained from Historic England’s National Heritage List for England. Information concerning designated and non-designated heritage assets was obtained from the Norfolk Historic Environment Record (NHER).

6.3.3 References used in this section refer to the National Heritage List for England list entry numbers (NHLE numbers) and Norfolk HER reference numbers (MNF numbers).

6.3.4 Table 6.1 summarises the existing baseline specifically for the Proposed Scheme.

**Table 6.1: Summary of existing baselines**

| Existing Baseline |
|---|
| **Designated assets**<br>There are no scheduled monuments, conservation areas, registered parks and gardens or historic battlefields within 1km of the Proposed Scheme.<br>There are 26 listed structures within 1km of the Proposed Scheme, including four grade I listed churches:<br>• Church of St Andrew (NHLE 1051522), 140m to the north of the Proposed Scheme, on the north-western edge of North Burlingham<br>• Church of St Peter (NHLE 1051521), 430m to the south of the Proposed Scheme associated boundary, on the northern edge of Lingwood<br>• Church of St Andrew and St Peter (NHLE 1304595), 860m south of the Proposed Scheme, on the southern edge of Blofield<br>• Church of St Michael (NHLE 1152849), 530m to the south of the Proposed Scheme associated drainage, south of Blofield<br>There are no grade II* listed buildings within the search area. There are 22 grade II listed buildings within the study area.<br>The listed buildings are predominantly clustered within the main settlements of Lingwood, Blofield and North Burlingham. |
| **Previous archaeological fieldwork**<br>Field survey along the proposed route of the A47 found very little archaeological material on the surface, however a small number of prehistoric flints were recovered from the fields to the south of the eastern end of the Proposed Scheme (Norfolk Archaeological Unit, 2003).<br>A geophysical magnetometer survey parallel to the southern edge of the A47, was undertaken in 2006 (APS 2006). Many of the survey areas detected a large buried service running parallel to, and south of, the road. Disturbance from this modern intrusion rendered the remainder of the survey area either side of the service illegible. However, several possible archaeological linear features were identified: one situated to the south of the eastern end of the route, aligned north-east to south-west; two situated to the north-west of Poplar Farm, one aligned north-east to south-west, the other north to south; another couple of possible archaeological features were identified to the south of North Burlingham a loose concentration of possible features was recorded in the fields at the eastern end of the Proposed Scheme, to the north and south of the A47**.** |
| **Non-designated assets**<br>Metal detectorists recovered Early Neolithic, Late Bronze Age/Early Iron Age and general prehistoric flints at the eastern end of the Proposed Scheme (NHER MNF54667). A prehistoric flint flake was found during geophysical survey within the Proposed Scheme footprint (NHER MNF67750).<br>Cropmarks to the north of the A47, to the west of North Burlingham, indicate possible late prehistoric or Roman field systems (NHER MNF55217). The linear features recorded to the north-west of Poplar Farm through geophysical survey, but to the south-west of MNF55217, could represent a continuation of this cropmark field system.<br>The focus of Roman activity within the region was at Caistor St Edmund – *Venta Icenorum* – some 12km to the south-west of the Proposed Scheme. Metal detecting to the east of Poplar Farm, to the north of the A47 revealed a Roman coin indicating an ephemeral Roman presence (NHER MNF62561).<br>An Early Saxon brooch was recovered through metal detecting within the proposed site boundary of the Proposed Scheme (NHER MNF25942) at North Burlingham. A small Saxon |

| Existing Baseline |
| --- |
| settlement is identified (NHER MNF55516) adjacent to a proposed drainage route at the south-western extent of the Proposed Scheme. The surrounding place names indicate a Saxon influence with elements such as *ing* and *ham*.<br>The line of a former medieval road is identified as cropmarks following a north-east to south-west alignment to the east of Sparrow Hall (NHER MNF54080) and through the Proposed Scheme, to connect to the Blofield Cross. The Cross was situated at the end of High Noon Lane, at a point that would have originally formed a crossroads with the original road layout, within the footprint of the Proposed Scheme (NHER MNF13378). Medieval pottery and coins (NHER MNF32029) have been recovered within the footprint of the Proposed Scheme to the west of Sparrow Hall, north of Blofield.<br>Post-medieval evidence distribution patterns are similar to those of the medieval period, with buildings, monuments and findspots largely clustered within the centres of the villages. A group of farm buildings (NHER MNF12283), part of Poplar Farm, are shown on the 19th century maps immediately south of the Proposed Scheme, however they have been demolished. Burlingham Hall parkland is situated on the northern side of the eastern end of the A47 (NHER MNF61984). The estate was designed in the 18th century and was sold in 1919.<br>Modern undesignated assets include the former horticultural school (NHER MNF46969) situated in the southern part of the Burlingham Hall parkland. An early 20th century milestone is situated on the northern side of the A47, at the junction of Main Road, Burlingham and the A47 (NHER MNF62995). The milestone marks 9 miles from Norwich and 13 miles from Great Yarmouth. |
| **Historic Landscapes**<br>The landscape within the study area comprises a majority of 20th century agriculture and 18th-19th enclosure. Many of the current field boundaries date to the 18th and 19th centuries, though 20th century developments resulted in increased field size and therefore historic field boundary loss.<br>One significant feature of the historic landscape along the route is the parkland associated with Burlingham Hall (NHER55630), situated on the northern side of the A47. This asset is surrounded to the north, west and south by discontinuous belts of woodland. |

## 6.4 Assumptions and limitations

6.4.1 The information presented here is based on the information from previous stages of design and assessment.

6.4.2 Buildings of local importance are not included within the Norfolk HER have not been considered to date. Further assessment will identify any such structures and will assess the impact and effect of the construction and operation of the Proposed Scheme upon them.

6.4.3 The assessment is based upon the DCO site boundary. Detailed design will be undertaken at a later stage and will include associated features such as, compound locations, drainage and landscaping. As such further development has the potential to alter the predicted effects of the construction and operation of the Proposed Scheme.

6.4.4 Information provided by HER can be limited because it depends on previous opportunities for research, fieldwork, and discovery. Where nothing of historic interest is shown in a particular area; this can be down to a lack of targeted research or investigation rather than the genuine absence of sub-surface archaeological deposits.

6.4.5 Documentary sources are rare before the medieval period, and many historic documents are inherently biased. Older primary sources often fail to accurately locate sites and interpretation can be subjective.

6.4.6 Where archaeological sites have been identified solely from aerial imagery without confirmation from archaeological excavation or supporting evidence in the form of find-spots etc., it is possible the interpretation may be revised in the light of further investigation.

6.4.7 Conclusions and recommendations may therefore be revised during the course of the EIA process on the basis of updated information following further research, survey, and investigation.

## 6.5 Guidance and best practice

6.5.1 The method for determining and appraising baseline conditions involved a desk-based study and was undertaken in accordance with the published standards and guidance set out below:

- DMRB Volume 11, Section 3, Part 2 Cultural Heritage
- Historic England (2008) Conservation Principles: Policies and Guidance
- Historic England (2015) Historic Environment Good Practice Advice in Planning Note 2 (GPA2) - Managing Significance in Decision-Taking in the Historic Environment
- Historic England (2015) Historic Environment Good Practice Advice on Planning Note 3 (GPA3) - The Setting of Heritage Assets,
- Standard and Guidance from the Chartered Institute of Archaeologists

## 6.6 Consultation

6.6.1 Non-statutory public consultation was undertaken between 13 March 2017 and 21 April 2017. Norfolk County Council requested a full historic environment implications assessment including a Heritage Statement and ‘full field evaluation'.

## 6.7 Potential effects, including monitoring and mitigation measures

### Construction

6.7.1 The Proposed Scheme has the potential to adversely affect designated and non-designated heritage assets during construction. Archaeological remains identified through geophysical survey, and any previously unrecorded buried

remains within the footprint of the Proposed Scheme, may be damaged or destroyed by construction excavation and other activities.

6.7.2 The placement of bunds, drainage assets, landscaping, compounds, haul roads and planting would take consideration of below-ground archaeological deposits, and preserving remains in-situ would be explored during the design process. Best practice measures to limit impacts on heritage assets would be employed during construction through the implementation of a CEMP.

### Operation

6.7.3 Below ground archaeological deposits will not be impacted by the operation of the Proposed Scheme. However, the improvements have the potential to impact to a varying degree on the setting of some heritage assets through changes in noise levels and visual impact of the movement of traffic. These would include the listed buildings / structures and the non-designated Burlingham Park.

### Summary

6.7.4 Table 6.2 provides a summary of the potential construction stage and operational effects upon heritage assets for the Proposed Scheme.

**Table 6.2: Summary of potential cultural heritage effects**

| Potential Construction Effects | Potential Operation Effects |
|---|---|
| Potential moderate adverse effect due to potential physical impact on archaeological remains.<br>Potential slight adverse effect as construction of the Proposed Scheme would potentially increase noise upon the settings of sensitive receptors due to faster traffic flow.<br>Potential slight adverse effect due to direct impact to the southern boundary of a non-designated historic park. | Potential adverse effects due to impacts on the setting of designated heritage assets. |

## 6.8 Proposed level and scope of assessment

6.8.1 Further assessment of the construction impacts will be necessary for the Proposed Scheme due to the potential for direct effects on grade I listed buildings, non-designated archaeological remains and a non-designated historic park. In addition, due to the presence of sensitive receptors within close proximity of the Proposed Scheme, further assessment of operational impacts is also required. Assessment will be undertaken to a Detailed level and will be used to inform an archaeological investigation strategy and subsequent archaeological works. All investigations will be based upon the regional research framework for the East of England (Medlycott, 2011).

## 6.9 Proposed methodology including significance

6.9.1 The assessment will consider all heritage assets, both designated and non-designated. These include listed buildings, non-designated below-ground archaeological remains, locally recorded historically important buildings, and historic landscapes. There are no scheduled monument, registered parks and gardens, registered battlefields, World Heritage Sites or conservation areas within the study area.

6.9.2 This assessment will consider both temporary and permanent construction and operational impacts on heritage assets. Temporary impacts will be classed as impacts on setting through construction-related activities; whereas permanent impacts can be either: physical impacts on the integrity of the asset; or impacts on the setting.

### Assessment of value / sensitivity

6.9.3 The value / sensitivity of historic environment receptors will be based upon Table 6.3. Assessment of value / sensitivity will be based on a combination of designated status and professional judgement. It will consider the Secretary of State's non-statutory criteria for the scheduling of ancient monuments, assessment criteria adopted by Historic England as part of the Monument Protection Programme (MPP), and the Secretary of State's Principles of Selection Criteria for Listed Buildings.

6.9.4 It will also recognise that occasionally some heritage assets have a lower or higher than normal value / sensitivity within a local context. Additionally; this assessment process should consider the component of the heritage asset that is being affected, and the ability of the heritage asset to absorb change without compromising the understanding or appreciation of the resource.

**Table 6.3: Criteria for assessing value / sensitivity**

| Value / Sensitivity | Typical criteria |
|---|---|
| Very High | World Heritage Sites, assets of acknowledged international importance, assets that can contribute significantly to acknowledged international research objectives. |
| High | Scheduled monuments, grade I and II* listed buildings, grade I and II* registered parks and gardens, registered battlefields, undesignated assets of schedulable quality, undesignated monuments, sites, or landscapes that can be shown to have specific nationally important qualities, and assets that can contribute significantly to national research objectives. |
| Medium | Grade II listed buildings, grade II registered parks and gardens, conservation areas, undesignated sites of high importance identified through research or survey, monuments or sites that can be shown to have important qualities in their fabric or historical association. |
| Low | Undesignated assets – monuments or archaeological sites with a local importance for education or cultural appreciation, and which add to local archaeological and historical research. Very badly damaged assets that are |

| Value / Sensitivity | Typical criteria |
|---|---|
| | of such poor quality that they cannot be classed as high or medium, parks and gardens of local interest. |
| Negligible | Heritage resources identified as being of little historic, evidential, aesthetic or communal interest resources whose importance is compromised by poor preservation or survival, or by contextual associations to justify inclusion into a higher grade. |

Source: Based on DMRB (Volume 11, Section 3. Part 2), 2007

### Assessment of magnitude of impact

6.9.5 The degree of impact to the heritage asset from the introduction of the Proposed Scheme will be assessed in accordance with the criteria presented in Table 6.4.

**Table 6.4: Criteria for assessing the magnitude of impact**

| Magnitude | Criteria |
|---|---|
| Major | Total loss or fundamental alteration to a heritage asset's significance and/or setting. Addition of new features that substantially alter the setting of a heritage asset. |
| Moderate | Partial loss or alteration a heritage asset's significance and/or setting. Addition of new features that partially alter setting of a heritage asset to the extent where the significance is impacted. |
| Minor | Minor loss of an element of a heritage asset and/or its setting. Addition of new features that form largely inconspicuous elements in the setting of a heritage asset to the extent that its significance is slightly impacted. |
| Negligible | Very minor loss of elements of a heritage asset and/or its setting. Addition of new features that do not alter the setting of a heritage asset. |
| No Change | No change to the heritage asset. |

Source: Based on DMRB (Volume 11, Section 3, Part 2), 2007

### Assessment of significance of effect

6.9.6 Effects will be evaluated by combining the assessment of both the value / sensitivity (heritage significance) of an asset, with the magnitude of the impact. This allows the prediction of the significance of the effect, as shown in Table 1.2. These effects can be beneficial or adverse temporary or permanent, depending on the nature of the development, the mitigation measures, and any enhancement measures proposed. In accordance with DMRB guidance, effects with an assessment of moderate and above are considered to be significant.

## 6.10 Conclusion

6.10.1 During construction, there is the potential for a direct effect upon the setting of: listed buildings, a non-designated historic park, to archaeological remains. Assessment of the construction impacts will therefore be necessary for the Proposed Scheme. In addition, due to the presence of sensitive receptors within

1km of the Proposed Scheme, assessment of operational impacts is also required.

6.10.2 Assessment to Detailed level will be undertaken and will be presented in the ES.

# 7 Landscape

## 7.1 Introduction

7.1.1 The Landscape and Visual Impact Assessment (LVIA) chapter of this Scoping Report aims to identify the potential for significant effects of the Proposed Scheme upon the surrounding landscape and visual receptors (consistent with the requirements of the DMRB Scoping Exercise process). This Chapter has been prepared with reference to DMRB Volume 11, Section 2, Part 4, DMRB Volume 11, Section 3, Part 5, IAN 135/10 and Institute of Environmental Management and Assessment 'Guidelines for Landscape and Visual Impact Assessment, Third Edition'. The potential requirement for assessment to either a Simple or Detailed level has been identified.

## 7.2 Study area

7.2.1 In recognition of the guidance given in DMRB Volume 11 Section 3 Part 5 Landscape Effects, the study area for the LVIA extends 1km from the Proposed Scheme limits. This has been limited to 1km due to the containing nature of the local topography and the existing vegetation cover, which limits the potential for wider effects. The study area will be extended for any receptors sitting outside of the 1km which have the capacity to experience significant effects as a result of the Proposed Scheme.

## 7.3 Existing and baseline knowledge

### Landscape character

7.3.1 The study area lies within National Character Area (NCA) 79; North East Norfolk and Flegg. The NCA comprises a generally flat, low-lying landscape. It has limited topographic variation and slopes gently from west to east, becoming flatter as it merges with the Broads. The area is notable for its deep, loamy, free draining and highly fertile soils which support productive arable farming. The rich agricultural land generally comprises small to medium scale fields which are bordered by high hedgerows and prominent hedgerow oaks. The area is also characterised by isolated farmsteads and small-nucleated villages with large medieval churches which are linked by a dense network of lanes.

7.3.2 In terms of local landscape character, the study area lies within the Broadlands District Council (BDC) Landscape Character Assessment 'Blofield Tributary Farmland' and 'Freethorpe Plateau Farmland' Landscape Character Areas (LCAs). The BDC landscape character assessment describes the Blofield Tributary Farmland LCA (which coincides with the western extents of the Proposed Scheme) as associating with a shelving and gently undulating landform, occasionally cut by small tributary valleys. Landcover is dominated by arable farmland, with medium to large fields bounded by hedgerows. Woodland cover typically associates with river corridors and the peripheries of settlements.

7.3.3 The eastern extents of the Proposed Scheme associate with the Freethorpe Plateau Farmland local LCA which is characterised by a flat, elevated landform that stands above the surrounding landscape. Landcover in the area is mainly arable farmland, with medium to large fields typically bounded by hedgerows, although many hedges have been lost due to the intensification of arable agriculture. Small woodland clumps of mixed or deciduous trees are infrequently scattered across the area. The landscape pattern of the area is therefore quite simple and open, allowing long distance views from several places.

7.3.4 Physical features in the immediate vicinity of the existing A47 corridor which contribute to the landscape character of the wider area include agricultural fields enclosed by hedgerows with mature trees and small areas of woodland. The existing A47 highway boundary is itself partially delineated by mature trees and hedgerows but also includes large sections of the route without notable vegetation cover.

7.3.5 There are no notable landscape designations associated with the Proposed Scheme study area.

**Visual amenity**

7.3.6 Towards the eastern extents of the study area the broad plateau topography and openness of the agricultural landscape affords extensive views across the area. Closer to Blofield and towards the western extents of the study area the rolling topography creates a more diverse visual experience with extensive views from high points and enclosed views associated with valley features. The extent of views across the landscape to the north of the Proposed Scheme are influenced by the partial screening effect of woodland and mature hedgerow trees.

7.3.7 The potential for views of the Proposed Scheme most notably associate with residential properties and users of the local Public Rights of Way (PRoW) network. The potential for views from residential properties includes the settlements of Blofield and Lingwood, the smaller grouping of residential properties at North Burlingham and a wider, dispersed pattern of individual properties and small hamlets spread extensively across the study area. Various PRoW footpaths and bridleways coincide with the extent of the study area, with notable concentrations of routes in the vicinity of Blofield, Lingwood and North Burlingham (those in the vicinity of Burlingham forming part of a signposted network of ‘Burlingham Woodland Walks’).

7.3.8 Views of the Proposed Scheme will also be experienced by users of the Church of St Andrew in North Burlingham, business users of Burlingham Business Centre and road users of the A47, B1140 and various minor roads within the extent of the study area.

## 7.4 Assumptions and limitations

7.4.1 The content of the EIA Scoping Report is based on a desk study and information gained from previous stages of design development and assessment.

7.4.2 Reference to landscape designation information and an analysis of the physical features of the local landscape have informed understanding of the likely sensitivity of the landscape character and visual receptors and the potential effects upon those assets.

## 7.5 Guidance and best practice

7.5.1 Guidance and best practice will be followed to industry standards, with particular reference to:

- DMRB Volume 11 Section 3 Part 5 Landscape Effects
- Interim Advice Note 135/10 (IAN 135/10) Landscape and Visual Effects Assessment
- Guidelines for Landscape and Visual Impact Assessment, Third Edition (Landscape Institute & IEMA, 2013)
- An Approach to Landscape Character Assessments (Natural England, 2014)

## 7.6 Consultation

7.6.1 Non-statutory public consultation on the options was undertaken in March and April 2017. Where relevant, points arising from this previous consultation stage will be taken into account in the development of mitigation measures for the Proposed Scheme.

7.6.2 Further consultation will be undertaken with statutory and non-statutory consultees as part of the formal application process. In particular, the Local Planning Authority and other relevant stakeholders will be consulted to; identify and agree key viewpoints to inform the assessment; consider the need for specific presentational material (such as photomontage) to assist understanding of the Proposed Scheme; review the methodology to ensure it robustly represents assessment of the potential effects of the Proposed Scheme provide comment on the landscape design and mitigation strategy to ensure landscape and visual effects are appropriately addressed within the design of the Proposed Scheme.

## 7.7 Potential effects, including monitoring and mitigation measures

### Construction

#### *Landscape effects*

7.7.1 The removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting (see Appendix C – Lighting Impact Assessment Methodology) would potentially result in a significant adverse impact on local landscape elements and character during construction.

#### *Visual effects*

7.7.2 The removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting, would potentially result in significant adverse visual effects on residential properties, PRoW users, local community facilities, and commercial and road users.

7.7.3 Receptors with potential to be adversely affected by the Proposed Scheme during construction include residential properties on the northern and eastern edges of Blofield, residential properties at North Burlingham and a number of residential properties dispersed across the area to the north and south of the existing A47. The potential for adverse effects would also extend to include recreational users of the local PRoW network, users of the Church of St Andrew in North Burlingham and business users of Burlingham Business Centre. There would also be the potential for adverse visual effects on road users of the A47, B1140 and other local minor roads within the study area.

### Operation

#### *Landscape effects*

7.7.4 At year 1 of operation the juvenile state of mitigation planting associated with the Proposed Scheme would potentially result in a significant adverse effect on landscape character due to the relative prominence of Proposed Scheme infrastructure (including highway and pedestrian overbridges) prior to the establishment of integrating Proposed Scheme mitigation planting. The adverse effect would also associate with the initial year 1 loss of mature tree and hedgerow landscape elements relative to the existing baseline and to the localised loss of agricultural land.

7.7.5 By year 15 of operation, the establishment of Proposed Scheme landscape mitigation would contribute to a reduction in the extent and significance of landscape effects. There would however remain the potential for residual not significant adverse landscape effects as an outcome of the relative increase in highway infrastructure associated with the junctions and highway overbridges within a relatively flat, open agricultural landscape.

### *Visual effects*

7.7.6 At year 1 of operation, prior to the establishment of Proposed Scheme landscape mitigation, there is potential for significant adverse visual effects associated with views of the road/highway infrastructure, including highway and pedestrian overbridges, and vehicles. Receptors with potential to be adversely affected by the Proposed Scheme during year 1 of operation include residential properties on the northern and eastern edges of Blofield, residential properties at North Burlingham and a number of residential properties dispersed across the area to the north and south of the existing A47. The potential for adverse effects would also extend to include recreational users of the local PRoW network, users of the Church of St Andrew in North Burlingham and business users of Burlingham Business Centre. There would also be the potential for adverse visual effects on road users of the A47, B1140 and other minor roads within the study area.

7.7.7 By year 15 of operation, the establishment of Proposed Scheme landscape mitigation would contribute to a reduction in the extent and significance of visual effects. There would however remain the potential for residual significant adverse visual effects on residential visual receptors on the northern and eastern edges of Blofield, a number of residential properties to the south of the existing A47 and recreational users of the local PRoW network.

7.7.8 There would also be potential for adverse night time visual effects as a result of the influence of vehicle headlights and scheme lighting on residential properties to the south of the Proposed Scheme where the proposed highway alignment extends the influence of vehicles beyond its current corridor. Night time lighting effects would potentially result in significant adverse visual effects at year 1 reducing to not significant adverse by year 15 following the establishment of Proposed Scheme mitigation planting.

## Summary

7.7.9 Table 7.1 provides a summary of the potential construction and operational effects of the Proposed Scheme upon the surrounding landscape and visual receptors.

**Table 7.1 Summary of potential landscape and visual effects**

| Potential Construction Effects | Potential Operation Effects |
|---|---|
| Landscape: Construction effects associated with the removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting. Potential significant adverse impact on local landscape elements and character. | Landscape: Year 1 – Operational significant adverse effects associated with a reduction in extent of tree and hedgerow cover, loss of agricultural land and prominence of highway infrastructure.<br>Year 15 – Operational not significant adverse effects associated with the relative increase in highway infrastructure associated with junctions and highway overbridges within a relatively flat, open agricultural landscape. |
| Visual: Construction effects associated with the removal of existing vegetation, | Visual: Year 1 – Operational effects associated with visibility of the road/highway infrastructure and |

| Potential Construction Effects | Potential Operation Effects |
|---|---|
| earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting. Potential significant adverse effects on residential properties on the northern and eastern edges of Blofield; residential properties at North Burlingham; a number of residential properties dispersed across the area to the north and south of the existing A47; recreational users of the local PRoW network; users of the Church of St Andrew in North Burlingham; business users of Burlingham Business Centre road users of the A47, B1140 and other minor roads within the study area. | vehicles. Potential significant adverse effects on residential properties on the northern and eastern edges of Blofield; residential properties at North Burlingham; a number of residential properties dispersed across the area to the north and south of the existing A47; recreational users of the local PRoW network; users of the Church of St Andrew in North Burlingham; business users of Burlingham Business Centre road users of the A47, B1140 and other minor roads within the study area. Potential significant adverse night time visual effects on residential receptors to the south of the Proposed Scheme as a result of the influence of vehicle headlights.<br>Year 15 – Operational effects associated with partial visibility of the road/highway infrastructure and vehicles. Potential significant adverse effects on residential receptors on the northern and eastern edges of Blofield, a number of residential properties to the south of the existing A47 and recreational users of the local PRoW network. Potential not significant adverse night time visual effects on residential receptors to the south of the Proposed Scheme as a result of the influence of vehicle headlights. |

## 7.8 Proposed level and scope of assessment

7.8.1 Given that significant effects upon both landscape character and visual amenity are likely for the Proposed Scheme during both construction and operation and the scale of the proposed works, the Proposed Scheme meets the criteria set out in IAN 135/10 Landscape and Visual Effects Assessment for a ‘Detailed’ level of assessment.

## 7.9 Proposed methodology including significance

7.9.1 No single prescribed methodology exists for assessing landscape and visual impact; however, the assessment will follow best practice guidelines as set out in Section 7.5.

7.9.2 A further desktop study and walkover survey will be undertaken to review and update the baseline information gathered in previous assessments. This will clarify both the study area and Zone of Theoretical Visibility (ZTV), and allow the project Landscape Architect to undertake a local Character Assessment to understand the Landscape Value and associated sensitivity to change of each character area.

7.9.3 The ZTV will be based upon the area from which the development will theoretically be visible to a person with a viewer height of 1.6m above ground

level. Digital Surface Model (DSM) data will be used to create the ZTV model. As outlined above the ZTV will be verified and refined during the site survey.

7.9.4 The significance of effect on the landscape character and its constituent elements will be determined by combining the sensitivity of the affected landscape with the magnitude of change attributable to the Proposed Scheme. The consideration of sensitivity will be determined by a combined judgement of the landscape's susceptibility and value.

7.9.5 The criteria for assessing landscape sensitivity is presented in Table 7.2 and the criteria for assessment of the magnitude of change is presented in Table 7.3.

**Table 7.2 Criteria for assessing landscape sensitivity**

| Sensitivity | Typical Descriptors |
|---|---|
| High | Landscapes, which by nature of their character, would be unable to accommodate change of the type proposed. Typically, these would be landscapes:<br>• With either a very simple or a very complex pattern.<br>• With limited presence of existing built features or linear infrastructure, including highways.<br>• Associating with areas of intimacy or tranquillity.<br>• Of high quality with distinctive elements and features making a positive contribution to character and sense of place.<br>• Likely to be designated e.g. National Park and Area of Outstanding Natural Beauty (AONB), but the aspects which underpin such value may also be present outside designated areas, especially at the local scale.<br>• Areas of special recognised value through use, perception or historic and cultural associations.<br>• Likely to contain features and elements that are rare and could not be replaced. |
| Medium | Landscapes, which by nature of their character, would be able to partly accommodate change of the type proposed. Typically, these would be landscapes:<br>• With a distinct, coherent pattern.<br>• With notable presence of existing built features or linear infrastructure, including highways.<br>• Associating with a broad sense of enclosure brought about by landform or vegetation cover.<br>• Comprised of commonplace elements and features creating generally unremarkable character but with some sense of place.<br>• Locally designated, or their value may be expressed through non-statutory local publications.<br>• Containing some features of value through use, perception or historic and cultural associations. |

| Sensitivity | Typical Descriptors |
|---|---|
| | • Likely to contain some features and elements that could not be replaced. |
| Low | Landscapes which by nature of their character would be able to accommodate change of the type proposed. Typically, these would be landscapes:<br>• Comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place.<br>• Not designated.<br>• Containing few, if any, features of value through use, perception or historic and cultural associations.<br>• Likely to contain few, if any, features and elements that could not be replaced. |

Source: Derived from IAN 135/10 with amendment

**Table 7.3 Criteria for assessing magnitude of landscape change**

| Magnitude | Description |
|---|---|
| Major Adverse | Total loss or large scale damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic conspicuous features and elements. |
| Moderate Adverse | Partial loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements. |
| Minor Adverse | Slight loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements. |
| Negligible or No Change | Barely perceptible change or no change to existing character or elements. |
| Minor Beneficial | Slight improvement to character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements. |
| Moderate Beneficial | Partial or noticeable improvement to character by the restoration of existing features and elements, and/or the removal of uncharacteristic and noticeable features and elements, or by the addition of new characteristic features. |
| Major Beneficial | Large scale improvement to character by the restoration of existing features and elements, and/or the removal of uncharacteristic and conspicuous features and elements, or by the addition of new distinctive features. |

Source: Derived from IAN 135/10 with amendment

7.9.6 Key visual receptors will be visited to identify the nature of existing view and the potential magnitude of change associated with the Proposed Scheme.

7.9.7 Visual Impact significance will be determined by combining the sensitivity of the visual receptor with the magnitude of change attributable to the Proposed Scheme. The consideration of sensitivity will be determined by a combined

judgement of a receptor's susceptibility and the value attached to a particular view.

7.9.8 The criteria for assessing visual sensitivity is presented in Table 7.4 and the criteria for assessment of the magnitude of change is presented in Table 7.5.

**Table 7.4 Criteria for assessing visual sensitivity**

| Sensitivity | Typical Receptors |
|---|---|
| High | Residential properties.<br>Users of PRoWs or other recreational trails (e.g. National Trails, footpaths, bridleways etc.).<br>Users of recreational facilities where the purpose of that recreation is enjoyment of the countryside (e.g. Country Parks, National Trust or other access land etc.).<br>Views with a value derived from association with a heritage asset or a planning designation or where associated with a literary or artistic point of reference. |
| Medium | Outdoor workers.<br>Users of scenic roads, railways or waterways or users of designated tourist routes.<br>Schools and other institutional buildings, and their outdoor areas. |
| Low | Indoor workers.<br>Users of main roads (e.g. trunk roads) or passengers in public transport on main arterial routes.<br>Users of recreational facilities where the purpose of that recreation is not related to the view (e.g. sports facilities). |

Source: Derived from IAN 135/10 wit amendment

**Table 7.5 Criteria for assessing magnitude of visual change**

| Magnitude | Description |
|---|---|
| Major Adverse | The Proposed Scheme, or a part of it, would become a dominant detracting feature or focal point within the view. |
| Moderate Adverse | The Proposed Scheme, or a part of it, would form a noticeable detracting feature or element within the view which would be readily apparent to the receptor. |
| Minor Adverse | The Proposed Scheme, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view. |
| Negligible or No Change | Barely perceptible change or no change to existing views. |
| Minor Beneficial | The Proposed Scheme would result in a perceptible enhancement of the view but would not alter the overall balance of features and elements that comprise the existing view. |
| Moderate Beneficial | The Proposed Scheme would result in a noticeable enhancement of the view which would be readily apparent to the receptor. |
| Major Beneficial | The Proposed Scheme would result in a prominent enhancement of the view and contribute to the defining focus or feature of the view. |

Source: Derived from IAN 135/10 with amendment

## 7.10 Conclusion

7.10.1 Given that significant effects upon both landscape character and visual amenity are likely for the Proposed Scheme during both construction and operation and the scale of the proposed works, the Proposed Scheme meets the criteria set out in IAN 135/10 Landscape and Visual Effects Assessment for a ‘Detailed’ level of assessment.

7.10.2 Assessment will be presented in the form of a Detailed LVIA within the ES.

# 8 Biodiversity

## 8.1 Introduction

8.1.1 This chapter presents the key ecological receptors within the footprint and surrounding areas of the Proposed Scheme. It has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, DMRB Volume 11, Section 3, Part 4, and IAN 130/10, to a Scoping Level, and where necessary, the requirement for assessment to either Simple or Detailed level will be identified. The potential impacts on these receptors as a result of the Proposed Scheme has also been assessed, and this will form the basis of any recommended further survey and assessment requirements, to determine the magnitude of impacts, the requirements for mitigation measures, and overall significance of effects. Where required, the assessment will be presented within the ES.

## 8.2 Study area

8.2.1 The study areas, identified in Table 8.1, have been used to gather information on ecological receptors that could be affected by the Proposed Scheme.

**Table 8.1 Study area boundaries for ecological receptors**

| Ecological Receptor | Boundary from Proposed Scheme |
|---|---|
| Internationally and nationally designated nature conservation sites, including Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar Sites, National Nature Reserves (NNR) and SSSIs (Site of Special Scientific Interest) | 2km |
| SACs designated for bat populations | 30km |
| Statutory sites designated for their bird interest | 10km |
| Locally designated nature conservation sites, including Local Nature Reserves (LNR), Local Wildlife Sites (LWS) and RSPB reserves | 2km |
| Habitat Suitability Index (HSI) assessments of waterbodies for Great Crested Newts (GCN) | 500m |
| Water vole and otter | 500m |
| Aquatic invertebrates from within wetland habitats | Direct impacts |
| Other preliminary ecological assessments including Phase 1 habitat survey, badger, reptiles, and breeding birds | 50m |

## 8.3 Existing and baseline knowledge

8.3.1 A number of nationally and locally designated sites occur within the study area, which are presented in Table 8.2.

**Table 8.2 Summary of existing baseline**

| Summary of Existing Baseline |
|---|
| • The Broads SAC 1.17km SW (from A47 at Brundall)<br>• Broadland SPA 1.17km SW (from A47 at Brundall)<br>• Broadland Ramsar 1.17km SW (from A47 at Brundall)<br>• Breydon Waters Ramsar 6.78km SE (from Acle on the A47)<br>• Breydon Waters SPA 6.78km SE (from Acle on the A47)<br>• Decoy Carr, Acle SSSI 0.6km S (from Acle on the A47)<br>• Paston Great Barn SAC designated for bat populations is located within 30km of the Proposed Scheme<br>• Lingwood Community Woodland 0.07km S (from A47 at Lingwood)<br>• Church & Drive Plantations County Wildlife Site (CWS) 0.14km N (from A47 at North Burlingham)<br>• Woodbastwick Road Roadside Nature Reserve (RNR) 0.29km N (from A47 at Blofield)<br>• Belt Plantation CWS 0.56km N (from A47 at North Burlingham)<br>• Howe's Meadow CWS 0.99km N (from A47 at Blofield)<br>• Acle Road RNR 1-1km N (from Acle on the A47)<br>• Birch Grove and Dawling's Wood CWS 1.39km NE (from A47 at Blofield)<br>• Damgate Wood CWS 1.42km S (from Acle on the A47)<br>• Highnoon Farm Braydeston CWS 1.60km N (from A47 on High Noon Lane)<br>• Land adjacent to Witton Lane CWS 1.65km N (from A47 at Yarmouth)<br>• Walsham Wood CWS 1.90km N (from A47 at Pedham)<br>• Long Lane RNR 2km SW (from Lingwood on the A47) |

8.3.2 An Extended Phase 1 Habitat survey was undertaken by two suitably qualified ecologists in April 2016 and updated in 2017, in order to assess the ecological importance of the site and determine the requirement for Phase 2 Surveys. The full findings of the surveys are reported in the A47 Blofield to North Burlingham Junction Stage 2 Preliminary Ecological Appraisal.

8.3.3 The survey work and desktop study identified suitable habitat for the following species:

- Bats
- Great crested newt
- Breeding birds
- Overwintering birds
- Badgers
- Reptiles
- Otters
- Water voles
- Aquatic invertebrates
- Terrestrial invertebrates
- Fungi
- Invasive species, both terrestrial and aquatic

8.3.4 Six Priority Habitats are recorded within the study area. These are: arable field margin, eutrophic standing water, hedgerows, lowland mixed deciduous woodland, traditional orchards and pond habitats.

8.3.5 The main habitat types recorded within the study area were arable, improved grassland, semi-improved grassland, broadleaved woodland, including semi-natural and plantation, mixed plantation woodland, hedgerows (including species-rich), scattered trees, standing water, tall ruderal, churchyard and cemeteries, allotments, dry ditches and scrub.

8.3.6 Surveys to date have taken place to support previous stages of design development and assessment. Surveys are also being carried out to inform the EIA, ultimately to inform production of the ES. These have taken place in 2016 and 2017, as detailed in Table 8.3.

**Table 8.3 Ecology surveys to date and ongoing**

| Survey | Dates Undertaken | Study Area (including areas not surveyed) | Survey Methodologies (methods, frequencies etc.) |
|---|---|---|---|
| Phase One Habitat Survey / Preliminary Ecological Appraisal | April 2016 | All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer. | JNCC's Handbook for Phase 1 Habitat Survey - a technique for environmental audit.<br>CIEEM's Guidelines for Preliminary Ecological Appraisal. |
| Phase 2 Botanical Surveys | June 2017 to July 2017 | | DAFOR |
| Tree surveys | June 2017 to July 2017 | | BS 5837:2012 |
| Fungi | September to October 2017 | | |
| Aquatic Invertebrates | June 2017 to August 2017 | | Drake et al (2007) |
| Terrestrial Invertebrates | June 2017 to October 2017 | | |
| Badgers | February 2017 and October 2017 | All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer. | Standard methodology [Harris et al (1989)].<br>Search for all field signs within the Study Area. Field signs include setts and other excavations, latrines, prints and paths, hairs, feeding evidence etc. |
| Bat Roost Appraisals | February 2017 | All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer. | All bat surveys have taken place in accordance with Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines, 3rd edition, Bat Conservation Trust. |

| Survey | Dates Undertaken | Study Area (including areas not surveyed) | Survey Methodologies (methods, frequencies etc.) |
|---|---|---|---|
| Bat Hibernacula surveys | February 2017 | | |
| Bat Emergence / Re-Entry Surveys | June 2017to August 2017 | All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer. | Emergence/Re-entry surveys for high habitat suitability/risk took place three times, for moderate suitability/risk two times, and for low suitability/risk once, in the period described. |
| Bat Activity Transect Surveys | June 2017 to October 2017 | | |
| Birds - Breeding | June 2017 to July 2017 | All accessible land within the footprint of the Proposed Scheme, plus a 100m buffer. | Bibby et al (2000)<br>Gilbert et al (1998)<br>Birds were recorded by walking, listening and scanning by eye and with binoculars.<br>Birds were considered to be breeding if singing, displaying, carrying nest material, nests or young found, repetitively alarmed adults, disturbance displaying, carrying food or in territorial dispute. |
| Birds – Breeding Raptor Surveys | July 2017 | | |
| Birds - Overwintering | January to March 2017<br>Surveys were undertaken on a monthly basis i.e. three surveys were undertaken through the above period. | All accessible land within the footprint of the Proposed Scheme, plus a 100m buffer. | As the breeding bird survey above.<br>As above, Birds were recorded by walking, listening, and scanning by eye and with binoculars.<br>All birds were recorded, regardless of the activity/behaviour. |
| Great Crested Newts | April to June 2017 | All ponds within 500m assessed. | English *Nature (2001)* Great Crested Newt: Mitigation Guidelines<br><br>Oldham R.S., Keeble J., Swan M.J.S. & Jeffcote M. (2000) Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*).<br><br>Biggs J et al 'Analytical and methodological development for |

| Survey | Dates Undertaken | Study Area (including areas not surveyed) | Survey Methodologies (methods, frequencies etc.) |
|---|---|---|---|
| | | | improved surveillance of the Great Crested Newt.<br>Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA. |
| Reptiles | October 2017 | All accessible land within the footprint of the Proposed Scheme, plus a 50m buffer. | Froglife (1999) Advice Sheet 10 and the Herpetofauna Workers' Manual (1998). Use of refugia to attract reptiles on site, manual searches of suitable refugia present on site, checks for signs of reptile activity including sloughed skins, burrows, egg laying sites etc. sustained visual observation of banks/other suitable habitat within the site. |
| Water Vole and Otter | February 2017 | All accessible, suitable habitat within the footprint of the Proposed Scheme, plus a 500m buffer. | Standard water vole survey methodologies of Strachan et al. (2011) and Dean et al. (2016), searching for field signs including latrine sites, feeding stations, lawns, prints and runways.<br>Standard otter survey methodology as identified in New Rivers and Wildlife Handbook, the Environment Agency's Fifth Otter Survey of England 2009-2010, and Monitoring the Otter Chanin, 2003). Surveys involved searching for spraints, footprints, feeding remains, slides and haul-outs, couches and holts. |
| Invasive Species surveys | No specific survey - invasive species have been identified during the PEA and as incidental sightings during other surveys | All accessible, suitable habitat within those areas surveys above. | By visual identification. |

8.3.7 Protected species surveys are currently being undertaken for a number of species. Surveys have identified the presence of great crested newts, overwintering birds, including several Schedule 1 species and badger activity.

8.3.8 Surveys are currently on-going for bats, water voles, otters, badgers, reptiles, breeding birds, overwintering birds, fungi, and aquatic and terrestrial invertebrates.

8.3.9 There are a number of hedgerows within the study area. Two hedgerows have been confirmed as meeting the criteria to be Important under The Hedgerow Regulations. Surveys of hedgerows are on-going.

8.3.10 Habitat Suitability Index assessments indicated that several ponds within a 500m radius of the junction were potentially suitable for breeding great crested newt *Triturus cristatus*. Subsequent eDNA surveys in 2016 returned five positive results and three indeterminate. In 2017, two additional ponds were found. These newly discovered ponds, and the ponds with a previous indeterminate eDNA result were subject to eDNA surveys in 2017.

8.3.11 All of the ponds with positive eDNA results were surveyed by bottle trapping, torching and searching for eggs. Two ponds were found to support a population of great crested newts. One pond (Pond 5a) tested positive using eDNA in 2017 but was subsequently filled in by the landowner. It is assumed that the positive eDNA result was a false positive. Pond 15 tested positive in 2016 but surveys in 2017 including bottle trapping and torching did not find any evidence of great crested newt presence. It is assumed that the 2016 eDNA result was a false positive and the species is likely absent from this pond.

8.3.12 The 2016 badger *Meles meles* survey identified two setts and badger field signs such as latrine sites and footprints throughout the study area. Subsequent surveys in early 2017 found one sett. It was not possible to access this sett to determine whether or not it was in use. Due to limitations such as access and vegetation not all areas could be fully assessed, therefore there may be additional setts within the survey area. Further badger surveys are being undertaken from September 2017. There is ample foraging habitats within the survey area including deciduous woodland and semi-improved grassland.

8.3.13 Otter *Lutra lutra* surveys were undertaken in February 2017. No signs of otter activity were found. The Rivers Bure and Yare offer suitable habitat along their lengths for otter and the Broads SAC lists otter as a qualifying feature of the designated site. However both rivers and the Broads SAC are over 1km from the extents of the four options and there is limited hydrological connectivity with the water bodies within this area. Within the extended Phase 1 survey area there were several semi-wet ditches, dykes and ponds that could provide suitable commuting and hunting habitat whilst otters are moving through the wider area but overall connectivity is considered to be limited.

8.3.14 Water vole *Arvicola amphibius* surveys in February 2017 found limited suitable habitat and no field signs. This survey was outside of the main survey season for water vole and additional surveys will be undertaken in 2018.

8.3.15 Records of water vole were returned from the Norfolk Biodiversity Information Service, including of a 2001 at Home Farm. The landowner has confirmed there had been water vole, at his property by Pond 41, for over a decade although no sightings noted within the last two years.

8.3.16 The extended Phase 1 survey identified 93 trees and six buildings with bat roost potential. No roosts have been found to date. The landscape is mainly arable with fields connected by hedgerows, lines of mature trees, grassland strips and pockets of woodland and scrub. The surrounding habitat provides moderate quality foraging habitats for various species. The open arable landscape offers habitat for species such as noctule *Nyctalus noctula* and common pipistrelle *Pipistrellus pipistrellus*, both likely to be present along field boundaries as well as in more open areas. The woodland areas have potential to accommodate a range of species in terms of foraging, commuting and roosting.

8.3.17 Three wintering bird surveys were undertaken, from January to March 2017. These only represent part of the overwintering season and additional surveys have been undertaken from November 2017 to ensure that adequate data is available. Two Schedule 1 species, fieldfare *Turdus pilaris* and redwing *Turdus iliacus* were observed on land within the study area. Potential impacts upon overwintering and breeding birds will considered as part of the HRA as well as in the ES Chapter.

8.3.18 There are 37 records of notable invertebrate species out of the two hundred and twenty-six species records held by Norfolk Biodiversity Information Service including; three species of butterfly, 33 species of moth, one Coleoptera, three Diptera and three bee species. These species are identified on the UKBAP, and under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (Sect. 41), with the exception of the stag beetle *Lucanus cervus* which is designated under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Terrestrial invertebrate surveys in 2017 will be used to inform any further assessment or mitigation requirements.

8.3.19 Desmoulin's whorl snail *Vertigo moulinsiana* is a qualifying feature of the adjacent Broads SAC and could be present within the project extents. However surveys to date have not found any evidence of the presence of this species. The Acle Straight, located to the east along the A47 just outside the survey area is the known location of little whirlpool ram's-horn snail *Anisus vorticulus*, an Annex II species and the only non-marine snail to be a European Protected Species. Highways England commissioned a study into the feasibility of conservation translocation of this species in and around the Acle to Great Yarmouth section of the A47. Any resident snails within the survey area may represent a significant proportion of the UK. Surveys are on-going for little whirlpool ram's-horn snail, to date no population has been found. Potential impacts upon both these species will considered as part of the HRA as well as in the ES Chapter.

8.3.20 No non-native invasive species have been found to date.

8.3.21 A Habitat Regulations Assessment Screening Report (HRA) was undertaken to determine whether any adverse impacts on Natura 2000 sites are likely as a result of the Proposed Scheme. It is considered that there the potential for an adverse impact on the habitats and species which are a qualifying reason for selection of some of the European sites due to the proximity of the Proposed Scheme and the mobility of some of the species.

8.3.22 The HRA screening determined that there was the potential for effects on the following sites:

- The Broads SAC
- Broadland SPA
- Broadland Ramsar
- Breydon Water SPA
- Breydon Water Ramsar
- Paston Great Barn SAC

8.3.23 Paston Great Barn is designated for bats. It has been scoped out of any further assessment due to distance from the Proposed Scheme and lack of connectivity.

8.3.24 There is the potential for likely significant effects upon overwintering birds, breeding birds, Desmoulin's whorl snail and little whirlpool ram's-horn snail during construction and/or operation. These could result in likely significant effects upon The Broads SAC, Broadland SPA, Broadland Ramsar, Breydon Water SPA and Breydon Water Ramsar.

## 8.4 Assumptions and limitations

8.4.1 It should be noted that the absence of certain protected or rare species from the Phase 1 Survey does not preclude their presence on a site. There is always the risk of protected or rare species being over-looked, either owing to the timing of the survey or the scarcity of the species at the site.

8.4.2 Ecological surveys are on-going and where undertaken field surveys were confined to locations where landowner permission has been obtained. Surveys will continue throughout 2018 with access sought to areas previously unsurveyed.

8.4.3 A number of the detailed surveys were started late in the season (mid-July), meaning that only half a season of data is available. To provide robustness to these surveys, it is intended to continue early season surveys in 2018 (as described below) to ensure that the sufficient surveys effort has been undertaken, and that surveys at the sensitive early part of the season are included for assessment.

8.4.4 The current programme is such that the surveys undertaken during the first half of 2018 will be used alongside those surveys already completed in 2016 and 2017, to inform the production of the ES. Surveys will continue through 2018 to inform a robust baseline against with future monitoring can take place, and to inform any European Protected Species (EPS) licences that would be required.

## 8.5 Guidance and best practice

8.5.1 Assessment will be undertaken in accordance with the following guidance, and targeted surveys for protected species will be necessary as part of this assessment:

- DMRB Volume 11 Section 3 Part 4 Ecology and Nature Conservation
- HA (2010) IAN 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment
- Chartered Institute of Ecology and Environmental Management (CIEEM) (2016) Guidelines for Ecological Impact Assessment in the UK
- CIEEM Sources of Survey Methods

## 8.6 Consultation

8.6.1 Detailed consultations have yet to be undertaken with various statutory and non-statutory bodies including Natural England, Environment Agency, Norfolk County Council, Norfolk Wildlife Trust and the RSPB. These organisations will need to be consulted fully during the EIA process and their responses will be included in the associated reporting.

8.6.2 Consultation with other groups may also be required, including:

- Local wildlife organisations and groups
- Landowners

## 8.7 Potential effects, including monitoring and mitigation measures

### Construction

8.7.1 Due to the proximity of designated sites to the Proposed Scheme (see Table 8.2 and Figures B.1 and B.2 in Appendix B), appropriate avoidance measures, mitigation and compensation will be assessed in detail with the final design.

8.7.2 Design mitigation for International and European designated sites (Broadlands SAC, Broadland SPA, Broadland Ramsar, Breydon Water SPA, Breydon Water Ramsar) includes, for example, timing of works to avoid sensitive periods for the qualifying features such as overwintering birds. This will also apply to designated sites of National importance (Decoy Carr, Acle SSSI), where direct impacts that cannot be avoided may be mitigated by habitat replacement and habitat improvement.

8.7.3 There is the potential for likely significant effects during species included within the Natura 2000 site citations. Changes in hydrology could impact Desmoulin's whorl snail or little whirlpool ram's-horn snail. Construction can result in noise and other disturbance to both overwintering and breeding birds. Direct loss of habitat and foraging areas can result in loss of roosting sites and reduced reproductive success. The impact may be mitigated by the implementation pollution control measures, designing the Proposed Scheme to ensure there are

no changes to hydrology, sensitive timing of construction and habitat enhancement or replacement. However, there is still the potential for impacts to be significant and further surveys are being undertaken in 2018 to inform the HRA and appropriate mitigation.

8.7.4 There is the potential for a direct loss or severance of habitats of value to overwintering, foraging and roosting birds, as suitable grassland, arable land and woodland is present along the route. These may be subject to increased noise disturbance during operation of the Proposed Scheme and an increased risk of collision. This has the potential to be significant and will be assessed in the ES Chapter and HRA.

8.7.5 The Proposed Scheme is not anticipated to directly or indirectly impact any CWS or regional Nature Reserves (RNR). It passes close to Belt Plantation CWS but would not have a direct impact, such as land take. Any indirect impacts, such as increased disturbance or pollutant deposition, are expected to be negligible.

8.7.6 There may be a direct impact upon Lingwood Community Woodland due to land take and associated habitat loss**.** This may be characterised as a significant negative impact. The impact may be mitigated by measures such as:

- habitat replacement and / or habitat improvement
- improving connectivity of habitat
- timing of works to avoid sensitive periods for associated species (e.g. breeding birds)

8.7.7 Appropriate mitigation and compensation for impacted habitats will be assessed in more detail with the final design and will be reported in the ES. However, mitigation is likely to include habitat replacement where priority habitat is directly impacted by land-take. Impacts on running water habitats and aquatic species (i.e. the ditches on the Arcle Straight) and Desmoulin's whorl snail may be mitigated against by adhering to pollution prevention measures identified in Chapter 13 Road Drainage and the Water Environment.

8.7.8 During the construction phase, vegetation clearance is likely to be required for Proposed Scheme. This would directly reduce and fragment the available terrestrial habitat for species, such as badgers, reptiles, otters, bats, terrestrial invertebrates and breeding and overwintering birds. Removal of trees could result in the loss of identified bat roosts.

8.7.9 Construction could result in the loss of badger setts, severance of badger paths, loss of foraging areas and increased mortality from road collisions. Badger surveys are on-going and appropriate mitigation will be included in the ES Chapter, this may include replacement setts, badger fencing and badger underpasses.

8.7.10 Construction will result in direct loss of woodland and scrub habitat that is used by a variety of common and widespread breeding species recorded during the surveys. It may also result in noise and other disturbance to species of

conservation concern and Schedule 1 birds observed overwintering within the study area. This is likely to result in a significant impact.

8.7.11 Specific bat mitigation will likely be required to some extent dependant on the final design and impacts, this may include creating, restoring or improving roosts (bat boxes, bat bricks in new or existing structures) or creating, restoring or enhancing habitat to facilitate foraging and/or commuting. Any loss of bat roosts will require appropriate mitigation and licensing from Natural England.

8.7.12 No direct loss of great crested newt breeding ponds is anticipated. The Proposed Scheme will result in destruction of suitable great crested newt terrestrial habitat and potential hibernacula and could result in fragmentation of the metapopulation. Great crested newt surveys will be undertaken in spring 2018 to inform, together with the 2016 and 2017 results, any requirement for licensing. At this stage, the impact upon great crested newt has been assessed as low minor negative.

8.7.13 Development adjacent to the wet ditches and other watercourses has the potential to impact water voles, otter, breeding and overwintering birds, and aquatic and terrestrial invertebrates.

8.7.14 Construction impacts may include increased risk of a pollution incident, such as contaminated land run off or spills/leaks of oils and fuels, and increased airborne pollutants into adjacent habitats which support these species. Changes in the drainage condition have the potential to have a negative impact upon impact aquatic vegetation, aquatic invertebrates, otters and water voles.

8.7.15 Any night-time works required may directly disturb nocturnal species such as bats and badgers as a result of increased lighting pollution, noise and vibration. This disturbance could potentially contribute to the displacement of this species from the area. During construction, if works are to take place during the night, any lighting required should be managed to avoid spill onto ecological features (note Appendix C – Lighting Impact Assessment methodology). The impact can be minimised through the use of hoods, cowls or shields to prevent back spill. Additional best practice measures would also be included within and implemented through a CEMP so as to manage and minimise adverse construction stage effects. Measures could include the presence of an ecological clerk of works, toolbox talks, the sensitive timing of works and phased, supervised vegetation clearance. Licences granted from Natural England with respect to protected species may also be required.

**Operation**

8.7.16 Impacts on the qualifying species of sites of International and National importance during operations are possible. This may include an increased risk of bird collision with traffic, increased levels of disturbance to wintering and breeding birds and loss of and severance of foraging habitat, including areas used by marsh and hen harriers. These impacts may be moderate minor negative.

8.7.17 Once operational the Proposed Scheme would result in the permanent loss and potential severance of habitats of biodiversity value such as broad-leaved plantation woodland, arable field margins and hedgerows. In the absence of mitigation, the permanent loss of habitat suitable for protected species has the potential to adversely affect individual species and their conservation status. As a result, it is anticipated that there is the potential for moderate intermediate negative effects upon nature conservation features once operational which warrants assessment and the development of mitigation measures. Such measures to minimise effects and to ensure that there is no net loss of biodiversity would be incorporated within the Proposed Scheme design and reported in the ES as appropriate. This could include the following measures:

- Habitat recreation and enhancement
- An appropriate ecological design
- An appropriate option design to ensure that irreplaceable features are avoided or fully compensated

8.7.18 There are also likely to be impacts during the operational phase as a result of any proposed new lighting or changes to existing lighting. This may result in adverse impacts upon the potential bat roosts or foraging routes and otter or badger activity. The preliminary lighting design will conform to maximum allowable obtrusive lighting levels and will provide recommended luminaire types, mounting heights and angles for use within various areas of the Proposed Scheme. The scale of this impact is not expected to be significant with these measures in place.

## 8.8 Proposed level and scope of assessment

8.8.1 It is proposed that a number of protected species surveys will be undertaken, for the following reasons:

- Preparation of the Biodiversity chapter of the ES.
- To inform any necessary European Protected Species (EPS) licence applications (and preceding ghost EPS license applications to support the DCO application process).
- To inform the production of the HRA.
- To inform the inclusion of suitable mitigation measures within the Proposed Scheme design.
- To provide up-to-date ecological data on which construction-phase and post-construction monitoring can be based.

8.8.2 Building on the information provided in Table 8.3, detailing completed and ongoing ecological surveys, it is proposed that the following surveys take place in 2018:

### Phase 1 Habitat Survey

8.8.3 This will take place to update existing survey data, to the geographical extents used to date. This will take place in spring 2018.

### Badgers

8.8.4 This will take place to update existing survey data. Badgers are a mobile species, and there would be implications for careful consideration should they be found in the study area. This will take place in spring 2018.

### Bats

8.8.5 A number of bat surveys will take place to update the existing survey data and monitor activity at the known roost sites. It is proposed that emergence/re-entry surveys would be carried out for high and medium potential trees, and high, medium and low potential buildings and structures. These surveys would take place between May and August 2018 and May and August 2019.

8.8.6 In addition, monthly transects and the associated static monitoring would take place, between May and September 2018.

8.8.7 All surveys will be to the BCT guidelines as detailed below as a minimum, with additional surveys proportional to the factors that the EPS Licence application will consider.

### Overwintering birds

8.8.8 Overwintering bird surveys are proposed to take place over winter of 2017 and 2018. They began in October 2017, taking place monthly for six months. The survey methodology (times, durations, survey locations, recording methods, acceptable weather conditions etc.) would replicate that used to date.

### Breeding birds

8.8.9 Breeding bird surveys will be undertaken from March 2018 to August 2018. Surveys in 2017 commenced in July. This will only provide limited data as it was very late in the season. Surveys throughout the bird breeding season are proposed to inform mitigation and the HRA.

### Great crested newt

8.8.10 Great crested newt populations have been confirmed as present in two ponds. These ponds will be surveyed from March to July 2018 to inform appropriate mitigation and any licensing.

### Water voles and otters

8.8.11 The mobile nature of these species (particularly otter), the high levels of protection, and the need for dedicated mitigation and potential licensing means that surveys will be carried out from April to September 2018.

8.8.12 It is not proposed to carry out the following surveys:

- Phase 2 Botanical Surveys – survey data is unlikely to change. Limited flora communities, of low to moderate ecological value only.
- Aquatic invertebrate surveys – It is assumed that the survey data from the 2017 surveys will be sufficient to inform the ES. Communities not likely to change/move in any significant way.
- Hedgerow surveys – It is assumed that the survey data from the 2017 survey will be sufficient to inform the ES.
- Reptiles – It is assumed that the survey data from the 2017 surveys will be sufficient to inform the ES and allow accurate assessment of impacts to be made.
- Terrestrial invertebrate surveys – as with the aquatic invertebrates, it is assumed that the survey data from the 2017 surveys will be sufficient to inform the ES so no further surveys are proposed.

### Survey methodologies

8.8.13 All protected species surveys proposed for 2018 onwards will be to the standard methodologies as described of those that have already taken place, as described in Table 8.3.

8.8.14 In addition, and where relevant, surveys will draw on the Ecological Impact Assessment methodology set out in the Guidelines for Ecological Impact Assessment in the UK and Ireland, Terrestrial, Freshwater and Coastal, Second Edition (January 2016).

### Evaluation of effects

8.8.15 Potential impacts arising from the Proposed Scheme will be addressed: direct or indirect, temporary, short term or long-term, and the effects of any environmental mitigation measures including alterations to the Proposed Scheme design will also be considered.

8.8.16 Impacts will be assessed for all ecological features (species, habitats and designated sites) identified during the assessment which are considered to be significant.

8.8.17 The significance of any impacts will be based on the consideration of the nature conservation value of the features (Table 8.4) and the magnitude of the impact on them (Table 8.5). These will be combined to give an overall appraisal category in the ES (Table 1.2).

**Table 8.4 Criteria for determining nature conservation value of features**

| Value | Criteria | Examples |
|---|---|---|
| Very High | High importance and rarity, international scale and limited potential for substitution | An internationally designated site or candidate site;<br>A viable area of a habitat type listed in Annex I of the Habitats Directive, or smaller areas of such habitat which are essential to maintain the viability of a larger whole<br>Any regularly occurring population of an internationally important species, which is threatened or rare in the UK i.e. UK BAP, red data book species. |
| High | High importance and rarity, national scale, or regional scale with limited potential for substitution | A nationally designated site or a discrete area, which meets the published selection criteria for national designation, including:<br>• Ancient woodland on Natural England register.<br>• A viable area of a priority habitat identified in the UK BAP.<br>• Any regularly occurring population of a nationally or regionally important species which is threatened or rare in the county (local BAP). |
| Medium | High or medium importance and rarity, local or regional scale, and limited potential for substitution | Any regularly occurring, locally and regionally significant population of a species listed as being nationally scarce.<br>Any County and other sites which the designating authority has determined meet the published ecological selection criteria for designation, including county wildlife sites.<br>A regularly occurring, locally significant number of a County and regional important species. |
| Low | Low or medium importance and rarity, local scale | A diverse and/or ecologically valuable hedgerow network<br>Local designated sites including Roadside Nature Reserves. |
| Negligible | Very low importance and rarity, local scale | Other sites, species or habitats with little or no local biodiversity and earth heritage interest. |

**Table 8.5 Criteria for determining magnitude of impact**

| Magnitude | Criteria |
|---|---|
| Major negative | The proposal (either on its own or with other proposals) may adversely affect the integrity of the site, in terms of the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest. |
| Intermediate negative | The site's integrity will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. However, if, in the light of full information, it cannot be clearly demonstrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as major negative. |
| Minor negative | Neither of the above apply, but some minor negative impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available). |
| Neutral | No observable impact in either direction. |
| Positive | Impacts which provide a net gain for wildlife overall. |

8.8.18 The significance of the impacts will be ascertained using the criteria listed in Table 8.6.

**Table 8.6 Description of the significance of effect categories**

| Significance category | Typical description of effect |
|---|---|
| Very Large | Only adverse effects are normally assigned this level of significance. They represent key factors in eth decision making process. These effects are generally, but not exclusively, associated with sites or features of international importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category. |
| Large | These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process. |
| Moderate | These beneficial or adverse effects may be important, but are unlikely to be highly important to the decision-making factors. The cumulative effects of such factors may influence the decision making if they lead to an increase in the overall adverse effect on a particular resource or receptor. |
| Slight | These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project. |
| Neutral | No effects or those that are beneath levels of perception, within normal bounds of variation or with the margin of forecasting error. |

8.8.19 The significance of the impacts will be considered during the following phases of the project:

### Construction phase

8.8.20 This will take account of the operations required to construct the Proposed Scheme including the potential sites for Contractors' compounds, haul routes as well as borrow and disposal areas.

### Operational phase

8.8.21 This will look at the land take required to construct the project together with any drainage and other ancillary works. It will consider the impact of traffic and other related effects on the designated sites, habitat and species. The ongoing, long term maintenance requirements and actions will also be considered.

8.8.22 Assessments for the operational phase will include one for the opening year of the Proposed Scheme, and one for the design year, 15 years after opening. This will allow any changes in impacts to be identified. For example, this will consider the establishment of any habitat created as part of the Proposed Scheme, which is unlikely to be functioning at opening year, but by 15 years will be maturing well, and becoming well used by protected and other species.

8.8.23 Similarly, it is likely that traffic flows will change between opening year and design year, with a corresponding potential change in impacts. As with above,

the two assessments will draw out any changes in the magnitude of impacts etc.

8.8.24 Table 8.7 provides a summary of potential construction and operational effects for biodiversity for the Proposed Scheme.

**Table 8.7 Summary of potential biodiversity effects**

| Potential Construction Effects | Potential Operation Effects |
|---|---|
| Potentially significant direct and indirect impacts to protected species, designated sites and sensitive habitats. | Potentially significant direct and indirect impacts to protected species, designated sites and sensitive habitats. |

8.8.25 The scope of the works and the potential significance of direct and indirect effects warrants assessment to a Detailed level, in accordance with IAN 130/10, as there is potential to cause disruption to protected species, designated sites and sensitive habitats as a result of the Proposed Scheme.

## 8.9 Proposed methodology including significance

8.9.1 The survey and assessment would be undertaken in line with best practice guidelines as recommended by the Chartered Institute of Ecology and Environmental Management (CIEEM), which coincide with the recommended approaches to survey methodologies detailed in the DMRB, Volume 11, Section 3, Chapter 7, parts 7.9-7.19. Exceptions may occur in circumstances where professional judgement is used to select an alternative methodology deemed to be more suitable for this particular site, if approved or suggested by the relevant consultees.

8.9.2 The published CIEEM guidelines (CIEEM, 2016) utilise an approach to valuing ecological features that involves the use of professional judgment, based on available guidance and information, together with advice from experts who know the area in which the study area sits and/or the distribution and status of the features that are being considered. Significance of effects would be assessed in accordance with DMRB guidance, which also relies on professional judgment and the advice and views of appropriate statutory agencies and other consultees on local ecological status, in its approach to assigning value.

## 8.10 Conclusion

8.10.1 There is potential for significant direct and indirect effects to protected species, designated sites, and sensitive habitats as a result of the Proposed Scheme. Subsequently, this warrants assessment to a Detailed level, in accordance with IAN 130/10.

8.10.2 This assessment will be presented within the ES.

# 9 Geology & Soils

## 9.1 Introduction

9.1.1 This chapter assesses the geology and soils issues (including contaminated land) which may impact, or may be impacted by, the construction and operation of the proposed scheme. This Chapter has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, DMRB Volume 11, Section 3, Part 11, to a Scoping Level. The Proposed Scheme could have an impact upon both the geology and soils of the area, and constraints could be imposed on Proposed Scheme construction as a result of existing ground conditions. The potential requirement for assessment to either Simple or Detailed level will therefore be identified. Where required, this will be presented within the ES.

9.1.2 The effects of the Proposed Scheme upon agricultural land have been assessed in Chapter 12 People and Communities and are not considered in this chapter.

## 9.2 Study area

9.2.1 The study area for this assessment considers all locations where physical works and ground disturbance would take place, and in addition extends to 1km beyond this in order to identify any past pollution incidents which may have affected soil within the works area.

## 9.3 Existing and baseline knowledge

9.3.1 Sources of information used in this Chapter include previous reporting, historical and geological mapping and online data sources. Key sources used include:

- Environmental Constraints Plan (refer to Appendix B).
- Road Investment Strategy East Area 6 Geotechnical Preliminary Sources Study Report, A47 Blofield to North Burlingham (Document Ref: A47IMPS2-AMY-BB-ZZ-DO-J0049) (AMEY 2017).
- A47 Improvements Programme – Blofield to N Burlingham Dualling Scheme Addendum Preliminary Sources Study Report (Document Ref: HEBLOFLD-MMSJV-HGT-000-RP-CE-00001) (HAGDMS: 29915) (MMSJV 2017).
- Envirocheck Report (Landmark, 2017).
- Unexploded ordnance (UXO) detailed threat and risk assessment (HAGDMS:29967) (6ALPHA, 2017).

9.3.2 Baseline data for the Proposed Scheme can be found in Table 9.1.

**Table 9.1 Baseline data**

<table>
<tr><th>Aspect</th><th colspan="3">Details</th></tr>
<tr><td>Geology</td><td colspan="3">Solid Geology - The solid geology comprises shelly sand / gravel of the Crag Group throughout the Proposed Scheme extents. This is reported to attain a maximum thickness of 70m and no faults are indicated within the Proposed Scheme extents.<br><br>The Crag Group is underlain by the ‘Upper Chalk Group’ at the western end of the site (this term is obsolete pending upgrade according to the BGS lexicon). At the eastern end the Crag Group is underlain by the Ormesby Clay which in turn is underlain by the ‘Upper Chalk Group’.<br><br>Solid geology is generally not exposed directly below or in close proximity to the Proposed Scheme. Superficial deposits are, however, absent to the south of the proposed alignment at Waterlow on Hemblington Road. The Crag Group strata are exposed here within a north east – south west trending topographic hollow at the proposed location of a road drain pipe corridor extending to the Run Dike.<br><br>Superficial Deposits – The natural superficial deposits comprise a succession of till diamicton and sands / gravels of glacial origin. These deposits are the Lowestoft Formation and the Happisburgh Glacigenic Formation.<br><br>Localised made ground and worked ground are shown on the published geological maps directly below the route or in close proximity.<br><br>The distribution of the superficial deposits beneath the route is variable. A summary is provided below. Note chainages (ch) are taken from the preferred route announcement design, also used in the PSSR.<br><br>
<table>
<tr><th>Stratum</th><th>Starting Chainage (ch)</th><th>Ending Chainage</th><th>Length (m)</th><th>Length total (m)</th></tr>
<tr><td>Lowestoft Formation – Diamicton</td><td>ch0<br>ch900</td><td>ch420<br>ch5200</td><td>420<br>4300</td><td>4,720</td></tr>
<tr><td>Happisburgh Glacigenic Formation-Sand</td><td>ch420<br>ch630</td><td>ch450<br>ch670</td><td>30<br>40</td><td>70</td></tr>
<tr><td>Happisburgh Glacigenic Formation - Diamicton</td><td>ch450<br>ch670</td><td>ch630<br>ch900</td><td>180<br>230</td><td>410</td></tr>
<tr><td>Made Ground</td><td>ch4900</td><td>ch5200</td><td>300</td><td>300</td></tr>
</table></td></tr>
<tr><td rowspan="3">Sites of Geological Interest<br><br>Sites of Geological Interest</td><td>Historic Quarrying</td><td colspan="2">Disused sand and gravel pits in close proximity to the route are in evidence on historical Ordnance Survey maps.</td></tr>
<tr><td>Local geological Sites</td><td colspan="2">There are no Sites of Special Scientific Interest (SSSI) or Geological Conservation Review Sites within the study area.</td></tr>
<tr><td>BGS Recorded Mineral Sites</td><td colspan="2">According to the Envirocheck report, two BGS Recorded Mineral Sites (disused) are within 250m of the route at ch1450 and ch1700.<br>There are no active mines or quarries within the study area.</td></tr>
</table>

| Aspect | Details | |
|---|---|---|
| | | Norfolk predominately extracts material from the extensive sand and gravel deposits which can be up to 40m thick. These deposits are typically worked for aggregate material. |
| Hydrogeology | The study area is underlain by the Crag Group which is designated as a Principal Aquifer. Principal Aquifers are defined as aquifers that "support water supply and/or river base flow on a strategic scale."<br><br>The Happisburgh Glacigenic Formation (Sand) is designated as a Secondary 'A' aquifer. The western extent of the site (from Ch.0 to Ch.1350) is classified as an area susceptible to groundwater flooding which roughly coincides with the Happisburgh Glacigenic Formation (Sand) deposits.<br><br>Secondary 'A' aquifers are defined as "permeable layers capable of supporting water supplies at local rather than strategic scale".<br><br>The Happisburgh Glacigenic Formation (Diamicton) and the Lowestoft Formation (Diamicton) are designated as unproductive strata. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow;<br><br><u>Groundwater Vulnerability</u><br>Groundwater vulnerability varies across the study area. The majority of the route is classified in terms of aquifer vulnerability as "Major Aquifer High", and is generally associated with superficial cover of Lowesoft Formation and Happisburgh Glacigenic Formation represented by sand and diamicton.<br><br>Smaller areas of intermediate vulnerability are located in the west and east ends of the Proposed Scheme.<br><br><u>Water Abstraction and Source Protection Zones</u><br>The Environment Agency website identifies three medium sized groundwater abstraction licenses in proximity of the existing A47 Road. The western extent of the route falls within a Total Catchment (Zone 3).<br><br>See Chapter 13 Road Drainage and the Water Environment for more information. | |
| Hydrology | <u>Surface Water Features</u><br>No river is indicated to cross the Proposed Scheme extents and the risk of flooding from river and sea is considered low.<br><br>Within proximity of the route there are two watercourses – Run Dike (1,000m south of Blofield Bypass) and Witton Run (1,500m west of Blofield Junction). | |

| Aspect | Details |
|---|---|
| | The south-easterly flowing River Yare is located approximately 2.6km south-west of the site.<br><br>Two ponds are located on the route at Ch.2210 and 2810.<br><br><u>Surface Water Abstractions</u><br>There are no abstractions from surface water sources along the route identified on the Environment Agency website.<br><br>See Chapter 13 Road Drainage and the Water Environment for more information. |
| Soil Survey | The MAGIC online map viewer provides information for the soil types present along the proposed route. The route is entirely underlain by one soil type - freely draining slightly acid loamy soils of low fertility (type 6).<br><br>The land cover is mostly arable and grassland; Natural England's agricultural classification map shows the surrounding farmland is classified as either Grade 1 (Excellent) or Grade 2 (Very Good).<br><br>See Chapter 12 People and Communities for more information. |
| Landfill Records | No former or existing landfills have been identified on or adjacent to the proposed route. |
| Current Land Use and Man Made Features | The existing A47 road infrastructure is the most prominent man-made feature which exists within sections of the footprint of the proposed route. The majority of the route lies within undeveloped agricultural land. |
| Route History | The area is generally bounded by farmland hamlets and villages. Apart from the expansion of the villages around the site, the area has not changed significantly during the period covered by the available historical information.<br><br>The UXO Threat and Risk Assessment report by 6 Alpha Associates for the study site has rated the overall risk to the site between Blofield and Lingwood and Burlingham as 'very high'. |
| Potential Contamination Risks | No site-specific baseline land quality data has been obtained for the PSSR.<br><br>Recorded environmental impacts on controlled waters are related to release of pollutants derived from agricultural land use (slurry, milk, manure etc.) and the existing A47.<br><br>The Envirocheck report records one pollution incident associated with spillage of vehicle fuel due to a collision on the A47 in 1998 at approximate Ch.2600. It is also possible that minor leaks and spillages of fuel at off-site farms and works, where stored in bulk tanks, may have locally impacted soil and groundwater without giving rise to reported pollution incidents.<br><br>The information reviewed has also highlighted the potential for land affected by contamination to be present at discrete locations within the study area; historical mineral working at pits along the route alignment have a potential to give rise to localised soil and groundwater contamination. |

| Aspect | Details |
|---|---|
| | Two garages in the site vicinity are considered to be located remote from the proposed works and, therefore, unlikely to represent a plausible risk.<br><br>It is noted that the Envirocheck report does not reference any notifications for land which has been formally determined as 'Contaminated Land' by the local authorities in the area under consideration.<br><br>The potential environmental risks above 'low' associated with possible localised extant on-site sources of contamination comprise:<br><br>• Potential risks to road construction and maintenance workers are considered to be moderate/low due to the higher likelihood of workers coming into contact with potential localised contamination sources during in-ground works. However the adoption of site health and safety measures may reduce this risk further.<br>• Potential risks to groundwater are considered to be moderate/low.<br><br>This assessment excludes potential acute risks presented by UXO. |

## 9.4 Assumptions and limitations

9.4.1 The baseline information on the Proposed Scheme has been based on a desk study of currently available information at the time of writing.

9.4.2 To the extent that this section is based on information supplied by other parties, it has been assumed that this information is complete and correct. All sources used have been listed within the section 9.3.

9.4.3 Reported baseline conditions from site walkovers have been assumed to be accurate, however owing to the dynamic nature of the environment, conditions may change during the construction and operational phases.

9.4.4 To the extent that this Chapter uses information obtained from a Ground Investigation (GI), persons using or relying on it should recognise that any such investigation can examine only a fraction of the subsurface conditions.

9.4.5 In relation to contaminated land, mapping and site walkovers may not always identify small areas of historic/hidden contamination and there is the potential for previously unidentified contamination to be encountered during the construction process.

9.4.6 A geotechnical GI will need to be undertaken to confirm the ground conditions in the vicinity of the Proposed Scheme. This can additionally establish whether any contamination is present in near surface soils.

9.4.7 The assessment of potential impacts on groundwater resources is not considered in this section; please refer to Chapter 13.

9.4.8 The effects of the Proposed Scheme upon agricultural land have been assessed in Chapter 12 People and Communities and are not considered in this section.

9.4.9 A very high risk has been attributed to UXO. This is excluded for the purposes of environmental impact assessment but will be a significant consideration in the planning and execution of the proposed geotechnical ground investigation.

## 9.5 Guidance and best practice

9.5.1 The assessment will be undertaken in accordance with the published standards and guidance, with particular reference to:

- DMRB Volume 11 Section 3 Part 11 Geology and Soils
- Environmental Protection Act 1990 (as amended by the Environment Act 1995)
- Environmental Protection (Duty of Care) Regulations 1991 (as amended 2003)

## 9.6 Consultation

9.6.1 The proposed works are not considered to warrant specific consultation in respect of land quality issues i.e. potential sterilization of mineral reserves and contaminated land risks. The former is unlikely to be a material consideration as the alignment does not impinge upon significant expanses of surface sand and gravel deposits. That latter can be addressed as part of routine investigation and assessment procedures which do not require a specific permit.

## 9.7 Potential effects, including monitoring and mitigation measures

### Construction

9.7.1 Excavation works associated with the Proposed Scheme have the potential to directly damage any underlying geological features. However, since the Proposed Scheme is located within a low sensitivity setting without any geologically protected sites, or scarce geological mineral resources present on site, it is anticipated that there would be no significant direct impacts upon geology in this respect during construction.

9.7.2 Detailed assessment of the potential impact on groundwater resources (high sensitivity) by the Proposed Scheme is considered in detail in Chapter 13.

9.7.3 A limited extent of the route is indicated to comprise worked or made ground. Further examination of the associated potential contaminated land risks is recommended in accordance with good practice. Further work comprising site reconnaissance, intrusive investigation, sampling and analysis is necessary to support an environmental risk assessment. This will be incorporated into proposed ground investigation to supplement the existing geotechnical data for

design purposes. There are several issues for further examination and investigation including:

- Extent, depth and composition of any contaminated soils
- The characterisation of waste for disposal
- Monitoring of ground gases and vapours
- Monitoring of groundwater quality and depth
- Environmental risk assessment considering short-term and chronic risks to controlled waters, ecosystems and health and safety risks

At this stage, based on the information available, such risks are considered unlikely to constitute moderate impacts but will be re-evaluated on the basis of site-specific data obtained.

9.7.4 The findings of the environmental risk assessment would identify the requirement and scope of any necessary remediation works. The remediation strategy should examine feasible and sustainable options to manage, remove/dispose or treat identified contaminated material where it is cost effective and practicable to do so.

9.7.5 The strategy should also address any particular regulatory requirements under development control for managing any previously unknown contamination encountered during the works.

9.7.6 Where practicable, material should be re-used on site provided performance criteria are met with respect to chemical composition and geotechnical parameters. This may be managed under a Materials Management Plan prepared in accordance with the CL:AIRE Code of Practice.

9.7.7 In addition, the implementation of a Construction Environmental Management Plan (CEMP) would affect controls to ensure identified risks associated with contamination are appropriately managed and minimised. Mitigation measures within the CEMP would include best practice environmental management procedures and appropriate waste management, such as:

- Ensuring adequate space for storage of topsoil and subsoil which must be segregated during excavation
- Protection of watercourses from entry of polluting matter
- Stripping, storing and reinstating of soils using best practice measures to minimise the risk of degradation to soils
- Suppression of odour and dust using best practice measures

**Operation**

9.7.8 It is anticipated that the operation of the Proposed Scheme would not give rise to any significant effects upon geology or soils.

### Summary

9.7.9 Table 9.2 provides a summary of potential construction and operational effects for geology and soils for the Proposed Scheme.

**Table 9.2 Summary of Potential Geology and Soils Effects**

| Potential Construction Effects | Potential Operational Effects |
|---|---|
| No significant effects anticipated. | No significant effects anticipated. |

## 9.8 Proposed level and scope of assessment

9.8.1 The limited potential impact may be further considered as part of routine GI to further establish the baseline information of the Proposed Scheme area. Detailed investigation will examine the areas identified as detailed in Section 9.7.2. A remediation strategy will then be developed to consider the appropriate methods of treatment if necessary. Assessment would be undertaken to a Simple Level in the first instance.

9.8.2 The completed and operational Proposed Scheme is not expected to result in any significant direct adverse impacts upon geology and soils. As a result, it is considered that no further assessment of operational stage effects is required for the Proposed Scheme.

## 9.9 Proposed methodology including significance

9.9.1 The assessment method for Geology and Soils will take into consideration the guidance provided in the DMRB Volume 11, Section 3, Part 11.

9.9.2 The sensitivity of geological receptors will be determined according to Table 9.3.

**Table 9.3 Scale for evaluation of the sensitivity of geological / soil receptors**

| Sensitivity | Criteria | Typical Examples |
|---|---|---|
| **Very High** | International Scale: Very high importance and rarity and very limited potential for substitution | Important on a European or global level:<br>• Geology: World Heritage Sites.<br>• Soils: Agricultural soils of Grade 1 quality.<br>• Minerals: Energy minerals – minerals used to generate energy such as coal oil and gas.<br>• Controlled Water: Groundwater vulnerability is classified as high; Principal aquifer providing a regionally important resource or supporting site protected under wildlife legislation; or source protection zone (SPZ) I.<br>• Future site users: Very sensitive land uses proposed such as residential housing with gardens, allotments.<br>• Built Environment: Sites of international Importance, World Heritage Sites. |

| Sensitivity | Criteria | Typical Examples |
|---|---|---|
| **High** | National Scale: High importance and rarity, limited potential for substitution | Important in the UK:<br>• Geology: Site protected under EU or UK wildlife legislation (SAC, SPA, SSSI, Ramsar site).<br>• Soils: Agricultural soils of Grade 2 quality.<br>• Minerals: Poor quality energy minerals or silica (industrial) sand for use in glass making.<br>• Controlled Water: Groundwater vulnerability is classified as high; Principal aquifer providing locally important resource or supporting river ecosystem; SPZ II.<br>• Future site users: Sensitive land uses proposed such as schools, residential housing without gardens, open spaces.<br>• Built Environment: Listed buildings, Scheduled Monuments. |
| **Medium** | Regional Scale: Medium quality and rarity | Important in the context of Eastern England:<br>• Geology: Regionally Important Geological Sites (RIGS).<br>• Soils: Agricultural soils of Grade 3 quality.<br>• Minerals: Construction aggregates – minerals used in building and engineering or to manufacture building and engineering products such as concrete.<br>• Controlled Water: Moderate classification of groundwater vulnerability; Secondary aquifer providing water for agricultural or industrial use with limited connection to surface water; SPZ III.<br>• Future site users: Moderately sensitive land uses such as commercial developments and open spaces.<br>• Built Environment: Sites with local interest for education or cultural appreciation. |
| **Low** | District Scale: Low quality and rarity | Important in the context of Norfolk:<br>• Geology: Rock exposures.<br>• Soils: Agricultural soils of Grade 4-5 quality.<br>• Minerals: Poor quality materials suitable for us as general fill only.<br>• Controlled Water: Deep Secondary aquifer with poor water quality not providing baseflow to rivers; Aquifer not used for water supplies (public or private).<br>• Future Site Users: Low sensitivity land use such as Industrial Sites, highways and rail.<br>• Built Environment: Infrastructure (e.g. Roads, railways, tramways). |
| **Negligible** | Local Scale: Very low importance and rarity | Important within and adjacent to site (~2km of site):<br>• Geology: No rock exposures.<br>• Soils: Urban classified soils.<br>• Minerals: No minerals.<br>• Controlled Water: Non-aquifer.<br>• Future Site Users: No sensitive land use proposed. |

9.9.3 Magnitude of effect will be determined by the predicted deviation from the baseline conditions and the scale of impact. The methodology for determining the magnitude of an impact is shown in Table 9.4.

**Table 9.4 Scale of magnitude of impact for geological / soil receptors**

| Magnitude of Effect | Geological Changes | Soils Including Waste | Human Health | Groundwater | Surface Water |
|---|---|---|---|---|---|
| **Major** | Disturbance or loss of geological features of interest e.g. change in condition status of geological SSSI or RIGS.<br>Permanent impact on geological conditions.<br>Sterilisation of 50% or more of mineral asset. | Generation of large volume of hazardous material for disposal off-site or treatment.<br>Physical removal or degradation of a large area of soil.<br>Remediation/ improvement of a large area of soil. | Site investigation data indicating severe contamination.<br>Quantitative or qualitative risk assessment data estimating a significant likelihood of adverse/ beneficial impacts from exposure/ reduction in exposure to pollutants in the environment. | Significant change in groundwater quality with respect to Drinking Water Standards (DWS).<br>Pollution/ treatment of potable source.<br>Any pollution inside Zone 1 or a groundwater protection zone of special interest. | Significant change in water quality, impacting quality with respect to Environmental Quality Standards (EQS).<br>Loss of attribute and/ or quality or function e.g. loss or extensive change to a fishery. |
| **Moderate** | Some disturbance or loss of geological feature.<br>Temporary impact on geological conditions.<br>Sterilisation of 15-50% of mineral asset. | Generation of hazardous/ non-hazardous material for disposal off-site or treatment.<br>Physical removal or degradation of a moderate area of soil.<br>Remediation/ improvement of a moderate area of soil. | Site investigation data indicating moderate contamination.<br>Quantitative or qualitative risk assessment data estimating medium risk of adverse/ beneficial impacts from exposure/ reduction in exposure to pollutants. | Moderate changes insufficient to change water quality with respect to DWS. | Moderate changes insufficient to change water quality with respect to EQS.<br>Moderate decline in the attribute quality or function. |
| **Minor** | No disturbance or loss of geological feature.<br>No permanent impact on geological conditions.<br>Sterilisation of <15% of mineral asset. | Generation of inert/ non-hazardous waste materials which may be suitable for re-use on site.<br>Physical removal or degradation of a minor area of soil. | Site investigation data indicating significant contamination is unlikely.<br>Quantitative and qualitative risk assessment data estimating low likelihood of adverse/ beneficial | Minor impact insufficient to impact on characteristics of water resource. | Measurable change in water quality but no change with respect to EQS or minor.<br>Negligible decline in attribute quality or function. |

| Magnitude of Effect | Geological Changes | Soils Including Waste | Human Health | Groundwater | Surface Water |
|---|---|---|---|---|---|
| | | Remediation/ improvement of a minor area of soil. | impacts from exposure/ reduction in exposure. | | |
| **Negligible** | Physical removal, degradation (including loss of structure and contamination) or improvement of a very minor area of soil. Minimal impact on geological conditions and minerals assets. | | | | |
| **No change** | No loss or alteration of characteristics, features or elements; no observable impact in either direction. | | | | |

9.9.5 The likely severity of effects on geology and soils due to the construction and operation phases of the Proposed Scheme will be assessed using the matrix presented in Table 1.2.

9.9.6 A descriptive meaning for each of the five significance categories relevant to geology and soils is detailed in Table 9.5.

**Table 9.5 Explanation of significance of effect for geological / soil receptors**

| Significance Category | Description and Examples | | Significance |
|---|---|---|---|
| **Neutral** | **-** | • Minimal effect on geological condition<br>• Minor loss of urban soils<br>• No discernible negative effect to buildings / infrastructure | **Not Significant** |
| **Slight** | **Adverse** | • Changes to Made Ground deposits only<br>• Moderate / major loss/degradation of Grade 4 or 5 soils<br>• Minor / moderate loss/degradation of Grade 3 soils<br>• Easily preventable, non-permanent health effects on humans<br>• Minor low-level and localised contamination of on-site soils<br>• Easily reparable damage to buildings / infrastructure | |
| | **Beneficial** | • Remediation of localised low levels of contamination<br>• Remediation of non-sensitive water resource<br>• contamination<br>• Minimal improvements to overall soil and water quality | |
| **Moderate** | **Adverse** | • Superficial disturbance to near surface deposits<br>• Changes in geomorphology, large loss / degradation of Grade 3 soils<br>• Minor loss/ degradation of Grade 1 or 2 soils<br>• Sterilisation of low quality mineral resources<br>• Easily preventable, permanent health effects on humans<br>• Pollution of non-sensitive water resource or Low long-term risk of pollution to sensitive water resource<br>• Localised damage to buildings/infrastructure (on or off site) | **Significant** |
| | **Beneficial** | • Remediation of localised moderate levels of contamination<br>• Remediation of moderate, localised sensitive water resource contamination | |

| Significance Category | Description and Examples | | Significance |
|---|---|---|---|
| **Large** | **Adverse** | • Moderate / large loss / Degradation of Grade 2 soils<br>• Moderate loss/degradation of Grade 1 soils<br>• Sterilisation of high quality mineral resource<br>• Medium / long-term (chronic) risk to human health<br>• Medium long-term risk of pollution of sensitive water resources<br>• Contamination of off-site soils | |
| | **Beneficial** | • Remediation of localised high levels of contamination<br>• Remediation of significant localised sensitive water resource contamination | |
| **Very Large** | **Adverse** | • Loss of exposed designated geological feature or large loss / degradation of Grade 1 soils<br>• Short-term (acute) risk to human health<br>• Short-term risk of pollution of sensitive water resources<br>• Catastrophic damage to buildings / infrastructure | |
| | **Beneficial** | • Remediation of significant, widespread elevated levels of soil contamination/sensitive water resource contamination | |

## 9.10 Conclusions

9.10.1 The scope of the construction works and the potential significance of direct effects warrant further construction stage assessment for the Proposed Scheme. This would include detailed investigation in order to examine the localised identified areas of potential land contamination. The investigation will identify the contaminants present and confirm extant ground conditions. A remediation strategy will then be developed to consider the appropriate methods of treatment if necessary.

9.10.2 Construction stage assessment to a Simple level in the first instance will be undertaken, and will be presented within an ES.

9.10.3 The completed and operational Proposed Scheme is not expected to result in any significant direct adverse impacts upon geology and soils. As a result, it is considered that no further assessment of operational stage effects is required for the Proposed Scheme.

# 10 Materials

## 10.1 Introduction

10.1.1 This chapter assesses the potential impact on materials as a result of the Proposed Scheme, and has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, to a Scoping Level. For the purposes of this Scoping Report, materials are defined as:

- The use of material resources
- The generation and management of waste

10.1.2 The potential requirement for assessment to either Simple or Detailed level will be identified. Where required, this will be presented within an ES.

## 10.2 Study area

10.2.1 Currently there is no guidance available for defining the study area to be used for materials assessments. As a result, the study, which will be adopted in the ES, has been determined through professional judgement by the influence of the Proposed Scheme, rather than through a set geographical location.

## 10.3 Existing and baseline knowledge

10.3.1 There are no current estimates on material resource use and waste generation during the site remediation/preparation, demolition and construction phases. These shall be developed as the design is progressed.

10.3.2 Information on historic land uses and potential sources of land contamination is addressed in Chapter 9 Geology & Soils. Potential sources of contamination that are greater than 1km away from the Proposed Scheme have not been considered since these are unlikely to impact upon the Proposed Scheme given the distance and nature of the proposed construction.

10.3.3 Commercial construction and demolition (C&D) waste is identified as by far the most significant source of inert waste in Norfolk and there is the need for additional inert waste recycling infrastructure within the region. Capacity of regionally appropriate waste management facilities is an important consideration in the assessment and will be considered in the environmental assessment.

10.3.4 Further available information from Defra, Environment Agency and Norfolk County Council on current waste generation and operational waste management facilities in Norfolk will be collated to provide the baseline for this assessment.

## 10.4 Assumptions and limitations

10.4.1 The potential impacts associated with material use and the production, movement, transport, processing and disposal of waste will be assessed once the type and quantity of materials and wastes have been estimated.

## 10.5 Guidance and best practice

10.5.1 The following legislation, standards and best practice guidelines are considered to be relevant to the Proposed Scheme which regulate the management of materials and waste:

- EU Waste Framework Directive 2008/98/EC
- Waste (England and Wales) Regulations 2011 (as amended 2012)
- Environmental Protection Act 1990, Part II, Section 34
- Hazardous Waste (England and Wales) Regulations 2005 (as amended, 2009)
- Environment Permitting (England and Wales) Regulations 2010 (as amended 2011 and 2012)
- Environment Agency (EA) (Standard Rules SR2015 No39: use of waste in a deposit for recovery operation
- CL:AIRE Definition of Waste: Development Industry Code of Practice Version 2, 2011
- DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, 2009

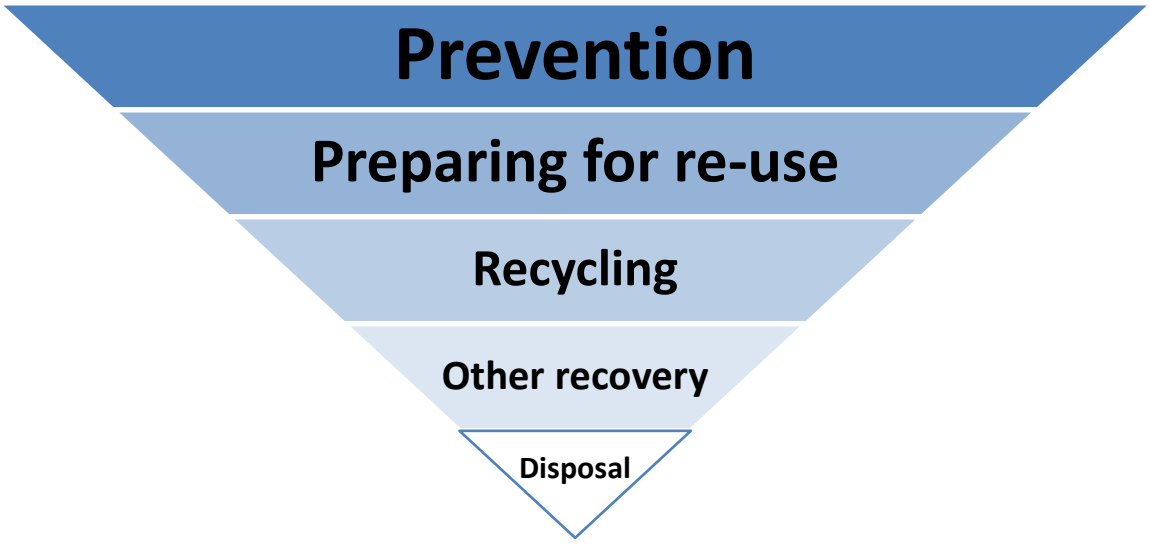
10.5.2 A Site Waste Management Plan (SWMP) is also an important tool for improving environmental performance, managing potential environmental impacts, meeting regulatory commitments and helping to reduce waste and therefore overall project costs. The SWMP aims to determine the waste types and amounts to be produced during design and construction and to identify appropriate waste management controls.

10.5.3 A Materials Management Plan (MMP) may also form part of the SWMP, where there is a need to demonstrate that any material re-use strategy does not pose any risk to human health or the environment and in accordance with ‘The Definition of Waste: Development Code of Practice’ Version 2 CLAIRE March 2011, is not a waste disposal activity.

10.5.4 The MMP documents how materials anticipated to be in the ground as part of the works are to be dealt with, including details on potential use, relative volumes, storage areas, intended final destination of the materials, protocols to track movements of these materials and any contingency arrangements (e.g. with regard to treatment of contaminated soils).

10.5.5 The waste hierarchy is a fundamental guidance to reduce waste generation at source and reduce the volume of waste to be sent to landfill (see Figure 10.1).

**Figure 10.1 Waste hierarchy**




Source: Guidance on applying the Waste Hierarchy, Defra 2011

## 10.6 Consultation

10.6.1 No specific consultation has been undertaken to date regarding materials and waste. Consultation and liaison with the Environment Agency will be ongoing, where relevant during the EIA process.

## 10.7 Potential effects, including monitoring and mitigation measures

10.7.1 Construction of the Proposed Scheme will involve the production, procurement, transport and use of material resources and the production of waste streams which have the potential to generate significant environmental effects, as summarised in Table 10.1.

**Table 10.1 Summary of materials and waste that have the potential to generate significant environmental effects**

| Activity | Material Use and Potential to Generate Significant Effects | Potential Waste Arisings and Potential to Generate Significant Effects |
|---|---|---|
| Site remediation / preparatory / earthworks | Potential direct effects associated with the import and use of materials, including: depletion of natural resources; noise and air emissions associated with their transportation; energy/fuel consumption through plant use and transportation; energy/fuel consumption through manufacture. | Potential direct effects associated with the generation of waste arisings (inert, non-hazardous, green and hazardous) including; demand on handling/disposal capacity of regional waste management facilities; release of contaminants to air, land or water; noise and air emissions associated with their transportation; energy/fuel consumption through plant use and transportation. |
| Demolition | N/A | Demolition waste from removal of surge chamber, footways and culvert modifications |

| Activity | Material Use and Potential to Generate Significant Effects | Potential Waste Arisings and Potential to Generate Significant Effects |
|---|---|---|
| Construction | • Road sub-base and surface materials<br>• Concrete, steel and other structural materials<br>• Pre-cast and prefabricated products (e.g. kerbs, gullies, barriers, manholes, drainage)<br>• Signage, lighting columns and markings<br>• Timber (e.g. for temporary use for shuttering)<br>• Topsoil | • Non-reusable demolition material<br>• Surplus earthworks<br>• Surplus, damaged and 'cut-off' construction materials |
| Operation and maintenance | • Materials use expected to be minimal | • Waste arisings generated expected to be minimal |

## Construction

10.7.2 Specific quantities of materials and waste have not been quantified at this stage and will be estimated at a later stage as the design is progressed. An opportunity to re-use surplus material on other sections of the A47 where improvements are planned would reduce the effects from the generation of waste arisings, as well as any other projects within the region.

10.7.3 The Proposed Scheme includes earthworks, construction of the mainline road alignment, side roads, associated structures, embankment ramps, reinforced concrete foundations, abutments and use of precast deck beams.

10.7.4 Where the existing A47 carriageway is unaffected by the dualling, it will become part of the local road network.

10.7.5 There is the potential for significant adverse effects during construction due to the use of materials and generation of waste. Mitigation measures to further reduce the effects from the use of materials may be achieved through reducing the material requirements through design, re-use of site-won or recycled materials and use of materials with a high proportion of recycled content.

10.7.6 In accordance with the waste hierarchy, consideration will also be given to the re-use of waste on-site before waste is transported off-site for re-use or disposal. Where waste cannot be re-used either on or off-site, direct effects may result from the demands on the capacity of waste management facilities and landfills and impacts associated with transport.

10.7.7 The preparation of a SWMP and inclusion of mitigation measures with the appointed Contractor's Construction Environmental Management Plan (CEMP) would ensure that adverse effects associated with materials use, waste generation and required transport are managed.

10.7.8 Mitigation measures to be included in the SWMP and CEMP may include (but are not limited to):

- Implementation of the waste hierarchy and avoiding generation of waste through design.
- Use of site-won or recycled materials as opposed to sourcing new materials.
- Where surplus materials cannot be re-used on-site, seek opportunities for re-use off-site, including other A47 schemes or other projects off-site (e.g. quarry restoration scheme).
- Encourage local and responsible resourcing of materials (e.g. through adoption of BES 6001) and efficiencies by minimal ordering of materials.
- Waste to be appropriately segregated and stored/stockpiled on-site by waste type, to ensure waste remains in a suitable condition to be re-used.
- Where waste must be taken to a recycling/disposal site, ensure these sites hold the appropriate permits.

**Operation**

10.7.9 Significant environmental effects from the use of materials and generation of waste are unlikely during the operation of the Proposed Scheme since there would be minimal requirements for materials, besides infrequent maintenance activities.

## 10.8 Proposed level and scope of assessment

10.8.1 There is a potential for significant volumes of earthworks and material use during construction, resulting in the need for potential off-site re-use and disposal of wastes generated. A Simple Assessment is proposed at this stage for both the use of materials and generation of waste during the construction. This will be followed by a Detailed Assessment, if considered necessary based primarily on the assessment and volume estimates.

10.8.2 No further assessment is likely to be required for material resource use and waste generation during operation, as no significant direct or indirect effects are anticipated.

## 10.9 Proposed methodology including significance

10.9.1 The Simple Level assessment will consider the following:

- The materials required for the project and where information is available, the quantities.
- The anticipated waste arisings from the project and where information is available, the quantities and type (e.g. hazardous).
- The impacts that will arise from the issues identified in the Scoping exercise in relation to materials and waste.

- The results of any consultation.
- A conclusion about whether this level of assessment is sufficient to understand the effects of the project or whether Detailed Assessment is necessary.

10.9.2 Professional judgement will be used to provide an assessment of effects based on several factors, including:

- The availability / scarcity of the material resources.
- The type of materials required and their associated embodied carbon, e.g. primary/virgin materials, manufactured materials, recycled materials.
- The type of waste generated, e.g. inert, non-hazardous, hazardous.
- The capacity and availability of suitable facilities within close proximity to the Proposed Scheme to manage, treat or dispose of waste generated.
- Implementation of the waste hierarchy, i.e. where the generation of the waste is avoided through design in the first instance, then minimised, recycled, recovered or disposed of.

## 10.10 Conclusion

10.10.1 There is a potential for significant adverse effects from the use of materials and generation of waste. An initial Simple Assessment is proposed, followed by a Detailed Assessment if the environment impacts cannot be clearly identified by the Simple Assessment. The requirement for a Detailed Assessment shall be considered following completion of the Simple Assessment.

10.10.2 The results of the assessment will inform development of a SWMP, MMP / Materials Logistics Plan (MLP) which shall be prepared for the Proposed Scheme by the appointed Contractor. The SWMP and MMP / MLP shall consider the sourcing, procurement, transport, delivery, storage, handling, use and disposal of materials in a sustainable manner, in accordance with the waste hierarchy.

10.10.3 With implementation of a SWMP, MMP / MLP and other appropriate mitigation measures during construction as detailed in the CEMP, the use of materials and generation of waste is unlikely to result in significant direct or indirect effects, although an assessment to a Simple Level will be undertaken to confirm this conclusion.

10.10.4 No further assessment is required for the effects of the Proposed Scheme on material resources during operation, as significant direct or indirect effects are unlikely as there would be minimal requirements for materials and generation of waste.

# 11 Noise & Vibration

## 11.1 Introduction

11.1.1 This Chapter has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, and DMRB Volume 11, Section 3, Part 7, to a Scoping Level. The construction and operation of the Proposed Scheme would have the potential to give rise to both temporary and permanent noise and vibration impacts at sensitive receptors in the area, which in turn could generate adverse or beneficial effects. This section identifies the key noise and vibration impacts, describes the study area and key receptors. The potential requirement for assessment to either Simple or Detailed level will also be identified. This will then be presented within the ES.

## 11.2 Study area

11.2.1 The DMRB Volume 11 Section 3 Part 7 HD213/11 Noise and Vibration (2011) provides the methodology for assessment of road projects within the UK.

11.2.2 For operational noise, the methodology requires that the study area is identified as an area within 1km of the physical works associated with the Proposed Scheme. Within this study area, road traffic noise predictions are performed at any sensitive receptor within 600m of a road where this is the possibility of a change of 1dB $L_{A10, 18hr}$ upon Proposed Scheme opening, or 3 dB $L_{A10, 18hr}$ in the long term.

11.2.3 For potential effects due to road traffic noise outside of the 1km area, the methodology requires that sensitive receptors are identified adjacent to roads where the change in received road traffic noise level would, as a result of the Proposed Scheme, increase or decrease by at least 1 dB $L_{A10, 18hr}$ on opening or 3dB in the long term. Consequently, the spatial extents of the assessment may extend beyond the physical works associated with the Proposed Scheme.

11.2.4 For construction noise, the study area is the same as that defined for assessment of operational noise impacts, although this may be extended to assess the impacts from construction traffic on the existing road network and from potential diversion routes. Within the study area the extent of the assessment will be limited to areas where total noise (calculated construction noise plus baseline noise) exceeds baseline noise levels.

## 11.3 Existing and baseline knowledge

11.3.1 A review of noise-sensitive receptors and an initial noise survey was undertaken as part previous stages of design development and assessment.

11.3.2 The Proposed Scheme is located in a rural area with sensitive receptors spread throughout, but principally concentrated in the villages of Blofield, Lingwood and North Burlingham. Sensitive receptors include dwellings, schools, nursing

homes and churches in addition to other community facilities. Almost 900 noise sensitive receptors within 600m of the Proposed Scheme have been identified.

11.3.3 Further sensitive receptors within the study area include designated areas.

11.3.4 Four Noise Important Areas were identified in the study area – these are indicated on Figure A.1 and are as follows:

- IA_ID:5206; Asset Owner: Highways England
- IA_ID:5207; Asset Owner: Highways England
- IA_ID:5208; Asset Owner: Highways England
- IA_ID:5209; Asset Owner: Highways England

11.3.5 Previous assessment reported results of a noise survey at representative receptors during which it was noted that road traffic noise was a dominant feature of the background noise. Noise levels ranged from 46 dB $L_{A10, 18hour}$ at the location furthest away from the A47 (540m distant) to over 70dB $L_{A10, 3hour}$ at the nearest location to the A47.

11.3.6 Table 11.1 identifies sensitive receptors, which includes typical examples identified in DMRB.

**Table 11.1: Noise and vibration resources and receptors**

| Resource/Receptor | Description |
|---|---|
| Dwellings | Houses and any other building in residential use such as public houses, hotels etc. |
| Commercial premises | Shops, offices etc. |
| Community facilities | Libraries, public halls, sports centres, theatres, concert halls, places of worship etc. |
| Recreational facilities | Amenity areas, footpaths, sports grounds etc. |
| Educational establishments | Schools, university campus. |
| Designated sites | If relevant, environmentally sensitive areas and buildings sensitive to noise and vibration. |
| Other | Any other premises highly sensitive to noise and vibration such as laboratories etc. |

11.3.7 Some further surveys will be necessary and the following sources will be consulted prior to deciding locations:

- Noise mapping undertaken as part of the requirements of The Environmental Noise (England) Regulations 2006
- OS mapping
- Consultation with the Local Authority
- Traffic flows
- Review of previous surveys and assessments

11.3.8 Surveys will comprise both long-term and short-term monitoring broadly in accordance with The Calculation of Road Traffic Noise (CRTN) methodology (HMSO, 1988).

## 11.4 Assumptions and limitations

11.4.1 There is currently no information on construction traffic movements, which is required to undertake an assessment of construction noise. Forecast traffic flows, speeds and percentage heavy goods data are also unavailable. Discussion on potential impacts and effects within this EIA Scoping Report have therefore been undertaken in the absence of this information. As design progresses and this information becomes available it will be incorporated into the assessment.

## 11.5 Guidance and best practice

11.5.1 The following legislation, standards and best practice guidelines are considered to be relevant to the Proposed Scheme.

- The National Planning Policy Framework 2012.
- The Noise Policy Statement for England 2010.
- The National Policy Statement for National Networks 2014.
- The Land Compensation Act 1973 Part 1.
- The Noise Insulation Regulations 1975 (amended 1988).
- Sections 60 and 61 of The Control of Pollution Act 1974.
- The Environmental Protection Act 1990.
- British Standard (BS) 5228-1:2009+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise’.
- BS5228-2:2009 'Code of construction practice for noise and vibration control on construction and open sites - Part 2: Vibration'.
- BS 7385:1993 ‘Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground-borne vibration’.
- Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 ‘Noise and Vibration’ (HD213/11 – Revision 1) 2011.
- Interim Advice Note 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’.
- Calculation of Road Traffic Noise (CRTN) 1988.
- Guidelines for Noise Impact Assessment, Institute of Environmental Management & Assessment (IEMA) 2014.

11.5.2 The above list is not exhaustive and further guidance will be referred to if necessary.

## 11.6 Consultation

11.6.1 Consultation with Environmental Health Officers (EHO) of Broadland District Council and Norfolk County Council will be progressed following the consultations undertaken to date. As a result of consultation to date a desire was expressed to minimise noise levels at adjacent residences and to surface the Proposed Scheme with a thin surface course which would give rise to less tyre/road surface noise than other road surfacing. Discussion on methodology for the EIA and proposed survey locations will also form a key element of the consultation.

## 11.7 Potential effects, including monitoring and mitigation measures

### Construction

11.7.1 During construction, the Proposed Scheme has the potential to directly alter the noise and vibration baseline for sensitive receptors for a temporary period. Impacts are likely to be restricted to areas where the existing baseline noise levels are exceeded. This would be principally in the vicinity of the Proposed Scheme option envelope, although could extend along elements of the existing road network, depending on haul routes and the quantity of construction-related traffic. With strict adherence to mitigation including the shielding of noisy items of plant, the use of enclosures and the use of appropriate screening, to be included within the CEMP, construction noise would be managed to appropriate levels and is therefore not anticipated to have significant direct effects. However, at this stage with insufficient information on construction activities further assessment will be needed to confirm this and to inform the mitigation strategy. This will be undertaken based upon the requirements of BS5228 Parts 1 and 2 during the EIA process.

### Operation

11.7.2 During operation, there is the potential for changes to traffic flows and new road alignment to result in noise changes at noise sensitive receptors, including NIAs. With the implementation of appropriate mitigation, such as the provision of noise barriers/bunds and low noise road surfacing, potential adverse effects may be minimised. Nonetheless, it is considered that there is the potential for significant residual adverse effects to noise sensitive receptors which warrants further assessment.

## 11.8 Proposed level and scope of assessment

11.8.1 The Proposed Scheme has the potential to directly alter the noise and vibration baseline for numerous sensitive receptors both temporarily (during construction) and permanently (during operation). Therefore, a quantitative assessment of both construction and operational noise and vibration is required in order to establish significant effects and to inform the mitigation strategy. The assessment will therefore be undertaken to a Detailed Level, in accordance with DMRB.

## 11.9 Proposed methodology including significance

11.9.1 The National Policy Statement for National Networks (DfT, 2014) requires that *'due regard'* must be given to relevant sections of the NPPF, the Noise Policy Statement for England (Defra, 2010) and the associated National Planning Policy Guidance on noise (CLG, 2014a). In order to comply with these documents, it will be necessary to determine Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL) for noise impacts. The mitigation strategy will depend upon the magnitude of any impacts at sensitive receptors between LOAEL and SOAEL, in addition to exceedances of SOAEL, which will indicate the occurrence of significant adverse effects.

### Construction noise

11.9.2 BS5228–1:2009+A1:2014 (BSI, 2014) does not define strict criteria to determine the significance of noise impacts, although examples of how limits of acceptability have been applied historically and some examples of assessing significance are provided. 'Example Method 2 – 5dB(A) change' (Annex E 'Significance of Noise Effects' Section E.3.3) will be adopted for the assessment of effects at sensitive receptors.

11.9.3 This approach considers the expected changes in ambient noise levels and more appropriately reflects conventional EIA methodologies compared with the use of fixed/absolute noise limits.

### Construction vibration

11.9.4 BS5228 'Code of construction practice for noise and vibration control on construction and open sites – Part 2: Vibration' (BSI, 2014) provides guidance on the effect of vibration and the likelihood they will cause complaint and cosmetic damage to buildings. BS 5228 does not indicate whether particular vibrations are significant. However, it does state that: *"It is likely that vibration of... [1.0mm/s].. in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents".*

11.9.5 Generally, vibration from construction activities would be temporary and intermittent in nature. On this basis, in the assessment a Peak Particle Velocity (PPV) of 1.0mm/s or more would be considered to have the potential to result in a significant adverse impact.

11.9.6 BS 7385 provides guidance on the levels of vibration that would be necessary to cause structural damage to different types of buildings. The Standard indicates that continuous PPVs of more than about 7 mm/s would be required to cause structural damage to residential buildings. Potentially vulnerable buildings and appropriate mitigation will be identified. For residential buildings, limits will be placed based upon levels at which there is a likelihood of complaint, these being considerably lower than those at which building damage may occur.

## Operational noise

11.9.7 DMRB HD213/11 describes the impacts of road traffic noise in terms of the noise descriptors conventionally used for assessing the impact of road traffic in the UK, i.e. the statistical noise level $L_{A10,18h}$ over an 18-hour period between 06:00 and 24:00 (the traffic noise index). The Calculation of Road Traffic Noise (CRTN) methodology (HMSO, 1988) will be followed in the calculation of road traffic noise, which will provide input to assessment of impact using the DMRB methodology.

11.9.8 The level of road traffic noise from the road network will be predicted using traffic data provided in terms of 18-hour Annual Average Weekday Traffic (AAWT) flow between the hours of 06:00 to 24:00, along with average vehicle speed and percentage heavy vehicles.

11.9.9 Calculations of the road traffic noise level will be undertaken for four scenarios:

- Do Minimum option in the baseline year
- Do Minimum option in the future assessment year
- Do Something option in the baseline year
- Do Something option in the future assessment year

11.9.10 In the above scenarios, 'Do Minimum' means traffic growth with committed development only. 'Do Something' means committed growth with the Proposed Scheme.

11.9.11 In accordance with DMRB HD213/11, for a Detailed Level of assessment, the assessment of road traffic noise impacts requires the following comparisons:

- The short-term change in road traffic noise upon Proposed Scheme opening (Do Minimum option in the baseline year vs. Do Something option in the baseline year).
- The long-term change in road traffic noise assuming the Proposed Scheme is built (Do Minimum option in the baseline year vs. Do Something option in the future assessment year).
- The long-term change in road traffic noise assuming the Proposed Scheme is not built (Do Minimum option in the baseline year vs. Do Minimum option in the future assessment year).
- The long-term change in road traffic noise assuming the Proposed Scheme is not built (Do Minimum option in the baseline year vs. Do Minimum option in the future assessment year).

## Operational vibration

11.9.12 Low frequency noise from vehicle exhausts may induce vibration (rattle) in light building elements such as windows i.e. airborne vibration. DMRB HD 213/11, para. A5.28 advises that vibration disturbance most closely parallels exposure to traffic noise levels, and that subject to professional judgement relating to

conditions under which the research was undertaken, disturbance from vibration may be quantified along similar lines to nuisance from noise (the original research was restricted to properties within 40m of the carriageways where there were no noise barriers or other screening).

11.9.13 DMRB notes that traffic induced vibration is expected to affect a very small percentage of people at noise exposure levels below 58dB $L_{A10}$.

### Summary of proposed significance criteria

11.9.14 Environmental assessment regulations and the NPPF require that the assessment considers the significance of any impacts. These will be considered on the basis of magnitude and change. NPPF requirements regarding single objective noise-based measures will be based upon those adopted for other recent infrastructure schemes.

11.9.15 Table 11.2 summarises proposed LOAEL and SOAEL values. Where values already exceed SOAEL criteria, small increases of 1dB will be regarded as significant whether they occur in the long-term or short-term.

**Table 11.2 Summary of potential noise and vibration effects**

| Time Period | Source | Adverse Effect Level | Noise Level |
|---|---|---|---|
| Day | Operational Noise | LOAEL | Free-field 50dB $L_{Aeq,16hr}$ |
| Day | Operational Noise | SOAEL | Façade 67.5dB $L_{A10\ 18hr}$ |
| Night | Operational Noise | LOAEL | Free-field 45dB $L_{Aeq,\ 8hr}$ |
| Night | Operational Noise | SOAEL | Free-field 55dB $L_{night,\ outside}$ |
| Day | Construction noise | LOAEL | Facade 50dB $L_{Aeq,16hr}$ |
| Day | Construction noise | SOAEL | Façade 75dB, $L_{Aeq,\ 12hr}$ |
| Night | Construction noise | LOAEL | Façade 45dB $L_{Aeq,\ 8hr}$ |
| Night | Construction noise | SOAEL | Facade 55dB $L_{Aeq,\ 8hr}$ |
| - | Construction Vibration | LOAEL | PPV 0.14mm/s |
| - | Construction Vibration | SOAEL | PPV 1.0mm/s |

## 11.10 Conclusion

11.10.1 During construction, the Proposed Scheme has the potential to directly alter the noise and vibration baseline for numerous sensitive receptors for a temporary period. Impacts are likely to be restricted to the vicinity of the Proposed Scheme option envelope, although could extend along elements of the existing road network. Mitigation will be key to minimising adverse impacts. Significant effects are unlikely with appropriate CEMP and mitigation in place. Nonetheless, assessment to a more Detailed level in the form of a quantitative construction noise and vibration assessment is required to inform the mitigation strategy.

11.10.2 For operational noise and vibration effects, whilst there is the potential for beneficial effects for existing NIAs, adverse effects from the introduction of a

new noise source and changes to traffic flows would also be likely. As a result, an assessment in the form of road traffic noise predictions is required for sensitive receptors using available traffic data. Appropriate mitigation and enhancement would ensure that direct impacts are minimised.

# 12 People and Communities

## 12.1 Introduction

12.1.1 This chapter sets out the baseline and assesses the impacts of the Proposed Scheme on people and communities, which is identified as a DMRB topic within IAN 125/15 ('Environmental Assessment Update').

12.1.2 However, the guidance contained within the DMRB Volume 11 Section 3 ('Environmental Assessment') has not yet been updated to accommodate the people and communities topic. As a result, and pending new guidance, this chapter has been prepared in accordance with DMRB Volume 11, Section 2, Part 4 ('Scoping of Environmental Assessments') and DMRB Volume 11, Section 3, Parts 6 ('Land Use'), 8 ('Pedestrians, Cyclists, Equestrians and Community Effects') and 9 ('Vehicle Travellers'), and IAN 125/09 ('Supplementary Guidance for Users of DMRB Volume 11') to a Scoping Level. This includes consideration of impacts:

- Non-motorised users (NMUs – pedestrians, cyclists, and equestrians)
- Amenity
- Motorised travellers (MTs) views from the road
- Motorised travellers (MTs) driver stress
- Demolition of private property and associated land take
- Community land and community facilities
- Community severance
- Development land
- Local economy
- Agricultural land
- Individual farm business

12.1.3 The potential requirement for assessment to either Simple or Detailed level will be identified, and where required, this will be presented within the ES.

## 12.2 Study area

12.2.1 The DMRB does not provide a set definition of the study area for assessing people and communities' effects. Therefore, the study area has been based on professional judgement. A local impact area (LIA) and wider impact area (WIA) will be used for the assessment.

12.2.2 The area within 250m of the Proposed Scheme boundary will be referred to as the Local Impact Area (LIA) and will be the primary study area for this topic. This LIA will be used to assess: demolition of private property and associated land take; impacts on community land and community facilities; community severance; impacts on development land agricultural land and individual agricultural businesses.

12.2.3 Wider social and community effects and effects on the local economy will be considered within a Wider Impact Area (WIA) which in this case will be the district of Broadland.

12.2.4 Because the Proposed Scheme is one of several along the A47, the cumulative impacts of the Proposed Scheme may be felt more widely than both the LIA and WIA and as such, the County of Norfolk will also be considered.

12.2.5 The study area for MTs Driver Stress and NMUs comprises all roads, connecting roads, Public Rights of Ways (PRoWs), footways, long distance walks and cycle routes located within 600 m of the Proposed Scheme.

12.2.6 The study area for Amenity will comprise all relevant assets, routes, communities and community facilities identified within 600m of the Proposed Scheme.

12.2.7 The study area for MTs View from the Road considers views from the Proposed Scheme.

## 12.3 Existing and baseline knowledge

12.3.1 The Proposed Scheme comprises the section of the A47 located between its junction with Yarmouth Road at Blofield and its junction with South Walsham Road and Acle Road at North Burlingham. This stretch of the A47 is within the Broadland district in the county of Norfolk.

12.3.2 Table 12.1 summarises the existing baseline for all People and Community topics, except for Local Economy.

**Table 12.1 Summary of existing people and communities baseline**

| Topic | Summary |
|---|---|
| MTs: Driver Stress | The section of A47 in the study area is a single carriageway road located between two sections of dual carriageway. This may cause an increase in driver stress along this stretch as the vehicle travelling along this route would have to join one lane and reduce speed.<br>Traffic volumes on the A47 are heavy during the peak commuter periods and delays are experienced when joining the A47 at the west end of Blofield.<br>Driver stress on the A47 is considered to be high, particularly at junctions and during peak periods. Stress experienced by users of side roads is considered to be lower, while roads within villages are unlikely to cause noticeable levels of driver stress. |
| MTs: View from the Road | The typical view from the road within the extent of study area is that of open fields, gently rolling hills or plateau landform, church towers and woodlands. The existing A47 corridor is partially delineated by mature trees and hedgerows, but also includes large sections of the route without notable vegetation cover. As the existing A47 corridor is typically slightly elevated above its surroundings views from the road look out across the surrounding |

| Topic | Summary |
|---|---|
| | landscape where gaps in highway vegetation occur. Overall, views from the road are considered to be intermittent. |
| NMUs | One Public Right of Way (PRoW), namely Burlington FP3, has been identified within the study area as being at risk of impact from the Proposed Scheme. Burlington FP3 runs north to south between A47 and Church Road.<br>A section of permissive footpath, which forms part of the Burlingham Woodland Walks, is also is also at risk of impact from the Proposed Scheme. This footpath runs in an easterly direction from FP3, close to the southern frontage of the A47 in North Burlingham, before heading south and then west to form a connection back to FP3.<br>NMU surveys were conducted on Tuesday 14th and Wednesday 15th February 2017 for approximately 3 hours, with those in the morning taking place between 8am and 11am and those in the afternoon between 3pm and 6pm. The surveys took place at two locations on Burlington FP3 given that this route may experience some degree of severance as a result of the Proposed Scheme. Only a small number of NMU movements were recorded during the surveys and all of these comprised dog walkers. It was considered likely that most users were from Lingwood, however, it was felt that some users may cross the A47 from North Burlingham even though none were observed doing this during the survey. |
| Amenity | Summary of the amenity levels likely to be experienced using the NMU route and the local side roads within the study area which could be affected by the Proposed Scheme.<br>• Burlingham FP3 PRoW: This is a well-established PRoW with access from the A47 to the north, Lingwood Lane to the east, Lingwood Road to the west and Church Road to the south. With the exception of where FP3 meets the A47, users are isolated from traffic. The PRoW is well used, particularly by dog walkers. It is likely that most users are from Lingwood, however it may be the case that some users may cross the A47 from North Burlingham even though none were observed doing this during the survey. The majority of the route is lined with trees and/or hedgerows with occasional wide views over the neighbouring fields.<br>• Burlingham Woodland Walks – permissive footpath: This a well-established footpath which connects to FP3 at two locations. With the exception of the stretch running parallel to the A47, users are isolated from traffic as the route effectively forms a circuit within an field.<br>• Yarmouth Road: A single carriageway road which joins onto the A47 north east of Blofield. It is used as a route for vehicles travelling towards or leaving Blofield and onto the A47 so is very busy. There is a single footway along this route, but this is discontinued opposite a commercial premises approximately 175 m south west of the Yarmouth Road/A47 junction. Verges are generally well kept and views are closed due to the presence of high hedgerows and trees. |

| Topic | Summary |
|---|---|
| | • High Noon Lane: A single track road which acts as an access road for residents north of A47. The road has two junctions with the A47 and partially runs parallel to the A47. Traffic is limited on this road and there are no footways, however traffic noise can be heard from the A47. There is a line of trees between High Noon Lane and A47 partially blocking views, but there are wide views across the surrounding landscape.<br>• Lingwood Road: A busy single-track road which acts as an arterial route between the A47 and the village of Lingwood. There are few views of the A47 and traffic cannot be heard by users. Users views are partially closed due to the road being lined by hedgerows, grass verges and trees with some wide views of the surrounding fields. There are no footways along this road.<br>• Dell Corner Lane: A single track road which is most likely used for access to local residential receptors north of the A47. There are no footways and the road is partially lined with hedgerows and trees blocking some of the views of surrounding arable fields.<br>• Main Road: A busy single carriageway allowing vehicles access to residential, community and commercial properties in North Burlingham and to exit back onto the A47 in both directions. A footway runs partially along one side of Main Road and continues along the A47 on the western side. Main Road still offers views of the A47 however they are intermittently blocked by buildings and tree lines. Traffic from the A47 can be heard from the road.<br>• South Walsham Road: A single track road with no footways, however, traffic levels are low. Views are open to the east of neighbouring arable fields and limited to the west by vegetation. Views in the opposite direction are relatively open and of arable fields. Verges are maintained but heavily vegetated.<br>• Acle Road: A single carriageway road and like Lingwood Road, acts as an arterial route from the A47 to Lingwood. There are no footways and views on both sides of the road are open to neighbouring arable fields and partially blocked by trees. The grass verges are well maintained.<br>• The Windle: A single carriageway road connecting the A47 to residential receptors and a reservoir. There are no footways and little traffic. Views are open to the western arable fields and closed to the east, particularly around the reservoir site. Verges are maintained. |
| Community Severance | No specific baseline information is included for Community Severance. |
| Demolition of Private Property and Associated Land Take | There are a number of residential properties within the LIA. The majority are located in the village of Blofield. There are further properties located within 15 metres south of the existing A47 in this area.<br>Further along the route, where the smaller Yarmouth Road intersects the A47 there are several residential properties (all within 15 metres of the road). There are houses within 20 m of where the Lingwood Road intersects the |

| Topic | Summary |
|---|---|
| | A47. Between the A47 and main road (within 25 m of the current route) there are several properties, and where the B1140 intercepts the A47 there is a large detached house.<br>There is a collection of warehouse buildings near to the route between the A47 and Main Road within 20 m of the Proposed Scheme. These include Furniture by Design and BHB Beads.<br>There are also the following businesses identified near the route:<br>• Blofield fish and chip shop<br>• Butterflies coffee shop<br>• Macron store<br>• Progress House meeting rooms<br>• Blofield pick your own<br>• Atlantic Affordable Car Centre<br>• Norwich Camping and Leisure<br>• Garden Lodge (hotel) |
| Agricultural Land and Individual Farm Businesses | The following information has been taken from previous stages of design development and assessment and confirmed through the Natural England land capability for agriculture maps.<br>The above documents state that the quality of the agricultural land for the footprint and 250 m buffer zone of the Blofield to North Burlingham Proposed Scheme varies between Grade 1 (excellent quality) to Grade 2 (very good quality).<br>The occurrences and broad locations of the different grades of agricultural land as defined by Ministry of Agriculture, Fisheries and Food (MAFF) are summarised below:<br>• Grade 1 agricultural land covers the majority of the study area.<br>• A small proportion of Grade 2 agricultural land is located east of Blofield and south of the A47.<br>It should be noted that maps provided by Natural England are not sufficiently accurate for use in assessment of individual fields or development sites, and should not be used other than as general guidance. They show only five Grades, as their preparation preceded the subdivision of Grade 3.<br>Agriculture dominates much of the landscape within the study area. Agricultural activities relate predominantly to the cultivation of a wide range of crops; including vegetables and cereals. However, a small number of areas have also been identified as being used for non-arable purposes such as the keeping of livestock or the cultivation of forage material.<br>Further assessment will be required as part of the next phase of works to properly assess the grade of agricultural land.<br>No information is available on individual farm businesses from previous assessment. |

| Topic | Summary |
|---|---|
| Community Land and Community Facilities | Within the LIA (250 m from the route) there are the following community facilities:<br>• Blofield primary school<br>• Norwich United football club<br>• St Andrew's church<br>• St Peters church ruin<br>• Local GP surgery in Blofield<br>• Community allotments<br>• School of Horticulture |
| Development Land | There are no development land sites in the LIA.<br>However, there are a number of sites in the WIA including planning permission for sites for residential dwellings and further sites that are in the process of seeking planning approvals. These will be reviewed and updated with the latest developments. |

## Local economy baseline

12.3.3 The Proposed Scheme is located on the A47 from Blofield to North Burlingham. This stretch of the A47 is within the Broadland district in the county of Norfolk.

12.3.4 The district of Broadland had a population of 124,646 in the 2011 Census. It has an aging population. There is a lower than average share of children aged under 16 (17% compared to 19% nationally), and a larger than average share of people aged over 65 (22% compared to 16% nationally). The wider county of Norfolk also has similar demographics to Broadland.

12.3.5 Broadland is an area of relative affluence and high employment. Table 12.2 presents the working age population (WAP) that are economically active and the proportion that are in employment. It shows there are proportionally more economically active people in Broadland and Norfolk than in England (83% and 80%) compared to 78% nationally. It also shows that employment is higher in Broadland at 81% and in Norfolk (77%), compared to 5% nationally.

**Table 12.2 Employment and unemployment (April 2016 – March 2017)**

| All people | Broadland* | Broadland** (%) | Norfolk* | Norfolk** (%) | England and Wales** (%) |
|---|---|---|---|---|---|
| Economically active | 63,400 | 83 | 441,800 | 80 | 78 |
| In employment | 61,800 | 81 | 424,100 | 77 | 74 |
| Unemployed | 1,800 | 3 | 17,700 | 4 | 5 |

Source: ONS annual population survey
* Numbers are for those aged 16 and over
** % are for those aged 16-64

12.3.6 The English indices of deprivation (Department for Communities and Local Government, 2015) provides a comparative assessment of the level of

deprivation between neighbourhoods in England, ranking lower super output areas (LSOAs) by level of deprivation. All of the LSOAs in the Broadland district are within the 50% least deprived in England. Five of the LSOAs in the district are within the 10% least deprived.

## 12.4 Assumptions and limitations

12.4.1 This assessment heavily relies on desk based information, using publicly available information where available. This information includes strategic documents, Geographical Information Science (GIS) software, and previous assessment undertaken. No additional site walkovers or desk study assessments have been undertaken to verify the findings.

12.4.2 Data used to define the baseline social and community conditions has been compiled from existing published sources. Assessments are based on the most recent data available for the LIA and WIA. The currency of data varies from dataset to dataset depending on how frequently information is collected. Dates for each dataset are noted in the baseline section where available.

12.4.3 To prevent double-counting of significant effects, effects relating to other environmental topics are not considered in detail as part of this scoping assessment.

12.4.4 Similarly, potential effects on human health are considered as part of those topics which are themselves determinants of health – namely noise, air quality, and, where relevant, within the social and community chapter. Any potential effects arising for human health are set out in the impacts section below.

12.4.5 The LIA is based on a 250 metre boundary from the outer limits of the Proposed Scheme, and not on distances via particular modes (such as walk times), by particular routes, or taking into account man-made and natural barriers (such as major roads, railway lines, or water courses).

12.4.6 The Construction Strategy for the Proposed Scheme has not yet been developed, and as such the construction footprint and the location of construction compounds are currently unknown. Assumptions have been made as to its proposed or recommended content. The full extent of land take (permanent and temporary) during construction is therefore unknown at this stage. A definite figure will be available as the design progresses through detailed design.

## 12.5 Guidance and best practice

12.5.1 People and Communities is identified as a DMRB topic within IAN 125/15 and the assessment will use this to guide the sub-topics considered and the approach to identifying the significance of potential effects.

12.5.2 Further guidance specific to the People and Communities topic is in development, and the assessment is cognizant of this, even where it is not directly used to inform the assessment approach itself.

12.5.3 This assessment approach will be conducted using previous professional experience of undertaking similar reviews on large scale transport infrastructure developments.

12.5.4 Guidance and best practice associated with individual areas of assessment are described below.

**Motorised Travellers: Driver stress**

12.5.5 The assessment of the effects of the Proposed Scheme on driver stress will be undertaken using guidance contained within DMRB Volume 11, Section 3 Part 9 – Vehicular Travellers.

**Motorised Travellers: View from the road**

12.5.6 DMRB Volume 11 Section 3 Part 9 – Vehicle Travellers includes a subsection on the assessment of impact on 'Views from the Road'. The DMRB guidance refers to a qualitative assessment of the nature of view in terms of the 'type of scenery' and the driver's ability to 'see the surrounding landscape' but does not include a measure for determining a relative significance of effect on Views from the Road attributable to a Proposed Scheme. The significance of visual effect experienced by road users as a result of the Proposed Scheme is instead included within Chapter 7 Landscape.

**Non-Motorised Users**

12.5.7 The assessment of effects of the Proposed Scheme on NMUs will be undertaken using the guidance contained within DMRB Volume 11, Section 3 Part 8 – Pedestrians, Cyclists, Equestrians and Community Effects and by applying professional judgement.

**Non-Motorised User amenity**

12.5.8 Amenity is described as the "relative pleasantness of a journey" in DMRB Volume 11, Section 3 Part 8 – Pedestrians, Cyclists, Equestrians and Community Effects. As such, the assessment will consider the NMU route and the local side roads within the study area which could be affected by the Proposed Scheme.

**Demolition of private property and associated land take, community severance, community land and community facilities, development land, local economy**

12.5.9 No specific published guidance currently exists for assessing the effects on social and community resources. The assessment approach will be conducted using previous professional experience of undertaking similar reviews on large scale transportation infrastructure.

### Agricultural land and individual farm businesses

12.5.10 DMRB Volume 11 Section 3 Part 6 (amendment number one): 'Land Use' identifies the types of agricultural land in the surrounding area.

12.5.11 Table 12.3 outlines the criteria used to assign importance and sensitivity of land use in accordance with the DMRB. The typical descriptors have been adapted from the DMRB to allow a greater understanding of the clarity and the sensitivity of this topic.

**Table 12.3 Sensitivity criteria for land use**

| Value (sensitivity) | Typical descriptors |
|---|---|
| High | Existing beneficial land uses (e.g. active property, private land associated with active property, community lands and woodlands). |
| Medium | Areas designated for future usage with a developer interest (e.g. land-use planning policy designations contained within local development plans), assess lanes, farm outbuildings. |
| Low (or lower) | Existing land uses of less beneficial nature (e.g. inactive property, private land associated with an inactive property) and without developer interest. |

Source: Derived by professional judgement and based on DMRB 11.3.6 chapters 6-10

## 12.6 Consultation

12.6.1 No topic specific consultation has been undertaken at this stage. However, a non-statutory public consultation process was undertaken in March and April 2017, refer to Chapter 4 for further details. The outcomes of the consultation have been used to inform this scoping assessment and will be used as appropriate to inform any further assessment.

12.6.2 No topic specific consultation will be required as part of any further assessment required for People and Communities.

## 12.7 Potential effects, including monitoring and mitigation measures

### Construction

#### *NMUs*

12.7.1 The Proposed Scheme would have a direct impact upon users of Burlingham FP3 and the permissive footpath forming part of the Burlingham Woodland Walks since it would sever both routes. This would result in increased journey times and lengths during the temporary construction period.

*Amenity*

12.7.2 Amenity is likely to be temporarily impacted for users of Burlingham FP3, a stretch of the permissive footpath forming part of the Burlingham Woodland Walks and the local side roads during construction through the presence of

construction plant, machinery, materials, construction compounds and construction lighting, whilst there is also potential for barriers and traffic flows to change.

12.7.3 In addition, construction activities may cause indirect effects for NMUs, due to noise, dust and the presence of construction plant, materials, compounds sites and machinery for a temporary period. The effects of such activities are discussed further in the Chapter 4 Air Quality, Chapter 6 Landscape and Chapter 10 Noise and Vibration.

***MTs: Driver stress***

12.7.4 During construction works, it is possible that overnight working may be undertaken. This could cause temporary disruption for motorised users along the A47 and adjoining side roads. Traffic management would be likely to result in temporary reduced speeds and potentially narrow lanes, which would increase journey times. This could temporarily increase stress for MTs and cause disruption for local communities. However, this would be managed through the implementation of a Traffic Management Plan and therefore temporary effects, whilst slight adverse, are unlikely to be significant.

***MTs: View from the road***

12.7.5 It is anticipated that construction of the Proposed Scheme would be undertaken whilst retaining the existing A47 as the 'live' highway corridor for at least part of the construction period. Within this scenario, construction of the Proposed Scheme would be experienced as a change to the landscape to the south of the A47 whereby the change would be perceived as detrimental to the relative quality of view from the road. Where construction activity associates more directly with the existing A47 at either end of the Proposed Scheme or following a switch of traffic to the route of the Proposed Scheme the driver view would associate the influence of construction more directly with the highway corridor and less so as one of change to the view out from the road. The nature of outlook during construction would however remain that characterised by 'intermittent' views in recognition that whilst the Proposed Scheme would break out from the partial visual containment afforded by the existing highway corridor, temporary construction earthworks and other activity would be anticipated to limit the potential for uninterrupted 'open' views from the road.

***Demolition of private property and associated land take***

12.7.6 The Proposed Scheme involves the creation of a new dual carriageway between Blofield and North Burlingham along the southern side of the existing A47. There will be the need to acquire private property along the full extent of route. At this stage detailed engineering designs are in development and the final spatial extent of the land required is not known. Permanent land take and property demolitions are nonetheless expected to result in significant adverse effects for landowners.

12.7.7 Temporary land take will be required for the main compound which will be located at the west end of the Proposed Scheme to the south of the new A47

alignment. A satellite compound will also be required at the east end to the north of the new compact grade separated junction. Temporary land take could result in significant adverse effects for landowners in the LIA.

12.7.8 Permanent land take will be required along the south of the existing A47 route where the new road will be constructed. Private land take and property acquisition will occur within Blofield village in particular, and further along the route. It is possible that the Norwich Camping and Leisure Store will be directly affected. The allotment gardens off Great Yarmouth Road are also likely to be directly affected, the proposed site boundary covers part of the allotments. Further investigation into the impacts on land and property take will be required once there is more detailed information on the footprint of the Proposed Scheme.

### *Community land and community facilities*

12.7.9 It is possible that access to the Blofield pick your own and community allotments will be temporarily though directly affected by the construction of the new road. This could result in adverse effects on users.

### *Community severance*

12.7.10 There will be temporary severance during the construction stage. In particular the side roads that connect with the A47 along the route between Blofield and North Burlingham will be affected. Hemblington Road and Yarmouth Road will be closed during construction. This could affect access to the eastern end of Blofield. Lingwood Road and Lingwood Lane and South Walsham Road are also likely to be affected and closed temporarily which is likely to affect access to properties along these roads. The new road and compact grade separated junction will be built offline to minimise disruption to the existing network.

12.7.11 It is also possible that access to the businesses located close to where the new link road between the A47 and Walsham Road will be constructed will be temporarily affected. This includes British Wildflower Plants, Garden Lodge, GHG Beads, Burlington Furniture Rental and Furniture by Design. Access to Norwich Camping and Leisure may also be affected.

12.7.12 A new bridge is included in the design and is proposed to the east of new proposed junction at Blofield that will act as a link road connection.

### *Development land*

12.7.13 No impacts on development land are anticipated during the construction phase.

### *Local economy*

12.7.14 The Proposed Scheme will require new construction workforce to deliver it. At present, a Construction Strategy for the Proposed Scheme is under development and there is no information on whether workers will be new or existing employees of the designated contractor (who is yet to be appointed), the skill levels likely to be required for delivery, and whether those workers can

and will be drawn from the LIA or WIA. If the Proposed Scheme results in new employment in the area, this could have a slight beneficial impact on employment rates.

### *Agricultural land and individual farm businesses*

12.7.15 The Proposed Scheme is likely to require both temporary and permanent land-take of a considerable area of Grade 1 (excellent quality) and a small proportion of Grade 2 (very good quality) agricultural land. Both Grade 1 and Grade 2 agricultural land is categorised as the Best Most Versatile (BMV) agricultural land, therefore the permanent and temporary land-take of this land required for the construction phase of this Proposed Scheme has the potential to have significant adverse effects during construction.

12.7.16 The overall land-take, both temporary and permanent is currently unknown. For temporary land-take, the mitigation measures for agricultural land would require the re-instatement of the area to the same quality as measured pre-construction phase, before it is returned to the landowner. For permanent land-take, the mitigation measures for agricultural land would require the provision of alternative land or financial compensation. It is assumed that alternative means of access will be provided where existing access points are disrupted by the Proposed Scheme. It is also assumed that hedgerows, field boundaries, water supplies and existing field drainage infrastructure will be re-instated where effects are sustained as a result of operation.

12.7.17 The Proposed Scheme would also require land-take (temporary and permanent) of parcels of agricultural land from a number of individual farm businesses, this number and their locations are currently unknown. For temporary land-take, this would result in the potential for significant adverse impacts for landowners for a temporary period during the construction phase. For permanent land-take, this would result in the potential for permanent significant adverse effects for landowners. For individual farm businesses affected by permanent land-take (e.g. alterations in farm husbandry, field severance and changes in farm access), where possible, mitigation measures would include the provision of new agricultural land of the same classification with an alternative means of access, or financial compensation.

12.7.18 The construction footprint (proposed site boundary) and the associated agricultural land-take has been based on the current proposed site boundary drawing (see Appendix A). The full extent of land-take (permanent or temporary) during construction is still unknown at this stage.

## Operation

### *NMUs*

12.7.19 The Proposed Scheme incorporates the provision of a new NMU route between Blofield and North Burlingham via the existing A47 and the proposed Blofield overbridge. As a result, there would be a negligible increase in journey time and length and crossing of the A47 would be made easier by the introduction of the overbridge resulting in an overall beneficial effect to NMUs. The section of the

permissive footpath (Burlingham FP3) lost to the Proposed Scheme would be re-provided to the south of the new alignment of the A47.

### *Amenity*

12.7.20 The Proposed Scheme would result in a major effect on amenity for users of Burlingham FP3 since the new alignment of the A47 would totally sever the route. Amenity would be significantly degraded and may put off users of the route. The Proposed Scheme would have a minor effect on amenity for users of the permissive footpath and local side roads.

### *MTs: Driver stress*

12.7.21 Driver stress would be reduced as a result of the Proposed Scheme owing to the reduction in the number of side roads with access to the carriageway. The upgrading of the road to a dual carriageway would provide greater overtaking opportunities. Despite this, the severance of many of the side roads would lead to a concentration of traffic on those which would maintain access to the A47, potentially increasing stress.

### *MTs: View from the road*

12.7.22 At year 1 of operation, prior to the establishment of Proposed Scheme mitigation planting, there would be ‘open’ views from the road to the south of the Proposed Scheme. The view to the north of the Proposed Scheme would be more limited by the partial screening influence of vegetation along the route of the existing A47 corridor. The nature of view at year 1 of operation would however remain comparable to that of the baseline, comprising views across open fields, gently rolling hills or plateau landform, church towers and woodlands. By year 15 of operation the establishment of roadside vegetation would broadly re-define the existing situation in terms of establishing ‘intermittent’ views from the road.

### *Demolition of private property and associated land take*

12.7.23 No land take or demolition of private property will be required in the operational phase. There will be permanent land and property take affecting several properties and businesses that are located close to the route during the construction phase, discussed above.

### *Community land and community facilities*

12.7.24 During the operation, it is likely that there will be permanent effects on the community facilities to the south of the A47. In particular it is likely to affect the pick your own and the community allotments and the Norwich Camping and Leisure Store located along the route. The extent to which they will be affected during operation is not yet clear from available information.

### *Community severance*

12.7.25 It is possible that there will be some permanent severance as the A47 will be more challenging to cross for pedestrians. A new NMU route between Blofield and North Burlingham via the existing A47 and the proposed Blofield overbridge.

12.7.26 There will be a new bridge constructed over the carriage way for a new link road near to the proposed new junction in Blofield. The detailed engineering designs are not yet available to identify the extent of the severance and the potential mitigation measures that can be put in place.

### *Development land*

12.7.27 There are a number of development sites in the wider impact area which are likely to benefit from the construction of the new road. The road will improve access to the area and traffic flow, creating a more favourable environment for new development.

### *Local economy*

12.7.28 Direct operational employment is not expected to be created as a result of the Proposed Scheme. However, there are likely to be increased indirect employment opportunities related to reduced congestion and improved journey times. There is also likely to be a slight increase in Gross Value Added (GVA) associated with the Proposed Scheme. Alone these are likely to be minor, but may be significant when viewed cumulatively alongside other schemes being undertaken on the A47. These are likely to be felt throughout Norfolk.

### *Agricultural land and individual farm business*

12.7.29 Temporary land-take can be defined as the land within the Proposed Scheme footprint required during the construction phase only (e.g. for access and construction compounds). Temporary land should be re-instated and restored to the baseline conditions and returned to the landowner, before the Proposed Scheme becomes operational.

12.7.30 Permanent land-take can be defined as the land within the Proposed Scheme footprint required for the construction phase and retained for the operational phase of the Proposed Scheme.

12.7.31 During the operational phase, the Proposed Scheme would require permanent land-take of a considerable area of Grade 1 (excellent quality) and a small proportion of Grade 2 (very good quality) agricultural land. Both Grade 1 and Grade 2 agricultural land is categorised as the BMV agricultural land, therefore permanent land-take of this agricultural land has the potential to have significant adverse effects during operation.

12.7.32 The effects and impacts to landowners caused by temporary land-take are alleviated during the operational phase of the Proposed Scheme, as the land is re-instated and returned to the landowner. The overall amount of permanent

land-take required is currently unknown. For permanent land-take, the mitigation measures for agricultural land would require the provision of alternative land, or financial compensation. It is assumed that alternative means of access will be provided where existing access points are disrupted by the Proposed Scheme.

12.7.33 The Proposed Scheme would also require permanent land-take of parcels of agricultural land from a number of individual farm businesses, this number and their locations are currently unknown. The effects and impacts to landowners caused by temporary land-take are alleviated during the operational phase of the Proposed Scheme as the land is re-instated and returned to the landowner. For individual farm businesses affected by permanent land-take (e.g. alterations in farm husbandry, field severance and changes in farm access), where possible, mitigation would include the provision of new agricultural land of the same classification with an alternative means of access, or financial compensation.

## Summary

12.7.34 Table 12.2 provides a summary of potential construction and operational stage effects on people and communities for the Proposed Scheme.

**Table 12.2 Summary of potential people and communities effects**

| Topic | Stage | Summary |
|---|---|---|
| MTs: View from the Road | Construction | Changes to views from the road during construction (to acknowledge both anticipated partial use of the existing A47 and transfer of live traffic to the Proposed Scheme alignment within the timeframe of construction) are considered insufficient to change the general categorisation of views from the road from that of the baseline. Construction views are therefore considered to remain 'intermittent'. |
| | Operation | Changes to view from the road at year 1 prior to establishment of mitigation planting are considered to be 'open'. By year 15 of operation the establishment of roadside vegetation would broadly re-define the existing situation in terms of 'intermittent' views from the road. The nature of view throughout operation would however remain comparable to that of the baseline, comprising views across open fields, gently rolling hills or plateau landform, church towers and woodlands. |
| MTs: Driver Stress | Construction | Driver Stress for MTs would increase with changes in traffic flows and speeds, however these effects are not considered to be significant. |
| | Operation | A reduction in the number of side roads with access to the carriageway and the upgrading of the road to a dual carriageway would reduce driver stress on the A47. |

| Topic | Stage | Summary |
|---|---|---|
| | | Despite this, the severance of many of the side roads may potentially increase driver stress. |
| NMUs | Construction | Direct impact upon users of Burlingham FP3 and the permissive footpath since it would sever both routes. This would result in increased journey times and lengths during the temporary construction period. |
| | Operation | Would result in a negligible increase in journey time and length. Crossing of the A47 would be made easier by the introduction of the new NMU route between Blofield and North Burlingham via the existing A47 and the proposed Blofield overbridge resulting in an overall beneficial effect to NMUs. |
| Amenity | Construction | NMU facilities would be temporarily impacted through the presence of construction plant, machinery, materials, construction compounds and construction lighting and changes to barriers and traffic flows. |
| | Operation | Burlingham FP3 amenity would be significantly degraded and may put off users of the route. The Proposed Scheme would have a minor effect on amenity for users of the permissive footpath and the local side roads. |
| Community Severance | Construction | There will be temporary severance, due to the closure of roads along the route of the new road. |
| | Operation | The new road may be more challenging to cross. There will be a new NMU route between Blofield and North Burlingham via the existing A47 and the proposed Blofield overbridge, enabling pedestrians access over the new road. |
| Demolition of Private Property and Associated Land Take | Construction | The creation of a new dual carriageway between Blofield and North Burlingham along the southern side of the A47 will require permanent private property and land take along the route. This may also affect local businesses. Temporary land take will also be required for the main and satellite compounds. |
| | Operation | There will be permanent land take in order to construct the new dual carriageway to the south of the A47, affecting several properties close to the route. |
| Agricultural Land | Construction | Both temporary and permanent land-take (Grade 1- excellent and Grade 2- very good quality agricultural land) are required for the Proposed Scheme. Therefore, the Proposed Scheme has the potential to have significant effects on agricultural land.<br>The full extent of land-take both permanent and temporary is currently undefined, therefore the extent of any effects to agricultural land are unknown |

| Topic | Stage | Summary |
|---|---|---|
| | Operation | The effects and impacts to landowners caused by temporary land-take will be alleviated during the operational phase of the Proposed Scheme as the land is re-instated and returned to the landowner.<br>Permanent agricultural land-take would be required to accommodate the new road layout, and therefore the Proposed Scheme has the potential to have significant effects on agricultural land.<br>The full extent of permanent land-take is currently undefined, therefore the extent of any effects to agricultural land are unknown. |
| Individual Farm Business | Construction | Individual farm businesses would experience the permanent and temporary land-take of agricultural land of Grade 1 (excellent quality) and Grade 2 (very good quality).<br>Temporary land-take is required to accommodate construction compounds and access during the construction phase.<br>Permanent land-take is required for the new road layout during the construction and operational phases. This land-take has the potential to have significant adverse effects.<br>The full extent of land-take, both permanent and temporary is currently undefined, therefore the extent of any effects to landowners and agricultural land are unknown. |
| | Operation | The effects and impacts to landowners caused by temporary land-take will be alleviated during the operational phase of the Proposed Scheme as the land is re-instated and returned to the landowner.<br>Permanent land-take is required for the new road layout once the Proposed Scheme is operational. This land-take has the potential to have significant effects.<br>The full extent of permanent land-take is currently undefined, therefore the extent of any effects to landowners and agricultural land are unknown. |
| Community Land and Community Facilities | Construction | It is possible that access to the Blofield pick your own and community allotments will be directly affected by the construction of the new road. Access to the Norwich Camping and Leisure Store will also be affected.<br>It is also possible that access to the businesses located close to where the new link road between the A47 and Walsham Road will be constructed will be temporarily affected during construction. |
| | Operation | During operation it is likely that there will be permanent effects on the community facilities close to the south of |

| Topic | Stage | Summary |
|---|---|---|
| | | the A47. In particular it is likely to affect the pick your own and the community allotments and the Norwich Camping and Leisure Store located along the route |
| Local Economy | Construction | The works could result in beneficial impacts on employment rates in the local area. On-site construction workers are also likely to have slight and indirect temporary benefits on the local economy through spend in local shops. |
| | Operation | Direct operational employment is not expected to be created as a result of the Proposed Scheme. However, there are likely to be increases in indirect employment opportunities related to reduced congestion, improved journey times and enhanced access to key existing and emerging employment sites. There is also likely to be an associated increase in GVA as a result of the Proposed Scheme. |
| Development Land | Construction | There are a number of development sites in the wider impact area which are likely to benefit from the construction of the new road i.e. during operation. They are not likely to be affected during the construction period. |
| | Operation | |

## 12.8 Proposed level and scope of assessment

### NMUs

12.8.1 Assessment is required for Non-Motorised Users to a Simple Level during construction and operation.

### Amenity

12.8.2 Assessment is required for Amenity to a Simple Level during construction and operation.

### Motorised Travellers: Driver stress

12.8.3 Assessment is required for Motorised Travellers: Driver Stress to a Simple Level during construction and operation.

### Motorised Travellers: View from the road

12.8.4 Whilst the assessment of Views from the Road does not directly associate with a measure of significance of effect, as defined in preceding sections above, the scale and nature of change associated with the Proposed Scheme merits assessment in the ES. Assessment is therefore required for Views from the Road to a Simple Level during construction and operation.

**Demolition of private property and associated land take, community severance, community land and community facilities, development land, local economy**

12.8.5 It is likely that the impacts on community severance, private property and associated land take, and on community land and facilities will be significant. Detailed assessment is required to determine the significance of the social and community effects during both construction and operation. This will include:

- Demolition of private property and associated land take
- Community land and community facilities
- Community severance
- Development land
- Local economy

**Agricultural land and individual farm businesses**

12.8.6 Due to the potential for significant effects, assessment is required for agricultural land and individual farm businesses during construction.

## 12.9 Proposed methodology including significance

**Non-Motorised Users**

12.9.1 The assessment of effects of the Proposed Scheme on non-motorised users (NMUs) will be undertaken using the guidance contained within the DMRB Volume 11, Section 3, Part 8 Pedestrians, Cyclists, Equestrians and Community Effects and by applying professional judgement. The assessment will examine the likely detriment or improvement to NMU journeys, including changes to journey length and quality of a journey.

**Amenity**

12.9.2 Amenity is described as the “relative pleasantness of a journey” in DMRB 11.3.8. As such, the assessment will consider Burlingham FP3, the permissive footpath running parallel to the A47 and the local side roads within the study area. Changes to the degree and duration of people’s exposure to traffic, fear or safety for people or existing barriers between pedestrians and vehicle traffic, footpath width, distance from traffic and any crossing facilities within the study area will also be considered. Exposure to noise, dirt and air quality and impacts relating to visual intrusion are also relevant to amenity but will not be included in the assessment, as these impacts are appropriately covered in Chapter 5 Air Quality, Chapter 7 Landscape and Chapter 11 Noise and Vibration.

**MTs: View from the road**

12.9.3 DMRB 11.3.9 considers that the existence of a new road may enable more people to see the surrounding landscape than before or require people to pass through visually unattractive areas. Route selection has potential to allow travellers to appreciate the wider area and their location in relation to distinctive landscape features through new appropriate views, although characteristics of

the new road that may also intrude on views. The view from the road assessment will provide a qualitative overview of the views afforded by the Proposed Scheme. A description will also be provided for traveller's exposure to different types of scenery through which the routes pass, using the four categories below:

- 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
- Open view – view extending over many miles, or only restricted by existing landscape features

**MTs: Driver stress**

12.9.4 The assessment of effects of the Proposed Scheme on driver stress will be undertaken using the guidance contained within DMRB Volume 11.3.9. DMRB considers that Driver Stress has three components: frustration, fear of potential accidents and route uncertainty. A qualitative overview will be provided for construction and operation periods applying the three-point descriptive scale (Low, Moderate or High) in line with DMRB 11.3.9.4. The construction driver stress assessment will consider the likely scope of works and will consider potential changes to traffic flows, speeds and congestion for roads within the study area, when compared with the baseline. The operational driver stress assessment will use the traffic forecasts and consider changes in traffic flows and speeds with and without the Proposed Scheme scenarios in the first 15 years after opening.

**Demolition of private property and associated land take, community severance, community land and community facilities, development land, local economy**

12.9.5 Further assessment will be undertaken in accordance with DMRB Volume 11.3.6 and 11.3.9, and will consider both direct and indirect effects arising as a result of the construction and operation of the Proposed Scheme. This involves identifying social and community resources in the study area, as well as receptors relevant to the topic, and then identifying the activities relating to the Proposed Scheme that could have an effect on those receptors and resources.

12.9.6 Social and community receptors include:

- Residents in the immediate area of the Proposed Scheme.
- Landowners in the immediate area of the Proposed Scheme.
- Local employers and businesses in the area.
- Employees and job-seekers, particularly those who live locally.
- Users of community facilities in nearby villages, such as educational establishments, health facilities, recreational facilities, places of worship and public transport.

12.9.7 Social and community resources include existing and potential:

- Residential, business, community and development land affected by the Proposed Scheme, construction works, and compounds.
- Community facilities and services including, for example, public transport, hospitals and community health facilities, primary and secondary schools, nurseries, places of worship and leisure and recreation services.

**Agricultural land and individual farm businesses**

12.9.8 Further assessment will need to be undertaken in accordance with DMRB Volume 11, Section 3, Part 6 (amendment number one): 'Land Use', and will consider both direct and indirect effects arising as a result of the construction and operation of the Proposed Scheme. As outlined in the DMRB, MAFF has classified agricultural land in England and Wales by Grade according to the extent to which its physical or chemical characteristics impose long-term limitation on agricultural use for food production.

12.9.9 The quality of the agricultural land, within the study area varies between Grade 1 (excellent quality) and Grade 2 (very good quality). The occurrences and broad locations of the different Grades of agricultural land as defined by MAFF are summarised as follows: Grade 1 agricultural land covers the majority of the study area with a small proportion of Grade 2 agricultural land located east of Blofield and south of the A47. This information has been taken from previous stages of design development and assessment and confirmed through the Natural England land capability for agriculture maps and shall be refined as part of the assessment work.

12.9.10 It should be noted that the maps provided by Natural England are not sufficiently accurate for use in assessment of individual fields or development sites, and should not be used other than as general guidance. They show only five Grades, as their preparation preceded the subdivision of Grade 3. Based on the information above, it will be required to undertake an Agricultural land classification survey (ALC) and Soil resource survey (SRS). The methodology required to be followed for both are set out below.

12.9.11 The purpose of the ALC survey is to categorise the agricultural land at the site in accordance with the ALC for England and Wales (MAFF, 1988). This will determine whether it qualifies as the "best and most versatile" (BMV) land as defined in the National Planning Policy Framework (NPPF). The MAFF ALC system classifies land into five Grades numbers 1 to 5, with Grade 3 divided into Sub-grades; 3a and 3b. BMV agricultural land falls into Grades 1, 2 and Sub-grade 3a. This land ranges from excellent (Grade 1) to good quality (Sub-grade 3a) and is the most flexible, productive and efficient in response to inputs. Land in Sub-grade 3b is of moderate quality with lower yields, and / or a more restrictive cropping range. Grades 4 and 5 are poor and very poor quality respectively, with severe or very severe limitations. The survey work required for an ALC shall be conducted in accordance with DEFRA (2009) and British Standards (BS) BS3882:2015 and BS8601:2013. The survey requires an examination of the local topography, surface conditions and climatic data in

addition to intrusive soil inspections, using a combination of hand augers and trial pits.

12.9.12 The purpose of the SRS is to further classify the soils of the site and to identify potential topsoil and subsoil resources present within the site boundary and assess their suitability for off-site sale, on-site re-use in landscaping and on-site re-use in the restoration of temporary areas of agricultural land required for the construction phase of the Proposed Scheme. The SRS component of this work shall be conducted in accordance with DEFRA (2009) section 2.1 paragraph 18 and section 4.1 and BS3882:2015 and BS8601:2013. This shall be based on existing field boundaries and differences in land-use and vegetation cover likely to influence soil properties.

12.9.13 The fieldwork required for an ALC and SRS survey shall be conducted at the same time, with a minimum density of one observation per hectare based on a rectilinear grid needed. A 0.07m diameter (Edleman) hand auger shall be used to log and sample these locations to a depth of 1.2m (or until an impenetrable layer is encountered after three attempts in a location). Soil material shall be brought to the surface in 0.2m auger segments for inspection and logging. Each excavated auger profile shall be photographed and horizon depths recorded to 0.1m accuracy.

12.9.14 Soil inspection pits allow the soil horizons identified by hand auger to be examined in greater detail and photographed. The frequency of the soil inspection pits would be related to the number of different soil types encountered in the auger profiles within the order of one pit per soil type being excavated. Where required, soil pits should be dug to a depth of 1.2m (or until an impenetrable layer is encountered).

12.9.15 Soil profile observations shall be supplemented by observation of field conditions (e.g. relief, vegetation cover) and desk study data. Soil properties shall be recorded in the field according to the Soil Survey Field Handbook (Hodgson, 1997) which provides the standard criteria for soil description. Soil matrix colour, mottles, organic matter, texture, stoniness, water state, structure, consistence and plant root characteristic shall be logged on-site for each horizon observed.

12.9.16 All auger holes and observation pits will be in-filled and re-instated immediately. Access shall be agreed with landowners in advance of any survey work.

12.9.17 Samples shall be collected in the field at each observation location for every soil profile in accordance with BS3882:2015 (topsoil) and BS8601:2013 (subsoil). These samples shall be submitted to a UKAS accredited laboratory for analyses according to BS3882:2015 and BS8601:2013. The analyses shall include:

- Soil texture
- Organic matter content
- Soil pH
- Plant nutrient content
- Electrical conductivity

- Potentially phytotoxic elements
- Visible contaminants
- Sharp contents

12.9.18 The combination of the field observations, soil profiles, climatic data and sample testing to BS3882:2015 and BS8601:2013 results allow for the land to be Graded to ALC Classifications and for the soil resources on-site to be identified. A report shall be produced identifying the ALC classification and soil resources of the site.

12.9.19 The results of the SRS shall inform the Soil management plan (SMP). DEFRA (2009) state: “A Soil Resource Plan (SRP) [or Soil Management Plan (SMP)] should be produced on all construction sites where re-usable reserves of topsoil and / or subsoil have been identified.”

12.9.20 The purpose of a SMP is to set out how soils are to be managed on-site, ensure the quality of the soil resources on-site are maintained during construction and ensure temporary land-take of agricultural land is restored satisfactorily upon return to the landowner. The SMP shall require site inspections throughout the construction phase to allow for observations of the soil management on-site.

12.9.21 The DMRB also outlines the assessment of effects on individual farm businesses. It considers land-take, changes in land quality, alterations in farm husbandry, field severance and changes in farm access likely to be imposed on individual farm businesses as a result of the Proposed Scheme. These are aspects which would be undertaken at stage three through an agricultural land questionnaire to specific identified farms. The assessment of effects on individual farm businesses will therefore be limited to the size and ALC grade of severed or potentially affected farms.

12.9.22 The assessment will be carried out by working directly with affected landowners, and their agents where appropriate. Questionnaires will be distributed to land users whose land is identified within the area of influence of the Proposed Scheme. These will be followed with direct communications, to discuss farm-specific operations, husbandry requirements and mitigation options. An ALC survey will also be conducted pre-construction to determine the quality and Grade of the effected agricultural land from the Proposed Scheme.

12.9.23 This information will be combined with local land registry data on the location and size of the land holdings to construct a profile of baseline agricultural conditions on each farm. The area of land-take (both temporary and permanent) will then be calculated for each farm business, both in absolute terms and as a percentage of the total area of land utilised by the farm.

## Significance of effects

### NMUs, amenity, and MTs

12.9.24 Criteria defining significance of effects are not outlined within DMRB Volume 11 Section 3 Part 6 or Part 8. However, DMRB Volume 11 Section 2 Part 5 provides an approach to determining significance of effects as outlined in Table 12.3. The significance of effects for each effect category have been assigned interpreting the guidance from DMRB and using professional judgement.

**Table 12.3 Descriptors of the significance of effect categories**

| Significance Category | Typical Descriptors of Effect |
|---|---|
| Very Large | Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or features of local importance may also enter this category. |
| Large | These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process. |
| Moderate | These beneficial or adverse effects may be important, but are not likely to be key decision making factors. The cumulative effects of such factors may influence decision making if they lead to an increase in the overall adverse effects on a particular resource or receptor. |
| Slight | These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the Proposed Scheme. |
| Neutral | No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. |

Source: DMRB Volume 11 Section 2 Part 5

12.9.25 Interpreting guidance from DMRB, the effect categories have been allocated the following significance (Table 12.4). All NMUs are highly sensitive to change and are considered to be highly valued. Therefore, the descriptors included in the magnitude of change table also correspond to the overall significance of effects for both NMUs (see Table 12.5) and amenity.

12.9.26 Low, Moderate and High descriptive scale is used to provide a description on driver stress changes from the baseline for motorised travellers in line with DMRB 11.3.9.4 (see Table 12.8).

**Table 12.4 Value, magnitude and significance assigned to the effect categories**

| Effect Category | Value | Magnitude | Significance |
|---|---|---|---|
| Non-Motorised Users | High | Negligible, Minor, Moderate or Major (depending on the scale of severance) | Slight, Moderate, Large or Very Large (depending on value and magnitude) |

| Effect Category | Value | Magnitude | Significance |
|---|---|---|---|
| Amenity | High | Dependant on changes to traffic flows and facilities | Slight, Moderate, Large or Very Large (depending on value and magnitude) |
| Driver Stress | Low | Low, Moderate or high (considers change in stress on individual roads from the baseline) | Neutral, Slight or Moderate or Large (depending on overall change from baseline in study area) |

**Table 12.5 Impacts and magnitude of change on Non-Motorised Users**

| Description of impacts on non-motorised users | Magnitude |
|---|---|
| • Substantially improve NMU network through the provision of new amenities for NMUs where none existed previously.<br>• Length of journeys decreased by over 500m. | Major Beneficial |
| • Improve existing NMU network through the provision of new amenities for pedestrians and cyclists where few or none existed previously.<br>• Length of journeys decreased by 250-500m. | Moderate Beneficial |
| • Improve existing NMU network through the upgrading of existing amenities or provision of new amenities for NMUs where some already exist.<br>• Length of journeys decreased by up to 250m. | Minor Beneficial |
| • Length of journeys not materially changed. | Negligible |
| • No change to journey length. | No Change |
| • Length of journeys not materially changed. | Negligible Adverse |
| • Improvements to existing NMU amenities are not provided.<br>• Length of journeys increased by up to 250m. | Minor Adverse |
| • Existing NMU facilities are degraded.<br>• Length of journeys increased by 250-500m. | Moderate Adverse |
| • Closure/ removal of NMU amenities where they previously existed.<br>• Length of journey journeys increased by over 500m. | Major Adverse |

Source: Derived by professional judgement and based on DMRB 11.3.8 Chapter 6

**Table 12.6 Impacts and magnitude of change on amenity**

| Description of impacts on amenity | Magnitude |
|---|---|
| • Substantial improvement to NMU network through the provision of new amenities for pedestrians and cyclists where none existed previously. | Major Beneficial |
| • Improvement to a greater degree than Slight (determined through professional judgement) for the existing NMU network through the provision of new amenities for pedestrians and cyclists where few or none existed previously. | Moderate Beneficial |
| • Improve existing NMU network through the provision of new amenities for pedestrians and cyclists where few or none existed previously. | Minor Beneficial |
| • No change in facilities. | No Change |

| Description of impacts on amenity | Magnitude |
|---|---|
| • Pedestrian at-grade crossing of a new road carrying below 8000 vehicles per day (AADT).<br>• A new bridge would need to be climbed or a subway traversed. | Minor Adverse |
| • Pedestrian at grade crossing of a new road carrying between 8000 - 16000 vehicles per day (AADT) in the opening year. | Moderate Adverse |
| • Pedestrian at grade crossing of a new road more than 16000 vehicles per day (AADT) in the opening year. | Major Adverse |
| • Description of impacts on amenity. | Magnitude |
| • Substantial improvement to NMU network through the provision of new amenities for pedestrians and cyclists where none existed previously. | Major Beneficial |

Source: Derived by professional judgement and based on DMRB 11.3.8 Chapter 6

**Table 12.7 Driver Stress from traffic flow for dual-carriageway roads**

| Average peak hourly flow per lane, in flow Units/1 hour | Average Journey Speed Km/hr | | |
|---|---|---|---|
| | Under 60 | 60-80 | Over 80 |
| Under 1200 | Moderate (urban area) | Moderate | Low |
| 1200-1600 | High | Moderate | Moderate |
| Over 1600 | High | High | High |

Source: DMRB 11.3.9, Table 2

**Table 12.8 Driver stress from traffic flow for single-carriageway roads**

| Average peak hourly flow per lane, in flow Units/1 hour | Average Journey Speed Km/hr | | |
|---|---|---|---|
| | Under 50 | 50-70 | Over 70 |
| Under 600 | Moderate (urban area) | Moderate | Low |
| 600-800 | High | Moderate | Moderate |
| Over 800 | High | High | High |

Source: DMRB 11.3.9, Table 3

### Demolition of private property and associated land take, community severance, community land and community facilities, development land, local economy

### Sensitivity

12.9.27 The sensitivity of receptors and resources is governed by their capacity to absorb proposed changes arising from the Proposed Scheme. It ultimately reflects their vulnerability to the impacts of the proposed activities and their access to additional or alternative resources of a similar nature. If a resource is frequently used, if few alternatives exist, or if receptors have limited capacity to absorb the changes arising from the Proposed Scheme, that receptor is considered to be sensitive to the changes. Criteria describing the sensitivity of receptors are identified in Table 12.11.

**Table 12.9 Socio-economic sensitivity criteria**

| Sensitivity | |
|---|---|
| **High** | • An already vulnerable receptor with very little capacity and means to absorb changes.<br>• No alternative facilities, access arrangements or opportunities are available within an easily accessible distance.<br>• A highly or frequently accessed resource. |
| **Medium** | • A non-vulnerable receptor with limited capacity and means to absorb changes.<br>• A limited range of alternative facilities, access arrangements or opportunities are available within an easily accessible distance.<br>• A moderately, or-semi-frequently accessed resource. |
| **Low** | • A non-vulnerable receptor with sufficient capacity and means to absorb changes.<br>• A wide range of alternative facilities, access arrangements or opportunities are available within an easily accessible distance.<br>• An infrequently accessed resource. |

## Magnitude

12.9.28 To assess the magnitude of an impact on these receptors and resources, each impact arising is assessed in terms of the following indicators:

- Spatial scope – whether impacts are likely to be felt within the Proposed Scheme boundary, within the LIA or WIA (Broadland District), or more widely.
- Extent – how many social and community resources and receptors are likely to be impacted.
- Duration – whether the impacts would be short or long-term.
- Reversibility – whether the impact is permanent or temporary.

12.9.29 Taking these indicators into consideration, and also any mitigation measures that can be applied; the criteria are used as guidelines to assess the magnitude of each impact. This is described in more detail in Table 12.10.

**Table 12.10: Socio-economic and community impact magnitude criteria**

| Magnitude | Criteria guidelines |
|---|---|
| **Major** | • Affects receptors within the WIA and beyond.<br>• Affects the well-being of many receptors (or the well-being of a few receptors in an acute way for an extended period).<br>• Affects receptors for an extended period (e.g. the majority of the construction period or is permanent).<br>• Requires considerable intervention to return to the baseline. |
| **Moderate** | • Affects either the well-being of receptors beyond the site boundary into the LIA.<br>• Affects the well-being of a moderate number of receptors.<br>• Continues over a number of years, but the baseline is re-established quickly.<br>• May require some intervention to return to the baseline conditions. |

| Magnitude | Criteria guidelines |
|---|---|
| **Minor** | • Affects the well-being of a small number of receptors.<br>• Occurs exceptionally, mostly within the site boundary.<br>• Does not extend beyond the life of the Proposed Scheme (the end of the construction period or first year of operation).<br>• Baseline returns naturally or with limited intervention within a short timescale. |
| **Negligible** | • Localised to a specific location within the site.<br>• Temporary or unlikely to result in detectable impact on the well-being of people or a socio-economic resource.<br>• Considered to be a risk that is manageable with intervention.<br>• Baseline remains consistent. |

## Significance

12.9.30 Effects will be evaluated by combining the assessment of both the sensitivity of the receptor or resource, with the magnitude of the impact. This allows the prediction of the significance of the effect, as shown in Table 1.2. These effects can be beneficial or adverse temporary or permanent, depending on the nature of the development, the mitigation measures, and any enhancement measures proposed. In accordance with DMRB guidance, effects with an assessment of moderate and above are considered to be significant.

### *Agricultural land and individual farm businesses*

12.9.31 Criteria defining significance of effects are not outlined within DMRB Volume 11 Section 3 Part 6 (amendment number one): 'Land Use'. The significance of effect for agricultural land and individual farm businesses have been assigned interpreting the guidance from DMRB and using professional judgement.

12.9.32 Table 12.11 outlines the criteria used to assign importance and sensitivity of land use in accordance with the DMRB. The typical descriptors have been adapted from the DMRB to allow a greater understanding of the clarity and the sensitivity of this topic.

**Table 12.11 Sensitivity criteria for land use**

| Value (sensitivity) | Typical Descriptors |
|---|---|
| High | Existing beneficial land uses (e.g. active property, private land associated with active property, community lands and woodlands). |
| Medium | Areas designated for future usage with a developer interest (e.g. land-use planning policy designations contained within local development plans), assess lanes, farm outbuildings. |
| Low (or lower) | Existing land uses of less beneficial nature (e.g. inactive property, private land associated with an inactive property) and without developer interest. |

Source: Derived by professional judgement and based on DMRB 11.3.6 chapters 6-10

**Table 12.12 Value assigned to the assessment of agricultural land based on the ALC grading criteria**

| Value | Grade |
|---|---|
| High | 1,2 and 3a |
| Medium | 3b |
| Low | 4 and 5 |

Source: Derived by professional judgement and based on DMRB 11.3.6 chapters 6-10

**Table 12.13 Magnitude of impact assigned to the assessment of agricultural land based on the ALC grading criteria and area of land-take**

| Grade | Land Take | | |
|---|---|---|---|
| | >20ha | <20ha | Indirect |
| 1, 2 and 3a | Major | Moderate | Minor |
| 3b | Moderate | Minor | Minor |
| 4 and 5 | Minor | Minor | Minor |

Source: Derived by professional judgement and based on DMRB 11.3.6 chapters 6-10

**Table 12.14 Overall effect assigned to the assessment of agricultural land based on the ALC grading criteria and area of land**

| Value | Magnitude | | |
|---|---|---|---|
| | Major | Moderate | Minor |
| High | Large adverse | Moderate adverse | Slight adverse |
| Medium | Moderate adverse | Slight adverse | Slight adverse |
| Low | Slight adverse | Slight adverse | Slight adverse |

Source: Derived by professional judgement and based on DMRB 11.3.6 chapters 6-10

**Table 12.15 Value assigned to the assessment of individual farm businesses, which is based on the area of land-take**

| Value | Receptor |
|---|---|
| High | Total area <20ha and / or limited or highly specific range of high-value crops or livestock and low operational flexibility |
| Medium | Total area 20-50ha and / or some diversification or range of crop or livestock types |
| Low | Total area >50ha and / or highly diversified income and flexible management |

Source: Derived by professional judgement and based on DMRB 11.3.6 chapters 6-10

**Table 12.16 Magnitude of impact assigned to the assessment of individual farm businesses, which is based on proportion of land lost**

| Receptor | Magnitude | | |
|---|---|---|---|
| | **25% permanent land lost and / or access severely severed** | **10-24% permanent land lost and / or access partially severed** | **Indirect 1-9% permanent land lost and / or minor access severed** |
| Total area <20ha and/or limited or highly specific range of high-value crops or livestock and low operational flexibility | Major | Moderate or Major | Minor or Moderate |
| Total area 20-50ha and/or some diversification or range of crop or livestock types | Moderate or Major | Moderate | Slight |
| Total area >50ha and/or highly diversified income and flexibility management | Minor or Moderate | Minor | Neutral or Minor |

Source: Derived by professional judgement and based on DMRB 11.3.6 chapters 6-10.

**Table 12.17 Significance of effect from the value and magnitude assigned to the assessment of individual farm businesses, which is based on the area of land take and proportion of land lost**

| Value | Magnitude | | |
|---|---|---|---|
| | **Major** | **Moderate** | **Minor** |
| High | Large adverse | Moderate or Large adverse | Slight or Moderate adverse |
| Medium | Moderate or Large adverse | Moderate adverse | Slight adverse |
| Low | Slight or Moderate adverse | Slight adverse | Neutral or Slight adverse |

Source: Derived by professional judgement and based on DMRB 11.3.6 chapters 6-10

## 12.10 Conclusion

### NMUs, amenity, and MTs

12.10.1 Assessment is required to a Simple Level in the first instance for Non-Motorised Users and Amenity for the Proposed Scheme, during both construction and operation. This will be undertaken in accordance with the DMRB Volume 11, Section 3, Part 9 'Vehicle Travellers' and Part 8 'Pedestrians, Cyclists, Equestrians and Community Effects' respectively.

12.10.2 Assessment is also deemed necessary for Motorised Travellers Driver Stress, for the Proposed Scheme to a Simple Level initially, as there would be the potential for significant effects associated with the Proposed Scheme. This will

be undertaken in accordance with DMRB Volume 11, Section 3, Part 9 'Vehicle Travellers'.

12.10.3 Whilst the assessment of Views from the Road does not directly associate with a measure of significance of effect, as defined in preceding sections above, the scale and nature of change associated with the Proposed Scheme merits assessment in the ES. Assessment is therefore required for Views from the Road to a Simple Level during construction and operation. The significance of visual effect experienced by road users as a result of the Proposed Scheme will be represented within Chapter 7 Landscape of the Proposed Scheme ES.

**Demolition of private property and associated land take, community severance, community land and community facilities, development land, local economy**

12.10.4 The Proposed Scheme is likely to result in a small number of effects on social and community receptors during the construction and operational phases of the Proposed Scheme.

12.10.5 During construction temporary and permanent land take will be required from private receptors, including residential properties, and private businesses giving rise to potentially significant effects. There is also likely to be some temporary severance resulting from the closure of roads that feed into the new route, which will affect access to local properties, and result in potentially permanent severance for pedestrians.

12.10.6 There are also likely to be a number of beneficial effects during construction and operation including the creation of temporary construction employment and the potential for a contribution to significant economic benefits arising from the overall programme of work scheduled for the A47 of which the Proposed Scheme is a part.

12.10.7 As the Proposed Scheme is considered likely to result in some significant effects on social and community receptors, this topic is scoped in for further assessment for both the construction and operation stages. The assessment will include community severance; demolition of private property and associated land take, community land and community facilities; development land; and the local economy.

**Agricultural land and individual farm businesses**

12.10.8 Overall, the Proposed Scheme is likely to impact on agricultural land and individual farm businesses during construction.

12.10.9 In particular, during the construction and operation phase of the Proposed Scheme, permanent and temporary land-take will be required from the BMV Grades 1 and 2 agricultural land which shall also impact on the individual farm businesses. It should be noted that the maps provided by Natural England are not sufficiently accurate for use in assessment of individual fields or development sites, and should not be used other than as general guidance. The land-take of BMV Grade 1 and 2 agricultural land shall require further assessment in the forms of ALC and SRS survey work informing the SMP and

Farm viability assessment. Work shall be undertaken in accordance with the DMRB Volume 11, Section 3, Part 6 (amendment No 1): 'Land Use'.

12.10.10 Further assessment is therefore required for agricultural land, including individual farm businesses during construction as there is potential for significant effects to result from the Proposed Scheme.

12.10.11 No further assessment is required for agricultural land, including individual farm businesses during operation, as there is unlikely to be any significant adverse or beneficial effects.

12.10.12 Table 12.18 outlines the level of assessment required for each sub-topic of People and Communities.

**Table 12.18 Level of assessment required**

| People and Communities Sub-Topic | Level of Assessment Required |
|---|---|
| NMUs | Simple |
| Amenity | Simple |
| MTs Driver Stress | Simple |
| MTs View from the Road (Operation only) | Simple |
| Community Severance | Detailed |
| Community Land and Community Facilities | Detailed |
| Development Land | Detailed |
| Demolition of Private Property and Associated Land Take | Detailed |
| Local Economy | Detailed |
| Agricultural Land and Individual Farm Business | Simple |

# 13 Road Drainage and the Water Environment

## 13.1 Introduction

13.1.1 This chapter considers existing environmental baseline information for Road Drainage and the Water Environment alongside the proposed scope of assessment and assessment methodologies. This chapter also addresses the potential effects as a result of the construction, demolition and operation phases of the Proposed Scheme on the Road Drainage and the Water Environment topic. It has been prepared in accordance with DMRB Volume 11, Section 2, Part 4, and DMRB Volume 11, Section 3, Part 10, to a Scoping Level. The topic incorporates surface water and groundwater, water resources and flood risk. This chapter identifies the key impacts, describes the study area and key receptors. The potential requirement for assessment to either Simple or Detailed level will be identified. Where required, this will be presented within the ES.

## 13.2 Study area

13.2.1 The study area encompasses a number of water features within a 1km area around the Proposed Scheme. This is extended where there are features that may be affected by pollutants transported downstream of the Proposed Scheme, and therefore these features would be included in the assessment as appropriate.

## 13.3 Existing and baseline knowledge

13.3.1 This chapter has been completed based on the information previous stages of design development and assessment, plus the following sources of information:

- British Geological Survey 1:50,000 and 1:625,000 superficial and bedrock geological map (British Geological Survey, 2017a)
- Defra Magic map (Defra, 2017)
- Environment Agency (EA) data (EA, 2017a, 2017b, 2017c, 2017d and 2017e)
- Highways Agency Drainage Data Management System (HADDMS), Drainage Data Management System v5.12.0
- Highways England (2017). A47 Corridor Improvement Programme. Stage 2 Buildability Summary Report

13.3.2 The information in Table 13.1 summarises the relevant waterbodies within the study area for the Proposed Scheme as well as any water dependent designated conservation sites. Figure 13.1 shows the surface water features within the study area, Figure 13.2 shows the fluvial flood risk features in the vicinity of the Proposed Scheme and Figure 13.3 shows the surface water flood risk (see Appendix D).

**Table 13.1 Summary of existing road drainage and the water environment baseline**

| | **Summary of Existing Baseline** |
|---|---|
| Surface Water | • Ordnance Survey (OS) mapping and HADDMS indicates the area of the Proposed Scheme has an elevation of 10 to 30mAOD running approximately along the catchment divide between the River Yare catchment to the south and west and the River Bure catchment to the north and east. The surrounding land is generally flat or gently sloping arable agricultural land.<br>• The study area comprises areas within the catchments of two WFD water bodies:<br>o The Witton Run water body catchment (Water Framework Directive (WFD) WBID: GB105034051310) which is located in the western half of the study area;<br>o The Bure (Horstead Mill to St Benet's Abbey) water body catchment (WFD WBID: GB105034050931) which is located in the north-eastern part of the study area, and;<br>o The south-eastern part of the study area is located within the Bure Operational Catchment with no designated WFD water body catchment.<br>• A review of OS Open Raster mapping identified approximately seven drainage channels within the study area. A number of isolated ponds are also located within the study area. Figure 13.1 shows the surface water features within the study area.<br>• Witton Run passes the through the south-western section of the Proposed Scheme, there are numerous minor drainage channels and ponds identified in this area associated with the water body, including Run Dike, which provides a potential continuous link from the Proposed Scheme to Witton Run.<br>• The remaining drainage channels are minor and discontinuous with each other and the River Bure.<br>• There are a number of smaller watercourses and ponds within the study area, these will need to be confirmed during the site walkover.<br>• The Envirocheck report (2017) identifies three surface water abstractions within 1km of the Proposed Scheme. These comprise:<br>o One used for general agriculture: spray irrigation (direct), and;<br>• Two used for general agriculture: spray irrigation (storage). |

| | **Summary of Existing Baseline** |
|---|---|
| Water Quality | • The study area and Proposed Scheme area are split approximately equally east to west between the Bure and Yare Operational Water Framework Directive Catchments respectively. Both of which are within the Broadland Rivers Management Catchment, part of the Anglian River Basin District.<br>• The current Anglian River Basin Management Plan (RBMP), as shown by the EA's Catchment Explorer (EA, 2017a) shows that Witton Run (GB105034051310) in the Yare Catchment is classified as a Heavily Modified Water Body. The Anglian RBMP classifies the current Ecological and Chemical Quality of the water body as 'Moderate' potential and 'Good' status, respectively. The Ecological potential is limited by physico-chemical elements (dissolved oxygen) and supporting surface water elements (linked to agricultural land management, abstractions and diffuse phosphate pollution) not achieving 'Good' potential. The overall water body status is classified as 'Moderate' and is not expected to improve as it is disproportionately expensive.<br>• Bure (Horstead Mill to St Benet's Abbey (GB105034050931) in the Bure operational catchment is classified as a Heavily Modified Water Body. The Anglian RBMP classified the current Ecological and Chemical Quality of the water body as 'Moderate' potential and 'Good' status, respectively. The Ecological potential is limited by physico-chemical quality elements (dissolved oxygen and temperature) and other surface water elements (mitigation measures) not achieving 'Good' potential. The overall water body status is classified as 'Moderate' with an objective for 'Good' potential by 2027.<br>• EA's Catchment Explorer (EA, 2017a) indicates both water bodies are protected under the Nitrates Directive, the Conservation of Wild Birds Directive and the Habitats and Species Directive. In addition, Bure (Horstead Mill to St Benet's Abbey) is protected under the Urban Waste Water Treatment Directive.<br>• The entire study area is within the Norwich Crag and Gravels Groundwater Nitrate Vulnerable Zone NVZ (G79). The northern half of the study area is within the South Walsham Broad Eutrophic Lake NVZ (EL108).<br>• The northern half of the study area is within a Drinking Water Protected Area (Essex and Suffolk Water, Ormesby WTW, SWGSGZ1018) at risk and designated for the pesticide metaldehyde.<br>• No assessment of pollution impacts from routine run-off to surface waters has been undertaken using the Highways Agency Water Risk Assessment Tool (HAWRAT) within the draft Stage 2 Environmental Assessment Report (EAR) (Amey, 2017). |

| | **Summary of Existing Baseline** |
|---|---|
| | • The Broadland Rivers Chalk and Crag groundwater body (GB40501G400300) has 'Poor' Chemical and Quantitative status (2016 cycle 2). The Quantitative status is limited by the Groundwater Dependent Terrestrial Ecosystems (GWDTE) test which scored poorly due to agricultural abstractions lowering the natural flow and levels of the groundwater. The objective is to achieve 'Good' Quantitative status by 2021. The Chemical status is limited by the Chemical Drinking Water Protected Area criteria, which scored poorly although data is reportedly suspect. Objectives are to achieve 'Good Chemical Status by 2027 by natural recovery. The water body is linked to the areas protected under the Nitrates Directive and Drinking Water Protected Areas highlighted above.<br>• There are five consented discharges to surface water within the study area of the Proposed Scheme. These consist of the following:<br>o One discharge from multiple domestic properties onto land/watercourse at OS National Grid Reference (NGR) TG 35987 09365 (ref NPSWQD000199)<br>o One discharge from single domestic property to freshwater river (ditch in catchment of tidal Yare) at OS NGR TG3634010791 (ref PRENF16038)<br>o Three WwTW discharges to freshwater (not water company or domestic property) at OS NGR TG 34060 08960, TG 36790 10040 and TG 33700 11050 (refs PRENF16037 PRENF19793 and PR PRENF11791) |
| Groundwater | • The bedrock and superficial geology within the study area is described in detail in Chapter 9 Geology & Soils.<br>• The majority of the study area has a cover of superficial geology. However, there are areas of no recorded superficial cover to the north-west of Braydeston Hall.<br>• The Happisburgh Glacigenic Formation Sand is classified by the EA as a Secondary A aquifer, which are described as formations that provide locally important water resources and may support base flow to rivers (see Figure 13.2).<br>• The Lowestoft Formation Diamicton is classified as a Secondary (undifferentiated) aquifer. It is present across most of the site and likely overlies the Happisburgh Glacigenic Formation Sand. Secondary (undifferentiated) aquifers are classified as such due to the formation previously designated as both a minor aquifer and non-productive strata in different locations due to variable characteristics. The Happisburgh Glacigenic Formation Diamicton is present to the west of the study area and is classified as unproductive strata.<br>• To the south of Blofield, in an area that may be required for the proposed drainage, the Crag Group and Bytham Sand and Gravel Formation (undifferentiated) and Lowestoft Formation Sand and Gravel are present. These are classified by the |

| | **Summary of Existing Baseline** |
|---|---|
| | Environment Agency (EA) as Secondary A aquifers. The Breydon Formation Peat is also present in this area and is classified by the EA as unproductive strata.<br>• The bedrock geology underlying the study area is the Norwich Crag. This is classified by the EA as a Principal Aquifer, and is likely in hydraulic continuity with the underlying Chalk. Principal Aquifers supply water resources and/or base flow at a strategic scale. The Norwich Crag has a Major Aquifer High vulnerability classification, with the exception of where it is overlain by Breydon Formation Peat, where vulnerability is classified as Major Aquifer Intermediate.<br>• The groundwater within the study area is part of the Broadland Rivers Chalk and Crag groundwater body (GB40501G400300).<br>• The Proposed Scheme crosses a source protection zone (SPZ) 3 (Total Catchment) at its western extent, associated with groundwater abstractions approximately 2.7km to the south of the main carriageway of the Proposed Scheme, near Strumpshaw. The area that may be required for the proposed drainage to the south of Blofield extends towards the SPZ and the associated abstraction. The Outer (SPZ2) and Inner (SPZ1) zones fall within 1km of the proposed drainage of the Scheme. There is no corresponding licensed groundwater abstraction for potable water supply shown on the EA's website (EA, 2017f) however.<br>• The Envirocheck report (2017) identifies ten licensed groundwater abstractions within 1km of the Scheme. These comprise:<br>o Three used for agriculture (general)<br>o Five used for spray irrigation (direct)<br>o One used for General Farming and Domestic<br>o One used for industrial purposes<br>• There may be other unlicensed abstractions of less than 20m3/day within the study area.<br>• There are four consented discharges to land and groundwater within the study area of the Proposed Scheme. These consist of the following:<br>o Two discharges from single domestic properties to soakaways at OS NGR TG 35846 10786 and TG 36315 10844 (refs PRELF11165 and NPSWQD005327)<br>o One sewage discharge to land from multiple domestic properties (likely septic tank with drainage field) at OS NGR TG 35999 09387 (ref NPSWQD000199),<br>o One WwTW discharge to soakaway (not water company or domestic property) at OS NGR TG 36380 10840 (ref PRELF20582). |

| | **Summary of Existing Baseline** |
|---|---|
| Flood Risk | • According to the EA's Flood Map for Planning (EA, 2017b), the whole of the Scheme area and majority of the study area are located within Flood Zone 1 (all areas outside of Flood Zones 2 and 3 in Figure 13.1) which is associated with a low risk of flooding from fluvial and coastal sources (an annual probability of less than 1 in 1,000 (0.1%) of river and sea flooding.<br>• A small proportion of the study area to the south of Blofield is within Flood Zone 2, which is associated with medium risk of flooding (land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding) and Flood Zone 3b, comprises as land where water has to flow or be stored in times of flood. This section of Flood Zone 3b is associated with Run Dike (Witton Run WFD water body), a tributary of the River Yare.<br>• There are no flood defences, areas benefitting from defences or flood storage areas with the study area.<br>• The EA's Historic Flood Map does not indicate any areas of previous flooding within the study area.<br>• The Norfolk County Council Norfolk Local Flood Risk Management Strategy (Norfolk County Council, 2015) indicated that <10 residential properties in Blofield are at risk of fluvial flooding.<br>• The EA's Risk of Flooding from Surface Water map (EA, 2017c) shows the majority of the study area is at very low and low risk of flooding (as identified in Figure 13.3), meaning there is an annual risk of less than 0.1% and between 0.1% and 1% respectively (Figure 13.3).<br>• There are localised areas of medium and high risk of surface water flooding, especially associated a surface water flow path running south west from the western edge of Blofield towards Run Dike, a tributary of the River Yare. The remaining areas of medium and high risk appear to be associated with isolated ponding.<br>• The EA flood risk map for reservoir failure (EA, 2017c) indicates the study area and Proposed Scheme are not at risk of flooding due to reservoir failure.<br>• HADDMS identified a number of instances of historic highway flooding on the A47 within the study area largely restricted to the eastern and western extents and outside the Scheme area itself:<br>o Two low severity (1-3) flooding events in 2013 in Blofield where the carriageway was flooded<br>o Four low severity (1-3) flooding events between 2012 and 2017 in North Burlingham where the carriageways and a layby were flooded<br>o No information was available on the cause of flooding apart from two events which were caused by blocked gullies |

| | **Summary of Existing Baseline** |
|---|---|
| | • Currently there is no information from Anglian Water regarding sewer flooding. |
| Groundwater Flood Risk | • The main carriageway of the Proposed Scheme is within an area that has limited potential for groundwater flooding to occur, with one small area (100m by 100m) on the southern boundary where there is potential for groundwater flooding to occur below ground (see Figure 13.4). The groundwater susceptibility dataset is only available for a 500m corridor around the existing road, and as such there is no information available for the areas to the south of the Proposed Scheme that may be required for the drainage regime. |
| Drainage | • The Highways Agency Drainage Data Management System (HADDMS) identifies the following drainage features within the study area:<br>o The eastern extent of the A47 within the study area (at Blofield) outfalls to approximately 18 existing soakaway chambers all classified as Priority D (low pollution risk) status<br>o The western extent of the A47 within the study area (at North Burlingham) outfalls to approximately 26 existing soakaway chambers all classified as Priority D (low pollution risk) status<br>o HADDMS indicated no other outfalls within the study area;<br>o HADDMS indicated a number of grip inlets at the eastern extent of the Scheme (at North Burlingham) suggesting run-off from the carriageway is routed locally to an adjacent grip / ditch<br>o No attenuation or detention ponds were indicated on HADDMS within the study area<br>o No pollution control devices or oil separators were indicated on HADDMS within the study area<br>• The majority of the Scheme lies within a rural catchment with drainage mostly via soakaway or outfall to ditch / grip.<br>• The western and eastern extents of the Proposed Scheme lies within a partly urbanised catchment, where surface water drainage is governed by highways drainage and Anglian Water's sewerage drainage network. Subject to the outcome of the existing drainage survey, the Proposed Scheme drainage does not appear to connect to the local sewerage network. |
| Aquatic Ecology | • Through potential impacts on the water environment, the Proposed Scheme has the potential to impact on the aquatic ecology in the study area, such as the Desmoulin's whorl snail Vertigo moulinsiana, little whirlpool ram's-horn snail Anisus vorticulus. The Desmoulin's whorl snail is a qualifying feature of the adjacent Broads SAC, and the little whirlpool rams-horn snail is a European Protected Species potentially located to |

| | Summary of Existing Baseline |
|---|---|
| | the east of the study area. The impact on such features has been considered in Chapter 8 Biodiversity.<br>• There are no Ramsar sites, Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSSI), Local Nature Reserves (LNR) or National Nature Reserves (NNR) within the study area.<br>• Groundwater dependent Priority Habitats (Lowland Fens) are present within 1km to the south-west of the areas that may be required for the drainage regime. These are located adjacent to Run Dike between Brundall and Highnoon Farm.<br>• There are potential direct surface water links between areas of Lowland Fen Priority Habitat to the south west of the scheme area and potential drainage discharge location via Run Dike.<br>• Furthermore, there are potential groundwater connections between the Proposed Scheme main carriageway works and the following aquatic ecological receptors:<br>o The Broads SAC (UK0013577) and Broadland SPA (UK9009253) – a 5885 hectare fenland site located over 2km north and south of the existing A47 carriageway. This includes the Yare Broads and Marshes SSSI, located within the River Yare floodplain to the southwest of the study area and the Damgate Marshes, Acle SSSI and Decoy Carr, Acle SSSI, both located to the east of the study area. These sites are also included in the Broadland Ramsar and Mid-Yare NNR.<br>o Witton Run WFD water body (GB105034051310) located south of the existing A47 carriageway. The current status of aquatic invertebrates and macrophytes in the water body is Good and High respectively<br>o Bure (Horstead Mill to St Benet's Abbey) WFD water body (GB105034050931) located north of the existing A47 carriageway. The current status of aquatic invertebrates and macrophytes in the water body is Good and High respectively<br>• Results of ecological surveys carried out during previous assessment indicate five ponds within the study area that may support Great Crested Newts (Amey, 2017).<br>• Other ecological surveys indicate the potential presence of Desmoulin's Whorl Snail within the study area and is a qualifying feature of the adjacent Broads SAC.<br>• The Acle Straight, located just to the east of the study area, is a known location of the little whirlpool rams-horn snail which is a European Protected Species. Ecological surveys for this species are ongoing although no population has been identified within the study area. |

| | **Summary of Existing Baseline** |
|---|---|
| | • Ecological surveys for Otter and Water Vole are ongoing. Further information on aquatic species is given in Chapter 8 Biodiversity. |
| Recreation and Human Health | • There are no surface water or groundwater abstractions used for potable water supply within the Scheme or study areas.<br>• Smaller unlicensed abstractions of less than 20m3/day may also be present within the study area.<br>• The Scheme crosses a SPZ 3 (Total Catchment) at its western extent, relating to groundwater abstractions for public water supply 2.7 km to the south of the proposed Scheme, near Strumpshaw. The current status of this licence requires verification, however.<br>• The majority of watercourses within the study area are minor Ordinary watercourses and drainage ditches which are unlikely to be used for recreation activities such as navigation or fishing. Run Dike is designated as a Main River and passes through the south west corner of the study area. However, the watercourse is relatively small and is unlikely to be used for recreation or navigation. Furthermore, there are some amenity green spaces surrounding the watercourses which are publicly accessible providing a space for recreational activities such as dog walking. |
| Climate Change | • The associated online climate change allowance (EA, 2017d) states that to allow for residual uncertainty in assessing the impacts of climate change on future flood risk, fluvial flow rates should be increased by 25% which refers to the 'central' category for the Anglian Region and a time horizon of 2080s (2070 to 2115), as the Site is classed as 'essential infrastructure' lying in Flood Zone 1.<br>• The Met Office regional climate summary for Eastern England (Met Office, 2016) indicates the current climate baseline to be:<br>o Mean annual temperatures ranging from 9.5°C to around 10.5°C in the low lying areas with mean daily minimum temperatures of 1°C in winter and mean daily maximum temperatures of 20°C to 23°C in summer.<br>o Average annual sunshine durations over Eastern England range from over 1600 hours in Norfolk Suffolk and Essex to less than 1450 hours in the east Yorkshire and Lincolnshire.<br>o Eastern England has a more even annual distribution of rainfall when compared with the rest of the UK with an average of 30 rain days in winter and less than 25 days in summer.<br>o The average number of days with snow falling is about 20 per year in low lying areas.<br>o Eastern England is one of the more sheltered parts of the UK in terms of wind. |

| | Summary of Existing Baseline |
|---|---|
| Major Accidents and/or Disasters (Events) | • Norfolk County Council Local Flood Risk Management Strategy (Norfolk County Council, 2015) identified no historic flooding events within the study area.<br>• No further information was available on major accidents, disasters or pollution events/spills within the study area.<br>• Further consultation will be required with Norfolk County Council, Broadland District Council and Anglian Water to fully understand the extent of extreme historical flooding in the study area. |

## 13.4 Assumptions and limitations

13.4.1 This scoping exercise has been prepared using publicly available information and with reference to previous assessments carried out and through the use of HAGDMS and HADDMS. The assessment presented is based on a desk study and no site visit was undertaken at the time of writing. Considering the nature of the Proposed Scheme, it is not considered that the data limitations introduce any significant uncertainties with respect to surface water, groundwater and flood risks.

13.4.2 There are currently no details of the Proposed Scheme drainage design.

## 13.5 Guidance and best practice

13.5.1 The scope, level of assessment and methodologies listed in Sections 13.8 to 13.9 represent the approach required to meet the following statutory and non-statutory requirements:

- National Planning Policy Framework (DCLG, 2012) and its associated Technical Guidance (DCLG, 2016).
- Highways (Environmental Impact Assessment) Regulations 2007 (EIA Highways Regulations 2007).
- Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (2000), more commonly known as the Water Framework Directive.
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2000.
- The Groundwater (Water Framework Directive) (England) Direction 2016.
- Groundwater protection guides covering: requirements, permissions, risk assessments and controls (EA, 2017e), previously covered by: Groundwater protection: principles and practice (GP3) (EA, 2013a).
- Land Drainage Act 1991 and 1994.
- Flood and Water Management Act (2010).
- EA environmental permitting guidance.
- The Environmental Permitting (England and Wales) Regulations (2010) which replaces the Water Resources Act (1991) as the key legislation for water pollution in the UK.

- The Greater Norwich Development Partnership (2014) Joint Core Strategy for Broadland, Norwich and South Norfolk.
- The Norfolk County Council Local Flood Risk Management Strategy (Norfolk County Council, 2015).
- The Broadland Local Plan (2015-2026).
- The Environment Act (1995).
- The Water Act (2014).

13.5.2 The Road Drainage and Water Environment assessment will be undertaken in accordance with Highways England's technical guidance provided in DMRB Volume 11, Section 3, Part 10 (HD 45/09, Highways Agency, 2009).

## 13.6 Consultation

13.6.1 Consultation with the following organisations will be required throughout the EIA process:

- Environment Agency
- Norfolk County Council as Lead Local Flood Authority
- Broadland District Council
- Anglian Water

13.6.2 Although many of the surrounding watercourses and catchments fall within the district of the Norfolk Rivers Internal Drainage Board (IDB), none of the watercourses within the study area are within the IDB district. Therefore, no consultation with the IDB is required.

13.6.3 It is proposed to initiate consultations with the organisations listed in Section 13.6.2 regarding clarifications on approach and other issues relating to water quality and WFD status, flooding, drainage and groundwater. The outcomes of the relevant consultation will be detailed in the ES.

## 13.7 Potential effects, including monitoring and mitigation measures

### Construction and demolition

13.7.1 The main construction compound would be located at the west end of the Proposed Scheme to the south of the proposed A47 alignment. A satellite compound would also be required at the east end to the north of the proposed compact grade separated junction. These areas are currently used as agricultural land.

13.7.2 The construction phase may have the potential to impact upon the water environment (including groundwater) through mobilisation of sediments and contaminants due to earthworks, construction dewatering, vehicular movements, plant and vehicle washing and alterations to ground levels. The impacts of these activities would be mitigated by best practice construction measures to be included within the Construction Environment Management Plan (CEMP) in accordance with Construction Industry Research and

Information Association (CIRIA) Guidelines (CIRIA C532, 2002; CIRIA C648, 2006 CIRIA C741, 2015).

13.7.3 Any permeable horizons present within the superficial deposits, particularly the Happisburgh Glacigenic Formation Sand deposits, may act as pathways for the migration of near-surface groundwater or contaminants. Any foundations (if present as part of the design) could create preferential pathways for the migration of pollutants to the underlying aquifer units. Foundations may also have the potential to act as groundwater dams.

13.7.4 The study area lies within a NVZ for groundwater and also for eutrophic lakes to the north of the study area. Where construction activities have the potential to mobilise nitrate during, for example, earthworks in areas of agriculture, there is a potential to increase nitrate concentrations within the lake or groundwater. The risk of nitrate mobilisation will be managed by the implementation of best practice construction measures through the CEMP. Indirect receptors, such as groundwater abstractions for potable water supply or surface water features, are considered to be sufficiently far enough away that any resultant increase in nitrate loading within the groundwater body would not be measurable.

13.7.5 The Bure (Horstead Mill to St. Benet's Abbey) water body is designated as a Drinking Water Protected Area (DrWPA) and is at risk for the pesticide metaldehyde. A small proportion of the Proposed Scheme between ch2200 and ch2600 lies within the DrWPA. Metaldehyde is used as a molluscicide on arable crops such as potatoes and in parks and gardens. It is highly unlikely that any construction activity, such as earthworks, has the potential to introduce or mobilise metaldehyde, due to its rapid degradation (DT90 of 18 days) in soil (University of Hertfordshire, 2017). The potential impact on the DrWPA is therefore considered negligible.

13.7.6 Construction activities for the Proposed Scheme could increase the risk of a pollution incident, associated with accidental spillages/or leaks of fuels, oil, chemicals, wastewater, concrete and cement and admixture. However, due to the temporary nature of these impacts, and with appropriate best practice working measures implemented through the CEMP, the risk is considered to be mitigated.

13.7.7 Where works will lead to temporary changes in the surface water run-off regime by the alteration of ground elevations and overland flow pathways for example, by earthworks or proposed structures, a temporary surface water drainage strategy would be developed for the Proposed Scheme and incorporated into the CEMP to ensure that there will be no increase in run-off and flood risk during the construction phase. Sustainable Drainage Systems (SuDS) would be implemented where appropriate.

13.7.8 The construction phase has the potential to affect recreational users of, and the aquatic ecology within, the local surface water features due to increased pollution during construction. Due to the temporary nature of these impacts, and with appropriate best practice measures implemented through the CEMP, these risks are likely to be mitigated. Aquatic ecology may also be affected by the impact of changes in groundwater levels, flow and quality on groundwater-

dependent habitats. However any changes in groundwater levels and flow are likely to be sufficiently small as to have a negligible impact on these indirect receptors, which are located outside of the study area.

13.7.9 Monitoring the impacts of the Proposed Scheme operation on the water environment is not considered necessary provided that appropriate measures are implemented as part of the design to mitigate any impacts.

13.7.10 The requirements for demolition are yet to be confirmed as part of the preliminary design.

13.7.11 Potential demolition activities include the removal of side roads and the main carriageway where they are no longer required.

**Operation**

13.7.12 The Proposed Scheme would require a new road drainage design, which is yet to be completed, and it is assumed that only a small section of the existing A47 drainage would be utilised where it ties in. The location of the proposed outfalls is currently not known although a number of options are currently being assessed:

- The use of soakaways at the eastern and western extents of the Proposed Scheme.
- The potential use of soakaways, infiltration basins and attenuation ponds in the central section of the Proposed Scheme dependent on the results of ground investigations.
- If soakaways are not viable in the central section of the Proposed Scheme then surface water run-off from the Proposed Scheme may be disposed via attenuation ponds to a number of ground or surface water outfall locations to the south of the Proposed Scheme. One of the potential outfall locations would be a ditch tributary to Run Dike (a Main River) and tributary of the Witton Run WFD surface water body.

13.7.13 The potential effects of Proposed Scheme operation on the water environment will be assessed, particularly with respect to the SPZ relating to public water supply abstractions and the downstream groundwater dependent Priority Habitats, and mitigated through the design.

13.7.14 The entire area of the Proposed Scheme lies within Flood Zone 1. The effect of an increase in impermeable area as a result of the proposed carriageway and side roads, could result in an increase in peak flow rate and volume which could, in turn, increase flood risk. Appropriate attenuation would be required in the drainage design to ensure there is no increase in surface water run-off peak flow rate or volume as compared to the existing condition, including a 20% allowance for climate change. This mitigation may take the form of SuDS, where appropriate and subject to suitable ground conditions. Permanent SuDS features should be designed in accordance relevant DMRB Standards (Highways England, 2016a; 2016b)the SuDS Manual (CIRIA, 2007).

13.7.15 The Proposed Scheme will require the infilling, removal or relocation of two small ponds (at ch2200 and ch2800). Appropriate mitigation or monitoring requirements will be identified as part of the environmental assessment.

13.7.16 Any underground structures, such as foundations or underpasses, have the potential to act as groundwater dams, potentially resulting in mounding of groundwater up-gradient of the structure and a reduction of groundwater availability down-gradient of the structure.

13.7.17 The increase in impermeable surface area is unlikely to reduce recharge to underlying groundwater bodies, as the proportional area of the new hardstanding compared to the overall area of the aquifer is considered negligible.

13.7.18 Any resultant variations in groundwater levels and flows have the potential to impact on groundwater-dependent habitats and aquatic ecology. However, any changes in groundwater levels, flow and quality are likely to be sufficiently small as to have a negligible impact on these indirect receptors, which are located outside of the study area.

13.7.19 The proposed sections of dualling along with the potential associated increase in the volume of traffic may result in an increase in pollutant loads in highway run-off, resulting in long term increase in diffuse pollution and subsequent deterioration in water quality of surface water and groundwater. Any potential impact would be mitigated using SuDS treatment measures (CIRIA, 2007).

13.7.20 It is considered that the operation on the Proposed Scheme will not increase nitrate loading to the groundwater and eutrophic lake NVZ. Similarly, the operation on the Proposed Scheme will not increase the risk of metaldehyde within the Bure (Horstead Mill to St. Benet's Abbey) DrWPA.

13.7.21 A possible deterioration in water quality may result in a detrimental impact on the aquatic ecology and the health of humans who participate in recreational activities in or adjacent to the local surface water features.

13.7.22 There is a risk of pollution to groundwater or surface water resulting from accidental spillages or pollution incidents. This risk is likely to increase with the potential increase in the volume of traffic. This may result in short term impacts on water quality and aquatic ecology without mitigation in the form of pollution control devices and SuDS treatment measures.

13.7.23 Monitoring the impacts of Proposed Scheme operation on the water environment is not considered necessary provided that appropriate measures are implemented as part of the design to mitigate any impacts.

## 13.8 Proposed level and scope of assessment

### Surface Water

13.8.1 Run Dike (a main river) along with a number of smaller watercourses, land drains and ponds are located within the study area and may potentially be affected by the Proposed Scheme during construction, operation and

demolition. These features may also be potential locations for outfall discharges, particularly Run Dike in the south west of the study area.

13.8.2 The Proposed Scheme has potential direct surface water hydrological connectivity to Witton Run, a tributary of the River Yare (GB105034051310) via the potential drainage outfall location to Run Dike. The environment assessment will consider the effects of the Proposed Scheme on this direct surface water receptor.

13.8.3 No direct surface water hydrological connectivity has been identified between the Proposed Scheme and the River Bure (GB105034050931). Therefore, subject to confirmation by a site walkover and drainage survey, this watercourse will not be assessed as part of the environmental assessment as a direct receptor.

13.8.4 The Proposed Scheme may have indirect links to the above water bodies via groundwater, this will be considered as part of the environment assessment.

**Groundwater**

13.8.5 The environment assessment will consider both groundwater level and quality impacts in accordance with the requirements of the WFD. Consideration will be given to the potential changes to water flow, volumes and quality during both the construction, demolition and operation phases. Consideration of conveyance of flow to indirect receptors, such as licensed abstractions, surface water and aquatic ecology will also be made. Additional information collected as part of the ground investigation, including groundwater level monitoring, will be used to inform the assessment. Potential impacts are likely to be covered by the CEMP and drainage design.

13.8.6 The Proposed Scheme may include discharges to groundwater, although this has not been confirmed at this stage. If discharges to groundwater are incorporated as part of the Proposed Scheme, a Detailed assessment will be required.

**WFD and water quality**

13.8.7 As noted previously, the Proposed Scheme has the potential to impact on surface water bodies and groundwater bodies during construction, operation and demolition through direct construction impacts and from potential run-off or spills during operation. This could potentially damage aquatic ecosystems and human health.

13.8.8 It is proposed to assess the impact of routine run-off and spillages on water quality on the receiving water bodies through a Simple, and if required, a Detailed assessment.

13.8.9 The study area lies within eutrophic lake and groundwater NVZs and a Surface Water Drinking Water Protected Area for metaldehyde. It is anticipated the Proposed Scheme will not impact upon these protected areas during construction, demolition and operation due to mitigation within the design and

through the implementation of best practice construction measures described in the CEMP.

13.8.10 The Proposed Scheme has a potential direct hydrological link to the Witton Run surface water WFD waterbody and also overlies the Broadland Rivers Chalk and Crag –WFD groundwater body. A preliminary WFD compliance assessment will be carried in consultation with the Environment Agency as part of the environmental assessment, to screen if the Proposed Scheme has the potential to have an effect on the WFD status of the water bodies within the study area. Any potential significant adverse impacts on these water bodies will trigger a standalone detailed WFD compliance assessment as part of the environment assessment.

### Licensed abstractions and public water supplies

13.8.11 Further information on licensed and unlicensed private water supplies will be identified in consultation with the EA and the local authority. This will include confirmation of the licensed abstraction relating to the SPZ.

13.8.12 It is anticipated that the Proposed Scheme will not result in an impact on the ability of licence holders to abstract surface water as any additional run-off from the Proposed Scheme, in terms of volume and pollutant load, is likely to remain unchanged through mitigation. However, this assumption will be reviewed once further information has been received.

13.8.13 A number of other licensed groundwater abstractions are also situated within the study area. These will also be considered as indirect receptors.

### Consented discharges

13.8.14 It is considered that the construction, demolition and operation of the Proposed Scheme will result in a minor impact on the dilution of existing consented discharges as any change in run-off from the Proposed Scheme, in terms of volume and pollutant load, is likely to be minimised through the CEMP or in-design mitigation. This will be assessed following the confirmation of the proposed drainage discharge rates and volume, outfall locations and type (groundwater or surface water).

### Road drainage

13.8.15 A drainage strategy is currently being developed for the Proposed Scheme, which will include an assessment of the impact of the proposed drainage on discharge rates and volumes entering receiving surface water or groundwater bodies using a detailed hydraulic drainage model.

### Flood risk

13.8.16 As the Proposed Scheme is over 1 hectare in area, a Flood Risk Assessment (FRA) will be undertaken, to comply with the National Planning Policy Framework (NPPF) (CLG, 2012) and the supporting online Planning Practice Guidance (PPG) (CLG, 2016) for Flood Risk and Coastal Change. This will focus on the surface water drainage implications associated with the creation of additional impermeable surfaces.

13.8.17 Given that any proposed new embankments or other structures would be located in Flood Zone 1, it is not currently envisaged that there would be a reduction of floodplain storage. As such, compensatory flood storage is not required.

### Groundwater flooding

13.8.18 Groundwater flood potential is considered to be low and is unlikely to impact on the Proposed Scheme. This will be reviewed at later stages following detailed ground investigations.

### Aquatic ecology

13.8.19 The environment assessment will review potential impacts on water availability, quality and status of the receiving surface water bodies within the study area (i.e. Run Dike, ponds and drains) as well as indirect groundwater-dependent receptors. Any consequential impact on the aquatic ecology will be considered under Chapter 8 Biodiversity.

### Human health

13.8.20 It is considered that impacts of the Proposed Scheme on human health will be considered indirectly through the water quality impact assessment and the impacts of the proposed drainage strategy on flood risk in the receiving watercourses.

### Climate change

13.8.21 To account for climate change, the latest 2016 guidance will be adopted to assess fluvial flood risk to the Proposed Scheme, which is a 25% increase in peak river flow (Central allowance in the 2080s for the Anglian region) and this should be used to assess any flood risk implications to and from the Proposed Scheme.

13.8.22 In addition to this, the current DMRB guidance will be adopted when considering climate change within the drainage design; this is a 20% allowance for an increase in peak rainfall intensity.

### Events

13.8.23 The impact of Climate Change and the occurrence of a Major Event or Disaster will be considered as part of the FRA principally in terms of the residual risk of flooding following the adoption of any mitigation measures. It is considered that the occurrence of an extreme pluvial/surface water flooding event is the primary major natural event to impact the Proposed Scheme.

## 13.9 Proposed methodology including significance

13.9.1 The proposed methodology will follow the methodology and guidance provided in DMRB Volume 11, Section 3, Part 10 HD 45/09 ‘Road Drainage and the Water Environment’ (Highways Agency, 2009) for assessing the significance of effects of proposed road schemes on the road drainage and the water environment. The procedures and the appropriate methods that must be used

when assessing the potential impacts from road projects on the water environment are described in Section 5.3 and Annex I of the DMRB document.

13.9.2 The following proposed methods will be adopted:

- If required, the potential impacts of routine run-off on surface waters will be assessed using Method A (HAWRAT), as advised in section 5.6 of HD 45/09 (Highways Agency, 2009). The assessment will use existing drainage information, updated Annual Average Daily Traffic (AADT) forecast data and the proposed preliminary drainage design to establish potential impacts of pollutants in routine highway run-off from the Proposed Scheme upon the local watercourses within the study area and the requirement for mitigation measures to adequately reduce the risk.
- If required, and dependent on the results of the HAWRAT assessment, Method B - Detailed assessment of pollution impacts from routine run-off will be undertaken.
- The Proposed Scheme may include discharges to groundwater, although this has not been confirmed at this stage. If this is the case, a groundwater risk assessment for routine run-off discharges to groundwater will be undertaken in line with Method C, as detailed within Annex I of the DMRB HD 45/09 (Highways Agency, 2009).
- If required, an assessment of pollution impacts on surface waters from accidental spillages will be undertaken in line with Method D detailed within Annex I of the DMRB HD 45/09 (Highways Agency, 2009). Predicted AADT data for the Proposed Scheme is required to inform this assessment.
- It is not currently anticipated that there will be any requirement for Method E (Hydrological Assessment of Design Floods) or Method F (Hydraulic Assessment).

13.9.3 The construction, operation and demolition stages could result in potentially adverse direct effects on the surface water and groundwater bodies classified under the WFD. Therefore, a WFD assessment will be required. This would be undertaken as part of the environment assessment, in consultation with the Environment Agency. The WFD assessment will be carried out in accordance with Planning Inspectorate Advice Note Eighteen: The Water Framework Directive (Planning Inspectorate, 2017).

13.9.4 A detailed FRA will be undertaken to address the risk from all pluvial and fluvial flooding and the potential impacts of the Proposed Scheme on flood risk. The FRA will be undertaken in accordance with the requirements of the NPPF (DCLG, 2012; 2014), and the EA's climate change allowances (EA, 2017d).

13.9.5 The extent of the work involved with the FRA at this stage will be discussed and confirmed in consultation with the EA, Norfolk County Council (as LLFA), Anglian Water and Highways England. The proposed scope of work required for the FRA is likely to be as follows:

- Undertake a desk based review of existing flood risk information available from the consultees including the outputs from any hydraulic models available from Norfolk County Council and the EA.

- Using information from consultees, surface water flood risk will be investigated to assess whether surface water overland flow should be incorporated into the highway drainage design model. Existing flow routes will be identified and the Proposed Scheme would be designed to take these into account.

13.9.6 The FRA will incorporate the findings and mitigation recommended as part of the drainage strategy for the Proposed Scheme.

13.9.7 A Drainage Strategy will be prepared for the Proposed Scheme which will detail outfall locations, any attenuation requirements and the inclusion of SuDS features, where appropriate. The results of the Drainage Strategy will be used to inform the environment assessment and Flood Risk Assessment.

**Assessment of magnitude of impacts and significance of effects**

13.9.8 The conservation value of water resources is in part defined by legislation which protects all controlled waters in England and Wales and, in effect, protects all water bodies (surface water or groundwater). Therefore, there cannot be any water feature which has a negligible value. The value of controlled waters can be defined by taking into account the use and conservation importance of the water body. The criteria used in this assessment to determine the value/importance of each water feature and its attributes are set out in Table 13.1, based on the definitions provided in Table A4.3 of Annex IV in DMRB HD 45/09.

13.9.9 The value/importance of water environment attributes within the study area are defined in Table 13.2.

13.9.10 Definitions for the magnitude of impact are given in Table 13.3 and are based on values set out in Table A4.4 of Annex IV of DMRB HD 45/09 (HA, 2009). The overall significance of effect is determined using the matrix presented as Table 2.4 in HA 205/08 (HA, 2008) and the definitions provided in Table 13.2. Effects can be beneficial or adverse. Effects that are moderate, large, or very large, are considered significant effects. Effects that are slight or neutral are not considered significant.

13.9.11 These tables are based on the guidance given in DMRB HD 45/09, although additional criteria have been added, where appropriate to Table 13.3 to meet the requirements of WFD, for which guidance on the assessment of compliance became available after the publication of DMRB HD45/09.

**Table 13.2 Criteria for estimating the importance of water environment attributes**

| Value | Criteria | Typical Examples |
|---|---|---|
| Very High | Attribute has a high quality and rarity on a regional or | Surface Water: Site protected under EU wildlife legislation (SAC, SPA, or Ramsar site); WFD high status water bodies.<br>Groundwater: Principal aquifer providing a regionally important resource or supporting site protected under EU wildlife legislation; Source Protection Zone 1 (SPZ1); international scale and very limited potential for substitution, or more than 100 residential, |

| Value | Criteria | Typical Examples |
|---|---|---|
| | national scale. | commercial, or industrial properties, which may be affected by changes to the groundwater regime.<br>Flood Risk: Receptor is at high risk from flooding (FZ3b); or floodplain or defence protecting more than 100 residential properties from flooding. |
| High | Attribute has a high quality and rarity on a local scale. | Surface Water: Site protected under UK wildlife legislation (SSSI); WFD status (or potential) is currently 'good' or has a target of good.<br>Groundwater: Principal or Secondary aquifer providing locally important resource or supporting site protected under UK wildlife legislation; SPZ2; national scale, and limited potential for substitution, or between 10 and 100 residential, commercial, or industrial properties, which may be affected by changes to the groundwater regime.<br>Flood Risk: Receptor is at high risk from flooding (FZ3a); floodplain or defence protecting between 10 and 100 residential properties or industrial premises from flooding. |
| Medium | Attribute has a medium quality and rarity on a local scale. | Surface Water: Site protected under Local wildlife legislation, Site of Nature Conservation Interest, LNR, WFD status (or potential) is moderate.<br>Groundwater: Secondary aquifer which is of limited value because the water quality does not allow potable or other quality sensitive uses, exploitation may be for agricultural or industrial use but is not extensive; limited connection to surface water and may provide some support to local site of nature conservation interest; SPZ3; regional scale, limited potential for substitution, or 10 or fewer residential, commercial or industrial properties, which may be affected by changes to the groundwater regime.<br>Flood Risk: Receptor is at moderate risk from flooding (FZ2); floodplain or defence protecting 10 or fewer industrial properties from flooding. |
| Low | Attribute has a low quality and rarity on a local scale. | Surface Water: WFD status (or potential) is poor, or water body is not classified under the WFD.<br>Groundwater: Unproductive strata, with no known past or existing exploitation and not providing baseflow to rivers or supporting a site of nature conservation interest no residential, commercial, or industrial properties that may be affected by changes to the groundwater regime.<br>Flood Risk: Receptor is at low risk from flooding (FZ1); floodplain with limited constraints and a low probability of flooding of residential and industrial properties. |

**Table 13.3 Estimating the magnitude of an impact on an attribute**

| Magnitude | Criteria | Example |
|---|---|---|
| Major adverse | Results in loss of attribute and/or quality and integrity of attribute | Failure of soluble and sediment bound pollutants in HAWRAT (Method A, Annex A) and compliance failure with EQS values (Method B).<br>Calculated risk of pollution from a spillage >2% annually (Spillage Risk Assessment, Method D, Annex 1). |

| Magnitude | Criteria | Example |
|---|---|---|
| | | Loss of, or extensive change to, a designated site or aquifer.<br>Potential high risk of groundwater pollution from routine run-off – risk score >250 (Groundwater Assessment, Method C, Annex 1).<br>Reduction in status of a WFD 'high' or 'good' status or potential water body.<br>Increase in peak flood level (1% annual probability) of >100mm. |
| Moderate adverse | Results in effect on integrity of attribute, or loss of part of attribute | Failure of soluble and sediment bound pollutants in HAWRAT (Method A, Annex A) but compliance with EQS values (Method B).<br>Calculated risk of pollution from a spillage >1 and <2% annually (Spillage Risk Assessment, Method D, Annex 1).<br>Partial loss of, or change to, a designated site or aquifer.<br>Potential medium risk of groundwater pollution from routine run-off – risk score 150-250 (Groundwater Assessment, Method C, Annex 1).<br>Reduction in status of a WFD 'moderate' status or potential water body.<br>Increase in peak flood level (1% annual probability) of >50mm. |
| Minor adverse | Results in some measurable change in attribute's quality or vulnerability | Failure of either soluble or sediment bound pollutants in HAWRAT (Method A, Annex A).<br>Partial change to an aquifer.<br>Calculated risk of pollution from a spillage >0.5 and <1% annually (Spillage Risk Assessment, Method D, Annex 1).<br>Potential medium risk of groundwater pollution from routine run-off – risk score <150 (Groundwater Assessment, Method C, Annex 1).<br>Reduction in status of a WFD 'poor' status or potential water body.<br>Increase in peak flood level (1% annual probability) of >10mm. |
| Negligible | Results in effect on attribute, but of insufficient magnitude to affect the use or integrity | No risk identified by HAWRAT.<br>Risk of pollution from spillages <0.5%.<br>No impact on aquifer and risk of groundwater pollution from spillages <0.5%.<br>Negligible change in peak flood level. |
| Minor beneficial | Results in some beneficial effect on attribute or a reduced risk of negative effect occurring | HAWRAT assessment of either soluble or sediment bound pollutants becomes Pass from baseline of Fail.<br>Calculated reduction in existing surface and groundwater spillage risk of 50% or more (when existing risk is <1% or more).<br>Increase in status of a WFD 'poor' status or potential water body.<br>Reduction in peak flood level (1% annual probability) of >10mm. |
| Moderate beneficial | Results in moderate improvement of attribute quality | HAWRAT assessment of both soluble and sediment bound pollutants becomes Pass from baseline of Fail.<br>Calculated reduction in existing surface and groundwater spillage risk of 50% or more (when existing risk is >1% or more). |

| Magnitude | Criteria | Example |
|---|---|---|
| | | Increase in status of a WFD 'moderate' status or potential water body.<br>Reduction in peak flood level (1% annual probability) of >50mm. |
| Major beneficial | Results in major improvement of attribute quality | Removal of existing polluting discharge to a watercourse or an aquifer or removing the likelihood of polluting discharges occurring.<br>Recharge of an aquifer.<br>Increase in status of a WFD 'good' status or potential water body.<br>Reduction in peak flood level (1% annual probability) of >100mm. |

**Table 13.4 Definitions of overall significance of effect**

| Significance | Examples |
|---|---|
| Very large adverse | Surface water: Potential failure of both soluble and sediment bound pollutants in a High or Good watercourse.<br>Groundwater: Potential high risk (score >250) of pollution in the Groundwater Assessment (Method C, Annex 1) to a principal aquifer providing a regionally important resource or supporting a site protected under habitat legislation.<br>Flood risk: An increase in peak flood levels (1% annual probability) >100mm increasing the risk to >100 properties. |
| Large adverse | Surface water: Potential failure of both soluble and sediment bound pollutants in a High or Good watercourse.<br>Groundwater: Potential high risk (score >250) of pollution in to a secondary aquifer providing water for a small number of dwellings agricultural/industrial use or supporting a LNR.<br>Flood risk: An increase in peak flood levels (1% annual probability) >50mm increasing the risk to >100 properties or an increase in peak flood levels (1% annual probability) >100mm increasing the risk to 1-100 properties. |
| Moderate adverse | Surface water: Potential failure of either soluble or sediment bound pollutants in a High or Good watercourse.<br>Groundwater: Potential medium risk (score 150-250) to a secondary aquifer providing water for a small number of dwellings agricultural/industrial and/or supporting a LNR.<br>Flood risk: An increase in peak flood levels (1% annual probability) >10mm increasing the risk to >100 properties or an increase in peak flood levels (1% annual probability) >500mm increasing the risk to 1-100 properties. |
| Slight adverse | Surface water: Potential failure of either soluble or sediment bound pollutants in a Moderate or Poor watercourse.<br>Groundwater: Potential low risk of pollution (score <150) to a secondary aquifer with limited agricultural use and connectivity to surface waters and local ecology.<br>Flood risk: An increase in peak flood levels (1% annual probability) >10mm increasing the risk to <10 industrial properties. |
| Neutral | Surface water: No risk identified by Method A or method B assessment (soluble and sediment bound). Calculated risk of spillage <0.5% annually. |

| Significance | Examples |
|---|---|
| | Groundwater: No predicted change in quality of any type of aquifer and/or its use as a resource.<br>Flood risk: Negligible change in peak flood (1% annual event) <+/- 10mm. |
| Slight beneficial | Surface water; Method A assessment of either soluble or sediment bound pollutants becomes Pass from previous Fail condition for existing discharges.<br>Groundwater: Reduction by 50% or more in existing pollution risk from spillages into an aquifer (when existing spillage risk is <1%).<br>Flood risk: A reduction in peak flood levels (1% annual probability) >10mm resulting in reduced flood risk to 1-100 residential properties. |
| Moderate beneficial | Surface water: Method A assessment of both soluble and sediment bound pollutants becomes Pass from previous Refer or Fail condition for existing discharges.<br>Groundwater: Recharge of aquifer through provision of treated discharges to ground resulting in measurable improvements to a connected site/habitat (LNR).<br>Flood risk: A reduction in peak flood levels (1% annual probability) >10mm resulting in reduced flood risk to >100 residential properties. |
| Large beneficial | Surface water: Removal of an existing polluting discharge through provision of pollution prevention measures, or any other measure, affecting a site/habitat protected under EC or UK legislation.<br>Groundwater: Removal of an existing polluting discharge within SPZ 1 or 2 and/or a principal aquifer.<br>Flood risk: A reduction in peak flood levels (1% annual probability) >50mm resulting in reduced flood risk to >100 residential properties. |

## 13.10 Conclusion

13.10.1 The following water receptors have been identified that could be impacted by the Proposed Scheme:

- Witton Run WFD surface waterbody (GB105034051310).
- A number of unnamed Ordinary watercourses/drainage ditches.
- A number of isolated ponds including two ponds that are likely to be removed or modified by the Proposed Scheme.
- Broadland Rivers Chalk and Crag groundwater body (GB40501G400300) and associated abstractions.
- Indirect impacts via the Broadland Rivers Chalk and Crag groundwater body, on public water supply abstractions and on aquatic ecology features associated with the WFD surface water body (Bure (Horstead Mill to Benet's Abbey GB105034050931) and the associated designated features in the Broads SAC (UK0013577) and the Broadland SPA (UK9009253), and priority habitats.

13.10.2 The potential for the Proposed Scheme to affect these water receptors will be assessed using the appropriate methodologies outlined in DMRB Volume 11, Section 3, part 10 (HD45/09).

13.10.3 A FRA will assess the impact to, and of, the Proposed Scheme on flood risk from all sources. This will include any mitigation proposed as part of the drainage strategy. Mitigation will be designed in accordance with relevant DMRB guidance (Highways England, 2016a; 2016b) and the SuDS Manual (CIRIA, 2007).

13.10.4 The construction, operation and demolition stages could result in potentially adverse direct effects on the groundwater bodies classified under the WFD. Therefore, A WFD assessment will be required. This would be undertaken as part of the environment assessment, in consultation with the Environment Agency and in accordance with the relevant advice from the Planning Inspectorate.

13.10.5 A Drainage Strategy will be prepared for the Proposed Scheme which will detail outfall locations, any attenuation requirements and the inclusion of SuDS features, where appropriate. The results of the Drainage Strategy will be used to inform the environment assessment and Flood Risk Assessment.

13.10.6 The above assessments will be presented within the ES.

# 14 Climate

## 14.1 Introduction

14.1.1 It has been established that as a result of rising concentrations of carbon dioxide ($CO_2$) and other greenhouse gases in the atmosphere, climate change is expected to have significant implications for infrastructure assets, particularly those with long operational lifetimes. This requires them to be resilient not only to the climate at the time of their construction, but also to climate variations over the decades of their use.

14.1.2 The Climate Change Act was passed in November 2008 which sets ambitious, legally binding targets for reducing the UK's $CO_2$ emissions by 34% by 2020 and 80% by 2050, relative to the 1990 baseline. The EIA Directive (2014/52/EU) and subsequent updates to UK EIA regulations (of which the Infrastructure Planning (EIA) Regulations 2017 are of relevance to Nationally Significant Infrastructure Schemes (NSIPs)) also now outline the requirement to assess the impact of projects on climate and their vulnerability to climate change, as presented within this chapter.

14.1.3 This chapter has been prepared following guidance provided by Highways England. This section presents the outcomes of the scoping assessment for the climate change related topics. To align with the requirements of the IP EIA Regulations 2017 and the National Policy Statement for National Networks (NNNPS) 2014, it has been divided into two separate aspects:

a) Greenhouse gas (GHG) impact assessment – effects on climate change of GHG emissions arising from the Proposed Scheme, including how the project will affect the ability of Government to meet its carbon reduction plan targets (in accordance with NNNPS paragraph 5.17).

b) Climate change resilience assessment – the resilience of the Proposed Scheme to climate change impacts, including how the proposal will take account of the projected impacts of climate change (in accordance with NNNPS paragraph 4.40 and the IP EIA Regulations 2017).

14.1.4 The potential requirement for assessment will be identified. Where required, this will be presented within the ES.

## 14.2 Study area

### Effects on climate

14.2.1 The ‘effects on climate’ assessment will consider the greenhouse gas emission potential throughout the lifecycle of the Proposed Scheme for both construction and operation (the latter for the design life of the Proposed Scheme).

### Vulnerability of the proposed scheme to climate change

#### *Spatial scope*

14.2.2 The assessment will identify the key climate change effects on Proposed Scheme design elements such as structures or technological assets, as well as environmental receptors identified within this EIA Scoping Report that may be affected by the Proposed Scheme.

14.2.3 There may be interrelationships between the assessment of potential effects on climate and other disciplines. Therefore, please refer to the following Chapters:

- Chapter 5: Air Quality
- Chapter 6: Cultural Heritage
- Chapter 7: Landscape
- Chapter 8: Biodiversity
- Chapter 9: Geology and Soils
- Chapter 10: Materials
- Chapter 12: People and Communities
- Chapter 13: Road Drainage and the Water Environment

#### *Temporal scope*

14.2.4 The assessment of vulnerability to climate change will consider construction and operational effects. Climate change effects on construction have the potential to be scoped out depending on the construction duration. The operation assessment will be informed by the design life of key elements of the Proposed Scheme and availability of UK Climate Projections.

## 14.3 Existing and baseline knowledge

### Effects on climate

14.3.1 Existing carbon emissions will be considered from a variety of sources in the Local Authority area relevant to the Proposed Scheme (e.g. Norwich City Council and Norfolk County Council), including those from transport infrastructure.

14.3.2 Norwich City Council reported a carbon footprint of approximately 6,000 tonnes of $CO_2e$ in 2016, measured in accordance with national indicator NI185 (Norwich City Council, 2017), although it is noted that this figure reflects emissions specifically associated with the Council’s operations (e.g. owned and contractor-operated buildings, vehicle fleet, etc.) rather than the wider local authority region. In 2015, total end-user $CO_2$ emissions from transport in

Norwich were reported as approximately 135,600 tonnes (Department for Business, Energy & Industrial Strategy, 2017b).

14.3.3 Norfolk County Council reported total emissions for the 2015-16 year to be approximately 99,147 tonnes of $CO_2e$ for Local Authority operations (Norfolk County Council, 2016), and the Council has committed to reducing emissions by 50% by 2020, relative to 2009-10 levels. Most recent figures released in 2015 indicated total transport emissions for the wider Norfolk County area (including all relevant Districts) to be approximately 1,953,000 tonnes of $CO_2$ (Department for Business, Energy & Industrial Strategy, 2017b).

14.3.4 In 2015, UK net CO2 emissions were estimated at 403.8 million tonnes, a decrease of 3.8% in comparison to 2014 levels (Department for Business, Energy & Industrial Strategy, 2017a). Furthermore, 24% of UK greenhouse gas emissions in 2015 originated from the transport sector with emissions of 120 $MtCO_2e$.

### Vulnerability of the proposed scheme to climate change

14.3.5 A current climate baseline for the project area has been compiled through the use of Met Office (2016) regional climate data for the Eastern England region, which comprises the counties of Bedfordshire, Cambridgeshire, Norfolk, Suffolk, Lincolnshire, the East Riding of Yorkshire and parts of Essex and Hertfordshire. High-level climate observations for the region over a 30-year averaging period (1981-2010) are presented in Table 14.1.

**Table 14.1: Historic climate baseline for Eastern England**

| Climate Variables | Climate Observations |
|---|---|
| Temperature | Mean daily minimum temperatures can range from 0°C to 2°C in winter, whilst summer daily maximum temperatures are in the region of 22°C. |
| Rainfall | Eastern England includes some of the driest areas in the country, with the majority of the region receiving less than 700 mm of rainfall annually, distributed fairly evenly throughout the year. On average, the region experiences approximately 30 rain days during the winter months (December – February) and under 25 days during the summer period (June – August). Despite generally low levels of precipitation, the area has encountered a number of severe storms which can contribute significantly to total annual rainfall and may also result in the occurrence of hail. |
| Wind | Eastern England is one of the more sheltered parts of the UK, however the winter months are when the strongest winds are experienced. Wind direction is fairly consistent across the region, however speeds are generally greater in coastal locations than inland, and gusts exceeding 90 knots have been recorded in East Anglia. The frequency of tornadoes is greatest in eastern England relative to other parts of the UK, nevertheless, the intensity of these events remains minor. |

| Climate Variables | Climate Observations |
|---|---|
| Sunshine | Average annual sunshine in the wider region ranges from approximately 1450 hours over Lincolnshire and East Yorkshire, to over 1600 hours in east Norfolk, Suffolk and Essex. |
| Air Frost | The average number of days with air frost ranges from less than 30 (coastal) to 55 (inland) per year. |

Source: Met Office (2016) Regional Climate Data

## 14.4 Future projections

### Effects on climate

14.4.1 The transport sector is a key driver in projected UK carbon emissions increases with road transport emissions projected to rise by 28 $MtCO_2e$ over 2023-2027 (the fourth carbon budget period) (Department for Business, Energy & Industrial Strategy, 2017c).

### Vulnerability of the proposed scheme to climate change

14.4.2 The UK Climate Projections provide regional climate information, for which the project area is included within the East of England Administrative Region. The East of England region is predicted to experience changes in temperature, rainfall, and frequency of extreme weather events as a consequence of climate change. These changes are predicted to occur under all three emissions scenarios (i.e. low, medium, and high greenhouse gas emissions), which are incorporated into the climate change models produced by the Met Office Hadley Centre. The general trend for the region is warmer, drier summers and warmer, wetter winters.

14.4.3 Under the high emissions scenario for the 2080s, estimated changes in climatic conditions are as outlined in Table 14.2 below.

**Table 14.2: Future climate projection data for the 2080s**

| Climatic Conditions | Climate Observations |
|---|---|
| Temperature | The average summer temperature is estimated to increase by 4.5°C under the central estimate, which represents 'as likely as not' probability of change (50th percentile), and average winter temperature is estimated to increase by 3.7°C (50th percentile). |
| Rainfall | The average summer rainfall rate is estimated to decrease by 27%, whereas the average winter rainfall rate is estimated to increase by 26% (in the 50$^{th}$ percentile or central estimate for both). |
| Wind | Climate projections for wind are more uncertain than those for temperature and precipitation, due to inherent difficulty in modelling future wind conditions. However, overall an increase in extreme weather including wind is projected (Committee on Climate Change, 2017). |

Source: UKCP09 Climate Projections

14.4.4 It should be noted that climate projection data corresponding to the 2080s (2070-2099) under a high emissions scenario have been selected in line with NPS paragraph 4.41, which states:

*"Where transport infrastructure has safety-critical elements and the design life of the asset is 60 years or greater, the applicant should apply the UK Climate Projections 2009 (UKCP09) high emissions scenario (high impact, low likelihood) against the 2080 projections at the 50% probability level."*

## 14.5 Assumptions and limitations

14.5.1 Information on the climate baseline and future projections are based on available information from third parties, including the historical meteorological variables recorded by the Met Office and the UK Climate Projections (UKCP09) developed by the Met Office.

14.5.2 Climate projections are not predictions or forecasts but simulations of potential scenarios of future climate under a range of hypothetical emissions scenarios and assumptions. The results, therefore, from running the climate models cannot be treated as exact or factual, but projection options. They are representations of how the climate may evolve in response to a range of potential scenarios and their reliability varies between climate variables. Projections exclude outlying 'surprise' or 'disaster' scenarios in the literature and any scenario necessarily includes subjective elements and is open to various interpretations. Generally global projections are more certain than regional, and temperature projections more certain than those for precipitation. The degree of uncertainty associated with all climate change projections increases for projections further into the future.

14.5.3 The climate projections have previously been independently verified and will not be reviewed for this report.

14.5.4 It should also be noted that at present, there is no single accepted methodology for the assessment of climate change (mitigation or adaptation) within EIA. A qualitative methodology for assessing the vulnerability of the Proposed Scheme to climate change will be produced in line with DMRB Volume 11 Section 2 Part 5. This will be updated as and when consolidated methodology or practice for this topic is published.

## 14.6 Guidance and best practice

14.6.1 The climate change assessment will be prepared following guidance provided by Highways England and in accordance with the National Networks National Policy Statement (2014). In addition, the following guidance documents have been used to inform the assessment:

- Climate Adaptation Risk Assessment Progress Update (Highways England, 2016)
- IEMA Environmental Impact Assessment guide to Climate Change Resilience and Adaptation (IEMA, 2015)
- IEMA's Guidance on Assessing the GHG Emissions and Evaluating their Significance (IEMA, 2017)
- TAG Unit A3 Environmental Impact Appraisal (DfT, 2015) Chapter 4 Greenhouse Gases
- PAS 2080:2016 Carbon Management in Infrastructure

## 14.7 Consultation

14.7.1 To date, no topic-specific consultation has been undertaken. For scheme-wide consultation refer to Chapter 4.

## 14.8 Potential effects, including monitoring and mitigation measures

### Construction

#### *Effects on climate*

14.8.1 The duration of the construction works for the Proposed Scheme is anticipated to be approximately 16 months. Embodied carbon emissions from the use of construction materials are the main contributor to climate change, with additional greenhouse gas emissions arising from the use of plant and transport of materials. As outlined in Sections 5.7 and 10.7, mitigation measures to be included in the Construction Environmental Management Plan (CEMP) such as the reduction of raw material usage, recycling, the use of local suppliers and ensuring vehicle engines and plant motors are switched off when not in use, would limit emissions as far as practicable. Further assessment appraising the greenhouse gas emissions of the Proposed Scheme will be carried out within the ES in accordance with TAG Unit A3 Chapter 4.

### *Vulnerability of the proposed scheme to climate change*

14.8.2 During the temporary construction period, climate change is not expected to bring about a change in the risk of severe weather between now and the start of the period of construction. Despite this, the construction site may be vulnerable to extremes of weather, leading to the risk of delay in activities. However, adaptation measures included in the CEMP such as ensuring construction materials are covered when stored and pro-active planning would minimise adverse effects. Therefore, climate change effects are not expected to affect Proposed Scheme construction.

## Operation

### *Effects on climate*

14.8.3 Over the design life of the Proposed Scheme, its operation has the potential to result in an increase in local $CO_2$ emissions due to changes in vehicle distributions and speeds. To derive the change in carbon dioxide equivalent (CO2e) emissions, an appraisal of greenhouse gases for the Proposed Scheme opening year and design year will be assessed within the ES in accordance with TAG Unit A3 Chapter 4.

### *Vulnerability of the proposed scheme to climate change*

14.8.4 Changes in climate as outlined in Table 14.2 are anticipated in the Study Area over the design life of the Proposed Scheme. This has the potential to pose a risk to the Proposed Scheme assets such as deformation and deterioration of asphalt surfacing associated with temperature increase and changes in precipitation affecting the foundation strength and deterioration of the road surface, with the potential to lead to an increased flood risk. A Flood Risk Assessment (FRA) to be carried out, will take into account the Environment Agency's 'Climate change allowances for planners' NPPF supporting guidance. Higher temperatures and increased precipitation may increase the frequency of maintenance required for gantries. In addition, higher wind speeds could pose a risk to gantries. Further assessment as outlined in Section 14.10 will be undertaken during the EIA and presented within the ES.

14.8.5 Changes in climate also have the potential to pose risks to the environmental receptors detailed throughout this EIA Scoping Report. For example, increased precipitation may affect the foraging habits of bats and more frequent rainfall events resulting in higher runoff could increase pollutant concentrations within the receiving water. These will be assessed in further detail within the ES.

## Summary

14.8.6 A summary of the potential effects on climate as a result of the Proposed Scheme is presented in Table 14.3.

**Table 14.3: Summary of potential climate effects**

| Potential Construction Effects | Potential Operation Effects |
|---|---|
| Potential for increased $CO_2$ emissions.<br><br>The construction site has the potential to be vulnerable to extremes of weather, although significant climate change is not expected during the construction period. | Potential for increased $CO_2$ emissions.<br><br>Changes in climate have the potential to pose a risk to the Proposed Scheme assets and environmental receptors. |

## 14.9 Proposed level and scope of assessment

14.9.1 The Proposed Scheme has the potential to contribute to climate change and be directly affected by climate change over its lifetime. Therefore, further assessment is required to inform relevant mitigation and adaptation measures.

14.9.2 The spatial and temporal scopes of the assessment have been outlined in Section 14.2.

## 14.10 Proposed methodology including significance

14.10.1 The assessment methodology presented in this chapter will be undertaken in accordance with Highways England guidance.

### Effects on climate

14.10.2 The assessment will include:

- The greenhouse gases emitted through the materials used to construct the Proposed Scheme, and the significance of the effects of this (the assessment and significance methodology is outlined in Chapter 10 Materials of this Scoping Report).
- The greenhouse gases and significant carbon dioxide emitted during the lifecycle of the Proposed Scheme using the Mott MacDonald Carbon Portal, which is PAS2080 compliant.
- Comparison of greenhouse gas emissions for both construction and operation in relation to the baseline and compared to regional (if available) and UK emissions predictions.
- Opportunities for mitigation in the Proposed Scheme design
- A conclusion about whether this level of assessment is sufficient to understand the effects of the project or whether further assessment is necessary. This will be completed in accordance with the findings in the Air Quality and Materials assessments (Chapters 5 and 10 of this Scoping document).

14.10.3 In line with the National Policy Statement for National Networks (2014), significance of impacts will be assessed by comparing estimated GHG

emissions arising from the Proposed Scheme with UK carbon budgets, and the associated reduction targets.

### Vulnerability of the proposed scheme to climate change

14.10.4 There is at present no single accepted methodology for the assessment of climate change within EIA. A qualitative methodology for assessing the vulnerability of the Proposed Scheme to climate change will be produced in line with DMRB Volume 11 Section 2 Part 5. In line with IP EIA Regulations 2017 Schedule 4 Part 5, a description of the likely significant effects of the development on the environment, resulting from the vulnerability of the project to climate change, will be provided.

## 14.11 Conclusion

14.11.1 During construction and operation, the Proposed Scheme would increase $CO_2$ emissions, therefore further assessment appraising the greenhouse gas emissions of the Proposed Scheme is required.

14.11.2 During construction, works may be vulnerable to extremes of weather, however adaptation measures included in the CEMP would address potentially adverse effects. During the operation of the Proposed Scheme, changes in climate have the potential to impact scheme assets and environmental receptors.

14.11.3 Further assessment of construction and operational effects, both on and as a result of climate change, is therefore required for the Proposed Scheme. This assessment will be presented within the ES.

# 15 Combined and Cumulative Effects

## 15.1 Introduction

15.1.1 Combined and Cumulative effects result from multiple actions on receptors over time and are generally additive or interactive (synergistic) in nature. They can also be considered as effects resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the project, identified as:

- Combined effects from a single project (the interrelationship between different environmental factors)
- Cumulative effects from different projects (with the project being assessed)

15.1.2 DMRB Volume 11, Section 2, Part 6 states that, in general, cumulative assessment will be most successful when the assessment of all other environmental effects of the project is complete. The previous chapters presented in this report have identified that assessment is required for a number of environmental topics, which would be prepared and presented within the ES. As a result, no assessment of combined and cumulative effects has currently been made within this report. Instead, this chapter provides an overview of the baseline, potential effects, and methodology of assessment for combined and cumulative effects, with assessment recommended to be included within the ES.

## 15.2 Study area

### Combined effects

15.2.1 The study area for the assessment of combined effects, for both construction and operation, would be defined by the study areas identified within the relevant environment topic chapters of this EIA Scoping Report.

### Cumulative effects

15.2.2 The search area for the identification of ‘other developments’ for inclusion in the assessment of cumulative effects would reflect a 2km Zone of Influence (ZOI) around the boundary of the Proposed Scheme, for both construction and operation. This 2km ZOI is large enough to cover the proposed developments likely to contribute to cumulative effects, whilst being proportionate to the scope and scale of the Proposed Scheme. DMRB Volume 11, Section 2, Part 5, states that the study area for the assessment of cumulative effects should be defined on a case-by-case basis reflecting the scheme in question and the area over which significant effects can be reasonably be considered to have the potential to occur from both the scheme and in combination with other developments. As such, a 2km search area is deemed appropriate for this Proposed Scheme.

15.2.3 The study area used to identify the ZOI for environmental receptors included within the cumulative assessment, during both construction and operation, will reflect the individual ZOIs of the topic chapters.

## 15.3 Existing and baseline knowledge

15.3.1 The baseline for the combined effects is described in the individual environmental topic chapters that precede this chapter.

15.3.2 The baseline for the cumulative effects will include the proposed major developments identified within the study area, once confirmed. The proposed major developments will be identified from the traffic model Uncertainty Log and committed developments to be confirmed with Broadland District Council (BDC).

## 15.4 Assumptions and limitations

15.4.1 At this stage of assessment, the proposed other major developments within the area have not been identified. Therefore, the environmental effects that would result from the other developments have not been identified. The assessment of potential effects is therefore limited at this stage, and has focused on some of the main receptors that could be affected as a result of both combined and cumulative effects. The likely residual effects and proposed mitigation for each of the other developments would be identified and incorporated into the cumulative effects assessment of the ES.

## 15.5 Guidance and best practice

15.5.1 This chapter draws upon the following guidance:

- The Planning Inspectorate's 'Advice Note Seventeen: Cumulative Effects Assessment'
- DMRB Volume 11 Section 2 Part 5 'Assessment and Management of Environmental Effects

## 15.6 Consultation

15.6.1 Consultation with BDC as the Local Planning Authority will be undertaken in advance of the production of the ES, to agree a list of proposed developments to be included within the cumulative effects assessment.

## 15.7 Potential effects, including monitoring and mitigation measures

### Combined effects

15.7.1 During construction and operation, there is the potential for combined effects to all receptors including geology and soils, landscape/townscape, cultural features, communities, vehicle travellers, water environment, biodiversity, climate, and material resources, as a result of the Proposed Scheme due to the potential effects reported in Chapters 5 to 14. However, during construction,

effects would be temporary in nature and best practice mitigation measures included in the CEMP would ensure that combined effects are reduced as far as possible. Combined effects during operation, although may be permanent, would be reduced as far as possible through best practice mitigation, enhancement measures would be developed as part of the Proposed Scheme design, and any monitoring requirements would be specified.

## Cumulative effects

15.7.2 During construction, there would be the potential for cumulative effects on all receptors as a result of the Proposed Scheme with any of the other developments, where the construction stages overlap. However, effects would be temporary in nature and it is assumed that best practice measures would be included in a CEMP for each of the other developments, reducing the likelihood of significant cumulative effects.

15.7.3 Once operational there would be the potential for cumulative effects to receptors, including (but not limited to) habitats, protected species, agricultural land, noise and air quality. However, it is assumed that mitigation would be provided by the other developments to offset any significant environmental effects, and monitoring of residual effects would also be in place for those other developments that have gone through the statutory EIA process, which would reduce the likelihood of significant cumulative effects during operation.

15.7.4 The likely residual effects and proposed mitigation for each of the other developments would be identified and incorporated into the cumulative effects assessment of the ES.

## Summary

15.7.5 A summary of the potential effects from combined and cumulative interactions as a result of the Proposed Scheme is presented in Table 15.1.

**Table 15.1: Summary of potential climate effects**

| Potential Construction Effects | Potential Operation Effects |
|---|---|
| During construction and operation, there is the potential for combined effects to all receptors including geology and soils, landscape/townscape, cultural features, communities, vehicle travellers, water environment, biodiversity, climate, and material resources. | Combined effects during operation, although may be permanent, would be reduced as far as possible through best practice mitigation, enhancement measures would be developed as part of the Proposed Scheme design, and any monitoring requirements would be specified. |
| During construction, there would be the potential for cumulative effects on all receptors as a result of the Proposed Scheme with any of the other developments, where the construction stages overlap. | For cumulative effects there would be the potential for cumulative effects to receptors, including (but not limited to) habitats, protected species, agricultural land, noise and air quality. |

## 15.8 Proposed level and scope of assessment

15.8.1 The assessment for combined and cumulative effects within the ES will be undertaken for the Proposed Scheme during both construction and operation.

## 15.9 Proposed methodology including significance

### Combined effects methodology

15.9.1 The assessment methodology for combined effects would involve the identification of impact interactions associated with the Proposed Scheme upon separate environmental receptors, to better understand the overall environmental effect of the Proposed Scheme.

15.9.2 The significance of construction and operational phase environmental effects would be brought forward from the preceding chapters of the ES into matrices, providing an overview of the potential effects on individual receptors. The assessment considers adverse effects, after mitigation has been taken into account. The significance of combined effects upon each environmental receptor group would then be made based upon the balance of scores and using professional judgement.

15.9.3 The methodology for the assessment of combined effects would follow DMRB Volume 11 Section 2 Part 5: Assessment and Management of Environmental Effects. For the purposes of the assessment, combined effects of Moderate, adverse or beneficial, and above would be considered significant.

### Cumulative effects methodology

15.9.4 The assessment methodology for cumulative effects would involve the identification of incremental changes likely to be caused by potential ’other developments’ together with the Proposed Scheme.

15.9.5 The assessment of cumulative effects would follow Advice Note Seventeen: Cumulative Effects Assessment (The Planning Inspectorate, 2015) with the four stages of assessment:

- Stage 1: Establish the Nationally Significant Infrastructure Project’s (NSIP’s) Zone of Influence (ZOI) and identify a long list of ‘other developments’.
- Stage 2: Identify shortlist of ‘other developments’ for the cumulative effects assessment.
- Stage 3: Information gathering.
- Stage 4: Assessment.

15.9.6 The ES will set out the methodology recognising the requirements of the NNNPS and advice on development of threshold criteria in PINS Advice Note Seventeen: Cumulative Effects Assessment, giving particular regard to the size and spatial influence of developments on the proposed project.

15.9.7 Rather than reporting every interaction, the methodology for the assessment of cumulative effects concentrates on the main significant effects, and will aim to differentiate between permanent, temporary, direct, indirect and secondary effects, positive or negative.

15.9.8 Where significant cumulative effects, beyond those identified as residual effects of the Proposed Scheme in isolation, have been identified, additional mitigation measures will be developed to avoid significant effects.

15.9.9 The significance of cumulative effects upon each environmental resource would then be based on the balance of scores and using professional judgement. An on-balance approach would also be taken when identifying the overall cumulative effect for the Proposed Scheme in conjunction with the other proposed major developments.

**Significance criteria**

15.9.10 The assessment of significance of the combined and cumulative effects would be determined in accordance with the significance criteria contained in Table 15.4 of DMRB Volume 11, Section 2, Part 5 (HA 205/08), which is described in more detail in Section 1.6 of this EIA Scoping Report. Typically, the greater the environmental sensitivity or value of the receptor or resource, and the greater the magnitude of impact, the greater the effect. In this way, the consequences of a highly value resource suffering a major detrimental impact would be a very large adverse effect, as shown in Table 1.2 contained in Chapter 1 of this EIA Scoping Report, and outlined in DMRB Volume 11, Section 2, Part 5 (HA 205/08).

15.9.11 For the purposes of this cumulative effects assessment, the value of a resource and magnitude of impact is determined according to the criteria set within the preceding chapters of this ES. The significance of effect is then carried forward from preceding chapters to enable an on-balance assessment of combined significance upon environmental receptors, as well as to identify the significance of cumulative effects with other developments. Typical descriptors of cumulative significance are included within Table 15.2, which reflects this on balance approach. Overall significance is determined, with mitigation included, as shown in Table 1.2.

15.9.12 Significance descriptors have also been aligned with the considerations included within PINS ‘Advice Note Seventeen: Cumulative Effects’. Accordingly, where impacts are likely to be temporary, the overall significance of effect is considered to be reduced from a permanent impact on a receptor of the same value. Equally, localised and infrequent impacts are likely to be of lower magnitude than those that cover a greater geographical scale and / or regularly occur, resulting in a reduced significance of effect. Effects can be additive (such as the loss of two pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss) or synergistic (two discharges combining to have an effect on a species not affected by discharges in isolation).

15.9.13 Where an effect is Moderate or above, adverse or beneficial, it is deemed to be significant.

**Table 15.2 Combined and cumulative significance criteria**

| Significance Category | Definition |
|---|---|
| Very Large (Adverse or Beneficial) | Where the combined effects of the Proposed Scheme or cumulative effects of the Proposed Scheme in association with other existing or more than likely / near certain future major development upon an individual or collection of environmental receptors would be highly significant. Effects would be:<br>• Permanent and far reaching for receptors of very high value |
| Large (Adverse or Beneficial) | Where the combined effects of the Proposed Scheme or cumulative effects of the Proposed Scheme in association with other existing or more than likely/ near certain major future developments upon an individual or collection of environmental receptors would be highly significant. Effects would be:<br>• Permanent and far reaching for receptors of high value,<br>• Localised for a receptor of very high value, or<br>• Temporary for a receptor of very high value |
| Moderate (Adverse or Beneficial) | Where the combined effects of the Proposed Scheme or cumulative effects of the Proposed Scheme in association with other existing or more than likely/ near certain major development upon an individual or collection of environmental receptors would be significant. Effects would be:<br>• Permanent and far reaching for receptors of medium value,<br>• Localised for receptors of high value, or<br>• Temporary for receptors of high value |
| Slight (Adverse or Beneficial) | Where the combined effects of the Proposed Scheme or cumulative effects of the Proposed Scheme in association with other existing or more than likely/ near certain future major developments upon an individual or collection of environmental receptors would be noteworthy but not significant. Effects would be:<br>• Permanent and far reaching for receptors of low value,<br>• Localised for receptors of medium value, or<br>• Temporary for a receptor of medium value |
| Neutral | Where the combined effects of the Proposed Scheme or the cumulative effects of the Proposed Scheme in association with other existing or more than likely / near certain future major developments would balance. |

Source: Based on DMRB Volume 11 Section 2 Part 5 and professional judgement

## 15.10 Conclusion

15.10.1 The baseline and methodology for the assessment of combined and cumulative effects has been considered within this chapter. The assessment for combined and cumulative effects will be undertaken and presented within an ES.

15.10.2 The assessment will draw upon the guidance outlined in the DMRB Volume 11, Section 2, Part 5 Assessment and Management of Environmental Effects, and the more recently published Advice Note Seventeen: Cumulative Effects Assessment (The Planning Inspectorate, December 2015).

# 16 Conclusions

16.1.1 This EIA Scoping Report has identified the potential for significant effects that may result during construction and operation of the Proposed Scheme. This information has been used to make recommendations for whether further environmental assessment is necessary for individual topics. Where required, assessment will be presented within the ES.

16.1.2 Table 16.1 provides a summary of the level of assessment required for each EIA topic proposed to be scoped into the EIA.

**Table 16.1 Summary of Scoping for A47 Blofield to North Burlingham**

| Topic | Environmental Statement – Level of Assessment |
|---|---|
| Air Quality | Simple |
| Cultural Heritage | Detailed |
| Landscape | Detailed |
| Biodiversity | Detailed |
| Geology & Soils | Simple |
| Materials | Simple |
| Noise & Vibration | Detailed |
| People and Communities | Various across sub-topics |
| Road Drainage & the Water Environment | Simple |
| Climate | Further Assessment |
| Combined and Cumulative Effects | Scoped in |

16.1.3 Table 16.2 provides a summary of the potential effects of the Proposed Scheme and identifies whether further Environmental Assessment is required on a topic-by-topic basis.

**Table 16.2 Summary of potential effects and further environment assessment requirements**

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| Air Quality | Construction | Production of on-site dust emissions arising from construction activities and vehicle movements. | Further assessment required to a Simple Level. | No further topic specific consultation is required. |
| | Operation | Impacts on ambient concentrations of Nitrogen Oxides (NOx) including $NO_2$ and fine particulates (PM10) as a result of changes to traffic. | Further assessment required to a Simple Level. | |
| Cultural Heritage | Construction | During construction, there is the potential for a direct effect upon the setting of: listed buildings, a non-designated historic park to archaeological remains. | Further assessment required to a Detailed Level. | Further consultation will be undertaken specifically with Historic England and Council Conservation and Historic Environment Officers. |
| | Operation | Potential adverse effects due to impacts on the setting of designated heritage assets. | Further assessment required to a Detailed Level. | |
| Landscape | Construction | Construction effects associated with the removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting. Potential (major/moderate) adverse impact on local landscape elements and character. | Further assessment required to a Detailed Level. | Consultation required with Local Planning Authority to agree representative viewpoints to inform the assessment of visual effects. |
| | Operation | Year 1 – Operational (major/moderate) adverse effects associated with a reduction in extent of tree and hedgerow cover, loss of agricultural land and prominence of highway infrastructure.<br>Year 15 – Operational (minor) adverse effects associated with the relative increase in highway infrastructure associated with junctions and highway overbridges within a relatively flat, open agricultural landscape. | Further assessment required to a Detailed Level. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| Visual | Construction | Construction effects associated with the removal of existing vegetation, earthworks and presence of construction plant, materials, machinery, construction compounds and construction lighting. Potential (major/moderate) adverse effects on residential properties on the northern and eastern edges of Blofield; residential properties at North Burlingham; a number of residential properties dispersed across the area to the north and south of the existing A47; recreational users of the local PRoW network; users of the Church of St Andrew in North Burlingham; business users of Burlingham Business Centre road users of the A47, B1140 and other minor roads within the study area. | Assessment required to a Detailed Level. | |
| | Operation | Year 1 – Operational effects associated with visibility of the road/highway infrastructure and vehicles. Potential (major/moderate) adverse effects on residential properties on the northern and eastern edges of Blofield; residential properties at North Burlingham; a number of residential properties dispersed across the area to the north and south of the existing A47; recreational users of the local PRoW network; users of the Church of St Andrew in North Burlingham; business users of Burlingham Business Centre road users of the A47, B1140 and other minor roads within the study area. Potential (moderate) adverse night time visual effects on residential receptors to the south of the Proposed Scheme as a result of the influence of vehicle headlights.<br>Year 15 – Operational effects associated with partial visibility of the road/highway infrastructure and vehicles. | Assessment required to a Detailed Level. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | Potential (moderate/minor) adverse effects on residential receptors on the northern and eastern edges of Blofield, a number of residential properties to the south of the existing A47 and recreational users of the local PRoW network. Potential (minor) adverse night time visual effects on residential receptors to the south of the Proposed Scheme as a result of the influence of vehicle headlights. | | |
| Biodiversity | Construction | Potential significant direct and indirect impacts to protected species, designated sites and sensitive habitats. | Assessment required to a Detailed Level. | Detailed consultation to be undertaking with Natural England, Environmental Agency, Local Planning Authority, The Wildlife Trust for Bedfordshire and Northamptonshire and RSPB. |
| | Operation | | | |
| Geology and Soils | Construction | A limited extent of the proposed route is indicated to comprise worked or made ground. Further examination of the associated potential contaminated land risks is recommended. This could be considered as part of the routine GI. | Assessment required to a Simple Level. | The proposed works are not considered to warrant specific consultation in respect of land quality issues. Can be addressed as part of routine investigation and assessment procedures. |
| | Operation | No significant adverse effects anticipated. | No further assessment required. | |
| Materials | Construction | Potential for significant adverse effect during construction due to the use of materials and generation of waste. | Assessment required to Simple Level. | Consultation with the Environmental Agency will be ongoing during the process. |
| | Operation | No significant effects anticipated. | No further assessment required. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| Noise & Vibration | Construction | Potential to directly alter the noise and vibration baseline for sensitive receptors for a temporary period. Construction noise would be managed with adherence to mitigation measures and is therefore not anticipated to have significant direct effects. | Assessment required to a Detailed Level. | Consultation with Environmental Health Officers of Local Planning Authority will be progressed. |
| | Operation | Potential for changes to traffic flows and new road alignment to result in noise changes at noise sensitive receptors. | Assessment in the form of road traffic noise predictions is required for sensitive receptors. | |
| People and Communities | Construction | **NMUs**<br>Direct impact upon users of Burlingham FP3 since it would sever the route. This would result in increased journey times and lengths during the temporary construction period.<br>NMU facilities would be temporarily impacted through the presence of construction plant, machinery, materials, construction compounds and construction lighting and changes to barriers and traffic flows. | Assessment is required to a Simple Level in the first instance. | Specific consultation required as per sub-topic. |
| | | **Amenity**<br>Amenity is likely to be temporarily impacted.<br>Construction activities may cause indirect effects for NMUs, due to noise, dust and the presence of construction plant, materials, compounds sites and machinery for a temporary period. | Assessment is required to a Simple Level in the first instance. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | **MTs Driver Stress**<br>Driver Stress for MTs would increase with changes in traffic flows and speeds, however these effects are not considered to be significant. | Assessment is required to a Simple Level in the first instance. | |
| | | **Community Severance**<br>Possible that access to the businesses located close to where the new link road between the A47 and Walsham Road will be constructed will be temporarily affected. | Detailed assessment is required. | |
| | | **Community Land and Community Facilities**<br>Possible that access to the Blofield pick your own and community allotments will be temporarily though directly affected by the construction of the new road. This could result in adverse effects on users. | Detailed assessment is required. | |
| | | **Development Land**<br>No impacts on development land are anticipated during the construction phase. | Detailed assessment is required. | |
| | | **Demolition of Private Property and Associated Land Take**<br>Permanent land take and property demolitions are nonetheless expected to result in significant adverse effects for landowners. | Detailed assessment is required. | |
| | | **Local Economy**<br>If the Scheme results in new employment in the area, this could have a slight beneficial impact on employment rates. | Detailed assessment is required. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | **Agricultural Land and Individual Farm Business**<br>The Proposed Scheme would also require land-take (temporary and permanent) of parcels of agricultural land from a number of individual farm businesses, this number and their locations are currently unknown. | Assessment is required to a Simple Level in the first instance. | |
| | Operation | **NMUs**<br>Would result in a negligible increase in journey time and length. Crossing of the A47 would be made easier by the introduction of the new NMU route between Blofield and North Burlingham via the existing A47 and the proposed Blofield overbridge. | Assessment is required to a Simple Level in the first instance. | |
| | | **Amenity**<br>Burlingham FP3 amenity would be significantly degraded and may put off users of the route. The Proposed Scheme would have a minor effect on amenity for users of the local side roads. | Assessment is required to a Simple Level in the first instance. | |
| | | **MTs Driver Stress**<br>A reduction in the number of side roads with access to the carriageway and the upgrading of the road to a dual carriageway would reduce driver stress on the A47. Despite this, the severance of many of the side roads may potentially increase driver stress. | Assessment is required to a Simple Level in the first instance. | |
| | | **MTs View from the Road (Operation only)**<br>Prior to the establishment of Proposed Scheme mitigation planting, there would be ‘open’ views from the road to the south of the Proposed Scheme.<br>By year 15 of operation the establishment of roadside vegetation would broadly re-define the existing situation | Assessment is required to a Simple Level in the first instance. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | in terms of establishing 'intermittent' views from the road. | | |
| | | **Community Severance**<br>It is possible that there will be some permanent severance as the A47 will be more challenging to cross for pedestrians. A new NMU route between Blofield and North Burlingham via the existing A47 and the proposed Blofield overbridge. | Detailed assessment is required. | |
| | | **Community Land and Community Facilities**<br>During operation it is likely that there will be permanent effects on the community facilities close to the south of the A47. | Detailed assessment is required. | |
| | | **Development Land**<br>There are a number of development sites in the wider impact area which are likely to benefit from the construction of the new road. The road will improve access to the area and traffic flow, creating a more favourable environment for new development. | Detailed assessment is required. | |
| | | **Demolition of Private Property and Associated Land Take**<br>Significant impacts anticipated. | Detailed assessment is required. | |
| | | **Local Economy**<br>Direct operational employment is not expected to be created as a result of the Proposed Scheme. However, there are likely to be increased indirect employment opportunities related to reduced congestion and improved journey times. | Detailed assessment is required. | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | **Agricultural Land and Individual Farm Business**<br>The Proposed Scheme would also require permanent land-take of parcels of agricultural land from a number of individual farm businesses, this number and their locations are currently unknown. | Assessment is required to a Simple Level in the first instance. | |
| Road Drainage and the Water Environment | Construction | The construction phase may have the potential to impact upon the water environment (including groundwater) through mobilisation of sediments and contaminants due to earthworks, construction dewatering, vehicular movements, plant and vehicle washing and alterations to ground levels.<br>Construction activities for the Proposed Scheme could increase the risk of a pollution incident, associated with accidental spillages/or leaks of fuels, oil, chemicals, wastewater, concrete and cement and admixture.<br>The construction phase has the potential to affect recreational users of, and the aquatic ecology within, the local surface water features due to increased pollution during construction. | Assessment required to Simple Level. | Consultation with the following organisations will be required: Environment Agency; Norfolk County Council as Lead Local Flood Authority (LLFA); Broadland District Council, and; Anglian Water. |
| | Operation | The effect of an increase in impermeable area as a result of the proposed carriageway and side roads, could result in an increase in peak flow rate and volume which could, in turn, increase flood risk<br>The Proposed Scheme will require the infilling, removal or relocation of two small ponds (at ch2200 and ch2800).<br>The proposed sections of dualling along with the potential associated increase in the volume of traffic may result in an increase in pollutant loads in highway | | |

| Topic | Stage | Potential Effects | Requirement for Further Assessment | Requirement for Further Consultation |
|---|---|---|---|---|
| | | run-off, resulting in long term increase in diffuse pollution and subsequent deterioration in water quality of surface water and groundwater<br>A possible deterioration in water quality may result in a detrimental impact on the aquatic ecology and the health of humans who participate in recreational activities in or adjacent to the local surface water features | | |
| Climate | Construction | Potential for increased $CO_2$ emissions;<br>The construction site has the potential to be vulnerable to extremes of weather, although significant climate change is not expected during the construction period. | Further assessment required. | No further topic specific consultation is required. |
| | Operation | Potential for increased $CO_2$ emissions;<br>Changes in climate have the potential to pose a risk to the Proposed Scheme assets and environmental receptors. | Further assessment required. | No further topic specific consultation is required. |
| Combined and Cumulative Effects | Construction | No assessment has been made at this stage. | The assessment for combined and cumulative effects will be undertaken and presented within the ES. | Consultation with Broadland District Council as the Local Planning Authority will be undertaken to agree a list of proposed developments to include within the cumulative effects assessments. |
| | Operation | No assessment has been made at this stage. | | |

# 17 References

## 17.1 Introduction


- Highways Agency (2008) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2 Part 4 Scoping of Environmental Impact Assessments (HA2/08)
- Highways England Report (June 2017). Road Investment Strategy East Area 6 A47 Blofield to North Burlingham Interim Environmental Assessment Report ((A47 IMPS2-AMY-BB-ZZ-DO-J0024)
- PINS (2017) Advice Note Seven: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping


## 17.2 Air Quality


- Department for Environment, Food and Rural Affairs (2016): Local Air Quality Management Technical Guidance (LAQM-TG(16))
- Highways Agency (2007) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1 Air Quality (HA 207/07)
- Highways Agency (2013) Interim Advice Note (IAN) 170/12v3: 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.
- Highways Agency (2013) Interim Advice Note (IAN) 174/13: Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Par 1 ‘Air Quality (HA207/07)
- Highways Agency (2013) Interim Advice Note (IAN) 175/13: Updated advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Proposed Scheme Air Quality Action Plans for user of DMRB Volume 11, Section 3, Part 1 ‘Air Quality
- Highways Agency (2015) Interim Advice Note (IAN) 185/15: Updated traffic, air quality and noise advice on the assessment of traffic data into speed-bands for users of DMRB Volume 11, Section 3, Part 1 ‘Air Quality


## 17.3 Cultural Heritage


- Highways Agency (2007) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 2: Cultural Heritage (HA 208/07)
- Highways England (2017) Road Investment Strategy A47 Improvements Blofield to North Burlingham Report on Public Consultation
- Historic England (2008) Conservation Principles: Policies and Guidance
- Historic England (2015) Historic Environment Good Practice Advice in Planning
- M. Medlycott, 2011 “Research and Archaeology Revisited: A Revised Framework for the East of England” East Anglian Archaeology Occasional Paper No. 24 Association of Local Government Archaeological Officers East of England
- Note 2 (GPA2) - Managing Significance in Decision-Taking in the Historic Environment

- Standard and Guidance from the Chartered Institute of Archaeologists

## 17.4 Landscape

- Highways Agency (1993) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 5: Landscape Effects
- Highways Agency (2010) Interim Advice Note 135/10: Landscape and Visual Effects Assessment
- Landscape Institute & the Institute of Environmental Management and Association (IEMA) (2013): Guidelines for Landscape and Visual Impact Assessment
- Natural England and Defra (2014) Landscape Character Assessment

## 17.5 Biodiversity

- Chartered Institute of Ecology and Environmental Management (CIEEM) (2016) Guidelines for Ecological Impact Assessment in the UK
- CIEEM Sources of Survey Methods
- Highways Agency (2010) Interim Advice Note 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment
- Highways Agency(1993) Design Manual for Roads and Bridges (DMRB): Volume 11, Section 3 Part 4 Ecology and Nature Conservation

## 17.6 Geology & Soils

- Environmental Protection Act 1990 (as amended by the Environment Act 1995)
- Environmental Protection (Duty of Care) Regulations 1991 (as amended 2003)
- Highways Agency (1993) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 11 Geology and Soils

## 17.7 Materials

- Building Research Establishment (BRE) Framework Standard for the Responsible Sourcing of Construction Products
- CL:AIRE Definition of Waste: Development Industry Code of Practice Version 2, 2011
- DEFRA (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites
- DEFRA (2011) Guidance on applying the Waste Hierarchy
- Environment Agency (EA) (Standard Rules SR2015 No39: use of waste in a deposit for recovery operation
- Environment Permitting (England and Wales) Regulations 2010 (as amended 2011 and 2012)
- Environmental Protection Act 1990, Part II, Section 34

- EU Waste Framework Directive 2008/98/EC
- Hazardous Waste (England and Wales) Regulations 2005 (as amended, 2009)
- Highways Agency (2001) Interim Advice Note 153/11: Guidance on the Environmental Assessment of Materials Resources
- Waste (England and Wales) Regulations 2011 (as amended 2012)

## 17.8 Noise & Vibration

- British Standard 5228-1:2009+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise’
- British Standard 5228-2:2009 'Code of construction practice for noise and vibration control on construction and open sites - Part 2: Vibration'
- Department of Transport (1988) Calculation of Road Traffic Noise (CRTN)
- Highways Agency (2011) Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7 (HD213/11) Noise and Vibration
- Highways Agency (2015) Interim Advice Note 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’
- Institute of Environmental Management & Assessment (IEMA) (2014) Guidelines for Noise Impact Assessment
- Road Investment Strategy; East Area 6; A47 Blofield to North Burlingham; Interim Environmental Assessment Report
- Sections 60 and 61 of The Control of Pollution Act 1974
- The Environmental Protection Act 1990
- The Land Compensation Act 1973 Part 1
- The National Planning Policy Framework 2012
- The National Policy Statement for National Networks 2014
- The Noise Insulation Regulations 1975 (amended 1988)
- The Noise Policy Statement for England 2010

## 17.9 People and Communities

- British Standards Institution (2013). Specification for Subsoil BS 8601:2013. London: BSI Standards Limited
- British Standards Institution (2015). Specification for Topsoil BS 3882:2015. London: BSI Standards Limited
- Department for Communities and Local Government (2015) English Indices of Multiple Deprivation
- Department for Environment, Food and Rural Affairs (DEFRA) (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. [pdf] London: Department for Environment, Food and Rural Affairs. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69308/pb13298-code-of-practice-090910.pdf> [Accessed 20 September 2017]

- Highways Agency (2007) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 8 – Pedestrians, Cyclists, Equestrians and Community Effects
- Highways Agency (2007) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 9 – Vehicular Travellers
- Highways Agency (2007) Design Manual for Roads and Bridges DMRB Volume 11 Section 3 Part 6 (amendment number one): 'Land Use'
- Highways England (2015) Interim Advice Note (IAN) 125/15: Environmental Assessment Update 'People and Communities'
- Hodgson, J.M. (1997). Soil Survey Field Handbook. 3rd ed. Silsoe: Cranfield University
- Ministry of Agriculture, Fisheries and Food (MAFF) (1988). Agricultural Land Classification (ALC) of England and Wales – Revised guidelines and criteria for grading the quality of agricultural land


## 17.10 Road Drainage and the Water Environment


- British Geological Society (2017a), TF30SE38 Borehole Log. Available online at http://scans.bgs.ac.uk/sobi_scans/boreholes/503914/images/12086402.html, last accessed September 2017
- British Geological Society (2017b), TF30SE61 Borehole Log. Available online at http://scans.bgs.ac.uk/sobi_scans/boreholes/18783351/images/18782698.html, last accessed September 2017
- Broadland District Council (2015) The Broadland Local Plan. Available online at: https://www.broadland.gov.uk/info/200139/policies_for_future_development/247/the_current_local_plan, last accessed September 2017
- CIRIA (2002) Control of Water Pollution from Construction Sites – Guide to Good Practice (C532)
- CIRIA (2006) Control of Water Pollution from Linear Construction Projects (C648)
- CIRIA (2007) The SuDS Manual (C753)
- CIRIA (2015) Environmental Good Practice on Site (Fourth Edition) (C741)
- Defra (2017) Magic Map Application, available online at http://www.natureonthemap.naturalengland.org.uk/MagicMap.aspx, last accessed September 2017
- Department for Communities and Local Government (2012) National Planning Policy Framework (NPPF)
- Department for Communities and Local Government (2014) Flood risk and coastal change. Available online at https://www.gov.uk/guidance/flood-risk-and-coastal-change, last accessed September 2017
- Directive 1991/676/EEC of the European Parliament and of the Council concerning the protection of waters against pollution caused by nitrates from agricultural sources (1991), more commonly known as the Nitrates Directive
- Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (2000), more commonly known as the Water Framework Directive

- Envirocheck Report, Landmark Information Group (2017), Report No. 133832593_1_1
- Environment Agency (2013) Groundwater protection: Principles and a practice (GP3) Version 1.1. Withdrawn document available online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/598799/LIT_7660.pdf, last accessed September 2017
- Environment Agency (2017a) Catchment Data Explorer. Available online at http://environment.data.gov.uk/catchment-planning/, last accessed September 2017
- Environment Agency (2017b) Flood map for planning. Available online at https://flood-map-for-planning.service.gov.uk, last accessed September 2017
- Environment Agency (2017c) Long term flood risk assessment for locations in England. Available online at https://flood-warning-information.service.gov.uk/long-term-flood-risk/, last accessed September 2017
- Environment Agency (2017d) Flood risk assessments: climate change allowances. Available online at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, last accessed September 2017
- Environment Agency (2017e) Groundwater protection. Available online at https://www.gov.uk/government/collections/groundwater-protection, last accessed September 2017
- Environment Agency (2017f) What's in your backyard. Available online at http://apps.environment-agency.gov.uk/wiyby/default.aspx, last accessed September 2017
- Environmental Assessment Report A47 Blofield to North Burlingham Version 0.3 (A47IMPS1-AME-BB-ZZ-DO-J0024, 2016)
- Fenland District Council (2011) Strategic Flood Risk Assessment Level 1 SFRA. Available online at http://www.fenland.gov.uk/CHttpHandler.ashx?id=3771&p=0, last accessed September 2017
- Flood and Water Management Act (2010)
- Groundwater protection guides covering: requirements, permissions, risk assessments and controls (EA, 2017d), previously covered by: Groundwater protection: principles and practice (GP3) (EA, 2013a)
- Highways (Environmental Impact Assessment) Regulations 2007 (EIA Highways Regulations 2007)
- Highways Agency (2009) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10 'Road Drainage and the Water Environment' (HD 45/09)
- Highways Agency (2011) Highways Agency Water Risk Assessment Tool, Version 1.0. Available online at http://infrastructure.planningportal.gov.uk/wp-content/ipc/uploads/projects/TR050002/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/5.2%20ES%20Appendix%208.4%20140409_HAWRAT_Outputs-Catchment%20E%20(M1%20Junction).pdf, last accessed September 2017
- Highways England (2017). A47 Corridor Improvement Programme. Stage 2 Buildability Summary Report
- Land Drainage Act (1991) and (1994)

- Met Office (2016) Eastern England: climate, available online at http://www.metoffice.gov.uk/climate/uk/regional-climates/ee, last accessed September 2017
- Norfolk County Council (2015) Norfolk Local Flood Risk Management Strategy, available online at https://www.norfolk.gov.uk/-/media/norfolk/downloads/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/flood-and-water-management/norfolk-local-flood-risk-management-strategy.pdf?la=en, last accessed September 2017
- Planning Inspectorate (2017) Advice Note Eighteen: The Water Framework Directive, available online at https://infrastructure.planninginspectorate.gov.uk /wp-content/uploads/2017/06/advice_note_18.pdf, last accessed December 2017
- Scott Wilson (2005) Highways Agency; A47 Blofield to North Burlingham Dualling Geotechnical Report
- Stage 2 Environmental Assessment Report A47 Blofield to North Burlingham (A47 IMPS2-AMY-BB-ZZ-DO-J0024, 2017)
- The Environment Act (1995)
- The Greater Norwich Development Partnership (2014) Joint Core Strategy for Broadland, Norwich and South Norfolk, available online at https://www.south-norfolk.gov.uk/sites/default/files/JCS_Adopted_Version_Jan_2014.pdf, last accessed September 2017
- The Groundwater (Water Framework Directive) (England) Directive 2016
- The Water Act (2014)
- University of Hertfordshire (2017). PPDB: Pesticide Properties Database. https://sitem.herts.ac.uk/aeru/ppdb/en/atoz.htm
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2000


## 17.11 Climate


- BSI (2016) PAS 2080:2016 Carbon Management and Infrastructure;
- Committee on Climate Change (2017) UK Climate Change Risk Assessment Synthesis Report
- Department for Business, Energy & Industrial Strategy (2017a) 2015 UK Greenhouse Gas Emissions, Final Figures
- Department for Business, Energy & Industrial Strategy (2017b) UK Local Authority and Regional Carbon Dioxide Emissions National Statistics: 2005-2015 [online] available at: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-2015, last accessed August 2017
- Department for Business, Energy & Industrial Strategy (2017c) Updated Energy and Emissions Projections 2016 [online] available at: https://www.gov.uk/ government/uploads/system/uploads/attachment_data/file/599539/Updated_energy_and_emissions_projections_2016.pdf, last accessed July 2017
- Department for Transport (2014) National Policy Statement for National Networks
- Department for Transport (2015) TAG Unit A3 Environmental Impact Appraisal [online] available at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/638648/TAG_unit_a3_envir_imp_app_dec_15.pdf, last accessed July 2017
- Highways England (2016) Climate Adaptation Risk Assessment Progress update 2016
- IEMA (2015) IEMA Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation
- IEMA (2017) IEMA Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance
- Norfolk County Council (2016) Greenhouse Gas Report 2015/16 [online] available at: https://www.norfolk.gov.uk/-/media/norfolk/downloads/what-we-do-and-how-we-work/policy-performance-and-partnerships/performance/corporate/greenhouse-gas-report-2015-16.pdf, last accessed August 2017;
- Norwich City Council (2017) Carbon Footprint Report 2016-17 [online] available at: https://www.norwich.gov.uk/download/downloads/id/4058/carbon_footprint_report_2016-17.pdf, last accessed August 2017
- The Met Office (2016) Eastern England: Climate [online] available at: http://www.metoffice.gov.uk/climate/uk/regional-climates/ee, last accessed August 2017
- UKCP09 Climate Projections: East of England Maps & Key Findings [online] available at: http://ukclimateprojections.metoffice.gov.uk/23955?emission=high, last accessed August 2017

## 17.12 Combined and Cumulative Effects

- Highways Agency (2008) Design Manual for Roads and Bridges (DMRB) Volume 11 Section 2 Part 5 HA205/08 ‘Assessment and Management of Environmental Effects
- PINS (2015) Advice Note Seventeen: Cumulative Effects Assessment

# Appendix A – DCO Site Boundary

Walsham Wood
Pedham
Hemblington Corner
Hemblington
Mill Road
Hemblington Hall Road
Wood Farm
Hemblington Road
Church La
Hall Farm
Burlingham Road
B1140
Newport Farm
Newport Road
Green Lane
Watts Hall Farm
Trunk Farm
Acle Road
Hangin
Church Road
The Windle
Windle Farm
Field La
Field Cottage
Woodbastwick Road
Ranworth Road
High Noon La
High Noon Farm
Perowne's Farm
Bullacebush Lane
Bullacebush Farm
Jary's Farm
Burlingham Green
Deli Corner Lane
Home Farm
South Walsham Road
North Burlingham
Norwich Road
Acle Hall Farm
Plantation Road
A47
Sparrow Hall
Poplar Farm
Blofield
Coxhill Farm
Glebe Barn
Lingwood Road
Hemblington Road
Braydeston Hall Lane
Brundall Road
Run Dike
The Old Granary
Home Farm
Heater Lane
Blofield Road
Church Road
School Road
Post Office Road
Lodge Road
Lingwood
Church View Farm
The Orchards
B1140
Highnoon Farm
Cuckoo Lane
Station Road
Brundall
Norwich Road
Strumpshaw
Strumpshaw Road
Buckenham Road
Home Farm
Buckenham Lane
Long Lane
Hill House
Beighton
Chapel Road
Dauber's Lane
Sandy Lane
South Burlingham
Low Road
Stone Road
Barn Hill
Mill Hill
Cantley
Waterworks
Squirrel View Cottage
0 250 500 Metres

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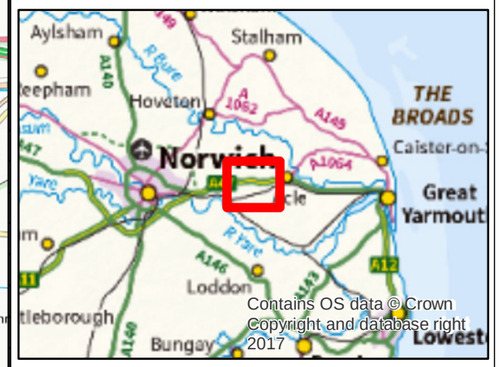
**Key to symbols**

DCO site boundary



**References drawings**




| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P02 | 06/02/18 | Drawing Produced | LC | BO | BJ |

Mott MacDonald Sweco

Client: highways england

Drawing Status: For Information

Suitability: S0

Project Title: A47 Blofield to North Burlingham

Drawing Title: Figure A.1 DCO Site Boundary

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:20,000 | Cutting, Lee | Cutting, Lee | O'Hickey, Ben | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 19/12/17 | 19/12/17 | 19/12/17 | 19/12/17 |

Drawing Number: HE PIN | Originator | Volume
HEBLOFLD - MMSJV - EGN -
000 - RP - LX - 00001
Location | Type | Role | Number

Project Ref. No.: HEBLOFLD

Revision: P02

# Appendix B – Environmental Constraints Figures

- Site Level – 500m buffer
- Wider context – 5km buffer (reduced site area detail)

Pedham
Hemblington Corner
Hemblington
Wood Farm
Newport Farm
Watts Hall Farm
Trunk Farm
Hall Farm
Field Cottage
High Noon Farm
Burlingham Green
Jary's Farm
Home Farm
North Burlingham
Sparrow Hall
Poplar Farm
Acle Hall Farm
Windle Farm
Blofield
Coxhill Farm
Glebe Barn
The Old Granary
Highnoon Farm
Lingwood
Strumpshaw
Hill House
South Burlingham
Beighton
Cantley
Moulton S
Brundall
Yare Broads & Marshes

B1140
A47
Newport Road
South Walsham Road
Norwich Road
Burlingham Road
Hemblington Road
Hemblington Hall Road
Church La
High Noon La
Mill Road
Field La
Woodbastwick Road
Ranworth Road
Bullacebush Lane
Plantation Road
Delli Corner Lane
Green Lane
Acle Road
Church Road
The Windle
Lingwood Road
Braydeston Hall Lane
Brundall Road
Run Dike
Heater Lane
Blofield Road
Church Road
School Road
Post Office Road
Lodge Road
S Burlingham Road
Station Road
Cuckoo Lane
Strumpshaw Road
Long Lane
Buckenham Road
Buckenham Lane
Barn Hill
Mill Hill
Low Road
Stone Road
Church Hill
Chapel Road
Dauber's Lane
Sandy Lane

0 250 500 Metres

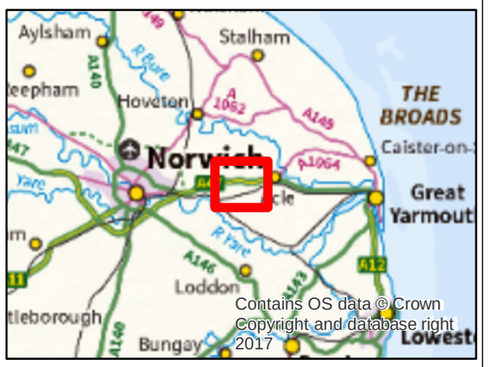


**Key to symbols**

- DCO site boundary
- Indicative 500m buffer
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland
- Ramsar
- Site of Special Scientific Interest (SSSI)
- Special Area Conservation (SAC)
- Historic Landfill Sites



**References drawings**






| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P02 | 06/02/18 | Drawing Produced | LC | BO | BJ |

Mott MacDonald Sweco

Client: highways england

Drawing Status: For Information

Suitability: S0

Project Title: A47 Blofield to North Burlingham

Drawing Title: Figure B.1 Environmental Constraints Site Level

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
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| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 19/12/17 | 19/12/17 | 19/12/17 | 19/12/17 |

Drawing Number: HE PIN | Originator | Volume
HEBLOFLD - MMSJV - EGN -
000 - RP - LX - 00001
Location | Type | Role | Number

Project Ref. No.: HEBLOFLD

Revision: P02

**Key to symbols**

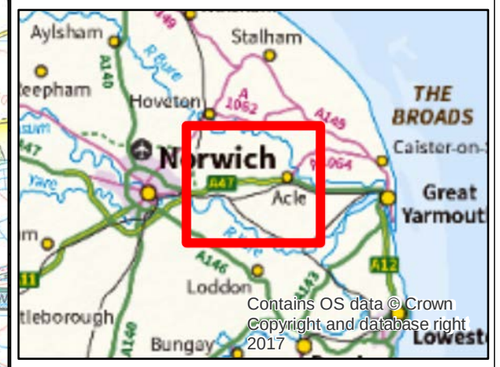
- DCO site boundary
- Indicative 5km buffer
- Scheduled Monument
- Ramsar
- Local Nature Reserve (LNR)
- Special Protection Area (SPA)
- Historic Landfill Sites
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland
- Special Area Conservation (SAC)
- Noise Important Areas (NIA)

Listed Building - Grade

- I
- II
- II*



**References drawings**




| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P02 | 06/02/18 | Drawing Produced | LC | BO | BJ |

Mott MacDonald Sweco

Client: highways england

| Drawing Status | Suitability |
|---|---|
| For Information | S0 |

Project Title: A47 Blofield to North Burlingham

Drawing Title: Figure B.2 Environmental Constraints Wider Context

| Scale | Designed | Drawn | Checked | Approved |
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| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 19/12/17 | 19/12/17 | 19/12/17 | 19/12/17 |

Drawing Number: HE PIN | Originator | Volume
HEBLOFLD - MMSJV - EGN -
000 - RP - LX - 00001
Location | Type | Role | Number

Project Ref. No.: HEBLOFLD

Revision: P02



0 250 500 1,000 Metres

# Appendix C – Lighting Impact Assessment Methodology

### Introduction and Study Area

A Lighting Impact Assessment Study will be included as part of the EIA process to determine the likely effects of this design on the surrounding environment. The assessment will ensure that the preliminary lighting design will conform to maximum allowable obtrusive lighting levels and will provide recommended luminaire types, mounting heights and angles for use within various areas of the Proposed Scheme.

The lighting assessment will inform the landscape and ecology impact assessments and will be included as a technical appendix to the Landscape and Visual Impact Assessment. The assessment is considered important to assess the possible impacts on nearby County Wildlife Sites, potential bat roosts or foraging routes, nearby residential properties and listed buildings.

### Guidance and Best Practice

In considering the potential effects of the proposed development, the following aspects of obtrusive light, taken from the Institute of Lighting Professionals Guidance Note for the Reduction of Obtrusive Light GN01:2011 must be considered and assessed:

- Sky Glow
- Light Intrusion
- Luminaire / Luminous Intensity
- Building or Façade Luminance

The assessment will be in accordance with the following legislation and guidance. Further guidance documents will be consulted as appropriate – the following list is not exhaustive:

- Environmental Protection Act 1990
- Clean Neighbourhoods and Environment Act 2005
- DEFRA: Statutory Nuisance from Insects and Artificial Light

- The Landscape Institute and Institute of Environmental Assessment, 3rd Edition, 2013
- Institution of Lighting Professionals (ILP) *Guidance Notes for the Reduction of Obtrusive Light* (GN01):2011)
- Institution of Lighting Professionals (ILP): ILP Professional Lighting Guide 04, *Guidance on Undertaking Environmental Lighting Impact Assessments* (2013)
- Commission Internationale de l'Eclairage (CIE) 150: Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations
- CIE 126: Guidelines for Minimising Sky Glow
- The Chartered Institution of Building Services Engineers (CIBSE) LG06 The Exterior Environment 2016
- BS EN 12464 Part 2 Outdoor Lighting
- BS EN 13201 European Norm for Road Lighting
- BS 5489-1:2013 Code of Practice for the Design of Road Lighting and Public Amenity Areas
- Bat Conservation Trust and the ILP: Bats and Lighting in the UK: 2009
- Bat Conservation Trust: Statement on the Impact and Design of Artificial Light on Bats. 2011
- Bat Conservation Trust: Landscape and Urban Design for Bats and Biodiversity. 2012
- Bat Conservation Trust: Artificial Lighting and Wildlife Interim Guidance: Recommendations to Help Minimise the Impact of Artificial Lighting, 2014

**Proposed Methodology and Scope**

The assessment will follow best practice guidance detailed in 'Lighting Professionals (ILP): ILP Professional Lighting Guide 04, *Guidance on Undertaking Environmental Lighting Impact Assessments*'. Potential receptors will be identified and discussed with the Local Planning Authority (LPA) as well as landscape and ecology teams to agree the proposed receptor locations and identify any further survey requirements or assessment methodology.

A baseline survey will be carried out, this will provide lux measurements and photographs taken at a survey viewpoint for each receptor and will provide a baseline against which any obtrusive light from the proposed development can be compared.

Information gathered on baseline surveys will facilitate agreement with the LPA in determining which environmental lighting zone the site falls under and therefore the maximum permissible levels of obtrusive light. Environmental zones are set out in Table C.1 below.

**Table C.1 Environmental Zones**

| Zone | Surrounding | Lighting Environment | Examples |
|---|---|---|---|
| E0 | Protected | Dark | UNESCO Starlight reserves, IDA Dark Sky Parks |
| E1 | Natural | Intrinsically dark | National Parks, Areas of Outstanding Natural Beauty etc. |
| E2 | Rural | Low district brightness | Village or relatively dark outer suburban locations |
| E3 | Suburban | Medium district brightness | Small town centres or suburban locations |
| E4 | Urban | High district brightness | Town / city centres with high levels of night-time activity |

Source: Guidance Notes for the Reduction of Obtrusive Light GN01:2011 (ILP/2011)

**Potential Effects, including Monitoring and Mitigation Measures**

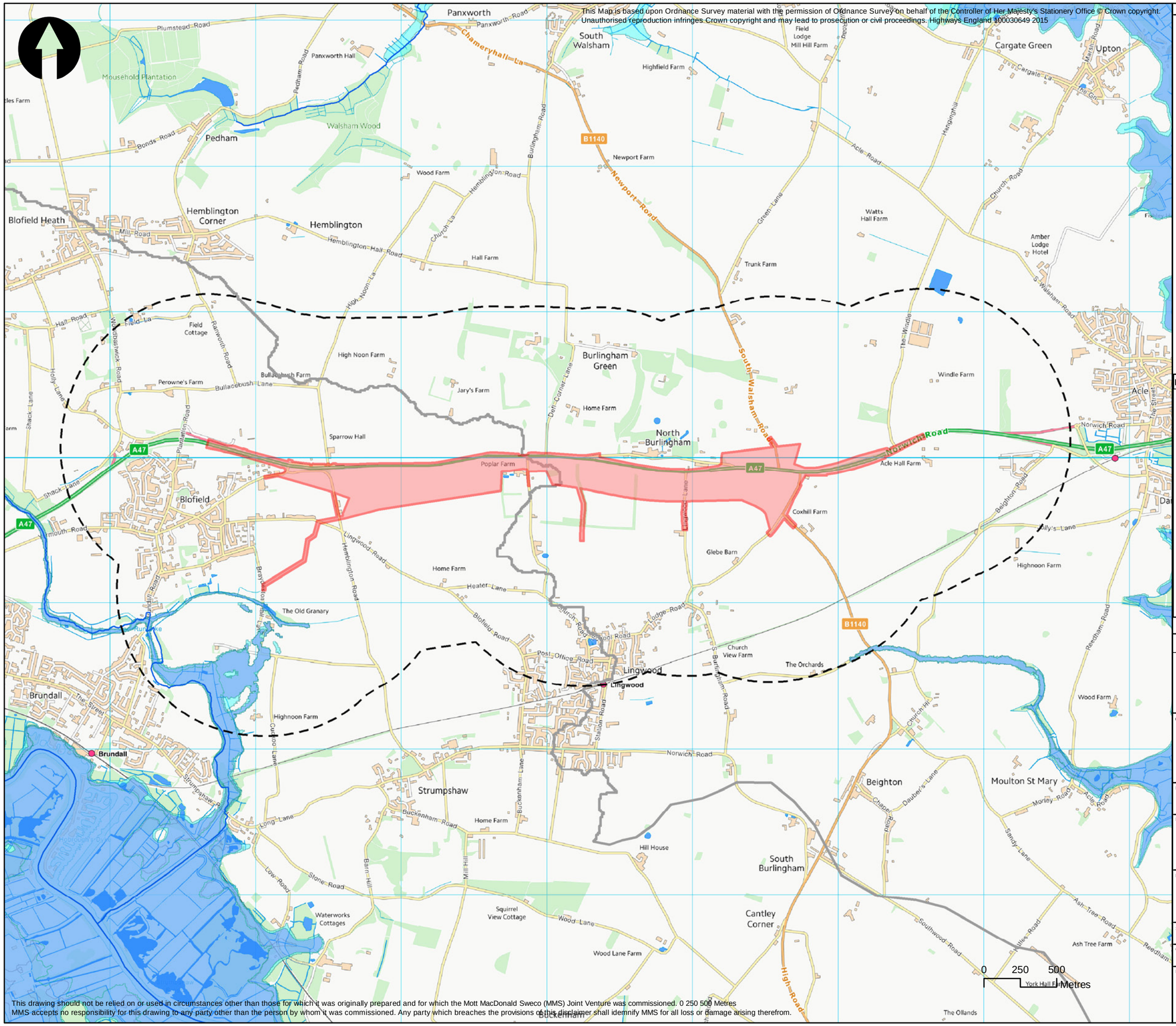
The Proposed Scheme is likely to result in obtrusive light impacts associated with construction such as temporary lighting for safety and security, lighting of haul routes, laydown areas, offices and temporary parking areas etc. There are also likely to be obtrusive lighting impacts during the operational phase as a result of any proposed lighting or changes to existing lighting.

Where mitigation is required, it will be zone and use specific i.e. it will be specific to areas of the Proposed Scheme and further assessed by the proposed use of the zone. Specific construction activities may require high lux-level task lighting and therefore this

lighting should be directional and sighted appropriately to minimize obtrusive light, whilst lower mounting height lighting or the restriction of working hours may be appropriate for other areas. Mitigation measures will also take into account the findings of the landscape / ecological assessment and any such mitigation which is proposed in the associated reporting.

# Appendix D – Road Drainage and the Water Environment Figures

- Figure 13-1 Surface Water Features and Flood Zones
- Figure 13-2 Groundwater Bodies
- Figure 13-3 Risk of Flooding from Surface Water
- Figure 13-4 Groundwater Flooding





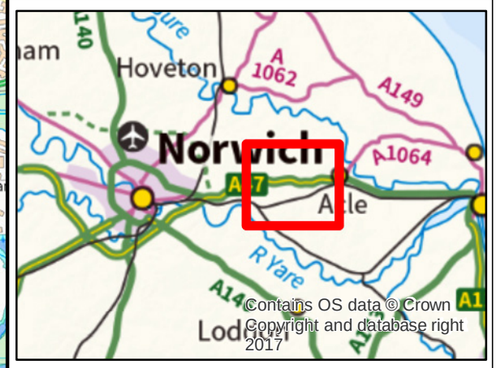

**Key to symbols**

- DCO site boundary
- Indicative 1km buffer
- OS Surface Water
- Flood Zone 3
- Flood Zone 2
- WFD - Surface Water Operational Catchments Cycle 2

**WFD - River, Canal and Surface Water Transfer Waterbodies Cycle 2**

- River

**References drawings**






| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P02 | 06/02/18 | Drawing Produced | LC | BO | BJ |

Mott MacDonald Sweco

Client: highways england

| Drawing Status | Suitability |
|---|---|
| For Information | S0 |

Project Title: A47 Blofield to North Burlingham

Drawing Title: Figure 13.1 Surface water features and flood zones

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:25,000 | Cutting, Lee | Cutting, Lee | O'Hickey, Ben | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 19/12/17 | 19/12/17 | 19/12/17 | 19/12/17 |

Drawing Number: HE PIN | Originator | Volume
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Location | Type | Role | Number

Project Ref. No.: HEBLOFLD

Revision: P02

**Key to symbols**

- DCO site boundary
- Indicative 1km buffer

**Source protection zones**

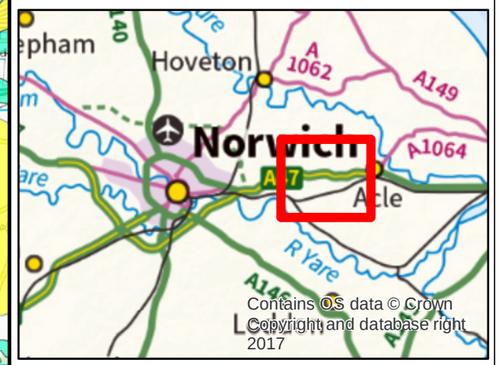
- Zone I - Inner Protection Zone
- Zone II - Outer Protection Zone
- Zone III - Total Catchment

**BGS Aquifer Maps - Superficial Deposits Designation**

- Secondary A
- Secondary B
- Secondary (undifferentiated)

Note:
BGS Aquifer Maps -
Bedrock Designation - Principal

**References drawings**






| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P02 | 06/02/18 | Drawing Produced | LC | BO | BJ |

Mott MacDonald Sweco

Client: highways england

| Drawing Status | Suitability |
|---|---|
| For Information | S0 |

Project Title: A47 Blofield to North Burlingham

Drawing Title: Figure 13.2 Groundwater Bodies

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:24,000 | Cutting, Lee | Cutting, Lee | O'Hickey, Ben | Jones, Bryn |
| Original Size: A3 | Date: 19/12/17 | Date: 19/12/17 | Date: 19/12/17 | Date: 19/12/17 |

Drawing Number: HE PIN | Originator | Volume
HEBLOFLD - MMSJV - EGN - 000 - RP - LX - 00001
Location | Type | Role | Number

Project Ref. No.: HEBLOFLD

Revision: P02

0 250 500 Metres

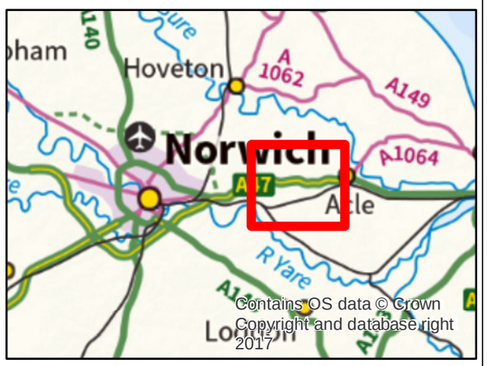
**Key to symbols**

- DCO site boundary
- Indicative 1km buffer

**Surface water flood risk**

- 1 in 30yr extent
- 1 in 100yr extent
- 1 in 1000yr extent

**References drawings**




| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P02 | 06/02/18 | Drawing Produced | LC | BO | BJ |

Mott MacDonald Sweco

Client: highways england

| Drawing Status | Suitability |
|---|---|
| For Information | S0 |

Project Title: A47 Blofield to North Burlingham

Drawing Title: Figure 13.3
Risk of flooding from surface water

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:25,000 | Cutting, Lee | Cutting, Lee | O'Hickey, Ben | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 19/12/17 | 19/12/17 | 19/12/17 | 19/12/17 |

Drawing Number: HE PIN | Originator | Volume
HEBLOFLD - MMSJV - EGN -
000 - RP - LX - 00001
Location | Type | Role | Number

Project Ref. No.: HEBLOFLD

Revision: P02

0 250 500 Metres

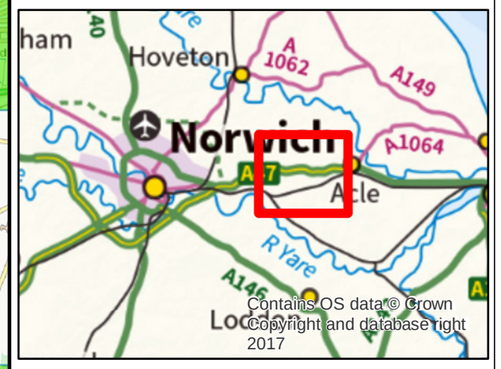
**Key to symbols**

- DCO site boundary
- Indicative 1km buffer

**Susceptibility to groundwater flooding**

- < 25%
- >= 25% <50%

**References drawings**




| Rev | Date | Amendment Details | Drawn | Chk'd | App'd |
|---|---|---|---|---|---|
| P02 | 06/02/18 | Drawing Produced | LC | BO | BJ |

Mott MacDonald Sweco

Client: highways england

| Drawing Status | Suitability |
|---|---|
| For Information | S0 |

Project Title: A47 Blofield to North Burlingham

Drawing Title: Figure 13.4 Groundwater flooding

| Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|
| 1:24,000 | Cutting, Lee | Cutting, Lee | O'Hickey, Ben | Jones, Bryn |
| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 19/12/17 | 19/12/17 | 19/12/17 | 19/12/17 |

Drawing Number: HE PIN | Originator | Volume
HEBLOFLD - MMSJV - EGN -
000 - RP - LX - 00001
Location | Type | Role | Number

Project Ref. No.: HEBLOFLD

Revision: P02

0 250 500 Metres