

A46

Newark Bypass

Preliminary Environmental
Information



Volume 1: Main Report
October 2022

About

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Contents

1	Executive Summary	9
1	Introduction	11
1.1	The role of Preliminary Environmental Information.....	11
1.2	Legislative context and the need for EIA	11
1.3	Planning policy context.....	12
1.4	Structure of the Preliminary Environmental Information Report	15
2	The scheme.....	17
2.1	Road Investment Strategy 2	17
2.2	Need for the scheme	17
2.3	Scheme objectives	18
2.4	Scheme location.....	18
2.5	Scheme description.....	22
2.6	Scheme construction.....	26
2.7	Embedded mitigation.....	27
3	Assessment of alternatives	30
3.1	Introduction	30
3.2	Assessment history	30
3.3	Design development following the preferred route announcement.....	39
3.4	Assessment of alternatives within the ES.....	48
4	Stakeholder engagement and consultation	50
4.1	Principles of engagement and consultation.....	50
4.2	Environmental consultation to date	50
4.3	Proposed consultation.....	53
5	Environmental assessment methodology	56
5.1	Environmental Scoping	56
5.2	Approach to assessment.....	61
5.3	Future baseline scenario	63
5.4	Surveys and predictive techniques and methods	64
5.5	General assessment assumptions and limitations.....	64
5.6	Significance criteria	66
5.7	Duplication of assessment	67
5.8	Environmental Statement	67
6	Air Quality	70
6.1	Introduction	70

6.2	Legislation and policy context.....	70
6.3	Assessment methodology	78
6.4	Study area.....	83
6.5	Existing baseline	84
6.6	Value (sensitivity of resources and receptors).....	93
6.7	Potential impacts.....	95
6.8	Consultation	95
6.9	Assumptions and limitations.....	96
6.10	Design, mitigation and enhancement measures.....	97
6.11	Assessment of effects	98
6.12	Monitoring requirements for significant adverse effects	103
6.13	Conclusions.....	103
7	Cultural Heritage	105
7.1	Introduction	105
7.2	Legislation and policy context.....	105
7.3	Assessment methodology	107
7.4	Study area.....	112
7.5	Existing baseline	114
7.6	Value (sensitivity of resources and receptors).....	118
7.7	Potential impacts.....	119
7.8	Consultation	120
7.9	Assumptions and limitations.....	121
7.10	Design, mitigation and enhancement measures.....	122
7.11	Assessment of effects	124
7.12	Monitoring requirements for significant adverse effects	135
7.13	Conclusions.....	135
8	Landscape and Visual Effects.....	137
8.1	Introduction	137
8.2	Legislation and policy context.....	137
8.3	Assessment methodology	141
8.4	Study area.....	148
8.5	Existing baseline	149
8.6	Value (sensitivity of resources and receptors).....	153
8.7	Potential impacts.....	162
8.8	Consultation	163
8.9	Assumptions and limitations.....	164
8.10	Design, mitigation and enhancement measures.....	164

8.11	Assessment of effects	166
8.12	Monitoring requirements for significant adverse effects	170
8.13	Conclusions.....	171
9	Biodiversity.....	172
9.1	Introduction	172
9.2	Legislation and policy context.....	172
9.3	Assessment methodology	177
9.4	Study area.....	183
9.5	Existing baseline	185
9.6	Value (sensitivity of resources and receptors).....	193
9.7	Potential impacts.....	198
9.8	Consultation	199
9.9	Assumptions and limitations.....	199
9.10	Design, mitigation and enhancement measures.....	200
9.11	Assessment of effects	204
9.12	Monitoring requirements for significant adverse effects	242
9.13	Conclusions.....	242
10	Geology and Soils	244
10.1	Introduction.....	244
10.2	Legislation and policy context.....	244
10.3	Assessment methodology	248
10.4	Study area.....	256
10.5	Existing baseline	256
10.6	Value (sensitivity of resources and receptors).....	263
10.7	Potential impacts	263
10.8	Consultation	265
10.9	Assumptions and limitations.....	265
10.10	Design, mitigation and enhancement measures.....	266
10.11	Assessment of effects	268
10.12	Monitoring requirements for significant adverse effects	277
10.13	Conclusions.....	277
11	Material Assets and Waste	278
11.1	Introduction.....	278
11.2	Legislation and policy context.....	278
11.3	Assessment methodology	293
11.4	Study area.....	296
11.5	Existing baseline	297

11.6	Value (sensitivity of resources and receptors).....	313
11.7	Potential impacts	313
11.8	Consultation	314
11.9	Assumptions and limitations	315
11.10	Design, mitigation and enhancement measures.....	316
11.11	Assessment of effects	318
11.12	Monitoring requirements for significant adverse effects	320
11.13	Conclusions.....	320
12	Noise and Vibration.....	321
12.1	Introduction.....	321
12.2	Legislation and policy context.....	321
12.3	Assessment methodology	327
12.4	Study area	333
12.5	Existing baseline	335
12.6	Value (sensitivity of resources and receptors).....	339
12.7	Potential impacts	341
12.8	Consultation	341
12.9	Assumptions and limitations	342
12.10	Design, mitigation and enhancement measures.....	342
12.11	Assessment of effects	344
12.12	Monitoring requirements for significant adverse effects	349
12.13	Conclusions.....	350
13	Population and Human Health	351
13.1	Introduction.....	351
13.2	Legislation and policy context.....	351
13.3	Assessment methodology	356
13.4	Study area	364
13.5	Existing baseline	365
13.6	Value (sensitivity of resources and receptors).....	373
13.7	Potential impacts	374
13.8	Consultation	376
13.9	Assumptions and limitations	376
13.10	Design, mitigation and enhancement measures.....	377
13.11	Assessment of effects	379
13.12	Monitoring requirements for significant adverse effects	392
13.13	Conclusions.....	393
14	Road Drainage and The Water Environment.....	394

14.1	Introduction.....	394
14.2	Legislation and policy context.....	394
14.3	Assessment methodology	401
14.4	Study area	412
14.5	Existing baseline	412
14.6	Value (sensitivity of resources and receptors).....	419
14.7	Potential impacts	422
14.8	Consultation	424
14.9	Assumptions and limitations	425
14.10	Design, mitigation and enhancement measures.....	425
14.11	Assessment of effects	428
14.12	Conclusions.....	447
15	Climate	448
15.1	Introduction.....	448
15.2	Legislation and policy context.....	448
15.3	Assessment methodology	454
15.4	Study area	460
15.5	Existing baseline	461
15.6	Value (sensitivity of resources and receptors).....	465
15.7	Potential Impacts.....	466
15.8	Consultation	469
15.9	Assumptions and limitations	469
15.10	Design, mitigation and enhancement measures.....	471
15.11	Assessment of effects	473
15.12	Conclusions.....	476
16	Combined and cumulative effects	477
16.1	Introduction.....	477
16.2	Legislation and policy	477
16.3	Assessment methodology	478
16.4	Study area	482
16.5	Existing baseline	486
16.6	Potential impacts	486
16.7	Consultation	488
16.8	Assumptions and limitations	488
16.9	Design, mitigation and enhancement measures.....	488
16.10	Assessment of effects	489
16.11	Conclusions.....	489

17 Summary	491
18 Glossary and Abbreviations	503
Appendix A: List of visual receptors	559
Appendix B: Habitats	561
Priority habitats	561
Other habitats.....	562
Appendix C: Protected and notable species	565
Bats	565
Birds	566
Reptiles	566
Great crested newts	567
Badgers.....	567
Otters	567
Water voles	568
Other mammals.....	568
White clawed crayfish.....	568
Invertebrates	568

1 Executive Summary

This Preliminary Environmental Information (PEI) report has been prepared for the A46 Newark Bypass scheme (hereafter referred to as 'the scheme') as part of the statutory consultation.

The information contained within this report is 'preliminary' and has been produced to enable consultees to understand the likely significance of environmental effects of the scheme and to help inform their consultation response on the scheme during the pre-application stage of the Development Consent Order (DCO). This PEI Report is based on the preliminary design presented at statutory consultation for the pre-application state of the scheme. The production of the PEI Report is a requirement of the Infrastructure Planning (Environmental Impact Assessment) (EIA) Regulations 2017. A full environmental assessment and presentation of the likely significance of environmental effects of the scheme will be presented within the Environmental Statement submitted for the DCO.

Chapters 1 to 4 of the PEI Report provide an overview of the scheme, summarise the alternative options considered, summarise the EIA process, and provide an overview of the consultation to date. Chapters 5 to 16 of the PEI Report include assessments for the following environmental disciplines:

- Air quality
- Cultural heritage
- Landscape
- Biodiversity
- Geology and soils
- Materials
- Noise and vibration
- Population and human health
- Road drainage and the water environment
- Climate
- Combined and cumulative effects

Each environmental discipline chapter provides information on the likely significance of environmental effects associated with the scheme, based on information available to date and with mitigation measures in place where they have been identified. Further mitigation measures may be identified for each discipline, following consultation and will be reported within the Environmental Statement (ES).

This PEI Report is supported by a series of figures contained within Volume 2.

A non-technical summary of the PEI report (Volume 3) has also been produced to support the statutory public consultation and is available at:

www.nationalhighways.co.uk/a46-newark-bypass.

Responses can be submitted using the following methods during the consultation period:

- Completing a copy of the response form and posting it back to the project team using the scheme freepost address:

FREEPOST A46 NEWARK BYPASS

There is no need for a stamp when using this freepost address, the response form can be placed in an envelope with the freepost address written on the front. Responses posted on the statutory consultation closing date will still be accepted.

- Completing the online version of the response form available via the scheme webpage at the following address:
www.nationalhighways.co.uk/a46-newark-bypass
- Giving a copy of a response form to a member of staff at one of the consultation events.

Further information about the consultation or about requesting consultation materials in alternative formats (including large print and additional languages) is available from the project team using the details below:

Email address: A46Newarkbypass@nationalhighways.co.uk

Telephone number: **0300 123 5000**
(24/7 Customer Contact Centre)

Postal address: **A46 Newark Bypass Project Team,
National Highways, 2 Colmore Square,
Birmingham B4 6BN**

1 Introduction

1.1 The role of Preliminary Environmental Information

- 1.1.1 Preliminary Environmental Information (PEI) is defined in Regulation 12(2) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017¹ as:
- 1.1.2 “In this regulation, ‘preliminary environmental information’ means information referred to in regulation 14(2) which –
- 1.1.3 Has been compiled by the applicant; and
- 1.1.4 Is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the development (and any associated developments)’ to assess the environmental effects of the development (and of any associated development)”.
- 1.1.5 The PEI Report has been prepared for the A46 Newark Bypass scheme (hereafter referred to as ‘the scheme’). The information contained within this report is preliminary. This report has been produced to enable consultees (both specialist and non-specialist) to understand the likely environmental effects of the scheme and to help inform their consultation response on the scheme during the pre-application stage.
- 1.1.6 Feedback received from this consultation will be taken into consideration within both the design of the scheme and the preparation of the Environmental Statement (ES).

1.2 Legislative context and the need for EIA

- 1.2.1 The scheme is classified as a Nationally Significant Infrastructure Project (NSIP) under the Planning Act 2008 Section 22 (3) and (4) (as amended by The Highway and Railway (National Significant Infrastructure Project) Order 2013) by virtue of the fact that it meets the following conditions:
- The scheme would involve the alteration of a highway
 - That is wholly within England
 - For which the Secretary of State is the highway authority
 - Where the highway is not a motorway and the speed limit for any class of vehicle is expected to be 50 miles per hour or greater
 - The area of development is greater than 12.5 hectares
- 1.2.2 The scheme falls within paragraph 10(f) of Schedule 2 to the Infrastructure Planning (EIA) Regulations 2017. By virtue of the fact

¹ Statutory Instrument (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, No. 527.

that the potential for significant environmental effects has been identified, an Environmental Statement (ES) will be prepared to accompany the Development Consent Order (DCO) application to the Planning Inspectorate.

- 1.2.3 The ES will meet the requirements of Regulation 14 of the Infrastructure Planning (EIA) Regulations 2017.

1.3 Planning policy context

National policy

National Policy Statement for National Networks

- 1.3.1 The National Policy Statement for National Networks (NPSNN)² 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 decision making for NSIPs on the national network in England.
- 1.3.2 The Government recognises in the Appraisal of Sustainability accompanying the NPSNN 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 NPSNN. Therefore, whilst applicants should deliver developments in accordance with Government policy and in an environmentally sensitive way, including considering opportunities to deliver environmental benefits, it is acknowledged that some adverse local effects of development may remain.
- 1.3.3 Evidence demonstrating how the scheme will comply with the NPSNN will be documented within the NPSNN Accordance Table that will be submitted as part of the DCO application. Any environmental assessment principles outlined in the NPSNN will be taken into account within the ES.
- 1.3.4 The ES will also confirm within each of the environmental discipline chapters how the requirements of the NPSNN will be met.

² Department for Transport (2014) National Policy Statement for National Networks [online] available at: https://www.gov.uk/Government/uploads/system/uploads/attachment_data/file/387223/NNNPS-web.pdf (last accessed June 2022).

National Planning Policy Framework

- 1.3.5 The National Planning Policy Framework (NPPF)³ sets out the Government's economic, environmental and social planning policies for England. These policies articulate a national strategy for sustainable development, with this vision interpreted to meet local aspirations and applied locally through the development of local and neighbourhood plans reflecting the needs and priorities of communities.
- 1.3.6 The NPPF promotes a “presumption in favour of sustainable development”. This presumption requires that economic, social and environmental considerations should be assessed in the determination of development proposals. In addition, the NPPF seeks to promote sustainable transport by encouraging solutions which support reductions in greenhouse gas emissions and reduce congestion.
- 1.3.7 The NPPF does not contain specific policies for NSIPs for which particular considerations apply. NSIPs are determined in accordance with the decision-making framework set out in the Planning Act 2008 and relevant National Policy Statements for major infrastructure, (for highways, the relevant National Policy Statement is the NPSNN, as described above) as well as any other matters that are considered both important and relevant, including the NPPF, as set out within Section 104(2)(d) of the Planning Act 2008.

Local Policy

- 1.3.8 The local plans of Newark and Sherwood District Council and Nottinghamshire County Council have been reviewed and where relevant, local planning policies have been included within the relevant topic chapters of this PEI Report.

National Highways policy, plans and guidance

National Highways Licence

- 1.3.9 The National Highways Licence⁴ sets out the Secretary of State's aims, objectives and conditions for National Highways to meet by way of an Order in accordance with Section 1 of the Infrastructure Act 2015. This maintains the functions of a strategic highways company to make sure the strategic road network (SRN) is managed responsibly, in a way that safeguards value for public investment, meeting the

³ Communities and Local Government (2021) National Planning Policy Framework [online] available at: https://www.gov.uk/Government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf (last accessed June 2022).

⁴ Highways England (2015) Highways England Licence – Secretary of State for Transport statutory directions and guidance to the strategic highways companies [online] available at: [Highways England: licence \(publishing.service.gov.uk\)](https://publishing.service.gov.uk) (last accessed July 2022).

needs of road users, securing individual well-being and supporting economic purpose, both today and for future generations.

National Highways Delivery Plan 2020-2025

1.3.10 The Delivery Plan⁵ outlines how National Highways will invest their Government funding in the SRN between 2020 to 2025, over the second road investment period. The Delivery Plan identifies that 52 schemes are planned to be opened during this road period to increase safety, improve reliability and deliver value for money. While the A46 Newark Bypass scheme will be open for traffic after the second road investment period, progression of this major road enhancement scheme throughout this period to enable road-user capacity, connectivity and access to be improved will be complete in the third road period.

National Highways Performance Specification

1.3.11 As part of the Road Investment Strategy 2⁶, the Performance Specification⁷ sets out the expectations for National Highways and the SRN, including metrics and indicators measuring the performance of both National Highways and the network against outcomes.

National Highways Net Zero Plan

1.3.12 In addition to the UK Government's Net Zero Strategy, National Highways have outlined their net zero strategy⁸ which contains three core commitments:

- Corporate emissions – net zero by 2030
- Maintenance and construction emissions – net zero by 2040
- Road user emissions – net zero by 2050

National Highways' People, Places and Processes

1.3.13 National Highways' 'People, places and processes: A guide to good design at National Highways'⁹ sets out a vision, which aims to put people at the heart of National Highways' work, by designing an inclusive, resilient and sustainable road network. This road network should be appreciated for its usefulness but also its elegance, reflecting in its design the beauty of the natural, built and historic

⁵ National Highways (2020) National Highways Delivery Plan 2020-2025 [online] available at: [5-year-delivery-plan-2020-2025-final.pdf \(nationalhighways.co.uk\)](https://nationalhighways.co.uk/5-year-delivery-plan-2020-2025-final.pdf) (last accessed July 2022).

⁶ Department for Transport (2020) Road Investment Strategy 2: for the 2020 to 2025 Road Period [online] available at: [Road Investment Strategy 2: 2020-2025 \(publishing.service.gov.uk\)](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/874247/road-investment-strategy-2-2020-2025.pdf) (last accessed June 2022).

⁷ Department for Transport (2014) Road Investment Strategy: Performance Specification [online] available at: [Road Investment Strategy: Performance Specification \(publishing.service.gov.uk\)](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/284247/road-investment-strategy-performance-specification.pdf) (last accessed July 2022).

⁸ National Highways (2020) Net zero highways: our 2030/2040/2050 plan available at <https://nationalhighways.co.uk/media/eispjcm/net-zero-highways-our-2030-2040-2050-plan.pdf> (Last accessed July 2022)

⁹ National Highways (2022) People Places and Processes: A guide to good design at National Highways [online] available at: [People, places and processes \(nationalhighways.co.uk\)](https://nationalhighways.co.uk/people-places-and-processes) (last accessed August 2022).

environment through which it passes, and enhancing it where possible. The accompanying set of principles for good road design follow the themes of people, places and processes. The focus on good design seeks to make a difference to both road users and the communities through which the roads pass, while being sensitive to the context of a road's surroundings. The road should contribute to higher quality of life, greater economic vitality and a more efficient use of resources.

1.4 Structure of the Preliminary Environmental Information Report

Volume 1 Main Report

- 1.4.1 The main report (Volume 1) is divided into four parts:
- Chapters 1 to 5 describe the proposed scheme, the alternatives considered and the approach taken to the EIA.
 - Chapters 6 to 15 present a preliminary assessment of the likely significant effects of the proposed scheme in relation to ten specialist topics covering particular aspects of the environment.
 - Chapter 16 considers the potential inter-relationships between the topics covered in Chapters 5 to 15, and between the proposed scheme and other developments in the surrounding area, which together have the potential to generate cumulative effects.
 - Chapter 17 presents a summary of the preliminary assessment of likely significant environmental effects.
- 1.4.2 The specialist topics defined by the Design Manual for Roads and Bridges (DMRB) are contained within Chapters 6 to 15 of this PEI Report:
- Chapter 6: Air quality
 - Chapter 7: Cultural heritage
 - Chapter 8: Landscape
 - Chapter 9: Biodiversity
 - Chapter 10: Geology and soils
 - Chapter 11: Material assets and waste
 - Chapter 12: Noise and vibration
 - Chapter 13: Population and human health
 - Chapter 14: Road drainage and the water environment
 - Chapter 15: Climate

Volume 2 Supporting Figures

- 1.4.3 A series of supporting figures referenced in this report are contained within Volume 2.

Volume 3 Non-Technical Summary

- 1.4.4 A separate document has also been prepared to provide a non-technical summary (NTS) of this PEI report.

Location of required information

1.4.5 Regulations 12 and 14, and Schedule 4 of the EIA Regulations set out the information which is to be included in the PEI Report. In accordance with Regulation 12(2)(b), this PEI Report presents information which “is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the development (and of any associated development)”. Table 1.1 identifies where the information defined by Regulation 14(2) can be found within this PEI Report.

Table 1.1: Location of information defined by Regulation 14(2) in the PEI Report

Specified information	Location within the PEI Report
(2) An environmental statement is a statement which includes at least– a) a description of the proposed development comprising information on the site, design, size and other relevant features of the development.	Chapter 2 – The scheme
b) a description of the likely significant effects of the proposed development on the environment.	Chapters 6 – 15
c) a description of any features of the proposed development, or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment.	Chapters 6 – 15
d) a description of the reasonable alternatives studied by the applicant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment.	Chapter 3 – Assessment of alternatives
e) non-technical summary of the information referred to in sub-paragraphs (a) to (d).	Non-Technical Summary (Volume 3)
f) any additional information specified in Schedule 4 relevant to the specific characteristics of the particular development or type of development and to the environmental features likely to be significantly affected.	Chapters 1 – 15

2 The scheme

2.1 Road Investment Strategy 2

- 2.1.1 In December 2014, the Department for Transport (DfT) published the Road Investment Strategy (RIS) for 2015-2020¹⁰. The RIS sets out the list of schemes that are to be developed by National Highways over the period covered by the RIS.
- 2.1.2 Following this, in December 2019, the Government built on the foundations of RIS by introducing a second Road Investment Strategy (RIS2)¹¹ which sets a long-term strategic vision for the network. This strategy specifies the performance standards that National Highways must meet, lists the planned enhancement schemes that are expected to be built, and states the funding that will be made available during the second road investment period, covering the financial years 2020/21 to 2024/25.
- 2.1.3 In exercising its functions and complying with its legal duties National Highways must 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.

2.2 Need for the scheme

- 2.2.1 The A46 forms part of the strategic Trans-Midlands Trade Corridor between the M5 in the southwest and the Humber Ports in the northeast. The improvements to the A46 corridor are detailed within the RIS2 as a mechanism for underpinning the wider economic transformation of the country. RIS2 makes a commitment to create a continuous dual carriageway from Lincoln to Warwick.
- 2.2.2 The stretch of A46 between the Farndon Junction, to the west of Newark-on-Trent and the A1 to the east of Newark-on-Trent, is the last remaining stretch of single carriageway between the M1 and A1 and consequently queuing traffic is a regular occurrence, often impacting journey time reliability.

¹⁰ Department for Transport (2015) Road Investment Strategy: for the 2015/16 – 2019/20 Road Period [online] available at: [Road Investment Strategy: for the 2015/16 – 2019/20 Road Period \(publishing.service.gov.uk\)](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/424247/road-investment-strategy-2015-2020.pdf) (last accessed June 2022).

¹¹ Department for Transport (2020) Road Investment Strategy 2: for the 2020 to 2025 Road Period [online] available at: [Road Investment Strategy 2: 2020-2025 \(publishing.service.gov.uk\)](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/884247/road-investment-strategy-2-2020-2025.pdf) (last accessed June 2022).

2.3 Scheme objectives

DfT objectives

2.3.1 The DfT's RIS2 sets out the following Strategic Outcomes:

- Improving safety for all
- Providing fast and reliable journeys
- A well maintained and resilient network
- Being environmentally responsible
- Meeting the needs of all users
- Achieving efficient delivery

National Highways' objectives

2.3.2 The current National Highways' scheme objectives are below:

Safety

- Improving safety through scheme design to reduce collisions for all users of the A46 scheme.

Congestion

- Improve journey time and journey time reliability along the A46 and its junctions between Farndon and Winthorpe, including all approaches and A1 slip roads.

Connectivity

- Accommodate economic growth in Newark-on-Trent and the wider area by improving its strategic and local connectivity.

Environment

- Deliver better environmental outcomes by achieving a net gain in biodiversity, and improve noise levels at Noise Important Areas along the A46 between Farndon and Winthorpe junctions.

Customer

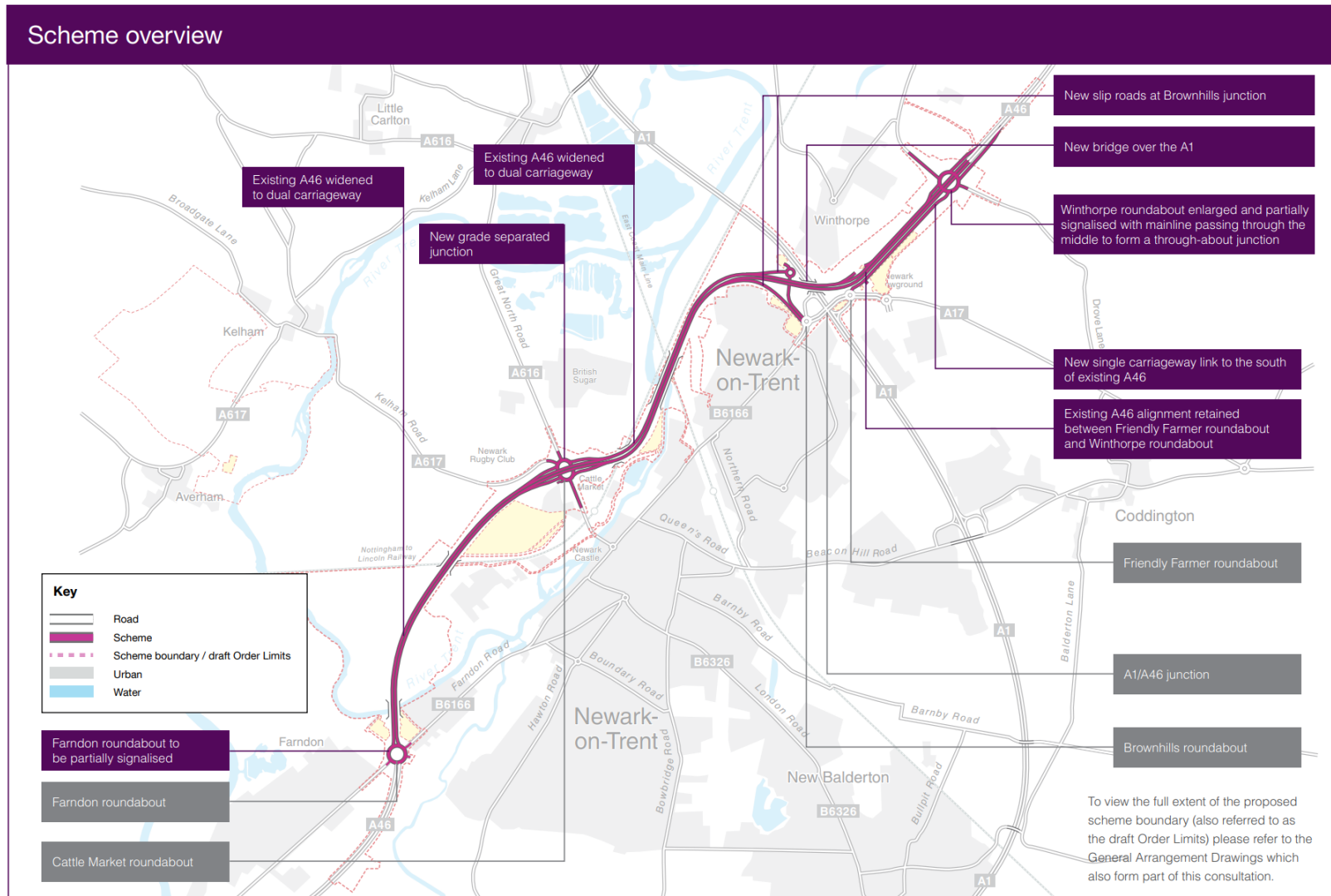
- Build an inclusive scheme which improves facilities for cyclists, walkers and other vulnerable users where existing routes are affected.

2.4 Scheme location

2.4.1 The scheme will provide a dual carriageway on the A46 between Farndon and Winthorpe. The Farndon roundabout is located at the western extent of the scheme where the B6166 Farndon Road joins the A46. The Winthorpe junction is located at the eastern extent where the A1133 joins the A46. Along its route, it crosses A617 and B6326, at the Cattle Market junction, and A1 between the Friendly Farmer and

Brownhills roundabouts. Figure 2.1 below shows the location of the scheme

Figure 2.1: Scheme location plan



- 2.4.2 The scheme will be situated within the county boundary of Nottinghamshire County Council and within the administrative boundary of Newark and Sherwood District Council.
- 2.4.3 The scheme crosses the River Trent twice, the Nottingham to Lincoln railway line twice, and the East Coast Main Line once.
- 2.4.4 The existing A46, currently single carriageway, is generally elevated on embankment due to the low-lying floodplain of the River Trent. Several roundabouts form key junctions along the route, linking with several local A roads. Road infrastructure is softened by roadside vegetation in places and the River Trent is a strong natural influence within an otherwise manmade landscape. To the north of the A46, farmland dominates, interspersed with small-scale settlements. To the south of the road, the town of Newark-on-Trent forms a notable urban settlement.
- 2.4.5 All of the environmental designations located within 2 kilometres of the scheme extent are shown on the Environmental Constraints Plan (Figure 2.1 contained in Volume 2). Notable statutory and non-statutory environmental designations and additional environmental constraints are as follows:
- Devon Park Pastures Local Nature Reserve (LNR) (approximately 500 metres east of Farndon junction) and Farndon Ponds LNR (approximately 800 metres west of Farndon junction).
 - 42 locally designated non-statutory ecological sites (39 of which are Local Wildlife Sites (LWS), 11 of which lie within the scheme footprint).
 - The River Trent and four other main rivers (two of which are crossed by the existing A46), which are reported reaches under the Water Framework Directive (WFD) and fall within the Humber River Basin District (RBD).
 - The scheme is located across areas within Flood Zone 2 and Flood Zone 3.
 - Noise Important Areas (NIAs) within the scheme footprint along the A1, A46, A617, Fosse Road and the East Coast Main Line.
 - Designated heritage assets including scheduled monuments (a Civil War sconce at Devon Bridge, Civil War redoubts at Dairy Farm, Valley Farm and the Sugar Refinery, and a Moated site at Dairy Farm are within the draft Order Limits).
 - Numerous listed buildings and structures (including Smeaton's arches, Newark Castle, and Newark and Winthorpe conservation areas) within 2 kilometres of the scheme extent.
 - Winthorpe Conservation Area and Newark Conservation Area are within the draft Order Limits. Averham and Kelham conservation areas are located immediately adjacent to the draft Order Limits. Farndon Conservation Area is located 1 kilometre west of the draft Order Limits.

- Newark Castle Gardens Grade II Listed Registered Park and Garden is located approximately 580 metres south of the A46.
- Non-designated heritage assets including from the English Civil War period and the likely potential for buried archaeological Palaeolithic remains of national or even international importance at Farndon.
- Predicted grade 3 land (good to moderate), according to Natural England's Agricultural Land Classification (ALC) maps (it is not possible to differentiate between subgrades 3a (deemed 'best and most versatile', BMV) and 3b (not deemed BMV) until soil surveys have been completed).
- The Trent and Belvoir Vales National Character Area.
- Four veteran and 10 notable trees have been identified within, or directly adjacent to, the draft Order Limits (of which 1 veteran and 9 notable trees are located at Kelham). Three veteran trees are currently in conflict with the scheme footprint.
- Extensive areas of Tree Protection Orders (TPOs), 3 of which will be in partial conflict with the scheme footprint (TPOs 116, 152 and 153).
- Existing communities in the vicinity of the scheme that are sensitive to environmental change include Newark-on-Trent to the south west of the scheme, accessed from the A46 via Farndon Road; Great North Road, and Lincoln Road; and the village of Winthorpe, located to the north east of the scheme, accessed via the A1133.

2.5 Scheme description

Introduction

- 2.5.1 The section of the A46 that is to be upgraded is approximately 6.5 kilometres in length. The scheme comprises on-line widening for the majority of its length between Farndon roundabout and the A1. A new section of offline dual carriageway is proposed between the western and eastern sides of the A1 before the new dual carriageway ties into the existing A46 to the west of Winthorpe roundabout. The widening works include earthwork widening along the existing embankments, and new structures where the route crosses the railway lines, River Trent and the A1.
- 2.5.2 A new grade separated junction will be provided at Cattle Market roundabout with improvements proposed at both the Farndon and Winthorpe roundabouts.
- 2.5.3 Three areas have been identified for floodplain compensation which are being referred to as the Kelham and Averham Floodplain Compensation Area, Brownhills Borrow Pit / Floodplain Compensation Area, and the Farndon Borrow Pits / Floodplain Compensation Area. The areas identified for floodplain compensation are shown on the Flood Constraints Plan (Figure 14.3 contained in Volume 2).

- 2.5.4 The maximum parameters (size and scale) of the scheme are unknown at this stage. However, the Environmental Statement (ES) will define these, along with any limits of deviation, and the description will reflect that of the scheme within the draft Development Consent Order (DCO) submission. The ES will be supported by appropriate figures and design drawings.

Proposed scheme components

- 2.5.5 The scheme consists of the following principal elements, which are described in further detail in the below sections:
- Widening of the existing A46 to a dual carriageway for a distance of 6.5 kilometres (approximately 4 miles) to provide two traffic lanes in both directions.
 - Partial signalisation of Farndon roundabout at the southern extents of the scheme.
 - A new grade-separated junction at Cattle Market junction with the A46 elevated to pass over the roundabout. A larger roundabout beneath the A46 to provide increased capacity.
 - Proposed off-line section between (approximately) Brownhills roundabout and Friendly Farmer roundabout.
 - New grade separated roundabout junction (Brownhills junction) providing local access with a two-way link road on the southern arm to connect with the existing Brownhills roundabout.
 - A new bridge structure across the existing A1, located to the north of the existing bridge.
 - An upgraded roundabout with possible signal controls at Winthorpe junction.
 - Improvements to non-motorised user (NMU) facilities through safer, enhanced routes for walkers, cyclists, and horse riders.
 - Provision of floodplain compensation to account for loss of floodplain as a result of the scheme footprint.

Mainline description

- 2.5.6 At its south-western limits, the scheme ties in with the northern arm of the existing Farndon roundabout, which already has two lanes on the entry and exit. Travelling north-eastwards, the route follows the alignment of the existing A46 for 2.5 kilometres during which it crosses over the River Trent and the Nottingham to Lincoln railway line. As the route approaches Cattle Market roundabout it begins to elevate so that it passes over the top of the southern half of the existing roundabout. The route then remains elevated and continues to follow the alignment of the A46 whilst it passes over the Nottingham to Lincoln railway line for a second time, the River Trent for a second time, and the East Coast Mainline. Throughout this stretch, between Farndon and just beyond the East Coast Main Line, the route is being widened to the north, away from Newark-on-Trent. Following this, the existing A46 bends to the right whilst the route of the scheme diverts to the north

where it crosses at a skew over the A1. The route then ties back into the existing A46 dual-carriageway and follows this alignment before it ties into Winthorpe roundabout at the north-eastern extent of the scheme.

Junction description

- 2.5.7 Farndon junction at the south west extent of the scheme will be enlarged to facilitate an additional circulatory lane, providing increased capacity. Traffic signals, operating during peak-hours, will control traffic movements through the roundabout, helping to improve flows and reduce congestion.
- 2.5.8 Cattle Market roundabout in the middle of the scheme will be enlarged, with the mainline elevated over the top to separate local traffic and through traffic. Eastbound and westbound slip roads will be provided to allow traffic to pass between the roundabout and mainline.
- 2.5.9 To the west of the A1 a new westbound on slip will be provided from Brownhills roundabout that will utilise the existing A46 carriageway. An eastbound off slip will be provided on the other side of the dual carriageway that will tie into a new, small roundabout near the A1. This will provide access to the properties and businesses to the north, and links to Brownhills roundabout via a new two-way link that crosses perpendicular beneath the mainline.
- 2.5.10 Winthorpe roundabout at the north-eastern extent of the scheme will be enlarged and fully signalised, with the mainline passing through the centre of the roundabout in a throughabout layout. Eastbound and westbound slip roads will be provided to allow traffic to merge and diverge between the mainline and the roundabout. An additional fifth arm will be provided for the two-way link to the Friendly Farmer roundabout.

Side roads description

- 2.5.11 Connections to all local roads in the vicinity of Farndon, Cattle Market and Winthorpe junctions will be retained, with the new junction layouts being designed to accommodate them. This includes Fosse Road, Farndon Road, the A617, the Great North Road, Drove Lane and the A1133. In addition, a new single carriageway link is provided between the Friendly Farmer roundabout and the new enlarged roundabout at Winthorpe.

Floodplain compensation site description

- 2.5.12 The proposed enlarged embankment for the A46 carriageway passes through land that acts as the floodplain for the River Trent. By using this land, the scheme has the potential to increase flood risk elsewhere unless mitigation is provided. This mitigation will include

floodplain compensation which will seek to provide an equivalent volume of floodplain storage in the local catchment by excavating land at similar elevations to that which will be displaced by the scheme.

- 2.5.13 To demonstrate that the floodplain compensation areas are effective, analytical flood modelling will be carried out. Three areas have been identified for floodplain compensation. These are being referred to as the Kelham and Averham Floodplain Compensation Area, Brownhills Borrow Pit / Floodplain Compensation Area, and the Farndon Borrow Pits / Floodplain Compensation Area. The location of these are shown on the draft Order Limits (Figure 2.2 contained in Volume 2). Floodplain compensation may be required at all three of these areas, for two reasons.
1. Like-for-like floodplain compensation is required. This means that the floodplain compensation needs to be at similar elevations to that which the new embankment would remove from the floodplain. The Kelham and Averham Floodplain Compensation Area would seek to provide floodplain compensation at higher elevations, the Farndon Borrow Pits / Floodplain Compensation Area middle elevations, and the Brownhills Borrow Pits / Floodplain Compensation Area lower elevations.
 2. Where possible floodplain compensation will be provided close to where the floodplain losses are occurring. From a scheme perspective, providing multiple sites would be more effective and would likely require less land-take and shallower depressions than providing all of the compensation at one location.
- 2.5.14 Where land is reduced in levels to create the additional floodplain compensation areas, these will effectively be borrow pits enabling the potential for material to be used in the permanent earthworks for the scheme. These areas will be re-topsoiled and landscaped appropriately on completion of the scheme. The current draft Order Limits (Figure 2.2 contained in Volume 2) includes large areas for the Farndon Borrow Pits / Floodplain Compensation Area and the Kelham and Averham Floodplain Compensation Area, however the floodplain compensation may not require all of this land. The draft Order Limits currently includes for a range of floodplain compensation options and ways of connecting the River Trent to the floodplain compensation areas and will be refined prior to submission of the DCO application.

Additional features

- 2.5.15 In addition to the above principal scheme elements, additional features associated with the scheme include new drainage, including improvements to existing infrastructure; landscape planting; environmental mitigation; lighting; traffic signage; facilities in and

around proposed junctions to accommodate walking, cycling and horse riding as required; and utility diversions.

- 2.5.16 Details of these additional features will be provided within the ES following further development of the scheme design.

Land take

- 2.5.17 Land would be required both temporarily and permanently to construct, operate and maintain the scheme. It has been estimated that the scheme would require approximately 357 hectares of land within the draft Order Limits to be acquired permanently, and approximately 60 hectares of land would be needed temporarily during construction. There would be requirements for National Highways to acquire permanent rights and to extinguish other rights over this land.

Demolition

- 2.5.18 The scheme would require the demolition of the redundant equipment/vehicle maintenance shed within the now disused Nottinghamshire County Council Highways depot to the west of the Great North Road at Cattle Market, and the demolition of the disused Mint Leaf restaurant adjacent to the existing A46 to the east of the A1, which is currently closed for business.

2.6 Scheme construction

- 2.6.1 As part of the proposed scheme, the following elements are likely to be required during construction:
- Temporary working and storage areas; material stockpiles; haul roads; borrow pits; and provision for site compounds to be used during the construction period for project offices, welfare facilities, and material and plant storage.
 - Enabling works including utility diversions.
 - Temporary traffic management arrangements on the A46, A1 and local road networks.
- 2.6.2 The types of construction elements that are likely to form part of the scheme include the following:
- Pre-construction and mobilisation activities, for example establishing site compounds, borrow pits and haul roads, and topsoil storage.
 - Excavation of soil to form floodplain compensation areas.
 - Earthworks to include noise attenuation and landscape bunds
 - Diversion of Statutory Undertaker's equipment and other apparatus.
 - Installation of attenuation features.
 - Ground water management.
 - Site clearance.
 - General excavation.

- Earthworks, including the construction of embankments and the relocation of spoil.
- Placing concrete foundations, including piling works.
- Laying of asphalt.
- Installation of drainage, which will include excavation and placement of pipes and chambers.
- Installation of a concrete central reservation along the A46.
- Installation of new street lighting and traffic signals at junctions.
- Landscaping and planting.
- Construction of new bridge structures including the lifting of beams into place.
- Construction of retaining wall solutions for the retention of new embankments.

2.6.3 Details of the construction methodology will be included as part of the ES. The ES will describe the construction phasing, the likely duration and location of construction activities, any requirements for night-time working, and the anticipated numbers and types of vehicle movements associated with the construction phase.

2.6.4 The development of the construction strategy will aim to ensure that adverse effects are reduced for sensitive receptors as far as practicable.

2.7 Embedded mitigation

2.7.1 The scheme design will be developed in line with the principles set out in Design Manual for Roads and Bridges (DMRB) GG 103¹² 'Introduction and general requirements for sustainable development and design'. To date, preliminary embedded mitigation has been established in line with these principles, as appropriate. The continued development of the scheme design shall be an iterative process, undertaken as part of an integrated design team to adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA104 Environmental Assessment and Monitoring¹³. The first principle being to avoid potential effects, if at all possible, before seeking to minimise or mitigate for any unavoidable impacts through a well-developed mitigation strategy.

2.7.2 An Indicative Environmental Masterplan has been developed and can be seen in Figure 2.3 contained in Volume 2.

¹² National Highways (2019) GG 103 – Introduction and general requirements for sustainable development and design [online] available at: [GG 103 - Introduction and general requirements for sustainable development and design - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/gg-103-introduction-and-general-requirements-for-sustainable-development-and-design-dmrbs-standardsforhighways.co.uk) (last accessed August 2022).

¹³ National Highways (2020) LA 104 – Environmental assessment and monitoring [online] available at: [LA 104 - Environmental assessment and monitoring - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/la-104-environmental-assessment-and-monitoring-dmrbs-standardsforhighways.co.uk) (last accessed August 2022).

2.7.3 Preliminary embedded design features for the scheme, grouped by National Highways design principles in DMRB GG 103, that have informed the scope of the EIA are as follows:

Safe and useful, and understandable:

- LED lighting columns limited to the approach to junctions, subject to further assessment in preliminary and detailed design stages.
- Traffic signals as required.
- Road restraint systems providing protection from features which may present a hazard, such as high embankments.
- Traffic signs at appropriate locations to provide route and destination information.
- Road markings as required.

Restraining, fitting into the context and environmentally sustainable:

- An important part of the design philosophy is to asymmetrically widen the A46 to mitigate the potential impact on views from Newark-on-Trent and the setting of the conservation area. This will be achieved by maintaining the position of the existing eastern edge of the carriageway in the southbound direction wherever possible and proposing drainage solutions that will aim to retain where practical the existing earthworks and screen planting, and avoid vegetation clearance.
- Floodplain compensation is required to mitigate the loss of existing floodplain along the western side of the scheme. This requires existing land to be lowered through the excavation of material which would ordinarily be sent to landfill. This has been mitigated by identifying some areas of land that can be used as a borrow pit to provide the structural fill to the widened embankments thus reducing the need to send material to landfill and import material from other locations.
- Retrofitting of existing structures, new rail and river crossings and an additional viaduct across the River Trent:
 - Changes were made in the optioneering stages to try to preserve the fabric of the original structures (existing highways bridges including the Windmill viaduct and the Nether Lock viaduct) by proposing a separate structure adjacent to the existing ones rather than removal of the historic structures and replacement with new.
- The use of thin surface courses on new carriageways to provide a reduction in road surface noise compared to hot rolled asphalt or concrete.
- Drainage features such as balancing ponds, drainage ditches and culverts, subject to further design consideration.
- Fencing for the highway boundary and restricted features (for example drainage ponds).
- Retention of the existing dual carriageway between Friendly Farmer and Winthorpe and building a new link to the south which

will move the A46 away from Winthorpe (when compared with the scheme design for the preferred route announcement). This also enables the retention of the Esso garage.

- Move Brownhills junction off-slip so that it no longer crosses beneath the dualled A46 near to the A1, to substantially reduce the height of the new dual carriageway.
- Retention of the existing A46 for the new southbound on-slip from Brownhills junction, allowing existing bunds and the majority of established vegetation to be retained.

Inclusive:

- Access in and around proposed junctions to accommodate walking, cycling and horse riding as required (excluding Winthorpe, existing provisions retained at Farndon).
- Where the proposed alignment severs an existing public right of way, connectivity will be maintained wherever possible. This will be achieved with the reconnection of severed PRowS with permanent diverted routes.
- In addition, there are a number of opportunities for further embedded mitigation, grouped by National Highway's design principles in DMRB GG 103, that will be considered during the development of the ongoing scheme design. These are detailed in the individual topic chapters (Chapters 6 to 16).

3 Assessment of alternatives

3.1 Introduction

3.1.1 This chapter presents the process by which the preferred route for the scheme has been identified. This will be further detailed within the Assessment of Alternatives chapter of the Environmental Statement (ES).

3.2 Assessment history

3.2.1 An initial 'option generation' exercise began in 2015, and identified three areas of interest, termed 'corridors' of interest; Corridors A, B and C. Figure 3.1 below shows their geographical locations. A further two corridors were identified as part of the 'initial sifting' stage. Figure 3.2 shows the further two corridors, corridors D and E. Detailed descriptions of Corridors A-E are provided in Table 3.1.

Figure 3.1: Corridors A, B and C

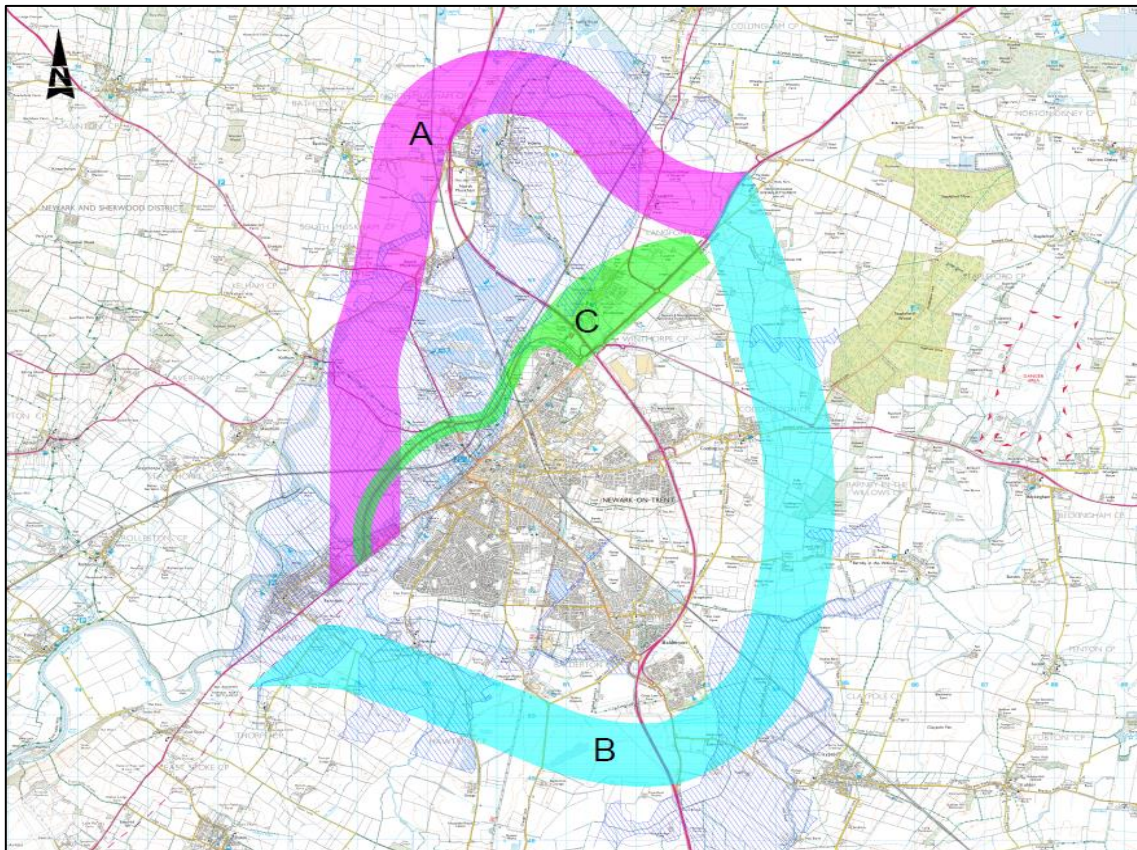
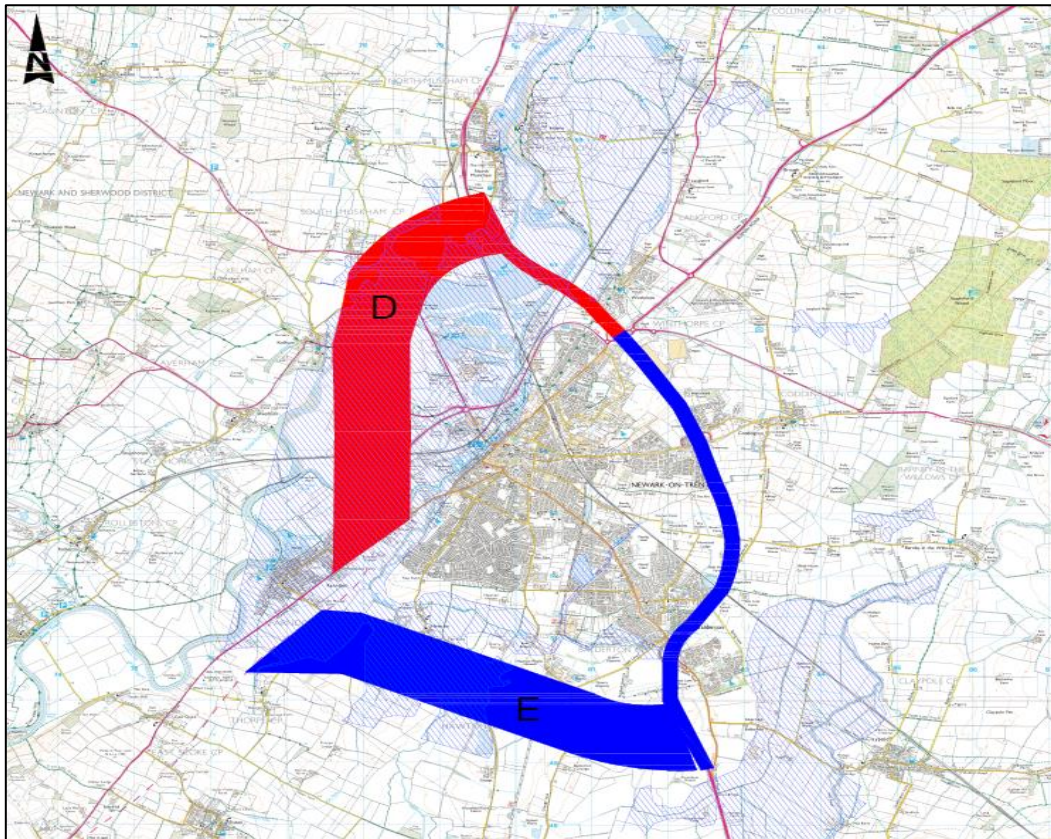


Figure 3.2: Corridors D and E**Table 3.1: Corridor descriptions**

Corridor	Description
A	Starts south-west of Newark-on-Trent, diverging towards west of Newark-on-Trent, cuts across the railway line, crosses the River Trent, bypasses South and North Muskham, crossing A1 road, crosses the River Trent again, cuts the railway line and re-joins the existing A46 near Brough.
B	Starts south-west of Newark-on-Trent, diverging near Thorpe on existing A46 avoiding the built-up area towards the east of Newark-on-Trent, crosses A1 road, cuts across the railway line, crosses the A17 road and re-joins the existing A46 near Brough.
C	Follows the existing A46 corridor which starts from Farndon junction through to Winthorpe junction. The carriageway would be widened to dual carriageway between Farndon and the A1/A46 junctions. Capacity improvements are proposed for the Cattle Market, the A1/A46 and Winthorpe junctions.
D	Starts south-west of Newark-on-Trent, diverging from the existing A46, avoiding the built-up area towards the west of Newark-on-Trent, cuts across the railway line and the River Trent, bypasses south Muskham, connects and follows A1 road and re-joining the existing A46 at Winthorpe junction.
E	Starts south-west of Newark-on-Trent, diverging near Thorpe on existing A46 avoiding the built-up area towards east of Newark-on-Trent and connects A1 road near Fernwood, further follows the existing A1 road and re-joining the existing A46 near Winthorpe junction.

- 3.2.2 An options workshop was held in January 2018 which included a review of the constraints and opportunities related to traffic, environment and highways for each corridor.
- 3.2.3 Each corridor was assessed against the following criteria, using a five-point scale:
- Client Scheme Requirements (CSRs).
 - Environmental criteria and the National Policy Statement for National Networks (NPSNN).
 - The DfT's Early Assessment and Sifting Tool (EAST) which includes environmental criteria.
- 3.2.4 Following the assessment, it was concluded that Corridor C should be taken forward for further consideration, and that no other corridors should be considered further. This is because Corridor C, which uses the existing A46 corridor, was the best performing corridor in terms of user benefits, providing the greatest reductions in journey times, delays and incidents, and improvement in reliability. The user benefits would be lower for corridors A, B, D and E. With a longer corridor there are less journey time savings and the lower level of diversion from the existing A46 corridor (as this would remain in place) would mean it is unlikely to resolve the capacity issues on the A46 at Cattle Market, Friendly Farmer, Brownhills or Winthorpe roundabouts, reducing the benefits for other users.
- 3.2.5 Furthermore, Corridor C performed better in environmental terms in achieving potential improvements in terms of carbon, noise and the local water environment. Corridor C was preferential in comparison with corridors A and D, and slightly more preferential than corridors B and E. Corridor C performed more strongly across a range of criteria including value for money and environment.
- 3.2.6 Various routes and junction arrangements within Corridor C were considered during the options identification stage. Having determined which route and junction options provided the benefits and improvements sought along the A46, to meet CSR objectives, the recommended route and junction options were combined into scheme options to allow them to be assessed.
- 3.2.7 The scheme options based on Corridor C were:
- Option A – Route Option 1A with all grade separated junctions.
 - Option B – Route Option 1B with all at grade junctions except A1/A46 Junction which would be grade separated.
 - Option C – Route Option 1A with all grade separated junctions as per Option A but with an additional proposed grade-separated junction at Hawton Lane.
- 3.2.8 All three options were evaluated against:

- Engineering assessment
- Traffic and economic assessment
- Environmental assessment
- Social assessment
- Safety, operational, technology and maintenance assessment

3.2.9 Following consideration and assessment of the objectives and examination of the constraints present in the vicinity of the scheme, options A, B and C were all recommended to be taken forward for non-statutory public consultation. These options were more favoured due to the substantial safety and economic benefits of the grade separated Cattle Market junction, together with the more marginal but still recognisable environmental benefits achieved through the online routes of the A46 in the vicinity of Winthorpe.

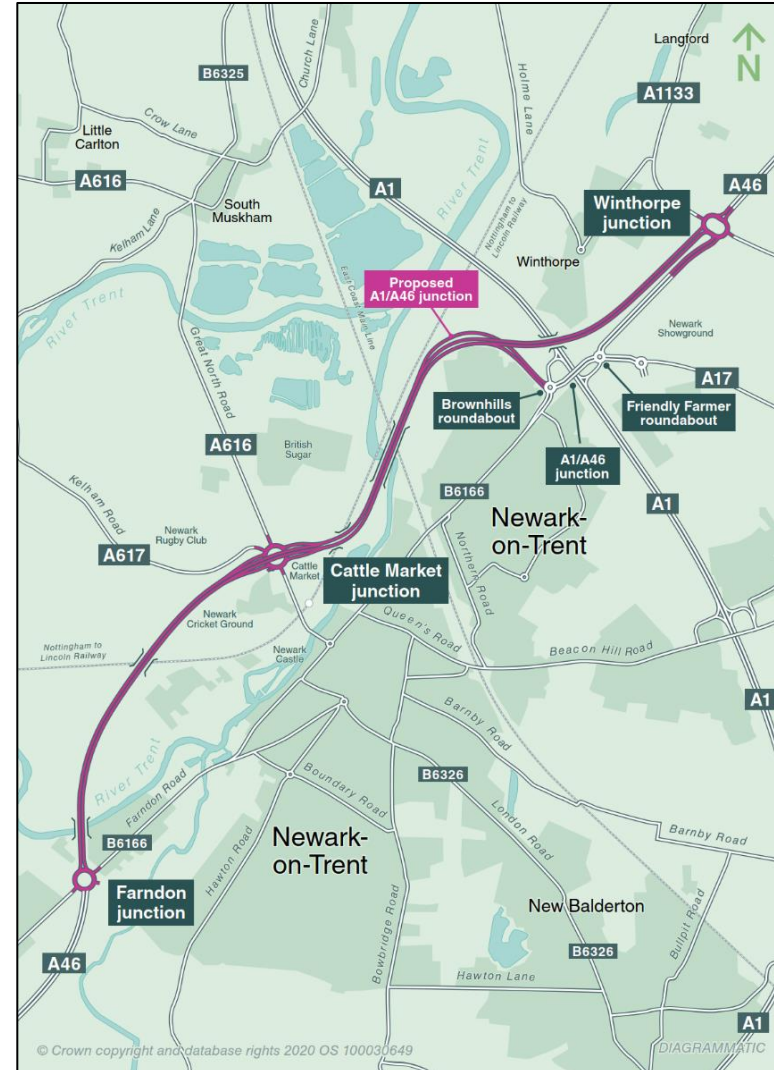
3.2.10 Following further review, a new scheme option (Option D) was identified and taken forward for further assessment prior to commencement of non-statutory consultation. Option D follows the existing A46 mainline from Farndon roundabout to the north of the existing Trent River Viaduct at Nether Lock. The route would then diverge away from the existing mainline, crossing over the A1 via a new structure. The route would run parallel to the northbound carriageway of the existing A46, to the south of Winthorpe, before tying-in to the existing Winthorpe roundabout. Farndon roundabout and Winthorpe roundabout would remain at-grade, with Cattle Market junction and the A1/A46 junction being grade separated.

3.2.11 A second option sifting exercise resulted in two of the four scheme options being carried forward to non-statutory consultation; Options B and D. This is because Option B and Option D, compared to Option A and Option C, included:

- The least number of structures and volumes of earthworks, hence the lowest scheme costs.
- Less land take, including agricultural and 'Best and Most Versatile' land (defined as excellent to good quality land which is able to best deliver food and non-food crops), resulting in a smaller volume of additional floodplain compensation storage required outside of the flood risk areas (flood zones 2 and 3).
- Less likely significant adverse environmental effects with mitigation as there would be less habitat fragmentation, have fewer heritage assets and a smaller impact on affected listed structures along the A616, and have the least likely significant adverse effects predicted for noise.
- Less likely significant adverse effects on landscape, townscape and visual receptors, water, mineral resources, waste generation, and materials asset use. This is due to the extent of land take, new sections of road and additional grade separated junctions, area of permeability and increased construction within the floodplain (which would require compensation).

3.2.12 The options were thus renamed Option 1 and Option 2 (Figure 3.3 below), respectively and we taken to non- statutory consultation. This non- statutory options consultation lasted for eight weeks from 9 December 2020 until 2 February 2021.

Figure 3.3: Option 1 (left) and Option 2 (right)

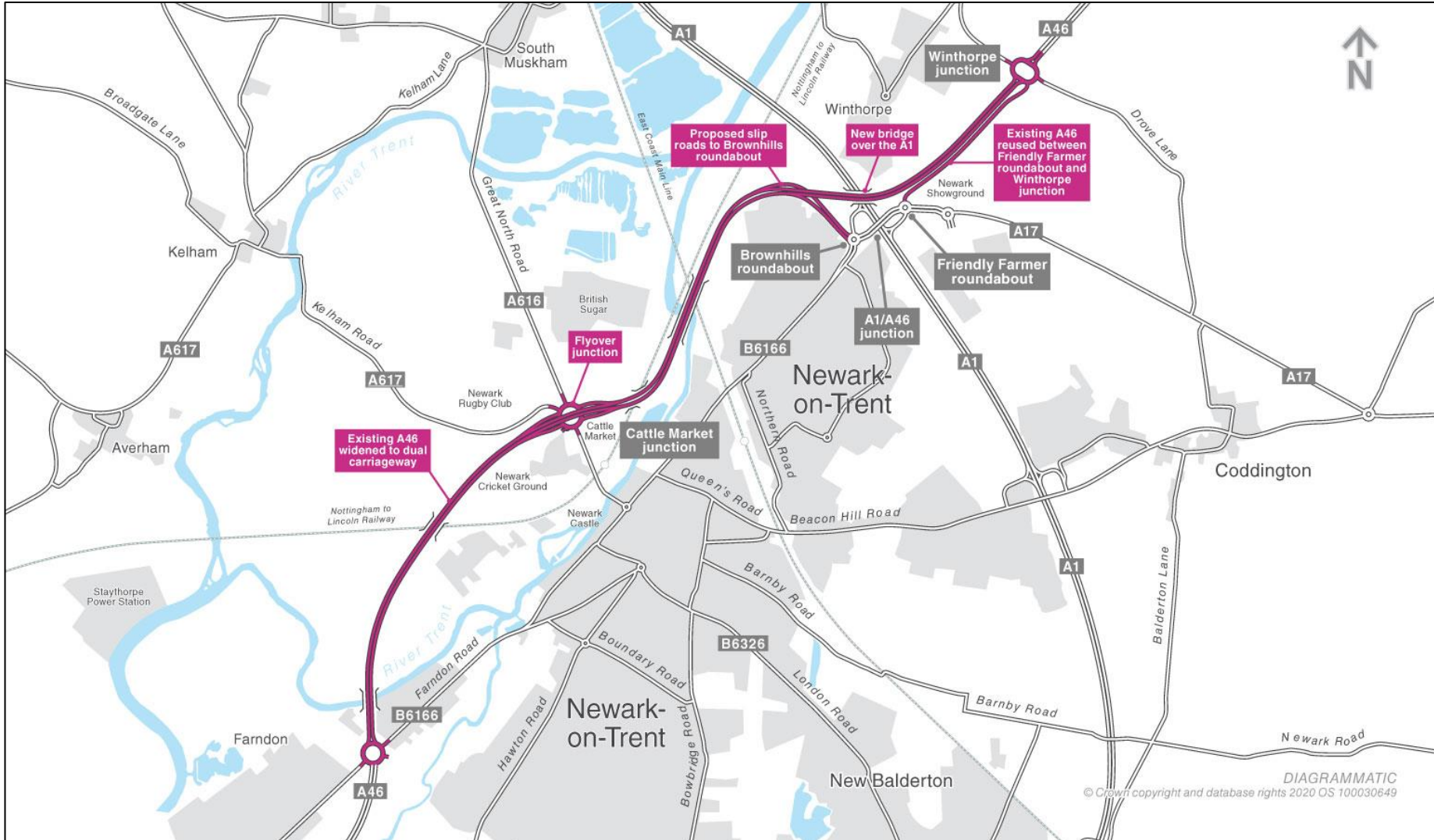


- 3.2.13 The non-statutory options consultation that took place at an earlier stage of the scheme (December 2020 to February 2021) formed a crucial part of the stakeholder engagement and development of the scheme. It was the first formal opportunity for all stakeholders to contribute their views to provide the design team an understanding of the local area and any potential impacts the scheme may have on users and the community. The views and feedback gained from the options consultation has helped to inform scheme development and feed into the decision on a preferred option.
- 3.2.14 A total of 852 respondents, out of 1,584 responses, gave feedback on concerns about issues in relation to the scheme. The most cited concerns included amendments and improvements to the proposed options covering such comments as:
- Need to grade separate all junctions.
 - Need to resolve issues caused by roundabouts.
 - Prefer a hybrid of the two options presented.
 - Consideration of Newark-on-Trent Flat Crossing (rail).
 - Scheme options not addressing safety concerns at the A1/A46 junction.
 - Noise pollution as a result of the scheme and associated noise mitigation.
 - Negative impact on local residents, including visual and setting impacts of residential properties, risk of flooding and water drainage capacity and associated mitigation.
 - Environmental/ecological impact and the associated mitigation required.
 - Air pollution and carbon emissions.
 - Safety and access for cyclists and pedestrians.
 - Negative impact of, and disruption during, construction.
- 3.2.15 The 'Think Again' Action Group proposed an alternative solution for the section of the A46 between the A1 and Winthorpe junction. The Think Again Option 3 was presented late on in the optioneering process and did not form part of the non-statutory consultation. However, a qualitative assessment was carried out to evaluate this option. Whilst there was a potential for some slight benefits to delays and journey times compared to Options 1 and 2, this would be unlikely to be sufficient to offset the substantially higher costs associated with the additional structures, land take and earthworks that would be required. This would adversely affect the value for money of the scheme, which was already assessed as having low value for money for Options 1 and 2. The Think Again Option 3 was considered to be environmentally worse than Options 1 and 2 due to the potential for it

to generate more materials and waste, and cause additional significant adverse effects on landscape and visual, cultural heritage, development land and businesses, and water quality receptors. The Think Again Option 3 was identified as being less favourable in engineering, economic and environmental regards than Options 1 and 2, it would present lower value for money and still bring the proposed A46 route closer to the village of Winthorpe. It was therefore recommended that the Think Again Option 3 should not be assessed further.

- 3.2.16 An Environmental Assessment Report (EAR) was produced to inform the comparison of environmental effects for Options 1 and 2 and to support the option selection. Option 2 was selected after the EAR was completed and was informed by conclusions of the EAR.
- 3.2.17 Option 2 was selected on the basis of a number of factors, including safety, improved journey time reliability, and the level of overall support from the local community. Creating a flyover for the A46 to pass over Cattle Market junction and adding traffic lights at Farndon roundabout means Option 2 would provide additional capacity and the greatest travel time savings on the road. Furthermore, Option 2 would have the most potential going forward to incorporate further embedded design and essential measures to help mitigate any potential significant effects, especially around Winthorpe and Cattle Market junction.
- 3.2.18 Concerns were voiced by Winthorpe with Langford Parish Council, the Think Again group, Newark and Sherwood District Council, Newark Town Council, Nottinghamshire County Council and local residents that Winthorpe village would experience negative environment impacts including noise, vibration, visual impact and light pollution as well as an impact on the Conservation Area of Winthorpe. Support was given to exploring alternatives in the vicinity of Winthorpe to minimise these impacts. Option 2 Modified was developed in response to these concerns, with the route of the new A46 link crossing the A1 moved approximately 75 metres further south from Winthorpe than Option 2. National Highways announced the preferred route (Option 2 Modified) in February 2022 (Figure 3.4 below).

Figure 3.4: Option 2 Modified



3.3 Design development following the preferred route announcement

- 3.3.1 This section summarises the design developments that have taken place since the preferred route announcement. These design developments have been integrated into the current scheme presented at statutory consultation and therefore the design that has been assessed within this PEI report.
- 3.3.2 The value engineering (VE) method that has informed the design development has been used to systematically increase the value of production by helping project stakeholders to identify alternative approaches that lower costs, reduce inefficiencies, and increase functionality. These design developments were assessed against compliance with design standards, including National Highways' 10 principles of good design¹⁴, and have been reviewed by the multi-disciplinary project team who considered wider impacts of the options on the scheme benefits, road safety, traffic, stakeholders and the environment.
- 3.3.3 The design developments that have taken place between the preferred route announcement and present, for each junction, are discussed below.

Farndon roundabout

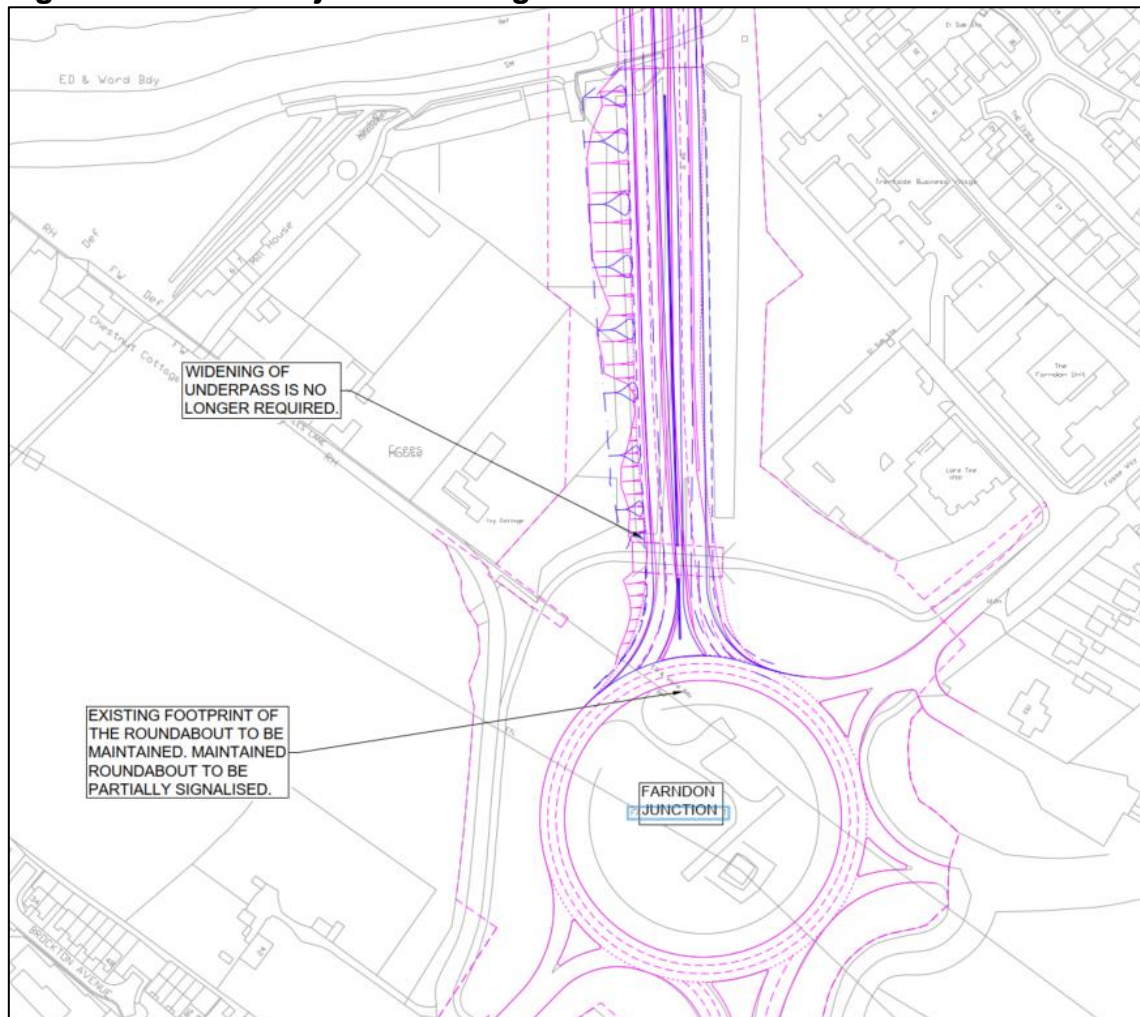
Option 2 Modified design

- 3.3.4 As part of the Option 2 Modified design, it was proposed that the existing footprint of the Farndon roundabout was to be maintained, and the roundabout partially signalised to improve traffic flows. Farndon Underpass, directly north of the roundabout, was proposed to be extended to make way for the new widened A46.

Current scheme design

- 3.3.5 The existing footprint of the roundabout will still be maintained and the roundabout will still be partially signalised. Lane designation and traffic signal phasing has been reviewed as part of the design development, to improve flows. The new widened A46 will now pass over the existing Farndon Underpass so there is no need to extend it.
- 3.3.6 A sketch of these design developments (blue) against the Option 2 Modified design (pink) are available in Figure 3.5 below.

¹⁴ National Highways (2022) People Places and Processes: A guide to good design at National Highways [online] available at: [People, places and processes \(nationalhighways.co.uk\)](https://www.nationalhighways.co.uk/people-places-and-processes) (last accessed October 2022).

Figure 3.5: Farndon junction design

Environmental benefits and disbenefits

3.3.7 The current scheme design has the potential to result in the following environmental benefits compared to the Option 2 Modified design:

- **Heritage:** a reduction in the proposed embankment will keep the structure further from the Grade II Listed Farndon Windmill.
- **Biodiversity:** a smaller footprint and a reduced construction effort will result in less habitat loss and lower levels of disturbance.
- **Water quality:** a reduced risk of impacting the drainage/stream to the east of A46.
- **Flood risk and drainage:** a reduction in proposed embankment footprint will reduce floodplain compensation requirements. The smaller footprint may allow for larger surface water storage features such as basins and swales. There would also be a reduced impermeable area in comparison to the Option 2 Modified design which has flood risk benefits.
- **Air quality:** a slight movement of vehicle emissions further away from Ivy Cottage, though no exceedance of air quality objectives were predicted at this location at previous assessment stages.
- **Noise:** a 2-metre shift east of the new carriageway, further from noise-sensitive receptors.

3.3.8 The current scheme design has the potential to result in the following environmental disbenefits, although this was also the case with the Option 2 Modified design:

- Flood risk and drainage – an unknown risk regarding the tie-in to existing Environment Agency flood defence.

Cattle Market junction

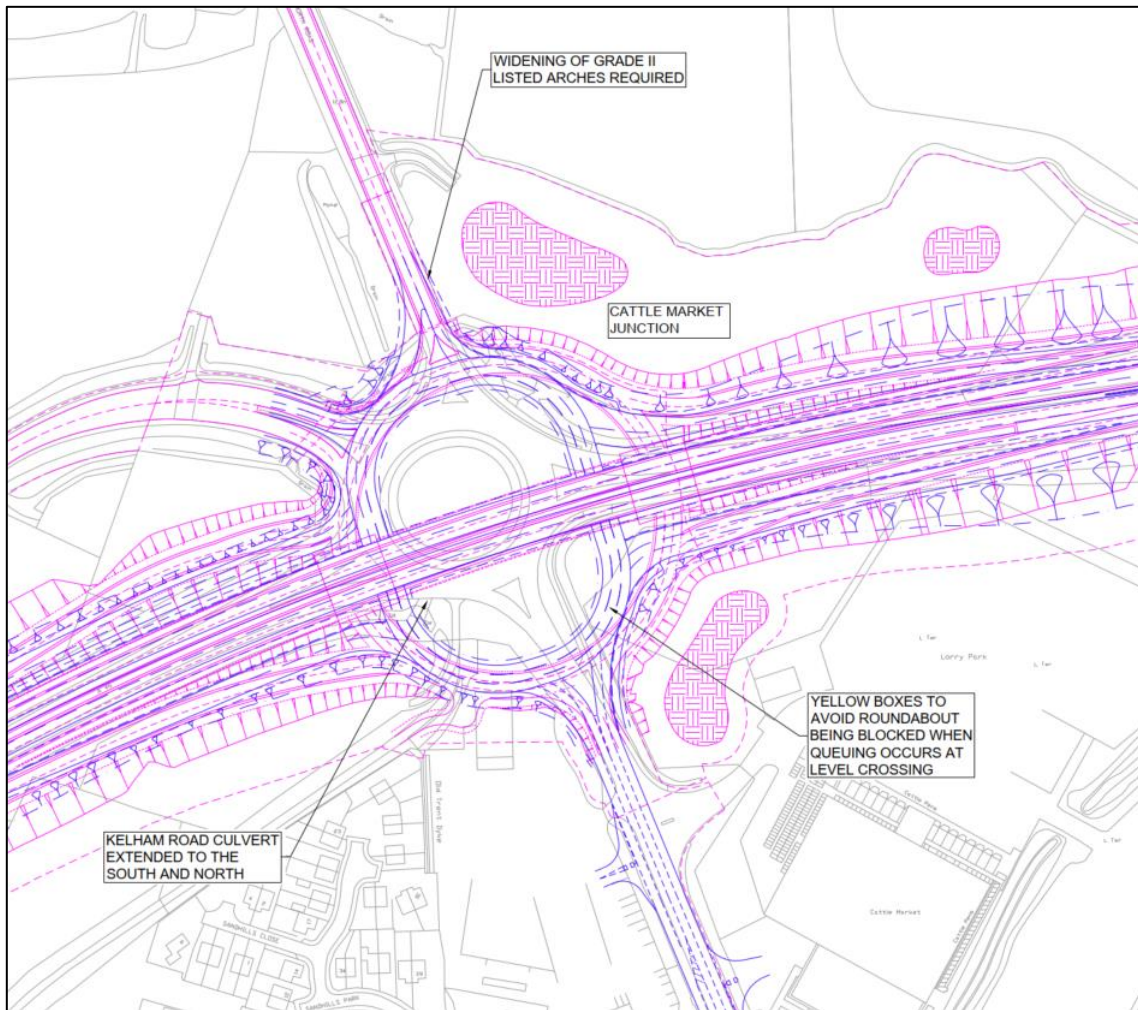
Option 2 Modified design

3.3.9 As part of the Option 2 Modified design, it was proposed that the A46 was elevated over an enlarged roundabout at Cattle Market. The diameter of the existing roundabout was approximately doubled to the south and east, with three lanes provided on slip road entries and around the circulatory. The Kelham Road culvert was extended to the north and the south which creates possible impacts to the Grade II listed Smeaton's Arches on the Kelham Road North approach. The layout was originally designed for full signalisation and space was provided for queuing at stop lines. When signalisation was removed the gyratory size was not reduced.

Current scheme design

3.3.10 The A46 is still to be elevated over the Cattle Market roundabout with two single span structures crossing the roundabout on the west and east, with full height reinforced earth walls on the approaches and within the central island (similar to the Option 2 Modified design). The footprint of the roundabout has been reduced and further design amendments will seek to reduce the impact on the listed Smeaton's Arches to the north.

3.3.11 A sketch of these design developments (blue) against the Option 2 Modified design (pink) are available in Figure 3.6 below.

Figure 3.6: Cattle Market junction design

Environmental benefits and disbenefits

3.3.12 The current scheme design has the potential to result in the following environmental benefits compared to the Option 2 Modified design:

- Heritage: a smaller roundabout will reduce the impact on the listed arches directly to the north of the roundabout.
- Archaeology: a smaller roundabout will help maintain a suitable distance between the structure and the Civil War redoubt Scheduled Monument 550m south east of Valley Farm. This will also help reduce the impact on setting.
- Biodiversity: a smaller roundabout footprint will decrease the amount of existing habitat loss.
- Geology and soils: a smaller roundabout will lead to less disturbance of soils.
- Flood risk and drainage: a smaller footprint will allow for larger surface water storage features such as basins and swales. Also, this design development has reduced the amount of impermeable area which has flood risk benefits.
- Air quality: a smaller size will result in vehicle emissions being moved further away from residences on Sandhills Close, though no

exceedances of air quality objectives were predicted at this location during early stages of assessment.

3.3.13 The current scheme design has the potential to result in the following disbenefits, although this was also the case with the Option 2 Modified design:

- Biodiversity: The culvert underneath the roundabout is an established pond with an invertebrate and fish assemblage. Extension to this culvert may damage this habitat.
- Water quality: Extension of culvert to the south has the potential to reduce water quality.
- Noise: The alignment of main carriageways of the A46 slightly closer to residential areas will give rise to an increase in noise level but this may be offset by realignment of westbound onslip.

Brownhills slip roads

Option 2 Modified design

3.3.14 As part of the Option 2 Modified design, the A46 westbound onslip was not located on the existing A46 and would have required the existing A46 carriageway from 200 metres north of Brownhills roundabout to be widened. This, in turn, would have required the removal of all existing vegetation and moved traffic closer to residential receptors. The proposed A46 was raised around 7 metres above the existing A46 throughout the junction, with the eastbound off slip to Brownhills Roundabout passing beneath it via a skewed underpass. Three underpasses were provided beneath the slip roads and mainline to maintain pedestrian access, creating a low point beneath the westbound offslip that would have presented drainage and construction challenges. Accommodation access was provided beneath the A46 alongside the A1.

Current scheme design

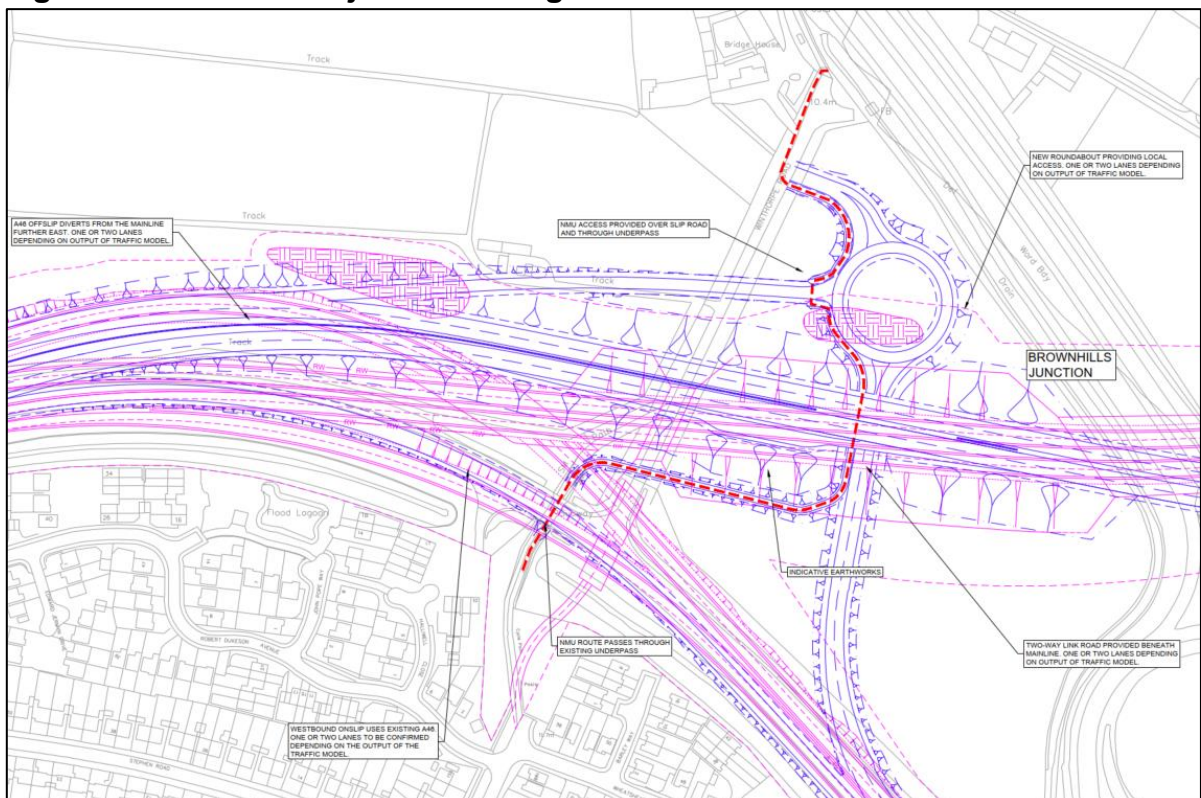
3.3.15 As part of the development of the design, the A46 westbound onslip from Brownhills roundabout now utilises the existing A46 carriageway footprint, allowing the existing vegetation to be retained. The A46 eastbound offslip will divert from the mainline further east, tying into a new small roundabout near the A1. This provides access to the properties and businesses to the north, and links to Brownhills roundabout via a new underpass that crosses perpendicular beneath the mainline.

3.3.16 The current scheme design proposes one underpass rather than four to maintain access to properties and businesses to the north and for non-motorised users, creating a more attractive route for pedestrians. The underpass for the eastbound offslip passes perpendicular beneath the mainline rather than at a skew and is located near the A1 crossing, minimising the need for a high embankment in front of the southern

properties. The current scheme design reduces the length of mainline embankment and existing vegetation is retained on the southern side of the A46. The current scheme design provides more space between Newark-on-Trent and the mainline, making it easier to retain the existing screening and possibly provide additional amenity space. This design eliminates the need for a tight radius on the eastbound offslip which presented safety concerns and would likely have resulted in a departure from standards.

3.3.17 A sketch of these design developments (blue) against the Option 2 Modified design (pink) are contained in Figure 3.7 below.

Figure 3.7: Brownhills junction design



Environmental benefits and disbenefits

3.3.18 The current scheme design has the potential to result in the following environmental benefits compared to the Option 2 Modified design:

- Biodiversity: retention of existing vegetation on the southern side of the A46 that would otherwise have been lost.
- Landscape: retention of existing vegetation on the southern side of the A46 acting as screening benefit from existing visual receptors that would otherwise have been lost.
- Flood risk and drainage: a reduction in earthworks within the floodplain, reducing floodplain compensation requirements. The smaller footprint allows for larger surface water storage features such as basins and swales. The revised design also presents a reduced impermeable area which has flood risk benefits.

- Noise: potential noise benefits associated with the removal of the eastbound offslip and southern slips from the new roundabout to Brownhills roundabout to a position further from residential properties southwest of the junction.

3.3.19 The current scheme design has the potential to result in the following disbenefits compared to the Option 2 Modified design:

- Geology and soils: additional land take resulting in increased disturbance of Grade 2 and 3 agricultural soils.
- Water quality: the proposed roundabout is located adjacent to an established drain and there will be an increased risk of surface water runoff directly into this drain.
- Flood risk and drainage: the additional roundabout and proposed new roads at Brownhills Junction will be 2 metres above existing ground levels which is within an area of flood risk. Impacts to floodplain compensation requirements and flood propagation will need to be managed.

A1 to Winthorpe alignment

Option 2 Modified design

3.3.20 As part of the Option 2 Modified design, the A46 passes just to the north of the existing, passing over the footprint of the existing Esso service station. The proposed westbound carriageway uses the existing A46 eastbound carriageway and the two-way link provided between Friendly Farmer roundabout and Winthorpe junction uses the A46 westbound carriageway.

Current scheme design

3.3.21 The proposed A46 passes south of the Esso service station and ties back into the alignment of the existing. The space between the two-way link and existing dual carriageway has been reduced to allow it to be sited within a similar corridor. This allows the Esso service station to be retained with new access provided via slip roads to the east and west. A new egress is also provided from the Shell service station to the south. It was envisaged that an access would also be provided from the two-way link, but to improve safety and reduce land take it was decided that only the existing access from the A17 would be utilised.

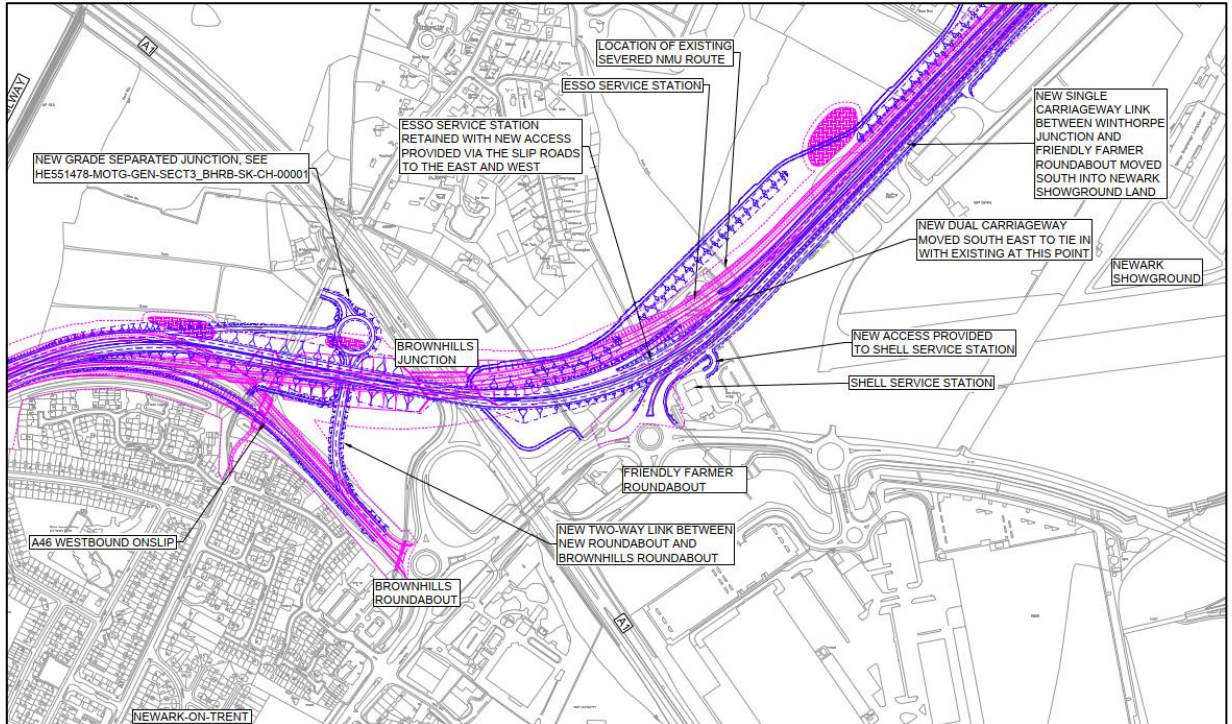
3.3.22 The design alignment moves further from Winthorpe and the Esso service station is retained. The design fully reuses a large section of the existing A46 and moves the A1 crossing further away from Winthorpe. Drainage attenuation is reduced.

3.3.23 However, the design requires amendments to the Shell service station's access and increases the skew of the A1 bridge (note that the total span remains similar to the Option 2 Modified design as the bridge no longer has to span over the access road). The slip roads to

and from the Esso service station are required on a bend. This may have visibility issues and associated departures, which will be reviewed as part of the ongoing design development.

3.3.24 A sketch of these design developments (blue) against the Option 2 Modified design (pink) are contained in Figure 3.8 below.

Figure 3.8: A1 to Winthorpe design



Environmental benefits and disbenefits

3.3.25 The current scheme design has the potential to result in the following benefits compared to the Option 2 Modified design:

- Heritage: reduced adverse effects on the Winthorpe Conservation Area as road alignment is moved further south.
- Archaeology: a potential reduction in the area that requires archaeological investigation.
- Biodiversity: the movement of the carriageway link between Winthorpe roundabout and Friendly Farmer roundabout to the south may protect a small woodland patch on the north side of the A46. The reduced footprint will result in less overall habitat loss.
- Flood risk and drainage: A smaller footprint allows for larger surface water storage features such as basins and swales. The revised design also presents a reduced impermeable area which has flood risk benefits.
- Noise: potential benefit to south Winthorpe by moving the carriageway further from the village, although this will be confirmed once detailed modelling has taken place. Noise bunds proposed between farm access/public footpath and the A46 will reduce noise impact.

- 3.3.26 The current scheme design has the potential to result in the following disbenefits compared to the Option 2 Modified design:
- Biodiversity: severance of active bat commuting route along small stream within tree line west of Esso service station. Proposed new access road to go through small, wooded patch that has value for bats and nesting birds.
 - Water quality: new access roads (for Esso and Shell service stations) proposed over existing minor watercourse, which could cause morphological changes or shading affecting aquatic ecology.
 - Air quality: the movement of vehicles and associated emissions closer to residential property (The Lodge) located to south east of the existing A46/A17 roundabout, though no exceedance of air quality objectives were predicted at this location during the options appraisal stages.

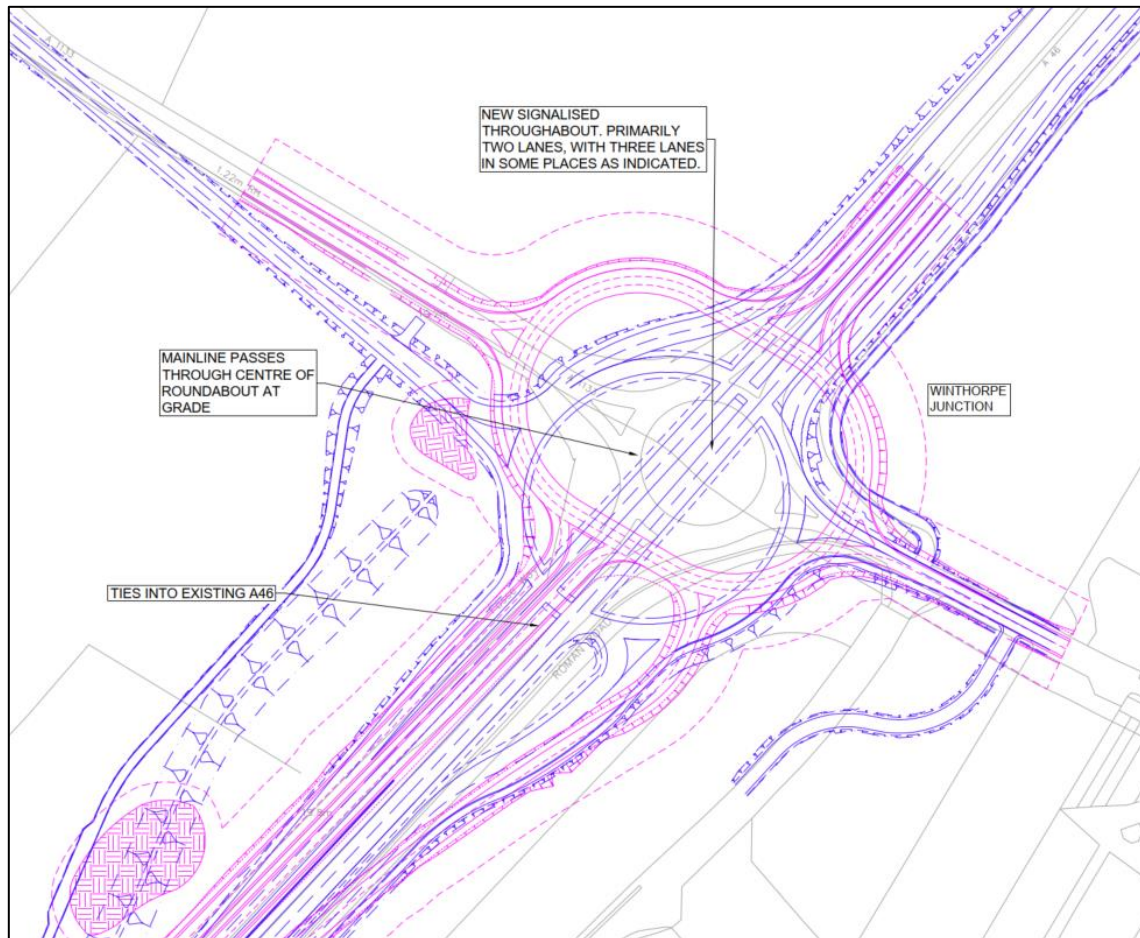
Winthorpe junction

Option 2 Modified design

- 3.3.27 As part of the Option 2 Modified design, Winthorpe roundabout was significantly enlarged and fully signalised. An additional fifth arm was provided for the two-way link to the Friendly Farmer roundabout.

Current scheme design

- 3.3.28 As part of the design development, upon review of the proposed junction by the traffic team, it was realised that the current layout at Winthorpe could be optimised to provide greater resilience to all highways that enter or leave the junction. As such, a 'throughabout' option has been proposed in an aim to improve traffic flows. In this option the roundabout has been enlarged and partially signalised with the mainline passing through the middle at-grade. The design improves traffic flows and aligns more closely to the high-level requirements. The configuration of the arms into the roundabout is improved which may provide safety benefits. There is less impact on the land to the north and east of the existing roundabout.
- 3.3.29 A sketch of these design developments (blue) against the Option 2 Modified design (pink) are contained in Figure 3.9 below.

Figure 3.9: Winthorpe junction design

Environmental benefits and disbenefits

3.3.30 The current scheme design has the potential to result in the following benefits compared to the Option 2 Modified design:

- Water quality: a reduced footprint which is likely to result in less surface water runoff and the associated adverse effects.
- Flood risk and drainage: a potential reduction in hard standing impermeable surface and associated drainage requirements.
- Noise: potential for a slight improvement in noise climate in the vicinity of the junction resulting from smaller roundabout, although there are no properties or noise-sensitive receptors in the immediate location.

3.3.31 The developing design has the potential to result in the following disbenefits compared to the Option 2 Modified design:

- Biodiversity: the loss of semi-mature and mature trees present within the roundabout and to the south of the A46, likely to be of use to nesting birds and commuting bats.

3.4 Assessment of alternatives within the ES

3.4.1 The assessment of alternatives presented within the ES will examine the complete suite of design variations of the preferred route, including

‘a description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects’, in line with the Infrastructure Planning (EIA) Regulations 2017. This will demonstrate the rationale and decisions made for the final preliminary design to be submitted as part of the Development Consent Order (DCO) application.

- 3.4.2 The design will continue to be under review and will respond to the feedback received at statutory consultation as appropriate. As detailed in Section 2.7 of this report, the continued development of the scheme design shall be an iterative process, undertaken as part of an integrated design team to adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA104 Environmental Assessment and Monitoring¹⁵.

¹⁵ National Highways (2020) LA 104 – Environmental assessment and monitoring [online] available at: [LA 104 - Environmental assessment and monitoring - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/la-104-environmental-assessment-and-monitoring-dmrbs/) (last accessed August 2022).

4 Stakeholder engagement and consultation

4.1 Principles of engagement and consultation

4.1.1 Stakeholder engagement for the scheme is based on the following principles:

- a) Early and ongoing engagement to inform and influence the proposed scheme development process.
- b) Seeking an appropriate level of feedback at each stage in the iterative design process and ensuring that comments received are taken into consideration.
- c) Building long-term relationships with key stakeholders throughout the different stages of the proposed scheme to help better understand their views.
- d) Where possible and practicable, ensuring concerns are addressed.
- e) Ensuring appropriate statutory consultation is undertaken in accordance with requirements of the Planning Act 2008 and associated guidance.

4.2 Environmental consultation to date

Engagement with statutory and non-statutory environmental bodies

4.2.1 In addition to engagement with local authorities, landowners, seldom heard groups and the community, National Highways has engaged with statutory environmental bodies (Natural England, the Environment Agency and Historic England) and non-statutory environmental bodies. A summary of the meetings is provided in Table 4.1. Stakeholders were engaged by group meetings, telephone discussions and emails.

Table 4.1: Meetings with environmental stakeholders to date

Date	Stakeholder	Discussion/topics raised
Engagement with environmental stakeholders during optioneering stages		
11/01/2021	Environmental Stakeholder Briefing	Introduction of the scheme and a briefing regarding various route options, discussions around key environmental features, constraints and opportunities, and sharing of views and local knowledge of stakeholders.
13/01/2021	Nottinghamshire County Council	County Archaeologist informed about the heritage work being undertaken for the scheme, and an opportunity for the County Archaeologist to raise any issues that should be addressed within the options assessments.
16/03/2021	Newark and Sherwood District Council	Introduction of the scheme and discussion of environmental features, constraints and opportunities, and share local knowledge.

Date	Stakeholder	Discussion/topics raised
29/04/2021	Environment Agency	Introduction of the scheme, and discussion of the climate change allowances, hydraulic model, floodplain compensation methodology, the flood reduction opportunities including legacy work and the Flood Risk Assessment.
26/05/2021	Nottinghamshire County Council, Newark and Sherwood District Council	Introduction of the scheme, and discussion of climate change allowances, the hydraulic model and hydrology, floodplain compensation methodology and flood reduction opportunities including legacy work.
09/06/2021	Environment Agency	Discussion regarding the Water Framework Directive (WFD) receptors, potential impacts and opportunities to start engagement and dialogue around the WFD compliance assessment that will continue during the scheme development.
Engagement with environmental stakeholders following preferred route announcement		
02/03/2022	County Archaeologist, Nottinghamshire County Council	Review and agreement of the scope and specification for proposed geophysical and metal detector surveys and to discuss the contents of the proposed Archaeological Management Plan.
30/03/2022	Environment Agency	Introductory meeting to discuss water quality and flood management issues.
05/04/2022	Nottinghamshire County Council, Internal Drainage Board (Water Management Consortium)	Introductory flood and drainage steering group meeting.
11/05/2022	Internal Drainage Board (Water Management Consortium), Environment Agency	Second flood and drainage steering group meeting to collate further information on the following items; River Trent model and others, basis of design for floodplain compensation, land drainage, records and models, historic flood records, run-off control conditions, flood resilience – joint probability.
12/05/2022	Environment Agency	Flood risk data transfer discussion following request for information submissions.
31/05/2022	Natural England	Introduction to the scheme, and an overview and findings of the ecology surveys undertaken to date, and survey-specific queries.
13/06/2022	Environment Agency	A meeting with the relevant Environment Agency water quality specialists to agree proposals for water quality monitoring for the scheme, to inform both the EIA as well as during construction.
06/07/2022	Senior Conservation Officer, Newark and	Introduction to the scheme, and a discussion regarding engagement with archaeological advisers,

Date	Stakeholder	Discussion/topics raised
	Sherwood District Council	and potential impacts to the Grade II listed arches at Cattle Market junction.
07/07/2022	Nottinghamshire County Council, Internal Drainage Board (Water Management Consortium), National Highways	Follow-up meeting with the flood and drainage steering group to get confirmation on data, current flood management, and drainage strategy.
08/07/2022	Historic England	Overview of the scheme, level of engagement required/expected during development of scheme design up to Development Consent Order (DCO) submission, and review of key heritage assets in the area.
20/07/2022	Archaeology Advisor, Newark and Sherwood District Council	Overview of the scheme, the environmental assessment milestones and a summary of work to date, including the draft Archaeological Management Plan and the geophysical, metal detecting and field walking survey specification.
21/07/2022	Senior Conservation Officer and Landscape/Ecology/Tree Officer, Newark and Sherwood District Council	Overview of the scheme, including the current scheme status, overview of EIA key milestones and level of engagement. Specifics included the agreement of visual receptor locations, a discussion regarding key built heritage assets, a summary of tree surveys undertaken to date and planned surveys going forward, and a summary of ecology surveys undertaken to date and planned surveys going forward.
05/08/2022	Senior Conservation Officer, Newark and Sherwood District Council	Explanation of the current design aspirations at Cattle Market junction and discussion to understand any mitigation required or areas of the design that would need amending to ensure adverse effects to Smeaton's Arches (Causeway Arches 500m north-west of the level crossing) along the Great North Road are reduced as far as practicable.
07/09/22	Countryside Access Manager (PRoW), Nottinghamshire County Council	Presented the current preliminary design and the interfaces with the PRoW in the Local Impact Area. Presented the alterations made to the design since the Preferred Route Announcement in February 2022 including the removal of the underpasses at the Brownhills junction and the proposals to connect FP2 to the footpath at the Friendly Farmer roundabout.
14/09/22	Environmental Health Officer, Newark and Sherwood District Council	Provided an overview of the air quality monitoring surveys currently taking place, and a summary of the noise monitoring surveys that have taken place.

Date	Stakeholder	Discussion/topics raised
14/09/2022	Environment Agency, Nottinghamshire County Council, Internal Drainage Board (Water Management Consortium), National Highways	Follow-up meeting with the flood and drainage steering group to discuss surveys and future engagement.
21/09/22	Environmental Technical Working Group meeting 1: Historic England, Natural England, Environment Agency, Newark and Sherwood District Council (Conservation Officer, Archaeology Advisor, and Environmental Health team).	The first Environmental Technical Working Group. Provided all attendees with a detailed overview of the scheme, the anticipated scheme timeline, an update on the EIA progress to date, an overview of the environmental surveys undertaken to date and planned future surveys to inform the EIA, a summary of the environmental design principles, and overview of the indicative environmental masterplan.

4.3 Proposed consultation

Statutory consultation

- 4.3.1 Between 26 October and 12 December 2022, National Highways are holding a statutory public consultation, seeking views, comments, and feedback on the scheme.
- 4.3.2 This Preliminary Environmental Information (PEI) Report and the non-technical summary (NTS) of the PEI will be published for the statutory consultation and will be available for statutory consultees to comment on. This PEI Report has been prepared to support consultees in developing an informed view of the likely significant environmental effects of the proposed scheme. A record will be made of all responses received during the consultation period, and these will be taken into account as part of the ongoing design-development and EIA of the scheme.
- 4.3.3 Further details on the consultation and downloadable copies of the full PEI Report, the non-technical summary of the PEI Report, the draft Environmental Masterplan, the consultation brochure and response form, and further information on the proposed scheme can be downloaded at: www.nationalhighways.co.uk/a46-newark-bypass.
- 4.3.4 To support the consultation a series of events are being held where people will be able to view information on the proposed scheme, speak to members of the project team and provide responses to the consultation. The series of events will be run on weekdays, weekends, evenings and at a number of different locations. The scheme webpage

provides current scheme information as well as historic information, including our statutory consultation brochure which outlines our consultation events and deposit locations for consultation materials throughout the consultation period. This can be accessed using the following web address: www.nationalhighways.co.uk/a46-newark-bypass. The scheme webpage can also be used to sign up to receive latest news and updates via email.

- 4.3.5 Copies of the consultation brochure and response form documents are also available free of charge at several deposit locations. Full details of the consultation events and information about where copies of the consultation documents can be viewed are available in the Statement of Community Consultation (SoCC) which can be found on the scheme webpage (see link above).
- 4.3.6 Responses to the consultation can be submitted using the following methods:
- **Online** - Completing a response form online at www.nationalhighways.co.uk/a46-newark-bypass
 - **By post** - Completing a copy of a printed response form and posting it back using the scheme freepost address: **Freepost A46 NEWARK BYPASS** (there is no need for a stamp when using the freepost address). The response form can be placed in an envelope with the freepost address written on the front.
 - **In person** - Completing a copy of the response form and giving it to a member of staff at one of our consultation events.
- 4.3.7 Following the consultation, National Highways will review all responses received. Comments will be taken into account when considering the need for further assessment or modification to the proposed scheme design or mitigation measures.
- 4.3.8 The comments received will also be used to produce a Consultation Report in accordance with section 37 of the Planning Act 2008, which will be submitted to the Planning Inspectorate with the DCO application. The Consultation Report will summarise the views and comments received, and outline how regard has been had to those comments in the proposed scheme design and the EIA.
- 4.3.9 Following submission of the DCO application, The Planning Inspectorate will consider, on behalf of the Secretary of State, whether the application should be accepted for examination. If the application is accepted, consultees including the general public will then be able to make relevant representations about the proposed scheme and its potential impacts.
- 4.3.10 The documents accompanying the DCO application will be publicly available on The Planning Inspectorate's website, and consultees will be able to submit comments to The Planning Inspectorate. These

comments will then be considered as part of the examination into the DCO application. Following examination, The Planning Inspectorate will make a recommendation to the Secretary of State, who will then decide whether to grant a DCO.

- 4.3.11 If the DCO is granted, construction is planned to start in 2025 and the proposed scheme is due to open to traffic in 2028.

Environmental Technical Working Groups

- 4.3.12 Engagement with the Environment Agency, Natural England, Historic England, Nottinghamshire County Council and Newark and Sherwood District Council, as well as other relevant environmental organisations will continue, through the format of an Environmental Technical Working Group (TWG). The first Environmental TWG took place on 21 September 2022 and will continue quarterly.
- 4.3.13 The Environmental TWG is responsible for discussing the findings of any scheme environmental issues, agreeing the proposed environmental assessment methodologies, considering appropriate scheme solutions and agreeing Statements of Common Ground (SoCGs) on environmental matters between National Highways and key stakeholders.
- 4.3.14 The Environmental TWG is also responsible for the technical review of the Environmental Impact Assessment (EIA) and associated surveys, development and review of environmental design, mitigation requirements and environmental opportunities and enhancements.

5 Environmental assessment methodology

5.1 Environmental Scoping

- 5.1.1 The purpose of the environmental scoping process is to determine which environmental factors (topics) should be included in the Environmental Statement (ES), and the level of detail to which they should be assessed.
- 5.1.2 An Environmental Scoping Report¹⁶ was produced in August 2022. It was prepared in accordance with Section 10 of the Infrastructure Planning (EIA) Regulations 2017¹⁷, LA103 (Scoping projects for environmental assessment) of the Design Manual for Roads and Bridges (DMRB)¹⁸ and the Planning Inspectorate's Advice Note Seven¹⁹ for all environmental factors (topics) set out in the Infrastructure Planning (EIA) Regulations 2017.
- 5.1.3 The Environmental Scoping Report has been submitted to the consultation bodies by the Planning Inspectorate and the responses from these bodies will be taken into account in adopting the Scoping Opinion. Table 5.1 below summarises the proposed scope of the ES.

¹⁶ National Highways (August, 2022) A46 Newark Bypass Environmental Scoping Report [online] available at: [TR010065-000002-A46N - Scoping Report.pdf \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/tr010065-000002-A46N-Scoping-Report.pdf) (last accessed October 2022).

¹⁷ Statutory Instrument (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, No. 527.

¹⁸ Standard for Highways (2020) Design Manual for Roads and Bridges, LA103 'Scoping projects for environmental assessment'.

¹⁹ The Planning Inspectorate (2020) Advice Note Seven: Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements [online] available at: [Advice Note Seven: Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements | National Infrastructure Planning \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/advice-note-seven-environmental-impact-assessment-process-preliminary-environmental-information-and-environmental-statements/) (last accessed August 2022).

Table 5.1: Proposed scope of the ES outlined in the Environmental Scoping Report

Chapter	Stage	Scoped in	Scoped out	Justification for scoping out where applicable
Chapter 6 Air Quality	Construction	Dust Traffic emissions	Construction plant emissions	Guidance from the IAQM notes that effects from on-site plant exhausts would likely not be significant. Given the nature of the site plant, effects of plant emissions on local air quality are considered of negligible significance relative to the surrounding road traffic contributions on the local road network. Construction plant emissions have therefore been scoped out as the impacts would be <i>de minimis</i> and not significant.
	Operation	Traffic emissions	-	-
Chapter 7 Cultural Heritage	Construction	Built heritage. Upstanding designated and non-designated assets. Buried archaeology Historic Landscape	-	-
	Operation	Built heritage. Upstanding designated and non-designated assets. Historic Landscape.	Buried archaeology	Buried archaeology will be unaffected during operation.
Chapter 8 Landscape and Visual Effects	Construction	Visual Effects Landscape Character	-	-
	Operation	Visual Effects	-	-

Chapter	Stage	Scoped in	Scoped out	Justification for scoping out where applicable
		Landscape Character		
Chapter 9 Biodiversity	Construction	Designated sites Habitats Protected species	-	-
	Operation	Designated sites Habitats Protected species	-	-
Chapter 10 Geology and Soils	Construction	Geology Contaminated Land Agricultural Land Classification soils	-	-
	Operation	-	Geology Contaminated land Agricultural Land Classification soils	No operational impacts are anticipated, and no further assessment is required.
Chapter 11 Material Assets and Waste	Construction	Use of materials	-	-
		Generation of waste		-
	Operation	-	Use of materials	No further assessment is required as maintenance activities will be infrequent and consequently expected volumes of materials will be minimal.

Chapter	Stage	Scoped in	Scoped out	Justification for scoping out where applicable
			Generation of waste	No further assessment is required as operational activities would unlikely generate large volumes of waste requiring treatment or disposal.
Chapter 12 Noise and Vibration	Construction	Noise and vibration	-	-
	Operation	Noise	Vibration	DMRB LA111 note: Operational vibration is scoped out of the assessment methodology as a maintained road surface will be free of irregularities as part of project design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effects.
Chapter 13 Population and Human Health	Construction	Land use and accessibility (including private property and housing; community land and assets; development land and businesses; agricultural land holdings; and walkers, cyclists and horse-riders)	-	-
		Human Health (including health profiles and affected communities; health determinants; and likely health outcomes)		
	Operation	Land use and accessibility (including private property and housing; community land and assets; development land and businesses; agricultural land holdings; and walkers, cyclists and horse-riders)	-	-

Chapter	Stage	Scoped in	Scoped out	Justification for scoping out where applicable
		Human Health (including health profiles and affected communities; health determinants; and likely health outcomes)		
Chapter 14 Road Drainage and Water Environment	Construction	Surface water	LNRs	The LNRs are not GWDTEs. Farndon Ponds is upstream of the scheme, and Decon Park Pastures LNR is considered to be at a suitable distance downstream for any contaminants to have dispersed and not be a credible pathway.
		Flood risk		
		WFD waterbodies		
		Groundwater (contaminated land / contaminated soils / groundwater flow).		
	Operation	Surface water	Groundwater quality impacts from authorised / historic landfills	Refer to Chapter 10 Geology and Soils for reasons why contaminated land (authorised / historic landfills) have been scoped out during operation.
		Flood risk		
		WFD waterbodies		
		Groundwater (contaminated soils/groundwater flow)		
		LNRs		
Chapter 15 Climate	Construction	Effects on climate Resilience of the scheme to climate change	-	-
	Operation	Effects on climate Resilience of the scheme to climate change	Decommissioning of the scheme at its end of life.	Assumed that the scheme will be maintained and used for longer than the 60-year assessment period of the scheme, as per Section 2.3 of DMRB LA 114.

- 5.1.4 Due to the limited time between the publication of this Preliminary Environmental Information (PEI) Report and the receipt of the Scoping Opinion from the Planning Inspectorate, the comments within the Scoping Opinion have not been incorporated into the environmental assessments contained within this PEI Report. However, all relevant consultees will be contacted to further discuss the assessment scope as per the Scoping Opinion. The ES will include a schedule of responses received from the Planning Inspectorate which will explain and identify how each of the comments have been addressed either within the ongoing environmental assessment work and ES, or as agreed through consultation with the relevant consultees.
- 5.1.5 Environmental Impact Assessment (EIA) is an iterative process and will therefore additionally take into account comments received as part of the statutory consultation, for which further details are provided within Chapter 4 of this document. The preliminary assessment presented in Chapters 6 to 15 will be updated within the ES, to take into consideration the Scoping Opinion and any additional comments received as part of the consultation process. The ES will be submitted as part of the DCO application.

5.2 Approach to assessment

- 5.2.1 This PEI Report considers the following factors contained in Regulation 5(2) of the Infrastructure Planning (EIA) Regulations 2017²⁰. These include:
- Population and human health (a)
 - Biodiversity (b)
 - Land, soil, water, air and climate (c)
 - Material assets, cultural heritage and the landscape (d)
 - The interaction between the factors referred to in sub-paragraphs (a) to (d)
- 5.2.2 The assessment for each of these factors are covered in one or more environmental assessment chapters in this report. The chapters have been written in accordance with the requirements presented in the Design Manual for Roads and Bridges (DMRB) LA 104 – Environmental assessment and monitoring²¹, for each of the relevant environmental factors (topics). This is shown in Table 5.2 below.

²⁰ Statutory Instrument (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, No. 527.

²¹ National Highways (2020) DMRB Volume 11 Environmental Assessment, LA 104 – Environmental assessment and monitoring.

Table 5.2: Environmental factors and respective DMRB environmental topics

Environmental factors contained within Regulation 5(2) of the Infrastructure Planning (EIA) Regulations 2017	DMRB environmental topic
Population and human health	Chapter 6 Air Quality (LA 105) Chapter 12 Noise and Vibration (LA 111) Chapter 13 Population and Human Health (LA 112) Chapter 14 Road Drainage and the Water Environment (LA 113)
Biodiversity	Chapter 8 Landscape and Visual Effects (LA 107, LD 117 and LD 119) Chapter 9 Biodiversity (LA 108 and LD 118)
Land, soil, water, air and climate	Chapter 6 Air Quality (LA 105) Chapter 10 Geology and Soils (LA 109) Chapter 11 Material Assets and Waste (LA 110) Chapter 14 Road Drainage and the Water Environment (LA 113) Chapter 15 Climate (LA 114)
Material assets, cultural heritage, and the landscape	Chapter 7 Cultural Heritage (LA 106) Chapter 8 Landscape and Visual Effects (LA 107, LD 117 and LD 119) Chapter 11 Material Assets and Waste (LA 110)
The interaction between the factors referred to in sub-paragraphs a) to d)	Chapter 16 Assessment of Cumulative Effects

5.2.3 Each topic chapter of this PEI Report contains:

- A summary of the topic-specific legislative and policy drivers.
- A description of the assessment methodology (including significance criteria).
- A description of the defined study area.
- the existing baseline conditions including any environmental constraints present.
- A description of value (sensitivity of resources and receptors).
- A description of the potential impacts.
- Details of any consultation undertaken to date and further consultation plans to inform the ES.
- Any assumptions and limitations associated with the assessments to date.
- A summary of the likely design mitigation and enhancement measures.

- A description of the likely significant effects.

5.2.4 Each topic has considered the potential environmental effects associated with the construction and operational phases of the scheme. The scheme would be unlikely to be decommissioned as it would form an integral part of the Strategic Road Network (SRN). As such, decommissioning has not been considered within this PEI Report, and it has been proposed that decommissioning is scoped out of the ES.

Major accidents and disasters

5.2.5 The Infrastructure Planning (EIA) Regulations 2017 (at paragraph 8 of Schedule 4) require an assessment of ‘the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned’.

5.2.6 The assessment will be undertaken prior to submission of the DCO and will be presented within the ES. The scope of the assessment will cover:

- Vulnerability of the project to risks of major accidents and/or disasters.
- Any consequential changes in the predicted effects of that project on environmental factors.

5.2.7 In considering the elements of vulnerability, professional judgement will be applied to develop project specific definitions of major events. Major events, both man-made and naturally occurring, will be identified and any potential effects and likely mitigation measures will be included as part of the assessment.

Heat and radiation

5.2.8 Due to the nature of the scheme, it is considered unlikely that heat and radiation effects associated with the proposals are likely to arise. As a result, the Environmental Scoping Report²² identified that further assessment as part of the ES is not required. Therefore, no assessment of heat and radiation effects has been included within this PEI Report.

5.3 Future baseline scenario

5.3.1 A description of the relevant aspects of the current state of the environment (baseline scenario) is included for each environmental factor within the baseline sections of Chapters 6 to 15 of this PEI

²² National Highways (August, 2022) A46 Newark Bypass Environmental Scoping Report [online] available at: [TR010065-000002-A46N - Scoping Report.pdf \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/tr010065-000002-A46N-Scoping-Report.pdf) (last accessed October 2022).

Report. Within the ES, an outline of the likely evolution of the baseline and future baseline scenarios, without implementation of the scheme and appraising only natural changes, will be included. This will make use of readily available information such as that available from Local Development Plan documents.

5.4 Surveys and predictive techniques and methods

5.4.1 Information gathered through desk top studies, environmental walkovers and any site surveys undertaken to date have been collated to inform this report. Specific details of the information sources used to inform this PEI Report are included within each of the individual environmental topic chapters (Chapters 6 to 15).

5.5 General assessment assumptions and limitations

5.5.1 General assessment assumptions and limitations relating to the preliminary assessments contained within this PEI Report are listed below. There are also a number of topic-specific assumptions and limitations, and these are detailed in the relevant sections of Chapters 6 to 15 of this report.

General assumptions

5.5.2 This PEI Report has assumed that the extents of the draft Order Limits (Figure 2.2 contained in Volume 2) represent the maximum area within which physical disturbance may occur to environmental resources and receptors.

5.5.3 In relation to construction, conventional methodologies and techniques have been assumed to be employed during construction of the scheme, with best practice mitigation measures implemented to protect sensitive environmental receptors during the works.

5.5.4 The key milestones for the scheme include:

- Start of construction – 2025 (construction duration has been assumed to be approximately three years in length)
- Opening year – 2028
- Design year – 2043

5.5.5 This report is based on the scheme design as presented at the statutory consultation (refer to the scheme description in Chapter 2, Section 2.5).

5.5.6 This PEI Report has acknowledged that the design of the scheme, including the environmental design, will be subject to further refinement and adjustment in response to the outcomes of statutory consultation and further stakeholder engagement, ongoing design development and the iterative EIA process.

- 5.5.7 As the scheme will become an integral part of England's Strategic Road Network, it has been assumed that the scheme will not be decommissioned.
- 5.5.8 Should any standards, guidance or relevant policy and legislation be updated prior to the DCO submission, consideration will be given to applying the new standards, guidance or policy and legislation, in discussion with relevant consultees and also if sufficient time allows for this to be done, and a justification provided in the ES.
- 5.5.9 Conclusions and recommendations may be revised within the ES, on the basis of updated information following further research, survey, and investigation. Any changes would be discussed with the relevant consultees.

General limitations

- 5.5.10 Site walkovers and site surveys at the Kelham and Averham Floodplain Compensation Area commenced in August 2022. As such, limited information is currently available, but the survey information collected at the Kelham and Averham Floodplain Compensation Area will be used to inform the ongoing design development and EIA and will be reported in the ES.
- 5.5.11 The preliminary assessments for air quality and noise presented within this PEI Report have been informed by previous options appraisal results for the preferred route announcement, which themselves were informed by traffic forecasts.
- 5.5.12 Ongoing environmental assessment work will make use of the updated traffic data which will also be used to inform the Case for the Scheme, to be submitted as part of the DCO application. The updated model will use the second generation regional transport models (RTM2) which have a March 2019 base. A March 2019 base has been used as this represents the most up to date information available on travel patterns and traffic volumes pre-COVID. Travel behaviour post-COVID has not yet stabilised, making more recent data collection difficult, and as such would not provide a reliable base for traffic forecasts. The impacts of COVID on travel behaviour will be incorporated into the forecasting process. Quantitative air quality and noise assessments will be undertaken using these revised traffic flows and will inform the ES.
- The model will comprise of a SATURN highway assignment model and a DIADEM variable demand model.
 - Future year forecasts will be provided for 2028, 2043 and the latest available year for traffic forecasts.
 - The National Trip End Model (NTEM) 7.2 and Road Traffic Forecasts 2018 (RTF18) are due to be replaced by NTEM8 and National Road Traffic Projections 23 (NRTP23). These will provide

the basis of the future year forecasts if available in advance of the traffic forecasting. If they are not available then NTEM7.2 and RTF 2018 will be used.

- The Uncertainty Log covering future network and developments will be updated to reflect the current situation. This will provide development trip information for the future year traffic models.

5.6 Significance criteria

- 5.6.1 The output of the environmental assessment is to report the likely significance of effects within the ES, using established significance criteria, as presented within the DMRB LA 104 – Environmental assessment and monitoring²¹. This requires an assessment of the receptor or resource's environmental value (or sensitivity) and the magnitude of the project's impacts (change).
- 5.6.2 LA 104 of the DMRB states that the approach to assigning significance of effect relies on reasoned argument, the professional judgement of competent experts and using effective consultation to ensure the advice and views of relevant stakeholders are taken into account. For some factors, predicted effects may be compared with quantitative thresholds and scales in determining significance. Each environmental assessment chapter within the ES will describe the specific thresholds/criteria used to determine value/magnitude/sensitivity and will align within the general methodology described within this section.
- 5.6.3 Assigning each effect to one of the five significance categories enables different environmental factor issues to be placed upon the same scale, to assist the decision-making process at whatever stage the project is at within that process. These five significance categories are set out in Table 5.3 below.

Table 5.3: Description of the significance of effect categories

Significance	Typical descriptors of effects
Very Large	Effects at this level are material in the decision-making process.
Large	Effects at this level are likely to be material in the decision-making process.
Moderate	Effects at this level can be considered to be material decision-making factors.
Slight	Effects at this level are not material in the decision-making process.
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 LA 104²¹

- 5.6.4 The environmental value will be identified for each of the receptors identified within the individual environmental factor that have been

carried forward from the Scoping exercise for further environmental assessment, along with the magnitude of change. Five significance categories can result from the assessment, as defined in Table 5.4. 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 Beneficial/ Adverse or above will be considered significant.

Table 5.4: Assessing significance of potential effects

Environmental value (sensitivity)	Magnitude of potential impact (degree of change)					
	No Change	Negligible	Minor	Moderate	Major	
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 LA 104²¹

- 5.6.5 There are a number of environmental topics which, for various reasons, do not follow this methodology exactly for defining significance; these include air quality, noise and vibration, material assets and waste, human health and effects on climate. Where this is the case, the criteria used to determine the significance of effects is outlined in these individual chapters.

5.7 Duplication of assessment

- 5.7.1 The ES will be prepared with reference to environmental assessments that have been, or are going to be, carried out for nearby schemes. In this way, duplication of assessment or survey effort can be avoided and consistency of approach, unless scheme-specific factors determine otherwise, can be assured. See Chapter 16 Combined and Cumulative Effects, for further details.

5.8 Environmental Statement

- 5.8.1 The ES will comprise four volumes:

- Volume 1 – Non-technical summary
- Volume 2 – Main ES text
- Volume 3 – ES figures
- Volume 4 – ES appendices

5.8.2 Volume 2 of the ES is currently anticipated to be structured as below, subject to further discussion with the statutory environmental bodies:

- Chapter 1 – Introduction
- Chapter 2 – The scheme
- Chapter 3 – Assessment of alternatives
- Chapter 4 – Consultation
- Chapter 5 – Environmental assessment methodology
- Chapter 6 – Air quality
- Chapter 7 – Cultural heritage
- Chapter 8 – Landscape and visual effects
- Chapter 9 – Geology and soils
- Chapter 10 – Biodiversity
- Chapter 11 – Material assets and waste
- Chapter 12 – Noise and vibration
- Chapter 13 – Population and human health
- Chapter 14 – Road Drainage and the water environment
- Chapter 15 – Climate
- Chapter 16 – Combined and cumulative effects
- Chapter 17 – Conclusions
- Chapter 18 – Glossary

5.8.3 Relevant supporting documents include:

Habitat Regulations Assessment (HRA):

- An HRA Screening Assessment will be undertaken for each Special Area of Conservation (SAC) and Special Protection Area (SPA) which could be affected. As a matter of policy Ramsar sites (wetlands of international importance) are also considered within the HRA Screening process. Where HRA Screening identifies that there is a likely significant effect this will determine any requirement for an Appropriate Assessment. The Appropriate Assessment will define any requirement for mitigation that is necessary to ensure there is no adverse effect on the integrity of these sites, alone or in combination with other plans and projects. Any required mitigation would then be incorporated into the proposed scheme.

Flood Risk Assessment (FRA):

- An FRA will be undertaken because the majority of the scheme is within Flood Zones 2 and 3. This report will review the scheme to assess it against the risk of flooding, whether that be from groundwater, river (fluvial), surface water (pluvial), estuary/coastal (tidal), or sewer sources. It should also take the surrounding area into account and whether the development poses a flood risk to areas nearby. The outcomes of this assessment will determine how, if at all, mitigation will be implemented into the design to

minimise the effect of flood risk. The results will be presented as a technical appendix to the ES.

Water Framework Directive (WFD) Assessment:

- A WFD Assessment will be undertaken and a WFD compliance assessment report produced alongside the ES. This report will consider the extent to which the proposed scheme could impact on the current and future target WFD status of the waterbodies. Where potential adverse effects are identified, an assessment of these will inform what mitigation measures need to be incorporated into the design and construction methods of the proposed scheme to remove or minimise the effect. The results will be presented in the ES.

5.8.4 A number of plans will be produced to support the preparation of the ES and the results presented therein, and will also be a mechanism for securing the required mitigation. These are likely to include:

- A First Iteration Environmental Management Plan.
- Indicative Environmental Masterplan (the draft of which is included as Figure 2.3 contained in Volume 2 and has been used to inform Chapter 8 Landscape and Visual Effects).

5.8.5 The First Iteration Environmental Management Plan will be submitted as part of the DCO application and will be further developed into the Second Iteration Environmental Management Plan by the Contractor prior to construction commencing.

6 Air Quality

6.1 Introduction

- 6.1.1 This chapter presents the on-going work for the assessment of the potential air quality effects of the scheme. Potential changes in air quality at sensitive receptors as a result of the scheme are considered with reference to relevant policy and legislation, and in the context of existing air quality in the study area.
- 6.1.2 The potential effects have been considered following the guidance contained in Design Manual for Roads and Bridges (DMRB) LA 105²³. Further detailed assessment is currently under way and will be reported within the Environmental Statement (ES) that will be submitted to support the Development Consent Order (DCO) application.

6.2 Legislation and policy context

Legislation

- 6.2.1 The Air Quality Standards Regulations 2010²⁴, Air Quality Standards (amendment) Regulations 2016²⁵, Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019²⁶, and Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020²⁷ implement Directive 2008/50/EC on ambient air quality²⁸.
- 6.2.2 These pieces of legislation define limit values and times by which they are to be achieved for the purpose of protecting human health and the environment by avoiding, reducing, or preventing harmful concentrations of air pollutants.
- 6.2.3 The limit values apply everywhere, with the exception of:
- Any locations situated within areas where members of the public do not have access and there is no fixed habitation.
 - In accordance with Article 2(1) of Directive 2008/50/EC, on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply.
 - On the carriageway of roads.
 - On the central reservations of roads except where there is normally pedestrian access to the central reservation.

²³ National Highways (2019) DMRB LA 105 – Air quality, Revision 0 [online] available at: [10191621-07df-44a3-892e-c1d5c7a28d90 \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk) (last accessed August 2022)

²⁴ Statutory Instrument. (2010), The Air Quality Standards Regulations, No. 1001.

²⁵ Statutory Instrument. (2016) The Air Quality Standards (Amendment) Regulations, No. 1184.

²⁶ Statutory Instrument. (2019) Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations

²⁷ Statutory Instrument. (2020) Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, No. 1313.

²⁸ European Union. (April 2008) Directive on ambient air quality and cleaner Air for Europe, Directive 2008/50/EC Official Journal, vol. 152, pp. 0001-0044

- 6.2.4 The Department for Environment Food and Rural Affairs (Defra) assesses and reports on the compliance with the limit values for each of the 43 zones and agglomerations across the UK. Zones and/or agglomerations achieve compliance when everywhere within the zone and/or agglomeration (except locations provided in the Directive) does not exceed the relevant limit value. The scheme is located within the Eastern Zone.
- 6.2.5 Part IV of the Environment Act 1995²⁹ (as amended in Schedule 11 of the Environment Act 2021³⁰) requires that every local authority shall periodically carry out a review of air quality within its area, including predictions of likely future air quality. The air quality objectives specifically for use by local authorities in carrying out their air quality management duties are set out in the Air Quality (England) Regulations 2000³¹ and the Air Quality (England) (Amendment) Regulations 2002³². In most cases, the air quality objectives are set at the same pollutant concentrations as the limit values transposed in UK law, although compliance dates differ.
- 6.2.6 As part of the review of air quality, the local authority must assess whether air quality objectives are being achieved, or are likely to be achieved within the relevant periods and identify the key sources of emissions responsible for the failure to achieve the objectives. Any parts of a local authority's area where the objectives are not being achieved or are not likely to be achieved within the relevant period must be identified and declared as an Air Quality Management Area (AQMA). Once such a declaration has been made, local authorities are under a duty to prepare an Action Plan which sets out measures to pursue the achievement of the air quality objectives within the AQMA.
- 6.2.7 The Environment Act requires the UK Government to produce a national Air Quality Strategy (AQS). The AQS establishes the UK framework for air quality improvements. The previous 2007 AQS³³ has now been superseded as of 14th January 2019 with the Clean Air Strategy 2019 (CAS)³⁴.
- 6.2.8 The CAS does not set legally binding objectives, the CAS instead has targets for reducing total UK emissions of nitrogen oxides (NOx) and fine particulate matter (PM2.5) from sectors such as road transport, domestic sources and construction plant (non-road mobile machinery (NRMM)). Environment Act requires the UK Government to produce a

²⁹ Department for Environment Food and Rural Affairs. (2003) Part IV of the Environment Act 1995 Local Air Quality Management

³⁰ Statutory Instrument. (2021) Chapter 30, Schedule 11 Local Air Quality Management Framework of Environment Act 2021.

³¹ Statutory Instrument. (2000) Air Quality (England) Regulations, No. 928

³² Statutory Instrument. (2002) Air Quality (England) (Amendment) Regulations, No. 3043.

³³ Department for Environment Food and Rural Affairs. (July 2007), 'The Air Quality Strategy for England, Scotland, Wales and Northern Ireland', Cm 7169, Department for Environment Food and Rural Affairs.

³⁴ Department for Environment Food and Rural Affairs. (January 2019), 'The Clean Air Strategy'

national Air Quality Strategy (AQS). The AQS establishes the UK framework for air quality improvements. The previous 2007 AQS³⁵ has now been superseded as of 14th January 2019 with the Clean Air Strategy 2019 (CAS)³⁶.

6.2.9 Air quality objectives and limit values relevant to the scheme are summarised in Table 6.1.

Table 6.1: Relevant air quality objectives and limit values

Pollutant	Averaging period	Concentration	Allowance	Attainment date	
				Air quality objectives	Limit values
Nitrogen dioxide (NO ₂)	Annual	40 µg/m ³	-	31 December 2005 ^(a)	1 January 2010 ^(c)
	1 Hour	200 µg/m ³	18	31 December 2005 ^(a)	1 January 2010 ^(c)
Particulates (PM ₁₀)	Annual	40 µg/m ³	-	31 December 2004 ^(a)	1 January 2005 ^(c)
	24 Hour	50 µg/m ³	35	31 December 2004 ^(a)	1 January 2005 ^(c)
Fine particulates (PM _{2.5}) ^(e)	Annual	20 µg/m ³	-	-	1 January 2020 ^(c)
		25 µg/m ³	-	2020 ^(b)	-
Oxides of nitrogen (NO _x) ^(d)	Annual	30 µg/m ³	-	31 December 2000 ^(a)	19 July 2001 ^(c)

Notes: ^(a) Air Quality (England) Regulations 2000 as amended

^(b) Air Quality Strategy 2007

^(c) EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe, as transposed into UK Law

^(d) Designated for the protection of vegetation and ecosystems and also referred to as the 'critical level' for NO_x. The policy of the UK statutory nature conservation agencies is to apply the annual mean NO_x criterion in internationally designated conservation sites and Site of Special Scientific Interest (SSSI) on a precautionary basis, as the limit value applies only to locations more than 20 kilometres from towns with more than 250,000 inhabitants or more than 5 kilometres from other built-up areas, industrial installations or motorways.

^(e) As the Air Quality Strategy 2007 and EU Directive 2008/50/EC have a different numerical standard for PM_{2.5}, the more stringent standard of 20µg/m³ has been adopted for this assessment.

6.2.10 Table 6.2 provides details of where the respective objectives should and should not apply and therefore the types of receptors that are relevant to the assessment of air quality.

Table 6.2: Locations where the air quality objectives apply

Averaging period	Objectives should apply at:	Objectives should not apply at:
Annual	<p>All locations where members of the public might be regularly exposed.</p> <p>Building façades of residential properties, schools, hospitals, care homes, etc.</p>	<p>Building façades of offices or other places of work where members of the public do not have regular access.</p> <p>Hotels, unless people live there as their permanent residence.</p> <p>Gardens of residential properties.</p> <p>Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.</p>
24-Hour	<p>All locations where the annual mean objective would apply, together with hotels.</p> <p>Gardens of residential properties.</p>	<p>Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.</p>
1-Hour	<p>All locations where the annual mean and 24-hour mean objectives apply.</p> <p>Kerbside sites (for example, pavements of busy shopping streets).</p> <p>Those parts of car parks, bus stations and railway stations, etc., which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more.</p> <p>Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.</p>	<p>Kerbside sites where the public would not be expected to have regular access.</p>

Source: Defra Local Air Quality Management Technical Guidance (LAQM TG16)³⁷.

³⁷ Department for Environment, Food and Rural Affairs and Devolved Administrations (April 2021). Local Air Quality Management – Technical Guidance LAQM.TG16

Statutory nuisance

6.2.11 Section 79(1)(d) of the Environmental Protection Act 1990³⁸ defines one type of 'statutory nuisance' as "any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance". Where a local authority is satisfied that a statutory nuisance exists, or is likely to occur or recur, it must serve an abatement notice. Failure to comply with an abatement notice is an offence. Best practicable means is a widely-used defence by operators, if employed to prevent or to counteract the effects of the nuisance.

National policy

National Policy Statement for National Networks

- 6.2.12 The National Policy Statement for National Networks (NPSNN)³⁹ sets out the policy which the scheme should comply with. It is also the basis for informing a judgement on the impacts of a scheme, for example is the scheme consistent with the needs of the NPSNN.
- 6.2.13 The NPSNN notes that the applicant should undertake an assessment of the impacts of the proposed project as part of the ES and should describe:
- Existing air quality levels.
 - Forecasts of air quality at the time of opening, assuming that the scheme is not built (the future baseline) and taking into account the impact of the scheme.
 - Any significant air quality effects, their mitigation and any residual effects, distinguish between the construction and operation stages and taking account of the impact of road traffic generated by the project.
- 6.2.14 Paragraphs 5.12 and 5.13 of the NPSNN provides advice for decision makers:
- 6.2.15 "5.12 The Secretary of State must give air quality considerations substantial weight where, after taking into account mitigation, a project would lead to a significant air quality impact in relation to EIA and/or where they lead to a deterioration in air quality in a zone/agglomeration."
- 6.2.16 "5.13 The Secretary of State should refuse consent where, after taking into account mitigation, the air quality impacts of the scheme will:
- "Result in a zone/agglomeration which is currently reported as being compliant with the Air Quality Directive becoming non-compliant.

³⁸ Parliament of the United Kingdom (1990) Environmental Protection Act 1990

³⁹ Her Majesty's Stationery Office. 2014. National Policy Statement for National Networks.

- “Affect the ability of a non-compliant area to achieve compliance within the most recent timescales reported to the European Commission at the time of the decision.”

6.2.17 Requirements set out in DMRB LA 105⁴⁰ ensures that an assessment to inform reasonable and robust decision making on judgements of significant air quality impacts (NPSNN paragraph 5.12) and determining whether a scheme would affect the UK’s reported ability to comply with the limit values transposed into UK law (NPSNN paragraph 5.13) can be completed and evaluated in line with the requirements of the NPSNN.

National Planning Policy Framework

6.2.18 The revised National Planning Policy Framework⁴¹ was published in July 2021 and sets out the Government’s planning policies for England. With regard to air quality, it states that:

6.2.19 “Planning policies and decisions should contribute to and enhance the natural and local environment by: ...preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air quality...”

6.2.20 And:

6.2.21 “Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas.”

6.2.22 “Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible, these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications.”

6.2.23 “Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.”

⁴⁰ National Highways (2019) DMRB LA 105 – Air quality, Revision 0 [online] available at: [10191621-07df-44a3-892e-c1d5c7a28d90 \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk) (last accessed June 2022)

⁴¹ Ministry of Housing, Communities and Local Government (July 2021). National Planning Policy Framework

National Planning Practice Guidance

- 6.2.24 On 6 March 2014, the Department for Communities and Local Government published a national planning practice guidance web-based resource⁴² which was updated on 1 November 2019.
- 6.2.25 The National Planning Practice Guidance includes a dedicated section on air quality. It notes that, for new planning applications, the local planning authority may require information on:
- 6.2.26 “The ‘baseline’ local air quality, including what would happen to air quality in the absence of the development.”
- 6.2.27 “whether the Scheme could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity)”.
- 6.2.28 “whether occupiers or users of the development could experience poor living conditions or health due to poor air quality.”
- 6.2.29 It also states the following in relation to determining whether air quality is relevant to a planning decision:
- 6.2.30 “Whether air quality is relevant to a planning decision will depend on the Scheme and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the Scheme would be particularly sensitive to poor air quality in its vicinity)”⁴³.

25 Year Environment Plan

- 6.2.31 The Department for Environment, Food & Rural Affairs (Defra) 25 Year Environment Plan (2018)⁴⁴ is a policy paper setting out what Government will do to improve the environment, including restoring and safeguarding wildlife habitats. This plan is being treated as the first Environmental Improvement Plan required under the Environment Act 2021. The plan sets out aims to achieve clean air by:
- Meeting legally binding targets to reduce emissions of five damaging air pollutants; this should halve the effects of air pollution on health by 2030

⁴² National Planning Practice Guidance web-based resource. Accessible at: <https://www.gov.uk/Government/collections/planning-practice-guidance>

⁴³ National Planning Practice Guidance ‘Air Quality Section’. Accessible at: <https://www.gov.uk/guidance/air-quality--3>

⁴⁴ HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online] available at: 25 Year Environment Plan - GOV.UK (www.gov.uk) (last accessed October 2022)

- Ending the sale of new conventional petrol and diesel cars and vans by 2040
- Maintaining the continuous improvement in industrial emissions by building on existing good practice and the successful regulatory framework

Local policy

6.2.32 The Newark and Sherwood Amended Core Strategy Development Plan⁴⁵ was adopted in 2019, this sets out policy up until 2033 and presents the objectives for development in the area. Core Policy 12, Biodiversity and Green Infrastructure, relates to air quality, this policy states that the council will work with partners to develop a strategic approach to air quality, with a specific focus on the Sherwood area. The strategy says that an air quality supplementary planning document will be produced. This document is not currently available but will be considered if it is available during the assessment for the Environmental Statement.

National Highways policy

6.2.33 National Highways supports the delivery of the Government's National Air Quality Plan, including the delivery of measures to achieve compliance in the shortest timescales possible alongside the strategic road network. In addition, air quality is one of the environmental topic areas where the six strategic levers of the National Highways' Environment Strategy will be applied. The strategic levers will make a contribution towards the organisation's environment vision.

6.2.34 National Highways' air quality strategy⁴⁶ sets out a strategy to improve air quality on and around the SRN, through to 2021. The strategy sets out the approach and activities to achieve this goal. National Highways has identified four areas of action to improve air quality:

1. Policy
2. Planning
3. Monitoring
4. Operational management

⁴⁵ Amended Core Strategy Development Plan (2019) Newark and Sherwood District Council. Accessible at: <https://www.newark-sherwooddc.gov.uk/media/nsdc-redesign/documents-and-images/your-council/planning-policy/local-development-framework/amended-core-strategy-dpd/amended-core-strategy-DPD.pdf>

⁴⁶ Highways England (2017) Our strategy to improve air quality [online]. Available at: [Highways England Air Quality Strategy - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/614442/Highways-England-Air-Quality-Strategy-2017.pdf) (Last accessed September 2022).

6.3 Assessment methodology

Construction phase

- 6.3.1 Key stages of the construction phase and the construction dust risk potential have been identified in accordance with DMRB LA 105. Appropriate mitigation measures will be identified in accordance with Best Practicable Measures (BPM) to reduce the risk of dust deposition and these will be incorporated into the First Iteration Environmental Management Plan (EMP).
- 6.3.2 The construction dust risk potential is assessed by identifying the construction dust risk potential of the scheme and the distance of receptors from construction activities using distance buffers of 50 metres, 100 metres and 200 metres. The construction dust risk is calculated in line with para 2.58 of DMRB LA 105.
- 6.3.3 The construction period of the scheme is predicted to be approximately three years. At this preliminary environmental assessment stage, the potential impacts associated with construction traffic have not been assessed and therefore are not included within this PEI Report. For the ES, construction traffic information will be screened using the Affected Road Network (ARN) criteria in DMRB LA 105 once data becomes available. If required, a detailed level assessment will be undertaken in accordance with DMRB LA 105, taking into account Defra Local Air Quality Management Technical Guidance 2021 (TG(16))⁴⁷ and its associated assessment tools.

Operation phase

- 6.3.4 The proposed scheme has the potential to affect air quality due to changes in traffic flows and road alignment. Whilst no assessment has specifically been undertaken as part of this Preliminary Environmental Information (PEI) Report, a previous assessment of the scheme impacts on air quality was undertaken at the options appraisal stage. Key information from this previous assessment has been used to inform the PEI Report.
- 6.3.5 The assessment determined significance of effect based upon:
- The assessment of the effects on human health through the determination of changes in pollutant concentrations at sensitive receptors where the air quality objectives apply.
 - The assessment of compliance risk by determining if the scheme could affect the UK's reported ability to comply with the Air Quality Directive.
 - The assessment of the impacts on designated sites.

⁴⁷ Defra (2021), Local Air Quality Management – Technical Guidance (16). Accessible at: <https://laqm.defra.gov.uk/documents/LAQM-TG16-April-21-v1.pdf>

- 6.3.6 Further details on significance of effect is available in Section 5.6.
- 6.3.7 The previous assessment included:
- An assessment of air quality effects using the advanced dispersion modelling software (ADMS Roads).
 - Verification of model outputs with local monitoring data.
 - Prediction of NO₂ concentrations in the base year, do-minimum and do-something scenarios at sensitive human health receptors and ecological designated sites.
 - Rationale as to why PM₁₀ was not assessed in the opening year, was consistent with the requirements of DMRB LA 105 and stated base year concentrations of PM₁₀ did not exceed relevant thresholds.
 - Predictions of NO_x and nitrogen deposition at designated sites located within 200 metres of the ARN. As per DMRB LA 105, designated sites considered in the assessment included Ramsar sites, Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs), local nature reserves (LNRs), local wildlife sites, nature improvement areas, ancient woodlands and veteran trees (hereafter referred to as 'designated sites').
- 6.3.8 The assessment was desk based and based upon traffic data generated specifically for the scheme at options appraisal stages. The assessment used baseline data collected by local authorities and National Highways scheme specific monitoring data.
- 6.3.9 The assessment for the ES will use updated traffic data for the scheme with a base year of 2019, which is currently being developed (see paragraph 5.5.12). Additionally, the assessment for the ES will use the results from an ongoing National Highways scheme specific air quality monitoring survey which is due to completed in November 2022.

Assessment scenarios

- 6.3.10 The following scenarios were considered in the assessment for local air quality. This was based on traffic data generated for the options appraisal phase which has been used to inform this PEI Report.
- Base year/model verification year 2017
 - Do-Minimum (without proposed scheme) 2028 opening year
 - Do-Something (with proposed scheme) 2028 opening year
- 6.3.11 Base year air quality predictions were used to verify the model against air quality monitoring data. Model verification was undertaken using local authorities' and National Highways' scheme-specific monitoring data.
- 6.3.12 Pollutant concentrations predicted in the opening year Do-Minimum and Do-Something scenarios of the scheme were compared to ascertain the effect of the scheme on local air quality. It should be

noted that the assessment of opening year air quality effects is expected to provide a worst-case assessment, as air quality is expected to improve in future years as a result of improvements in vehicle emissions and background air quality.

Traffic data

6.3.13 The previous air quality assessment was undertaken at options appraisal based on traffic data produced for the options appraisal stages of the scheme. This data was produced for an earlier iteration of the current design that is being taken forward, however, key information from this previous assessment has been used to inform this PEI report. Data on vehicle flow speed and percentage of Heavy Duty Vehicles (HDVs - the sum of Heavy Goods Vehicles and buses) for the following periods in the base, Do-Minimum and Do-Something scenarios informed the assessment:

- AM peak period (07:00 to 10:00)
- Inter peak period (10:00 to 16:00)
- PM peak period (16:00 to 19:00)
- Off peak period (19:00 to 07:00)

6.3.14 The diurnal traffic flow characteristics, and therefore emissions, were represented in the modelling. The same profile used for weekdays was applied to the weekend.

Background pollutants

6.3.15 Total air pollutant concentrations comprise a background and local component. Background concentrations are determined by regional, national and international emissions, and often represents a significant proportion of the total pollutant concentration. The local component is determined by local pollutant sources such as roads, and in this case, was considered using ADMS.

6.3.16 Background pollutant concentrations are spatially and temporally variable throughout the UK. Annual mean background concentrations of NO_x, NO₂ and PM₁₀ were obtained from Defra's Air Information Resource (AIR)⁴⁸ website at the time of assessment during options appraisal. The Defra maps provide yearly forecasts based on a grid at a resolution of 1km² across the whole of the UK.

6.3.17 NO₂ background data was compared against monitored NO₂ data within the study area. It was determined that there was no systematic bias in the comparisons and no adjustment was deemed necessary for use of the Defra backgrounds within the assessment. There was no suitable background PM₁₀ monitoring within the study area to allow a

⁴⁸ Background Mapping data for local authorities. (2022) Department for Environment, Food and Rural Affairs (Defra), available at: <https://uk-air.defra.gov.uk/data/laqm-background-home>

similar comparison for PM₁₀, the Defra background PM₁₀ concentrations were therefore unadjusted in the assessment.

NO_x to NO₂ relationship

- 6.3.18 Emission rates used within the ADMS modelling use NO_x to represent all nitrogen-oxygen species emitted in vehicle exhaust gases. The proportion of NO₂ is needed for comparison with the air quality objectives.
- 6.3.19 Defra provide a NO_x to NO₂ conversion tool spreadsheet⁴⁹ for calculating the annual mean. The latest available NO_x to NO₂ calculator at the time of the options appraisal assessment was used.

Predicted 1-hour NO₂

- 6.3.20 Annual mean NO₂ concentrations were presented for identified worst affected receptors. According to Defra guidance, the hourly NO₂ air quality objective of 200µg/m³ (not to be exceeded more than 18 times per year) is unlikely to be exceeded at roadside locations where the annual mean concentration is less than 60µg/m³⁴⁷. Therefore, exceedances of 60µg/m³ as an annual mean are used as an indicator of potential exceedances of the 1-hour mean NO₂ objective.

Receptors – human health

- 6.3.21 Pollutant concentrations were predicted at sensitive receptors, defined according to Defra as:
- 6.3.22 'Locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the relevant air quality objective'.
- 6.3.23 During the options appraisal assessment, 182 receptors were assessed that were within 200 metres of the ARN. Receptors were selected using professional judgement where the highest pollutant concentrations would be likely to arise, and where the greatest effects would be expected to occur due to the scheme. The 12 receptors that were deemed to be most impacted upon by the scheme from the options appraisal assessment are presented on Table 6.3 below and are presented on Figure 6.1 contained within Volume 2.

⁴⁹ NO_x to NO₂ Calculator (2022) Department for Environment, Food and Rural Affairs (Defra), Available at: <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/>

Table 6.3: Human health receptors

Receptor ID	Receptor description	British national grid coordinates	
		X	Y
R51	Castle View Court, Mather Road, Newark-on-Trent	479614	354162
R55	The Ossington, Beast Market Hill, Newark-on-Trent	479733	354095
R57	Midland House, Great North Road, Newark-on-Trent	479573	354220
R58	79, Fosse Road, Farndon	477728	352121
R69	North Gate, Newark-on-Trent	479962	354310
R77	27, Pooh Corner, North Gate, Newark-on-Trent	479935	354283
R80	Bridgend Cottage, Bridgend, Blacksmith Lane, Kelham	477496	355678
R106	134, North Gate, Newark-on-Trent	480197	354544
R120	70, The Elms, Newark-on-Trent Road, Coddington	482361	354332
R151	79, Low Wood Lodge, Gainsborough Road, Winthorpe	481116	356278
R164	The Lodge, Fosse Road, Winthorpe	481456	355909
R206	3, Dryden Avenue, Balderton	478156	351986

Receptors – ecological

6.3.24 The assessment undertaken at options appraisal stages covered designated sites within 200 metres of the ARN, the following designated sites were assessed:

- Twenty Acre Piece SSSI
- Devon Park LNR
- One veteran tree
- 41 LWSs

6.3.25 Transects were employed at each site with an assessment of the annual mean NO_x critical level and nutrient nitrogen deposition.

Compliance risk assessment

- 6.3.26 DMRB LA 105 sets out the approach to assess the risk of the proposed scheme being non-compliant with Directive 2008/50/EC⁵⁰. The compliance risk assessment has been undertaken using the results obtained from the local air quality assessment and has been undertaken using the principles in DMRB LA 105 (para 2.64 to para 2.87).
- 6.3.27 Defra's Pollution Climate Mapping (PCM) model is used to report compliance with limit values and provides NO₂ concentrations for a number of roads across the UK for a selection of future years. For the options appraisal assessment, the available data at the time of the assessment is the 2018 reference year, which is still the latest version of the PCM model.
- 6.3.28 Details on PCM links are presented in Section 5.5.12 and the compliance risk assessment is presented in Section 5.11.
- 6.3.29 This assessment methodology is consistent with the proposed approach for the ES.

6.4 Study area

- 6.4.1 For the construction phase the study area for assessing dust risk is limited to 200 metres from the scheme limits in accordance with DMRB LA 105²³.
- 6.4.2 The study area used to assess vehicle emissions during the construction and operation phases for the air quality assessment covers human health receptors and ecologically designated sites within 200 metres of roads that are expected to be affected by the scheme in accordance with DMRB LA 105.
- 6.4.3 For the local air quality assessment, DMRB LA 105 defines the affected road network (ARN) for the air quality assessment as all roads that trigger the traffic screening criteria and adjoining roads within 200 metres. The traffic screening criteria are:
- Annual average daily traffic (AADT) will change by $\geq 1,000$; or
 - Heavy duty vehicle (HDV) AADT will change by ≥ 200 ; or
 - A change in speed band; or
 - A change in carriageway alignment by $\geq 5\text{m}$.
- 6.4.4 The ARN used within this PEI Report is based on traffic data prepared for the scheme at the options appraisal stages which covered areas to the north-west of Newark-on-Trent, sections of the A1 around Newark-

⁵⁰ European Union. (April 2008). Directive on Ambient Air Quality and cleaner Air for Europe, Directive 2008/50/EC Official Journal, vol. 152, pp. 0001-0044 [online] available at: [Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe \(legislation.gov.uk\)](#) (last accessed November 2021).

on-Trent (from North Muskham to Fernwood) and the A46 as far north as Brough and as far south as Ratcliffe on the Wreake. Traffic forecasts are currently being updated to account for the latest design iterations. It is anticipated that the ARN for the scheme, based on the updated traffic forecasts, will cover a similar extent to that assessed at options appraisal stages. This will be confirmed within the ES.

6.5 Existing baseline

- 6.5.1 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 assessment completed for the PEI Report, data has been obtained from Newark and Sherwood District Council (NSDC), South Kesteven District Council (SKDC), National Highways and the Department for Environment, Food and Rural Affairs (Defra).
- 6.5.2 The effects associated with the coronavirus (Covid-19) pandemic during 2020 and 2021, when England was subject to full lockdowns, may have had an influence on the air quality monitoring data in the study area during these periods and therefore the data may not be representative of normal conditions at the monitoring sites and should be appraised with caution. To account for this, 2019 data has been used to determine baseline conditions, data from 2020 and 2021 is presented for reference only. Additionally, the assessment for the ES will also use the results from an ongoing National Highways scheme specific air quality monitoring survey which is due to be completed in November 2022.

Local air quality management

- 6.5.3 There are no current or historical air quality management areas (AQMA) declared within the administrative area of Newark and Sherwood, indicating NSDC have not monitored or modelled any exceedances of the air quality objectives at locations where there is relevant human exposure.
- 6.5.4 The closest AQMA to the scheme are the Nottingham City Council (NCC) AQMA located approximately 22 kilometres south-west of the scheme which encompasses the entirety of the NCC administrative area, and the SKDC No 6 AQMA located in the centre of Grantham approximately 21.5 kilometres south-east of the scheme. Both of these AQMA are declared for exceedances of NO₂ air quality objectives. The ARN for the scheme at the options appraisal phase did not extend into either of these AQMA. The nearest AQMA to the ARN at options appraisal stages was the NCC city wide AQMA located approximately 7 kilometres west of the A46 close to Bingham which was within the options appraisal ARN.

Automatic monitoring

6.5.5 NSDC does not undertake any automatic monitoring within the study area within their administrative boundary. Particulate matter with an aerodynamic diameter of less than 10 microns (PM₁₀) were monitored in the area at one location in the centre of Newark-on-Trent until 2018. There were no monitored exceedances of PM₁₀ at this site during the monitoring period and concentrations were well below annual and daily air quality objective levels.

Local authority diffusion tube monitoring

6.5.6 NSDC undertake diffusion tube monitoring at 13 sites within their administrative area. Of these sites, 12 are located within 0.7 kilometres of the scheme or to the ARN that was identified during options appraisal stages. The monitoring data collected at these locations are presented below in Table 6.4.

6.5.7 The data for 2020 and 2021 has been presented as it is available, but as discussed in paragraph 6.5.2, this data appears to have been affected by national lockdowns implemented during the Covid-19 pandemic as there is a large decrease from concentrations monitored in 2019. Therefore, the 2019 monitoring data has been used to determine the most recent baseline conditions at the scheme within PEI Report.

6.5.8 There were no exceedances of the NO₂ annual mean air quality objective in 2019. The highest concentration of 35.4µg/m³ was monitored at location 16N, which is located on Brunel Drive/Lincoln Road. This tube is located less than 10 metres away from the scheme alignment and 20 metres away from the closest receptor. The location of local authority monitoring data is presented on Figure 6.2 in Volume 2.

Table 6.4: Local authority diffusion tube monitoring

Site ID	British National Grid Coordinates		Site Type	Data Capture 2019 (%)	Annual Mean NO ₂ Concentration (µg/m ³)			
	X	Y			2018 ^(b)	2019 ^(a)	2020 ^(c)	2021 ^(d)
1N	479851	353692	Roadside	100.0	31.4	31.2	24.3	24.5
3N	481681	351500	Suburban	100.0	17.6	16.4	12.3	12.9
4N	477200	351900	Suburban	100.0	14.8	14.4	10.8	10.8
5N	480400	355000	Roadside	100.0	29.9	29.0	21.0	22.9
6N	480006	353892	Urban centre	100.0	21.6	21.2	16.0	16.9

Site ID	British National Grid Coordinates		Site Type	Data Capture 2019 (%)	Annual Mean NO ₂ Concentration (µg/m ³)			
	X	Y			2018 ^(b)	2019 ^(a)	2020 ^(c)	2021 ^(d)
7N	480153	353320	Kerbside	79.2	30.3	28.5	21.8	25.9
9N	479778	353621	Roadside	100.0	28.6	27.9	19.7	22.7
10N	479859	354223	Urban Background	100.0	21.2	20.6	14.7	16.6
11N	481460	355900	Urban Background	100.0	32.5	30.3	21.0	24.3
12N	479676	354016	Urban Centre	83.3	18.6	18.5	12.0	13.0
16N	481152	355589	Roadside	91.7	35.3	35.4	23.3	27.9
21N	480276	354029	Roadside	91.7	26.8	25.1	18.7	21.1

Source: 2022 Annual Status Report, Newark and Sherwood District Council.

Note: Results have been bias adjusted by NSDC.

^(a) Bias adjustment factor of 0.93.

^(b) Data capture for 2018 was unavailable.

^(c) Data capture for 2020 was between 33.2% and 66.8%, data capture affected by Covid-19 pandemic.

^(d) Data capture for 2021 was between 82.1% and 100%.

National Highways diffusion tube monitoring

6.5.9 A scheme specific diffusion tube monitoring survey was undertaken in 2016 to support the scheme. Monitoring was undertaken at 22 locations along the scheme alignment and surrounding areas. An update of this monitoring survey is currently being undertaken to support the ES. Monitoring commenced in May 2022 and is due to complete in November 2022. The results will be included in the baseline of the ES.

6.5.10 The results from the 2016 survey were bias adjusted and annualised to 2017 to support the assessment during options appraisal. The results from this survey are presented below in Table 6.5. There were no exceedances of the NO₂ annual mean air quality objective, and concentrations were generally low. The location of the National Highways monitoring data is presented on Figure 6.2 of Volume 2.

Table 6.5: National Highways scheme specific monitoring data

Site ID	British National Grid Coordinates		Site Type	Survey Period Data Capture	2017 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$) ^(a)
	X	Y			
A46NNB_001_121 5	4810 86	35581 4	Roadside	83.3	22.9
A46NNB_002_121 5	4810 91	35628 5	Kerbside	100	21.5
A46NNB_005_121 5	4824 04	35678 0	Roadside	83.3	20.2
A46NNB_006_121 5	4822 45	35686 8	Roadside	100	24.6
A46NNB_007_121 5	4832 80	35791 5	Roadside	83.3	14.1
A46NNB_008_121 5	4811 11	35555 1	Roadside	100	28.1
A46NNB_009_121 5	4806 20	35599 2	Roadside	100	17.4
A46NNB_012_121 5	4808 96	35532 1	Roadside	100	22.2
A46NNB_014_121 5	4806 70	35484 6	Kerbside	100	16.8
A46NNB_015_121 5	4803 50	35472 7	Kerbside	100	22.3
A46NNB_016_121 5	4797 81	35452 5	Roadside	100	15
A46NNB_017_121 5	4793 21	35450 1	Roadside	100	16.6
A46NNB_018_121 5	4791 77	35433 7	Roadside	83.3	15.9
A46NNB_020_121 5	4800 70	35422 9	Roadside	100	20.9
A46NNB_021_121 5	4795 51	35382 9	Roadside	100	21.8
A46NNB_022_121 5	4792 12	35337 6	Roadside	83.3	15.8
A46NNB_023_121 5	4782 40	35282 9	Roadside	83.3	15.1
A46NNB_024_121 5	4782 11	35256 9	Roadside	83.3	20.9
A46NNB_025_121 5	4778 07	35221 7	Roadside	100	15.6
A46NNB_026_121 5	4772 95	35178 0	Roadside	100	11.8
A46NNB_027_121 5	4770 14	35164 9	Roadside	100	11.2
A46NNB_028_121 5	4764 63	35450 7	Kerbside	83.3	10.3

Source: Atkins (2021) Assessment – A46 Newark Bypass.

Note: Results have been bias adjusted and annualised.

^(a) Bias adjustment factor of 0.93.

Defra projected background concentrations

6.5.11 Defra provides mapped future year projections of background pollution concentrations for NO_x, NO₂, PM₁₀ and PM_{2.5} for each 1 kilometre grid square across the UK for all years between 2018 to 2030⁵¹. The maps include a breakdown of background concentrations by emission source, including road and industrial sources, which have been calibrated against 2018 (the baseline year) UK monitoring data. The maximum concentrations from across the grid squares of the scheme alignment are presented below in Table 6.6. There are no exceedances of air quality objectives.

Table 6.6: Defra projected background concentrations across the scheme area

Year	Pollutant			
	NO _x	NO ₂	PM ₁₀	PM _{2.5}
2022	23.8	18.6	23.1	16.0

Source: Defra (2018)

Note: The background concentrations shown are for the 1 kilometre square centred on 481500, 355500.

Limit value compliance

6.5.12 Defra uses the Pollution Climate Mapping (PCM) model to report compliance with limit values as transposed into UK Law from Directive 2008/50/EC⁵². PCM projections are available for all years from 2018 to 2030 from the base year of 2018. The most recent PCM model was published in 2020.

6.5.13 There are no PCM links in the vicinity of the scheme alignment. There was one PCM link that coincided with the ARN during the assessment undertaken at options appraisal. This link was located on the A1 to the southwest of Grantham 21.3 kilometres southeast of the scheme. The concentration on this link is 25.0 µg/m³ in 2022 and is projected to be 17.4µg/m³ in the opening year of the scheme (2028).

Ecological designated sites

6.5.14 The habitat type, critical loads and background nitrogen deposition rates for designated sites sensitive to nitrogen within 200m of the ARN at the options appraisal stage are presented below in Table 6.7. It should be noted that these background deposition rates are from when the options appraisal assessment was undertaken and reflect

⁵¹ Defra Background maps (2018) [Online] Available at: <https://uk-air.defra.gov.uk/data/laqm-background-maps>

⁵² European Union. (April 2008). Directive on Ambient Air Quality and cleaner Air for Europe, Directive 2008/50/EC Official Journal, vol. 152, pp. 0001-0044 [online] available at: [Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe \(legislation.gov.uk\)](https://eur-lex.europa.eu/eli/dir/2008/50/oj) (last accessed November 2021).

the 2016-2018 APIS data. This data has since been updated and the updated APIS data will be used in the assessment for the ES.

Table 6.7: Habitat type, critical loads and background nitrogen deposition for designated sites

Site name	Designation	Habitat type	Critical load (kgN/ha/yr)	APIS 2016-18 background N-dep rate (max) (kg N/ha/yr)
A606 Woodland	LWS	Broadleaved, mixed and yew woodland	10	39.9
Balderton Dismantled Railway South	LWS	Neutral grassland	10	22.4
Beacon Hill Gypsum Workings	LWS	Neutral grassland	10	22.4
Borders Wood	LWS	Broadleaved, mixed and yew woodland	10	34.4
Coneygre Wood	LWS	Broadleaved, mixed and yew woodland	10	23.9
Crossroads Meadow, Hickling	LWS	Neutral grassland	10	23.2
Dairy Farm Railway Strip, Newark	LWS	Broadleaved, mixed and yew woodland	10	34.3
Devon Park Pastures	LNR	Neutral grassland	10	19.9
Devon Nurseries Grassland	LWS	Neutral grassland	10	19.9
Flintham Park	LWS	Broadleaved, mixed	10	32.1

Site name	Designation	Habitat type	Critical load (kgN/ha/yr)	APIS 2016-18 background N-dep rate (max) (kg N/ha/yr)
		and yew woodland		
Grantham Canal (Hollygate Bridge to Kinoulton)	LWS	Fen, marsh & swamp	10	20.3
Great North Road Grasslands	LWS	Neutral grassland	20	19.9
Hawton Civil War Fort	LWS	Neutral grassland	20	19.9
Hill Holt	LWS	Broadleaved, mixed and yew woodland	10	39.3
Jerico Farm Grassland	LWS	Neutral grassland	20	20.0
Kelham Hills	LWS	Broadleaved, mixed and yew woodland	10	34.3
Kelham Road Grassland II	LWS	Neutral grassland	20	19.9
Kelham Road Redoubt Grassland	LWS	Neutral grassland	20	19.9
Kelham Road Grassland	LWS	Neutral grassland	20	19.9
Langord Moor Area	LWS	Coniferous woodland	5	27.4
Lowfield Grassland, Balderton	LWS	Neutral grassland	20	22.4
Moorhouse Lane Drain	LWS	Fen, marsh & swamp	15	19.9

Site name	Designation	Habitat type	Critical load (kgN/ha/yr)	APIS 2016-18 background N-dep rate (max) (kg N/ha/yr)
Newark (Beet Factory) Dismantled Railway	LWS	Neutral grassland	20	19.9
Newark Grassland	LWS	Neutral grassland	20	19.9
Newark Golf Course	LWS	Acid grassland	10	19.2
Newark Dismantled Railway	LWS	Neutral grassland	20	19.9
Newark Trent Grassland	LWS	Neutral grassland	20	19.9
Old Dalby, Abattoir Hedgerow	LWS	Hedgerows	10	41.2
Ollerton Road Grasslands	LWS	Neutral grassland	20	19.9
Potter Hill Plantation	LWS	Broadleaved, mixed and yew woodland	10	23.9
Queen's Sconce, Newark	LWS	Acid grassland	10	19.9
Roehoe Wood	LWS	Broadleaved, mixed and yew woodland	10	34.4
Roehoe Wood Grassland	LWS	Neutral grassland	20	23.9
Saxondale Railway	LWS	Calcareous grassland	15	23.1
Six Hills Golf Course Hedgerows	LWS	Hedgerows	10	41.2

Site name	Designation	Habitat type	Critical load (kgN/ha/yr)	APIS 2016-18 background N-dep rate (max) (kg N/ha/yr)
South Scaffold Lane, Collingham	LWS	Hedgerows	10	39.3
Stanton Railway (including Stanton Tunnel Top)	LWS	Calcareous grassland	15	23.2
The Fleet, South Muskham	LWS	Fen, marsh & swamp	15	19.9
Thrussington Wolds Gorse – Scrub/Woodland	LWS	Broadleaved, mixed and yew woodland	10	42.8
Trent Banks/Wharves, Newark	LWS	Fen, marsh & swamp	15	20.4
Trent Banks/Wharves, Newark	LWS	Fen, marsh & swamp	15	19.9
Twenty Acre Piece	SSSI	Fen, marsh & swamp (Molinia caerulea - Cirsium dissectum fen-meadow)	15	23.9
Valley Farm Grassland	LWS	Neutral grassland	20	19.9
Veteran Tree	Veteran Tree	Broadleaved, mixed and yew woodland	10	39.4

Note: LWS: Local wildlife site, LNR: Local nature reserve, SSSI: Site of Special Scientific Interest.

Summary

6.5.15 There are no AQMAs in close proximity to the scheme and the available monitoring data for the area show no exceedances of air quality objectives. A scheme specific monitoring survey was

undertaken in 2016 which showed that air quality concentrations in the schemes surroundings is generally low. An update to this monitoring survey is being undertaken to support the EIA and will be reported in the ES.

6.6 Value (sensitivity of resources and receptors)

- 6.6.1 DMRB LA 105 provides the requirements for assessing and evaluating significant local air quality effects at receptors. 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 concentrations between the two scenarios is used to describe the magnitude of change which will be determined in line with Table 6.8 as per DMRB LA 105.
- 6.6.2 The larger the magnitude of change, the more certainty there is that there will be an impact as a result of the proposed scheme. Where the scheme impact on concentrations is less than 1% of the air quality threshold, then the change at these receptors is considered to be imperceptible, and these receptors are scoped out of the judgement on significance.

Table 6.8: 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 Measure of Uncertainty (MoU) value of 10% of the air quality objective (4µg/m ³).
Medium (>2)	Greater than half of the MoU (2µg/m ³), but less than the full MoU (4µg/m ³) of 10% of the air quality objective.
Small (>0.4)	More than 1% of objective (0.4µg/m ³) and less than half of the MoU i.e. 5% (2µg/m ³). The full MoU is 10% of the air quality objective (4µg/m ³).
Imperceptible (<= 0.4)	Less than or equal to 1% of objective (0.4µg/m ³).

- 6.6.3 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 from Table 2.91 of DMRB LA 105, presented below in Table 6.9.

Table 6.9: Guideline to number of receptors 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

- 6.6.4 Table 6.8 presents guideline bands, setting an upper level of likely non-significance and the lower level of likely significance, for the number of receptors affected by the scheme.
- 6.6.5 Between these two levels are the ranges where likely significance is more uncertain, therefore professional judgement is required. Where the total number of receptors are less than the lower guideline band for all of the six magnitude of change categories, the scheme is unlikely to trigger a significant air quality effect for human health. Where the total number of receptors are greater than the upper guideline band in any of the magnitude categories the scheme will trigger a significant air quality effect.
- 6.6.6 If a scheme results in effects where the number of receptors falls between the lower and upper guideline bands for any of the magnitude of change criteria, the information in Table 6.8 is used along with the following key criteria to determine the overall evaluation of local air quality significance:
- The absolute concentration at each receptor, for example is the modelled concentration $40 \mu\text{g}/\text{m}^3$.
 - How many receptors are there in each of the magnitude of change criteria, for example does the project create more worsening than improvements.
 - The magnitude of change in concentration at each receptor, for example $0.6 \mu\text{g}/\text{m}^3$ vs $1.8 \mu\text{g}/\text{m}^3$.
- 6.6.7 For designated sites, the assessment of significance is undertaken following the approach set out in Figure 2.98 of DMRB LA 105. If required, a competent expert for biodiversity will review concentrations and conclude whether changes are likely to trigger a significant air quality effect.

6.7 Potential impacts

Construction

- 6.7.1 The construction period for the scheme is currently expected to last approximately 3 years. The main risks to sensitive receptors during the construction phase include the generation of dust arising from construction activities which can lead to nuisance at nearby receptors. Dust can be mechanically transported, either by wind or re-suspension via vehicles. It can also arise from wind erosion on material stockpiles and earth moving activities.
- 6.7.2 In addition, the construction phase will introduce additional construction vehicle movements to the road network and traffic management which have the potential to affect traffic flows and speeds. This has the potential to directly affect ambient concentrations of NO₂ and PM₁₀ (for human health receptors) and NO_x and nitrogen deposition (for ecological receptors).
- 6.7.3 Construction can require the use of different equipment such as excavators, cranes and on-site generators. All construction plant has an energy demand; with some plant resulting in direct emissions to air from exhausts.

Operation

- 6.7.4 The operational phase of the scheme has the potential to directly affect ambient concentrations of NO₂ and PM₁₀ (for human health receptors) and NO_x and nitrogen deposition (for ecological receptors) through:
- Changes in emissions associated with changes in traffic flows and speeds on the affected road network.
 - Changes in road layout which may bring road traffic emission sources closer to, or further away from, sensitive receptors.

6.8 Consultation

- 6.8.1 Non-statutory public consultation took place between 9 December 2020 and 2 February 2021. Stakeholders relevant to air quality who were contacted as part of the consultation included:
- Nottinghamshire County Council and Lincolnshire County Council
 - Newark and Sherwood District Council
 - Nottingham City Council
 - Landowners and local residents
 - Local businesses (where appropriate)
 - Developers (where appropriate)
- 6.8.2 Environmental themes that arose out of the public consultation included, but were not limited to, concerns regarding possible

increases in the levels of air pollution as a result of the scheme and associated proposed mitigation.

- 6.8.3 Consultation with local authority Environmental Health Officers (EHOs) will be progressed through the key stakeholder engagement exercises as part of the ES. A meeting with the Newark and Sherwood District Council EHOs was held on the 14 September 2022 where air quality was discussed. There were no requests from Newark and Sherwood District Council as a result of this meeting.

6.9 Assumptions and limitations

- 6.9.1 The assessment presented within this PEI Report is based on outputs from the air quality assessment produced for the options appraisal stage. This was an earlier iteration of the scheme design which is subsequently being updated. The historical assessment data will be updated and will form the basis of the assessment undertaken for the ES.
- 6.9.2 Since the options appraisal assessment has been undertaken, there have been updates to Defra Emissions Factor Toolkit (EFT) and the subsequent emissions used for National Highways speed bands and NO_x to NO₂ calculator. It is not expected that the updates to these tools will materially change the conclusions from the options appraisal assessment. The updated Defra tools will be used in the assessment undertaken for the ES.
- 6.9.3 Air quality modelling predictions are 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 model predictions, including:
- Uncertainties with previous and future traffic forecasts.
 - Uncertainties with vehicle emission predictions.
 - Uncertainties with background air quality data.
 - Simplifications made within screening tool calculations or post processing of the data that represent atmospheric dispersion or chemical reactions.
- 6.9.4 In order to best manage these uncertainties, the air quality assessment during the options appraisal stage was undertaken with model verification against the available monitoring data. The verification was undertaken in line with best practice guidance produced by Defra.
- 6.9.5 In order to best manage these uncertainties, the air quality assessment during the options appraisal stage was undertaken with model verification against the available monitoring data. The verification was undertaken in line with best practice guidance produced by Defra. It should be noted that at options appraisal stages ammonia was not

considered as part of the nitrogen deposition assessment at ecological receptors. However, following recent consultation responses from Natural England on other schemes, ammonia will likely be required to be modelled during the assessment for the ES. At this stage it cannot be determined if assessing ammonia will result in a change to the conclusions of the assessment presented within the ES when compared with this PEI Report.

- 6.9.6 The assessment to be undertaken which will form part of the ES will undergo model verification and will be verified using the air quality measurements from the National Highways monitoring survey due to complete in November 2022, as well as any local authority data that is within the ARN study area and has suitable data capture.

6.10 Design, mitigation and enhancement measures

Design

- 6.10.1 The development of the scheme design is an iterative process undertaken as part of an integrated design team to adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA 104. The first principle being to avoid adverse effects, if at all possible, before seeking to minimise or mitigate any unavoidable impacts through a well-developed mitigation strategy. Embedded mitigation incorporated into the scheme design development to date is outlined in Chapter 2 Section 2.6 of this report.

Mitigation – construction

- 6.10.2 To mitigate against construction dust effects at receptors, the construction works will be carried out in accordance with Best Practicable Means (BPM), as described in Section 79(9) of the Environmental Protection Act 1990, to reduce emissions which may affect air quality. Mitigation measures will be proportionate to the level of construction dust risk identified within the assessment and could include, but are not limited to, the following:
- Avoid double handling of materials.
 - Minimise height of stockpiles and profile to minimise wind-blown dust emissions and risk of pile collapse.
 - Locate stockpiles out of the wind (or cover, seed or fence) to minimise the potential for dust generation.
 - Ensure that all vehicles with open loads of potential dusty materials are securely sheeted or enclosed.
 - Provide a means of removing mud and other debris from wheels and chassis of vehicles leaving the site. This may involve a simple coarse gravel running surface or jet wash, or in the case of a heavily used exit point, wheel washers.
 - Maintain a low speed limit on site to prevent the generation of dust by fast moving vehicles.

- Damp down surfaces in dry conditions.
- Spray water during cutting/grinding operations (for example, cutting kerbs).
- Switch off all vehicle engines and plant motors when not in use.

6.10.3 Full details of all mitigation measures will be included within the ES and the Second Iteration EMP.

Mitigation – operation

6.10.4 Based on the outputs of the previous air quality assessment, which concluded there were no significant air quality effects, and on a review of the baseline conditions within the study area as part of this PEI Report, it is considered unlikely that operational mitigation measures will be required.

6.10.5 This will be reviewed and confirmed following the assessment undertaken for the ES.

Enhancement measures

6.10.6 Enhancement measures will be considered as part of the ongoing design development and will be reported in the ES. However, these enhancement measures will not be taken into account when determining whether effects are significant or not.

6.11 Assessment of effects

6.11.1 This section summarises the key construction and operation impacts predicted by the air quality assessment undertaken at the options appraisal stage. The assessment will be updated and reported within the ES once the new traffic data has been made available.

Construction

6.11.2 The construction phase is expected to last approximately 3 years and could affect local air quality through the generation and subsequent deposition of construction dust arising from construction activities and vehicle movements. A construction assessment was undertaken in accordance with DMRB LA 105, which involves identifying the construction dust risk potential of a scheme and sensitive receptors within 200 metres of the works. Figure 6.3 contained in Volume 2 shows the 200 metres construction buffer where sensitive receptors have been identified⁵³. At this stage it was not known where the site compound would be located and therefore only the construction boundary associated with the scheme alignment in relation to sensitive receptors was considered. Indicative locations of site compounds have

⁵³ Construction dust boundary did not include areas of the scheme where there is no risk of dust raising activities, such as the Kelham-Averham floodplain compensation area.

since been identified and these will be taken into consideration in the assessment reported in the ES.

- 6.11.3 In association with Table 2.58a of DMRB LA 105, the scheme has a large construction dust risk potential due to it being a bypass scheme with major junction improvements.
- 6.11.4 Receptor counts within 200 metres of the works have been undertaken to determine the receiving environment sensitivity. The counts are presented below in Table 6.10. There are 76 receptors within 50 metres of the works. The greatest proportion of the total number of receptors identified (560) are within 100 – 200 metres of the construction works.

Table 6.10: Construction dust receptor counts

Distance from construction activities (metres)	Number of sensitive receptors
0 – 50	76
50 – 100	156
100 – 200	560

- 6.11.5 The construction dust risk potential based on the proximity of sensitive receptors and risk potential of the scheme is 'high' in accordance with table 2.58b of DMRB LA 105. However, with the implementation of appropriate mitigation measures for a high-risk site, air quality impacts from the construction phase of the scheme are not expected to be significant.

Operation

- 6.11.6 This section presents results where the highest NO₂ concentrations and greatest effects are predicted and was undertaken with the existing tools available at the time. Based on DMRB LA 105, effects are only likely to be considered significant where air quality objectives are exceeded.

Human health

- 6.11.7 Predicted NO₂ concentrations at the worst affected receptors as part of the option appraisal assessment are presented in Table 6.11.
- 6.11.8 Overall, the results demonstrate that there are no receptors that experience an exceedance of the annual mean quality objectives in either the Do-Minimum or Do-Something scenario. As such it was also concluded there were no exceedances of the 1-hour NO₂ objective as a result of the scheme and therefore the effect on human health was not significant.

- 6.11.9 Overall, the scheme is predicted to reduce traffic flows in the centre of Newark-on-Trent. Flows on the A46 are predicted to increase as a result of the increased lanes and junction improvements. These increased flows result in small deteriorations in NO₂ concentrations along the existing A46 alignment.
- 6.11.10 Modelled results predict that there will be reductions in annual mean NO₂ concentrations on the B6166 Farndon Road, North Gate and Lincoln Road. There are also decreases in NO₂ concentrations predicted on the A1 as a result of the scheme. The biggest reduction along North Gate in the centre of Newark-on-Trent is a change of 1.7 µg/m³ in the Do-Something at R106. The resulting concentration remains well below the annual mean objective in the Do-Minimum and Do-Something scenarios.
- 6.11.11 Traffic is predicted to increase on the B6326 Great North Road, which is located that is close to the junction improvement works at Cattle Market Junction, which is to undergo junction improvements as a result of the scheme. The receptor with the greatest increase in annual mean NO₂ concentrations is R57, located at Cattle Market Junction. This receptor was predicted to experience an increase in annual mean concentrations of 1.9 µg/m³ resulting in a Do-Something annual mean NO₂ concentration of 20.7 µg/m³, which is well below the annual mean objective.
- 6.11.12 The modelled receptor with the highest predicted annual mean NO₂ concentration in the Do-Something scenario is R164. R164 is located within the current A46/A1/A17 junction and was predicted to have a concentration of 26.1 µg/m³. The scheme moves traffic from the A46 further north of this receptor due to the proposed changes in the alignment of the A46, which contributes to a decrease 3.9 µg/m³ and is the largest predicted decrease across all of the modelled receptors. Whilst the scheme design is currently evolving, the movement of this junction further north is consistent with the latest version of the scheme design and so it is expected that similar changes will be expected when the updated assessment is completed.

Table 6.11: Annual Mean NO₂ concentrations at most affected receptors

Receptor	Location	NO ₂ annual mean concentration (µg/m ³)			
		2017 Base Year	2028 Do-Minimum	2028 Do-Something	Change (Do-Minimum to Do-Something)
R51	Castle View Court, Mather Road,	25.7	17.9	19.5	1.6

Receptor	Location	NO ₂ annual mean concentration (µg/m ³)			
		2017 Base Year	2028 Do-Minimum	2028 Do-Something	Change (Do-Minimum to Do-Something)
	Newark-on-Trent				
R55	The Ossington, Beast Market Hill, Newark-on-Trent	29.1	20.2	21.5	1.3
R57	Midland House, Great North Road, Newark-on-Trent	27.3	18.8	20.7	1.9
R58	79, Fosse Road, Farndon	14.9	10.8	10.7	-0.1
R69	North Gate, Newark-on-Trent	27.3	19.4	18	-1.4
R77	27, Pooh Corner, North Gate, Newark-on-Trent	30.1	21.1	19.8	-1.3
R80	Bridgend Cottage, Bridgend, Blacksmith Lane, Kelham	22.5	16	17.3	1.3
R106	134, North Gate, Newark-on-Trent	28.4	20.5	18.8	-1.7
R120	70, The Elms, Newark-on-Trent Road, Coddington	33.9	25.4	24.5	-0.9
R151	79, Low Wood	28.3	21	21.2	0.2

Receptor	Location	NO ₂ annual mean concentration (µg/m ³)			
		2017 Base Year	2028 Do-Minimum	2028 Do-Something	Change (Do-Minimum to Do-Something)
	Lodge, Gainsborough Road, Winthorpe				
R164	The Lodge, Fosse Road, Winthorpe	41.4	30	26.1	-3.9
R206	3, Dryden Avenue, Balderton	30.7	22.9	22.1	-0.8

Ecological effects

- 6.11.13 The assessment undertaken at options appraisal stages found that there were no exceedances of the NO_x annual critical level at any of the ecological designations assessed.
- 6.11.14 Nitrogen deposition was calculated at all ecological designations that were deemed sensitive to nitrogen. There were no significant effects at the designated sites: Twenty Acre Piece SSSI or the Devon Park Pastures LNR.
- 6.11.15 There was potential for significant effects at four LWSs with changes above the screening criteria of 1% of the nitrogen critical loads as a result of the scheme. These sites were:
- Newark (Beet Factory) Dismantled Railway LWS
 - Dairy Farm Railway Strip, Newark LWS
 - Trent Banks/Wharves, Newark LWS
 - Flintham Park LWS
- 6.11.16 These sites were assessed by a biodiversity expert during the options appraisal stage with all effects deemed to be not significant. This assessment will be revisited during the ES based on the updated traffic data for the proposed scheme alignment and if appropriate include contributions of ammonia from vehicle emissions.

Limit Value Compliance

- 6.11.17 There was one PCM link that coincided with the ARN during the assessment undertaken at options appraisal. This link was located on the A1 (Census ID: 802075200) to the southwest of Grantham 21.3 kilometres southeast of the scheme. The concentration on this link is

31.7 $\mu\text{g}/\text{m}^3$ in the PCM model reference year of 2018 and is projected to be 17.4 $\mu\text{g}/\text{m}^3$ in the opening year of the scheme (2028).

- 6.11.18 The PCM link is located entirely within a junction. The assessment undertaken at options appraisal determined that in accordance with DMRB LA 105 there were no qualifying features within 15 metres of a running lane or within 25 metres of the junction. No further compliance risk assessment was required.
- 6.11.19 The risk of non-compliance is therefore very low. The compliance risk assessment will be undertaken in the assessment for the ES.

6.12 Monitoring requirements for significant adverse effects

- 6.12.1 No significant effects were predicted at the options appraisal stage and whilst the assessment will be updated for the ES, these conclusions are not expected to change. Therefore, no further air quality monitoring is proposed for the scheme.

6.13 Conclusions

- 6.13.1 This chapter provides a summary of the assessments that have been undertaken so far of the potential air quality effects of the scheme in accordance with DMRB LA 105.
- 6.13.2 Some construction activities would be likely to generate dust, which has the potential to cause annoyance at nearby properties if uncontrolled. These effects would be mitigated through the implementation of best practicable means included within the Second Iteration EMP.
- 6.13.3 Operational air quality effects have been predicted on a worst-case basis at receptors using the ADMS-roads dispersion model at options appraisal stages.
- 6.13.4 No significant air quality effects at human health or ecological receptors were identified at the options appraisal stage and it is not anticipated that there is a risk to limit value compliance. It should be noted that ammonia was not considered within the nitrogen deposition assessment undertaken at ecological receptors. However, following recent consultation responses from Natural England, this will be undertaken during the assessment for the ES which could impact the conclusions of the assessment.
- 6.13.5 The scheme is not considered to conflict with any national or local policy and is considered to satisfy the requirements within the NPSNN.
- 6.13.6 An update to this assessment will be undertaken based on updated traffic data for the scheme, which accounts for the final design, once it

is available. This will be reported within the ES that will be submitted to support the DCO application.

7 Cultural Heritage

7.1 Introduction

7.1.1 This chapter presents the on-going work for the assessment of the potential effects upon the cultural heritage resource that are anticipated from the construction and operation of the proposed scheme and outlines proposed measures to help mitigate these potential effects.

7.1.2 The cultural heritage resource can be defined as a building, monument, site, place, area or landscape identified as having a degree of significance (termed value/sensitivity in this report) meriting consideration in planning decisions, because of its heritage interest. These heritage assets can include:

- Designated heritage assets which are afforded statutory protection, such as Scheduled Monuments, Listed Buildings, Registered Park and Gardens, Registered Battlefields and Conservation Areas.
- Non-designated heritage assets such as buildings, monuments, sites, places, areas and landscapes identified by plan-making bodies as having a degree of heritage significance meriting consideration in planning decisions but which do not meet the criteria for designated heritage assets.

7.1.3 The assessment has been undertaken in accordance with Design Manual for Roads and Bridges (DMRB) LA 104 Environmental assessment and monitoring⁵⁴ and LA 106 Cultural heritage assessment⁵⁵. Further detailed assessment is currently underway and will be reported within the Environmental Statement (ES) that will be submitted to support the Development Consent Order (DCO) application for the scheme.

7.2 Legislation and policy context

7.2.1 The following legislation and policy are relevant to the proposed scheme.

Legislation

Planning (Listed Buildings and Conservation Areas) Act 1990

7.2.2 This act sets out the protection given to buildings of special architectural or historic interest through listing. It also sets out the process for designation of conservation areas. The scheme could have potential effects on Listed Buildings and Conservation Areas.

⁵⁴ DMRB (2020) LA 104 [online] available at: <https://standardsforhighways.co.uk/dmrb/search/0f6e0b6a-d08e-4673-8691-cab564d4a60a> (last accessed August 2022)

⁵⁵ DMRB (2020) LA 106 [online] available at: <https://www.standardsforhighways.co.uk/dmrb/search/8c51c51b-579b-405b-b583-9b584e996c80> (last accessed August 2022)

Ancient Monuments and Archaeological Areas Act, 1979

- 7.2.3 This act relates to the investigation, preservation and recording of matters of archaeological and historic interest. The scheme could have potential effects on scheduled monuments and important archaeological deposits.

National policy

National Policy Statement for National Networks (NPSNN)

- 7.2.4 The NPSNN sets out the need for, and the Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks in England. Chapter 5, paragraphs 5.120 to 5.142 set out the approach for impact assessment, decision making and recording for the Historic Environment.
- 7.2.5 Most relevant to the scheme are paragraphs 5.126 and 5.127 which state that where development is subject to EIA the applicant should undertake an assessment of any likely significant heritage impacts. This should include a description of the significance of any heritage assets affected including any contribution made by their setting. The level of detail should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on their significance. Consent should not be granted unless it can be demonstrated that any substantial harm or loss of significance is necessary in order to deliver substantial public benefits that outweigh that loss or harm.

National Planning Policy Framework (NPPF)

- 7.2.6 Chapter 16 (paragraphs 189-208) of the NPPF sets out a framework for the management of the historic environment and provides guidance for proposals affecting heritage assets.

25 Year Environment Plan

- 7.2.7 The Department for Environment, Food & Rural Affairs (Defra) 25 Year Environment Plan (2018)⁵⁶ is a policy paper setting out what Government will do to improve the environment, including restoring and safeguarding wildlife habitats. This plan is being treated as the first Environmental Improvement Plan required under the Environment Act 2021. The plan sets out aims to conserve and enhance the beauty of our natural environment, and make sure it can be enjoyed, used by and cared for by everyone by:

⁵⁶ HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online] available at: 25 Year Environment Plan - GOV.UK (www.gov.uk) (last accessed October 2022).

- Safeguarding and enhancing the beauty of our natural scenery and improving its environmental value while being sensitive to considerations of its heritage.

Local policy

Newark & Sherwood Plan Review – Amended Core Strategy, 2019

- 7.2.8 The Amended Core Strategy sets out the District Council’s spatial policy framework for delivering the development and change needed to realise the District Council’s vision for the District up to 2033. The document sets out Spatial and Core strategies for the protection of Heritage in particular Spatial policies 3 and 9 and Core policies 5, 7 and 14: Guidance and standards

National Highways policy

- 7.2.9 Cultural heritage is one of the environmental topic areas where the six strategic levers of the National Highways’ Environment Strategy will be applied. The strategic levers will make a contribution towards the organisation’s environment vision.

7.3 Assessment methodology

- 7.3.1 The assessment methodology for this chapter has been established in accordance with the following standards and guidance:
- Standard and guidance for historic environment desk-based assessment (Chartered Institute for Archaeologists, 2020): This guidance seeks to define good practice for the execution and reporting of historic environment desk-based assessment in line with the regulations of ClfA, in particular the Code of conduct.
 - Conservation Principles, Policies and Guidance (Historic England, 2008): This guidance seeks to support the quality of decision-making, w A46 Env Survey Schedule Report ith the ultimate objective of creating a management regime for all aspects of the historic environment that is clear and transparent in its purpose and sustainable in its application.
 - Good Practice Advice in Planning Note 2: Managing Significance in Decision-Taking in the Historic Environment (Historic England, 2015): The purpose of this guidance is to provide information on good practice to assist local authorities, planning and other consultants, owners, applicants and other interested parties in implementing historic environment policy in the National Planning Policy Framework and the related guidance given in the National Planning Practice Guide.
 - Good Practice Advice in Planning Note 3: The Setting of Heritage Assets (Historic England, 2017): This document sets out guidance, against the background of the National Planning Policy Framework and the related guidance given in the Planning Practice Guide, on managing change within the settings of heritage assets, including

archaeological remains and historic buildings, sites, areas, and landscapes.

- Historic England Advice Note 12: Statements of Heritage Significance: Analysing Significance in Heritage Assets (Historic England, 2019): This advice note covers the National Planning Policy Framework requirement for applicants for heritage and other consents to describe heritage significance to help local planning authorities to make decisions on the impact of proposals for change to heritage assets. Understanding the significance of heritage assets, in advance of developing proposals enables owners and applicants to receive effective, consistent and timely decisions.
- Principles of Cultural Heritage Impact Assessment in the UK (Institute of Environmental Management and Assessment, Chartered Institute for Archaeologists and Institute of Historic Building Conservation, July 2021): Guiding principles to supplement existing guidance and give a consistent framework for cultural heritage impact assessment in a variety of settings. The application of these principles and good practice will enable practitioners to improve the standard of their assessments, regardless of their specialism within the discipline.
- Planning Practice Guidance – Historic Environment (Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, 2019): Advises on enhancing and conserving the historic environment.
- DMRB LA 106 Cultural Heritage sets out the requirements for environmental assessment of projects, including reporting and monitoring of significant adverse environmental effects.

7.3.2 As this scheme is in the early stages of assessment, limited in depth desk-based analysis has been undertaken (see section 7.3.3 and 7.3.5). A summary baseline and initial impact assessment has been undertaken based on up to date National Heritage List for England (NHLE) data, Nottinghamshire Historic Environment Record (HER) data from August 2022 and an initial walkover survey undertaken in March 2022. The NHLE data is shown in Figure 7.1, the HER data is divided between two figures showing non designated assets in Figure 7.2 and events in Figure 7.3 all of which are contained in Volume 2.

7.3.3 Following this PEI Report, a full baseline and impact assessment will be developed for the inclusion within the ES. This will be informed by:

- Continuing consultation with the relevant stakeholders (see Section 4.2 and 7.8)
- NHLE data
- HER data
- Setting assessment of heritage assets
- Any relevant images prepared by the landscape team utilising the Zone of Theoretical Visibility (ZTV)
- Further archaeological walkover survey
- Fieldwalking and metal detecting surveys

- Geophysical survey
- Geoarchaeological assessment
- A programme of trial trenching (if undertaken prior to the DCO submission).

7.3.4 The setting of heritage assets will be considered in the ES to determine any significant effects on these assets from the scheme and enable appropriate mitigation to be designed. These will continue to be discussed with the relevant stakeholders as per Section 7.8.

Baseline and surveys

7.3.5 The following steps will be followed to develop an understanding of the heritage assets surrounding the scheme and the impacts upon them from its construction and operation:

- Production of a detailed historic environment desk-based assessment (DBA) in line with DMRB, to determine the nature, extent, and significance of the historic environment within the scheme study area. This will include archaeological remains, historic buildings and historic landscapes.
- Field work surveys to further determine the potential for and extent of any unknown archaeological features. These will include geophysical survey, geoarchaeological survey and metal detector and fieldwalking survey.

7.3.6 More in depth analysis of the design of the scheme will be required in order to understand the potential impacts on listed buildings, Conservation Area and known and unknown archaeological remains. This will include consulting the ZTV produced by the Landscape team.

Assessment of value/sensitivity

7.3.7 The value and sensitivity of historic environment assets will be based on Table 7.1 below. The 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 and principles of selection criteria for listed buildings.

7.3.8 It will also recognise that occasionally some sites have a lower or higher than normal sensitivity within a local setting. The assessment of sensitivity therefore needs to take into account the part of the site that is being affected and the ability of the site to absorb change without compromising the understanding or appreciation of the historic environment.

Table 7.1: Criteria for assessing value/sensitivity

Value	Typical criteria
Very High	Very high importance and rarity, international scale and very limited potential for substitution. These include World Heritage sites, assets of acknowledged international importance, assets that can contribute significantly to acknowledged international research objectives.
High	High importance and rarity, national scale, and limited potential for substitution. Scheduled monuments, Grade I, II* and II Listed Buildings, Registered Parks and Gardens, Conservation Areas and Registered Battlefields where the asset and its setting retain archaeological, architectural and artistic, and historic interest which contributes to their value. Non-designated 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	Medium importance and rarity, regional scale, limited potential for substitution. Registered Parks and Gardens, Conservation Areas and Registered Battlefields where the asset and its setting retain less archaeological, architectural, artistic and/or historic interest which contributes to a lesser extent of their value. Non-designated sites of regional importance identified through research or survey, monuments or sites that can be shown to have important qualities in their fabric or historical association.
Low	Low or medium importance and rarity, local scale. Non-designated assets – buildings, structures, monuments, or archaeological sites with a local importance for education or cultural appreciation, and which add to local archaeological and historic research. Very badly damaged assets that are of such poor quality that they cannot be classed as high or medium, parks and gardens of local interest
Negligible	Very low importance and rarity, local scale. Heritage resources identified as being of little historic, archaeological, architectural and artistic interest, resources whose importance is compromised by poor preservation or survival or by contextual associations to justify inclusion into a higher grade.

Source: Adapted from DMRB LA 104

Assessment of magnitude of impact

7.3.9 The magnitude of impact on the heritage asset from the scheme will be assessed in accordance with the criteria presented in Table 7.2 below.

Table 7.2: Criteria for assessing the magnitude of impact

Magnitude		Criteria
Major	Adverse	Total loss or fundamental alteration to a heritage asset's value or setting so that the quality and integrity of the resource is lost. Addition of new features that substantially and detrimentally alter the setting of a heritage asset.
	Beneficial	Changes that are extremely beneficial to the heritage value of the asset. Comprehensive changes to the setting of the asset which greatly reveal and enhance its heritage value.
Moderate	Adverse	Partial loss or alteration to a heritage asset or its setting but not adversely affecting its integrity. 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.
	Beneficial	Changes that are beneficial to the heritage value of the asset. Changes that result in the setting of the asset being noticeably enhanced and improving the ability to understand the asset and its historic context and setting.
Minor	Adverse	Minor loss of an element of a heritage asset 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.
	Beneficial	Changes that have a limited benefit to the heritage value of the asset. Changes to the setting of the asset which have a slight beneficial impact on heritage value and enhance the ability to understand the asset its historic context and setting.
Negligible	Adverse	Very minor loss of elements of a heritage asset or its setting. Addition of new features that do not alter the setting of a heritage asset.
	Beneficial	Very minor enhancements to the heritage asset or its setting that help slightly to better reveal the asset's heritage value.
No change		No change to the heritage asset.

Source: Adapted from DMRB LA 104

Significance of effect

7.3.10 Effects will be evaluated by combining the assessment of both the value/sensitivity (significance) of an asset, with the magnitude of the impact. This allows the prediction of the significance of the effect, as shown in Table 7.3. These effects can be beneficial or adverse; and temporary or

permanent, depending on the nature of the development, the mitigation measures, and any enhancement measures proposed.

Table 7.3: Significance matrix

Heritage Value	Magnitude of impact					
		No change	Negligible	Minor	Moderate	Major
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: Adapted from DMRB LA 104

Standards and guidance

7.3.11 The method for determining and appraising baseline conditions will involve both desk study and baseline survey. The assessment will be undertaken in accordance with the published standards and guidance set out below:

- Chartered Institute for Archaeologists (CIfA), Standards and Guidance (updated 2020).
- CIfA, IHBC and IEMA (2021) Principles of Cultural Heritage Impact Assessment.
- Transport Analysis Guidance (TAG) Environmental Impact Appraisal (TAG Unit A3).
- Design Manual for Roads and Bridges (DMRB), LA 104 'Environmental assessment and monitoring' and LA 106 'Cultural Heritage' (updated 2020).
- Historic England, Conservation Principles (2008).
- Historic England, Good Practice Advice in Planning Note 2: Managing Significance in the Decision-Taking in the Historic Environment (2015).
- Historic England, Good Practice Advice in Planning Note 3: The Setting of Heritage Assets (2017).
- Historic England Statements of Heritage Significance: Note 12 Analysing Significance in Heritage Assets (2019).

7.4 Study area

7.4.1 DMRB LA 106 Cultural heritage assessment⁵⁷ states that the assessment shall define a study area according to the sensitivity of the

⁵⁷ DMRB (2020) LA 106 [online] available at: <https://www.standardsforhighways.co.uk/dmrB/search/8c51c51b-579b-405b-b583-9b584e996c80> (last accessed August 2022)

environment and the potential impacts of the project. Where a new road or road improvement is proposed, the study area shall include the footprint of the scheme plus any land outside that footprint which includes any heritage assets which could be physically affected. The study area should also include the settings of any designated or other cultural heritage resource in the footprint of the scheme or within the zone of visual influence.

7.4.2 The following study areas have been used to gather information on the heritage receptors (assets) which have the potential to be affected by the scheme:

- Designated heritage assets have been assessed within the footprint of the scheme, plus a 1 kilometre radius buffer around the scheme footprint. This is considered proportionate as the potential for designated assets to be impacted through changes to setting beyond 1 kilometre from the scheme is considered low. This is because woodland to the north and east, dense settlement to the west, general vegetation cover and rising topography to the north and south, limits visibility of the scheme within the surrounding landscape. Therefore, the level of potential change to the setting of designated assets located over 1 kilometre from the scheme footprint is unlikely to result in significant effects to the heritage value of these assets (subject to paragraph 7.4.3 below).
- Non-designated heritage assets have been assessed within the footprint of the scheme, plus a 500 metre radius buffer around the scheme footprint. This study area allows a consideration of all known archaeological remains within 500 metres of the scheme which may indicate the potential for further unrecorded archaeological remains to survive within the scheme footprint. The 500 metre study area is also considered a wide enough area to take into account any changes and alterations to the setting of locally listed and non-designated buildings, which would result in significant effects to the heritage value of these assets. The level of potential change to the setting of non-designated historic buildings located over 500 metres from the scheme footprint is unlikely to result in significant effects.

7.4.3 Further refinement of the study area may be undertaken, following the findings of field studies and any inputs from key stakeholders. The emphasis would be on a proportionate and reasonable approach to the area over which the effects of the scheme are considered likely to occur.

7.4.4 Further to this a Zone of Theoretical Visibility (ZTV) will be produced to inform the Landscape and Visual Impact Assessment. The ZTV will also be used to identify sensitive cultural heritage assets beyond the 1 kilometre study area that may be affected by the scheme due to a change in setting. This extended study area will allow a full understanding of the context and setting of the heritage assets identified, facilitating an assessment of the potential effects of the scheme during construction and operation.

7.5 Existing baseline

7.5.1 The following summary outlines the known cultural heritage baseline within 1 kilometre of the scheme. The cultural heritage baseline is also illustrated in Figures 7.1 to 7.3 contained in Volume 2.

Topography and geology

7.5.2 The solid geology of the study area as mapped by the British Geological Survey (BGS) is predominantly mudstone of the Mercia, Edwalton and Gunthorpe members, formed in the Triassic period. Superficial deposits are made up of alluvium – clay, silt and sand – with the River Trent running from north-east to south-west through the study area⁵⁸.

7.5.3 Being almost entirely within the floodplain of the River Trent, the topography of the study area is generally flat, at around 10 metres Above Ordnance Datum (AOD). Soils are characterised as loamy and clayey floodplain soils with naturally high groundwater.

Archaeological and historical background

7.5.4 A considerable number of designated and non-designated heritage assets identified within the study area are located within the built-up urban area of Newark-on-Trent.

7.5.5 A full description of the archaeological and historical background will be provided within the ES which will include assets identified by fieldwork, including geophysical survey, geoarchaeological survey, metal detecting, field walking, and trial trenching.

7.5.6 A full setting assessment will be undertaken for heritage assets and will be provided in the ES. ne

7.5.7 The following cultural heritage baseline is compiled from the NHLE and HER. It is restricted to areas of the scheme where impacts are most likely to occur or where assets give additional knowledge of potential for previously unrecorded finds:

Designated heritage assets

7.5.8 There are 17 Scheduled Monuments, Seven Grade I Listed Buildings, 15 Grade II* Listed Buildings, 387 Grade II Listed Buildings, one Grade II Registered Park and Garden, and 5 Conservation Areas within the 1 kilometre study area (see Figure 7.1 contained in Volume 2).

7.5.9 The Scheduled Monument and Grade I Listed Building of Newark Castle (SM: 1003474/LB: 1196278) was originally constructed in the Medieval period although evidence of earlier occupation and use of the site has been

⁵⁸ BGS (2022) Geology of Britain Viewer [online] available at: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> (last accessed June 2022)

identified. Church of St. Mary Magdalene (LB: 1279450) was first constructed in the 12th Century and all major features relate to the medieval period including the spire which can be seen from Cattle Market roundabout. The medieval scheduled monument of Averham Moated Site (SM: 1017687) lies to the south of the scheme at Kelham.

7.5.10 Several English Civil War redoubts (a type of temporary fortification) and siege works are identified along the route. The heritage assets most likely to see an impact to their value/sensitivity due to a change in their setting are the Civil War redoubt 680 metres north west of Dairy Farm (SM: 1016048), Moated site 750 metres north west of Dairy Farm (SM: 1016051) and the Civil War redoubt 550 metres south east of Valley Farm (SM: 1016046) which are all situated close to Cattle Market roundabout. Newark Castle's (SM: 1003474/LB: 1196278) main period of activity was during the post medieval period when it was part of the Civil War defense works and ultimately slighted.

7.5.11 The Grade II listed Farndon Windmill (LB: 1196287) is located to the north of Farndon roundabout. The Grade II listed Causeway Arches are located north to south through Cattle Market roundabout and are listed individually including some locations within or adjacent to the draft Order Limits including Causeway Arches and Embankment Walling (LB: 1228781), Causeway Culvert (LB: 1228791), Causeway Culvert (LB: 1297727) and Causeway Arches (LB: 1228733). The Grade II and II* listed buildings of Langford Hall (LB: 1046033, 1178591, 1046034) lie to the north of Winthorpe Roundabout.

7.5.12 The Conservation Areas of Winthorpe, Kelham and Newark are partially overlapped by the draft Order Limits, while the Conservation Area of Averham lies in close proximity to the draft Order Limits.

Non-designated heritage assets

7.5.13 Non-designated heritage assets are shown on Figure 7.2 in Volume 2. Several sites have been previously investigated and a number of the non designated assets below are identified through these works, these sites are shown on Figure 7.3 in Volume 2.

7.5.14 Highly significant prehistoric finds have been discovered in the area to the south of Farndon roundabout, through geoarchaeological investigation, archaeological excavations and fieldwalking (MNT272240, MNT14729). Several prehistoric findspots have been identified along the scheme including Neolithic and Bronze Age flint finds, worked to create tools (MNT11218, MNT3078). A settlement dating to the Neolithic/early Bronze Age is identified in the HER at Langford (MNT18427).

7.5.15 A settlement dating to the Iron Age to Romano British has been identified north west of Farndon Roundabout (MNT14324). Iron Age pottery was recovered from Crankley Point (MNT10886). Crop marks across the area

around Kelham demonstrate probable prehistoric settlement and field patterns. These include a possible Iron Age ladder settlement, defined by enclosures either side of a linear trackway (MNT2938) and field enclosures (MNT9643).

7.5.16 The line of the Fosse Way Roman Road is defined by the A46 before Farndon roundabout, the B6166 and the continuation of the A46 from the A1 Junction. Settlement evidence includes a Roman settlement excavated between the B6166 and the River Trent (MNT27088) and a Romano British Settlement has been identified at Farndon (MNT14324). A single Roman coin find was identified between the A46 and the A1 (MNT3665).

7.5.17 An early medieval brooch was recovered to the west of Farndon roundabout (MNT12168). An early medieval burial site was identified between Stephen Road and Robert Dukeson Avenue (MNT11746). Early medieval settlement evidence has been excavated at Northgate (MNT27051). The early medieval period is further represented by a Saxon settlement identified at Kelham Hall (MNT27612).

7.5.18 Medieval enclosures have been recorded in the HER to the west of Farndon (MNT8318). At Cattle Market roundabout the HER demonstrates the course of a medieval road (MNT14369) orientated north to south through the roundabout, pits and other archaeological features (MNT9606) are also identified to west of the roundabout. Medieval findspots of pottery have been located in various locations across the scheme. The site of a medieval watermill (MNT 14628) is identified in the HER on the banks of the River Trent.

7.5.19 The non designated first and second Circumvallation's of Newark-on-Trent (MNT17103, MNT14372) are identified in the HER at Farndon roundabout and between the A46 and the A1 respectively. However, it is noted these are transcribed from Civil War era mapping and may not be accurate. A number of non designated post medieval industrial buildings are identified in the HER along the River Trent this includes both extant and demolished buildings. The entrance to Langford Hall through the non designated grounds is included within the draft Order Limits. Features associated with Kelham Hall including surrounding buildings and associated features including ponds, culverts and brick platforms have been identified. Further post medieval evidence has included the discovery of the entrance to a Civil War Era building east of the River Trent south of the A617 during a watching brief in 2015⁵⁹, as well as a Parish boundary ditch south of Kelham Hall.

7.5.20 RAF Winthorpe (MNT27025) is a former World War II airfield opposite Winthorpe which is partially overlain by the redline boundary.

⁵⁹ Wessex Archaeology (2015). River Trent Crossing, Nottinghamshire, Archaeological Watching Brief Report.

Historic landscape character

7.5.21 The Nottinghamshire Historic Landscape Characterisation project⁶⁰ has identified 21 distinct character areas within the county, five of which are represented within the 1 kilometre study area:

- Modern modified field patterns make up the majority of the land within the study area. These are fields in which the earlier patterns shown on 19th century mapping are no longer present, or no longer readable or have been radically reorganised. Frequently, but not entirely, this change is associated with responses to post-World War II agricultural policies and technology.
- Patterns reflecting open fields. These are field patterns with strong linear dominants, often sinuous, which demonstrably, or probably, originated in enclosure of strips, combinations of strips, or furlongs in open fields. These reflect the layout of open fields (pre-Enclosure).
- Regular field patterns. These involve large geometric enclosures of type commonly associated with Parliamentary Enclosures.
- Irregular geometric field patterns. These are field patterns involving geometric layouts which are less regular (i.e. less linear or rectangular) than those described as regular field patterns. Again, may be associated frequently with Parliamentary Enclosures.
- Semi-regular field patterns. These are field patterns which are loosely geometric in layout, involving linear, rectangular or square arrangements, but which are less sharply defined, wavier, or be discontinuous over distance (short linear dominants) and are usually smaller in scale.

7.5.22 In general, the historic landscape of the study area reflects recent changes to the landscape in terms of urban development, large-scale agriculture and mineral extraction. Amongst the modern field patterns and urban development, traces of earlier land-use remain, reflecting 18th and 19th century enclosures, as well as earlier, piecemeal enclosures and the remnants of medieval open fields. While historic landscape character is not considered to be a heritage asset in itself, it forms a consideration of how setting contributes to their value/sensitivity of heritage assets.

7.5.23 The Historic Landscape Character (HLC) of the study area will be considered to inform the baseline of the ES which will be produced to support the DCO application for the scheme. Further understanding of the HLC will be required to understand the impact of any changes to the HLC from the scheme.

⁶⁰ Nottinghamshire County Council (2016) The Nottinghamshire HLC project [online] available at: http://archaeologydataservice.ac.uk/archivesview/notts_hlc_2016/index.cfm (last accessed June 2022).

7.6 Value (sensitivity of resources and receptors)

- 7.6.1 The value/sensitivity of the known heritage assets along the scheme is discussed below. The predicted impact and subsequent effects on individual heritage assets is detailed within section 7.11.
- 7.6.2 The value/sensitivity of receptors (heritage assets) will be based upon Table 7.1 above. Assessment of value/sensitivity will be based on a combination of designated status and professional judgement. The assessment 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.
- 7.6.3 Within the 1 kilometre study area, archaeological remains of high value/sensitivity include the medieval moated site at Averham (SM: 1017687) and Civil War era Scheduled Monuments such as Newark Castle (SM: 1003474) and Civil War redoubt 550 metres south east of Valley Farm (SM: 1016046). These assets and their setting are considered to have national importance and rarity through the retention of archaeological and historic interest which contributes to their value. Non designated archaeological remains, directly associated with the Farndon prehistoric deposits and the Civil War era remains, may also be considered to be of high value/sensitivity as a result of their association with designated heritage assets and the significant contribution they can make to national research objectives.
- 7.6.4 Non designated archaeological remains, associated with the Farndon prehistoric deposits such as Neolithic and Bronze Age flints (MNT11681), may be considered to be of medium to high value/sensitivity. Further assets of medium to high value/sensitivity associated with the Civil War era may be present at Cattle Market roundabout. Further assets of this value/sensitivity are present at Kelham identified through cropmarks representing prehistoric settlement (MNT2938), (MNT9643).
- 7.6.5 Potential additional features associated with early medieval settlement finds at Kelham (MNT27612) would be of a medium/medium high value.
- 7.6.6 Artifacts associated with key periods but with no direct correlation with a related feature such as the Civil War era gunflints recovered at Farndon fields (MNT11682) may also be considered as medium value/sensitivity.
- 7.6.7 Potential archaeological finds of negligible or low value/sensitivity may include post medieval agricultural features and artefacts scatters such as those at Farndon (MNT8386) and Kelham (MNT11215) or individual finds which are not associated with a particular heritage asset.

7.6.8 The value/sensitivity of archaeological remains which have not yet been discovered/investigated is dependent on a number of factors including level of importance (local, regional, national), preservation and association with designated assets as well as the nature of the remains themselves. Based on research undertaken to date, finds and features of prehistoric, medieval and civil war era date are likely, with a lower potential for early medieval and other post medieval finds and features. The heritage value of these assets can range from negligible to high and further investigations as outlined in sections 6.3 and 6.10 will help determine the potential heritage value of such discoveries.

7.6.9 Built heritage assets of high value/sensitivity include the Grade II listed buildings such as Causeway Arches (NHLE 1228733 & 1196289), the Registered Park and Garden at Newark Castle and Conservation areas including Newark-on-Trent, Winthorpe and Kelham, as well as any associated archaeological discoveries. Further high value/sensitivity built heritage assets include the Grade I listed Church of St. Mary Magdalene and attached railing (NHLE: 1279450), the Grade II listed Langford Hall (NHLE: 1046033) and Concrete Footbridge across the River Trent (NHLE: 1297721).

7.6.10 Scheduled monuments and listed buildings are not expected to be physical affected, except for elements of Causeway Arches. However, the settings of these sensitive receptors will need to be considered during the design process. Most of the designated assets likely to be impacted by the scheme will have already had their settings compromised by the existing route and other modern developments through noise intrusion and the visual encroachment upon their setting as well as the removal of intervisibility between related designated assets.

7.7 Potential impacts

Construction

7.7.1 Potential adverse impacts on the heritage value of cultural heritage assets during the construction phase of the scheme would result from the following:

- Temporary changes to setting due to the presence of construction machinery, traffic and construction work compounds including lighting.
- Temporary changes to setting due to increased noise, vibration and dust generated during construction.
- Temporary changes to setting due to the diversion or alteration of existing utility services and installation of new utility services.
- Permanent demolition or removal of heritage assets due to excavation, ground disturbance and compaction.
- Permanent changes to the setting of heritage assets due to the construction of new and modification of existing infrastructure.

7.7.2 Potential beneficial impacts on the heritage value of cultural heritage assets may result from the advancement of knowledge and understanding of known and unknown heritage assets through discovery and recording.

Operation

7.7.3 Potential adverse impacts on the heritage value of cultural heritage assets during the operational phase of the scheme would be due to:

- Changes in their setting as a result of increased noise and/or visual change.
- Increases in vibration associated with changes in traffic movements.

7.7.4 Potential beneficial impacts on the heritage value of cultural heritage assets may result from:

- A potential reduction in noise, vibration or traffic enhancing the setting of assets.
- Landscape design and planting that, once established, would enhance the setting of assets.

7.8 Consultation

7.8.1 Consultation has been carried out with Historic England and the Newark and Sherwood District Council. While it is anticipated that some further specialist consultees will be included at later stages, key consultees at this stage of the project are:

- Historic England
- Newark and Sherwood Conservation Officer
- Newark and Sherwood District Archaeologist

7.8.2 Consultation during the optioneering stages took place as part of the non-statutory consultation with Historic England and Nottinghamshire County Council. Consultation meetings in early 2021 with the Nottinghamshire County Archaeologist identified the need for continuity in the treatment of the early prehistoric remains found at Farndon, as well as the need to understand the contributions of setting to the value of the Scheduled Monuments, particularly as relating to the Civil War monuments. This includes understanding how the Scheduled Civil War Monuments relate to the non-designated assets from the same era, all of which combine to create a distinctive heritage for Newark-on-Trent associated with the English Civil War.

7.8.3 In March 2022, following the preferred route announcement, engagement continued with the County Archaeologist including a meeting to discuss planned surveys, and also to gain feedback and comment on the draft Archaeological Management Plan and non-intrusive survey specification. Engagement has since commenced with Newark and Sherwood District Council's Archaeological Advisor who will shortly be sent the draft

Archaeological Management Plan for review. The geophysical survey and field walking and metal detector survey scope and the associated Written Scheme of Investigations have been issued for approval, prior to commencement of surveys.

- 7.8.4 In relation to built heritage, a meeting with Historic England took place in July 2022 to re-introduce them to the scheme and outline plans for engagement during the design development of the scheme. Engagement also commenced in July 2022 with Newark and Sherwood District Council's Senior Conservation Officer in relation to built heritage assets and historic setting. Discussions centered around direct impacts upon the Grade II listed Causeway Arches and on the wider setting impacts particularly in regard to the approach to Newark-on-Trent from the great North Road. A follow up meeting with the Conservation Officer took place in August 2022, which further discussed the Grade II listed Causeway Arches, including discussions on the actual location of the Grade II Listed Causeway Culvert (SM 1297727) and potential impacts on the listed culverts to the south of Cattle Market roundabout.
- 7.8.5 Consultation will continue throughout the development of the scheme with the District and County Archaeologist as survey work progresses, in addition to consultation with Historic England and the Senior Conservation Officer at Newark and Sherwood District Council.
- 7.8.6 These stakeholders will also be invited to be part of the Environmental Technical Working Group (see Section 4.3 for further details).

7.9 Assumptions and limitations

- 7.9.1 No surveys for buried archaeology have taken place to date and there is therefore limited information as to the presence or absence of archaeological assets. A programme of non-intrusive and intrusive surveys for buried archaeology are planned to inform the ES. These surveys will include geophysical survey, geoarchaeological survey, field walking and metal detector surveys followed by targeted trial trenching.
- 7.9.2 Setting assessments are limited at this stage to desk-based research and familiarisation surveys. As this scheme consists mostly of an upgrade of an existing road, the setting of heritage assets in proximity to the scheme has been considered at this stage. However, heritage assets with clear views of the scheme (including those in Newark-on-Trent) will be considered in greater detail during the ES.
- 7.9.3 The design of the scheme including the vertical alignment and location of some elements (such as balancing ponds and construction compounds) remains unknown.
- 7.9.4 Designated data is up to date as of June 2022. Non designated data is from HER data acquired in August 2022. This data will be used to provide a

background to the surveys being undertaken and to inform the scheme development and the ES.

7.9.5 It has been assumed that the Grade II Listed Causeway Culvert (SM 1297727) at Cattle Market roundabout was located in the wrong place on Historic England mapping and relates to a culvert visually identified to the south east of the roundabout. This assumption was agreed during a meeting with the Newark and Sherwood Conservation Officer. It is noted that the most recent online Historic England mapping shows the culvert in the correct location.

7.9.6 Within national planning policy and guidance, the value/sensitivity attributed to a heritage asset is referred to as its "significance". To prevent confusion with EIA terminology regarding "significance of effect", the ES will use the phrase "value" in place of "significance" when referring to heritage assets. The definition attributed to "value" remains unchanged from that attributed to "significance" in national planning policy and guidance.

7.9.7 At this stage in the development of the scheme, limited assessment of effects on specific heritage assets can be carried out. Further study and analysis of key heritage assets from the HER and NHLE datasets, as well as desk based and field work studies, will indicate those assets likely to be affected by the scheme. The assessment of the value/sensitivity of the heritage assets identified to date (Section 7.6) may therefore be revised in the light of this further work. Additional heritage assets may also be identified during this process.

7.10 Design, mitigation and enhancement measures

Design

7.10.1 The development of the scheme design is an iterative process undertaken as part of an integrated design team to adhere the principles of the design and mitigation hierarchy outlined in DMRB LA 104. The first principle being to avoid potential adverse effects, if at all possible, before seeking to minimise or mitigate any unavoidable impacts through a well-developed mitigation strategy. Embedded mitigation incorporated into the scheme design development to date is outlined in Chapter 2 Section 2.7 of this report.

7.10.2 Construction and operation cultural heritage design objectives shall be developed for the project in accordance with national, regional and local policies. The cultural heritage design objectives should provide a clear statement of how the project, through mitigation and offsetting, is expected to contribute to the value of, or the understanding and dissemination of, the cultural heritage resource, and how this is to be achieved, monitored and validated. This should be guided by the East Midlands Archaeological research framework.

7.10.3 There are a number of opportunities for further embedded mitigation that will be considered during the development of the ongoing scheme design. These include:

- Use of minimal or sympathetic design to reduce changes within the settings of heritage assets.
- Use of planting to further minimise any impacts on setting as well as reinforcing the existing landscape character.
- Use of noise fencing to manage noise and vibration in the vicinity of heritage assets.
- Maintenance of access routes to heritage assets to maintain viability.
- Use of land within Winthorpe Conservation Area, which is included in the draft Order Limits, to lessen the visual impact of the road and enhance the setting of the Conservation Area.
- Limiting the increase of vertical alignments of new routes including junctions, structures and associated infrastructure as far as practicable to minimise landscape and visual impacts to the historic environment and its setting, including avoiding the location of fence lines at the top of any embankment slopes where they could dominate the skyline.
- Ensuring lighting columns are kept to a minimum height and are directional to minimise impact of light spill on the setting of heritage assets, whilst still meeting operational safety requirements.

Mitigation – construction

7.10.1 DMRB LA 106 ‘Cultural heritage assessment’ defines mitigation as follows: “measures intended to avoid, reduce and, where possible, remedy significant adverse environmental effects”.

7.10.2 Archaeological investigation and recording cannot be construed as mitigation, as per paragraph 5.139 of the NPSNN and paragraph 205 of the NPPF. Where physical effects upon heritage assets are unavoidable, excavation and recording will be undertaken to offset the loss of these assets.

7.10.3 Where possible, results of any desk and field-based investigation will add to public knowledge and understanding of heritage assets.

7.10.4 Mitigation measures of relevance during construction, to be included within an Archaeological Mitigation Strategy include the following:

- A draft Archaeological Management Plan will be updated at each phase of archaeological works to ensure best practice and limit impacts on heritage assets.
- Avoidance, preservation by burial, or investigation in the case of archaeological remains.
- Management of noise and vibration in the vicinity of heritage assets during construction (see Section 12.10 for details).

- Installation of physical protection measures, or temporary removal of heritage assets for reinstatement following the completion of construction works.
- The use of noise fencing or maintenance of access routes to a heritage asset to maintain its viability during construction.
- Photographic or drawn surveys in the case of historic buildings.

Mitigation – operation

7.10.5 Further assessment is required to establish whether any significant effects from noise and vibration from traffic upon designated and non-designated heritage assets could occur. Further mitigation will be developed as necessary once the full assessment is complete. This will be provided within the ES and the Second Iteration Environmental Management Plan as appropriate.

Enhancement measures

7.10.6 There are opportunities for additional enhancements that will be considered during the ongoing development of the scheme design and the development of the heritage assessment and associated works. These may include:

- The dissemination of results to the public through works such as the creation of information panels and public outreach online and in person.

7.10.7 These enhancements measures will be reported within the ES, although these will not be taken into account when determining whether effects are significant or not.

7.11 Assessment of effects

7.11.1 The assessment of effects set out below is based on what is known of the heritage assets from research undertaken to date. This has identified key heritage assets from the HER and NHLE datasets likely to be affected by the scheme. The assessment of the value/ sensitivity of the heritage assets identified to date (section 7.6) may therefore be revised in the light of the programme of non-intrusive and intrusive archaeological surveys proposed to inform the ES. Additional heritage assets may also be identified during this process. In accordance with DMRB guidance, effects with an assessment of moderate and above are considered to be significant.

Construction

7.11.2 The assessment of effects during construction is shown in Table 7.4.

Table 7.4: Summary of the assessment of value, magnitude of impacts and significance of effects upon key heritage assets during construction

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
The Civil War redoubt 680 m north-west of Dairy Farm (NHLE: 1016048)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	High (Scheduled Monument)	Permanent changes: Moderate adverse Temporary changes: Minor adverse	Moderate Adverse (Significant)
Moated site 750 m north-west of Dairy Farm (NHLE: 016051)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	High (Scheduled Monument)	Permanent changes: Moderate adverse Temporary changes: Minor adverse	Moderate Adverse (Significant)
Civil War redoubt 550 m south-east of Valley Farm (NHLE: 1016046)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the	High (Scheduled Monument)	Permanent changes: Minor adverse Temporary changes: Negligible adverse	Slight Adverse (Not Significant)

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
	presence of construction machinery, compounds.			
Civil War redoubt 580 m ENE of sugar refinery (NHLE: 1016152)	Permanent changes to the setting of the assets due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	High (Scheduled Monument)	Permanent changes: Minor adverse Temporary changes: Negligible adverse	Slight Adverse (Not Significant)
The Civil War redoubt on Crankley Point (NHLE: 1016050)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	High (Scheduled Monument)	Permanent changes: Negligible adverse Temporary changes: Negligible adverse	Slight Adverse (Not Significant)
Civil War fieldwork on Crankley Point (NHLE: 1016049)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure.	High (Scheduled Monument)	Permanent changes: Negligible adverse Temporary changes:	Slight Adverse (Not Significant)

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
	Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.		Negligible adverse	
Newark Castle (NHLE: 1003474 & 1196278)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	High (Scheduled Monument & Grade I Listed Building)	Permanent changes: Minor adverse Temporary changes: Minor adverse	Slight Adverse (Not Significant)
Church of St. Mary Magdalene and attached railing (NHLE: 1279450)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	High (Grade I Listed Building)	Permanent changes: Minor adverse Temporary changes: Minor adverse	Slight Adverse (Not Significant)
Concrete Footbridge	Permanent changes to the setting of the	High	Permanent changes:	Moderate Adverse

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
across the River Trent (NHLE: 1297721)	asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	(Grade II* Listed Building)	Moderate adverse Temporary changes: Minor adverse	(Significant)
Langford Hall (NHLE: 1046033)	Permanent changes through the partial loss of the asset due to the modification of the historic carriage way. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	High (Grade II* Listed Building)	Permanent changes: Moderate adverse Temporary changes: Minor adverse	Moderate Adverse (Significant)
Causeway Arches 500m north-west of the level crossing (NHLE: 1228733)	Permanent impact associated with the alteration of the assets historic fabric associated with the modification of existing infrastructure. Permanent changes to the setting of the asset due to the modification of existing infrastructure.	High (Grade II Listed Building)	Permanent changes: Moderate adverse Temporary changes: Moderate adverse	Large Adverse (Significant)

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
	Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.			
Causeway culvert 420 m north-west of the level crossing (NHLE: 1297727)	Permanent alteration of the assets historic fabric associated with the modification of existing infrastructure. Permanent changes to the setting of the asset due to the modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	High (Grade II Listed Building)	Permanent changes: Moderate adverse Temporary changes: Moderate adverse	Large Adverse (Significant)
Causeway culvert 135 m north-west of the level crossing (NHLE: 1228791)	Permanent alteration of the assets historic fabric associated with the modification of existing infrastructure. Permanent changes to the setting of the asset due to the modification of existing infrastructure. Temporary changes to the setting of the asset from noise	High (Grade II Listed Building)	Permanent changes: Moderate adverse Temporary changes: Moderate adverse	Large Adverse (Significant)

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
	during construction, as well as the presence of construction machinery, compounds.			
Causeway Arches 650 m north-west of the level crossing. (NHLE: 1196289)	Permanent impact associated with the partial loss of the asset due to excavation and ground disturbance associated with the modification of existing infrastructure.	High (Grade II Listed Building)	Permanent changes: Minor adverse Temporary changes: Minor adverse	Slight Adverse (Not Significant)
Church of All Saints (NHLE: 1178837)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds..	High (Grade II Listed Building)	Permanent changes: Minor adverse Temporary changes: Minor adverse	Slight Adverse (Not Significant)
Thompson Tomb in Church of All Saints (NHLE: 1178838)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the	High (Grade II Listed Building)	Permanent changes: Minor adverse Temporary changes: Minor adverse	Slight Adverse (Not Significant)

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
	presence of construction machinery, compounds.			
Gate Piers to Church of All Saints (NHLE: 1369952)	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	High (Grade II Listed Building)	Permanent changes: Minor adverse Temporary changes: Minor adverse	Slight Adverse (Not Significant)
Winthorpe Conservation Area	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure. Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.	Medium (Conservation Area)	Permanent changes: Moderate adverse Temporary changes: Moderate adverse	Moderate Adverse (Significant)
Newark Conservation Area	Permanent changes to the setting of the asset due to the construction of new and modification of existing infrastructure.	Medium (Conservation Area)	Permanent changes: Moderate adverse Temporary changes:	Moderate Adverse (Significant)

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
	Temporary changes to the setting of the asset from noise during construction, as well as the presence of construction machinery, compounds.		Moderate adverse	
Palaeolithic Site at Farndon (HER: M3571)	Permanent impact associated with the partial loss of the asset due to excavation and ground disturbance associated with the modification of existing infrastructure.	High (Non-designated)	Permanent changes: Moderate Adverse	Large Adverse (Significant)
RAF Winthorpe (HER: MNT27025)	Permanent impact associated with the partial loss of the asset due to demolition and excavation and ground disturbance associated with the modification of existing infrastructure.	Low (Non-designated)	Permanent changes: Minor Adverse	Slight Adverse (Not Significant)
Second Line of Circumvallation at Newark (HER: M3114)	Permanent impact associated with the partial loss of the asset due to excavation and ground disturbance associated with the modification of existing infrastructure.	Low (Non-designated)	Permanent changes: Minor Adverse	Slight Adverse (Not Significant)
First Line of Circumvallation at Newark (HER: M8401)	Permanent impact associated with the partial loss of the asset due to	Low (Non-designated)	Permanent changes: Minor Adverse	Slight Adverse (Not Significant)

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
	excavation and ground disturbance associated with the modification of existing infrastructure.			
Medieval Road at Newark (HER: M3093)	Permanent impact associated with the partial loss of the asset due to excavation and ground disturbance associated with the modification of existing infrastructure.	Low (Non-designated)	Permanent changes: Minor Adverse	Slight Adverse (Not Significant)
Fragment of the Fosse Way at Langford (HER: L3737)	Permanent impact associated with the partial loss of the asset due to excavation and ground disturbance associated with the modification of existing infrastructure.	Low (Non-designated)	Permanent changes: Minor Adverse	Slight Adverse (Not Significant)
Linear feature at Newark (HER: L8468)	Permanent impact associated with the partial loss of the asset due to excavation and ground disturbance associated with the modification of existing infrastructure.	Low (Non-designated)	Permanent changes: Moderate Adverse	Slight Adverse (Not Significant)
Enclosures and Pits at Newark (HER: L9701)	Permanent impact associated with the partial loss of the asset due to excavation and ground disturbance associated with the modification of existing infrastructure.	Low (Non-designated)	Permanent changes: Major Adverse	Moderate Adverse (Significant)

Asset	Description of impact	Sensitivity (value) of asset	Magnitude of impact	Significance of effect
Well at Newark (HER: M3490)	Permanent impact associated with the partial loss of the asset due to excavation and ground disturbance associated with the modification of existing infrastructure.	Low (Non-designated)	Permanent changes: Moderate Adverse	Slight Adverse (Not Significant)

7.11.3 Temporary construction work is unlikely to result in adverse significant effects on heritage assets when mitigation and construction measures are taken into account.

7.11.4 Potential adverse significant effects identified at this stage from the permanent construction of the scheme include direct physical impacts from the removal of buried archaeological remains. These include the prehistoric deposits at Farndon, the prehistoric settlement features at Kelham and the archaeological assets related to the Civil War. Additional impacts to unknown archaeological remains may also be identified due to fieldwork.

7.11.5 Direct physical impacts on Grade II listed Causeway Arches due to the permanent construction of the scheme is likely to constitute an adverse significant effect.

7.11.6 The permanent construction and expansion of the existing road toward Scheduled Monuments such as the Civil War redoubts at Cattle Market roundabout will potentially degrade the setting of these monuments and may constitute an adverse significant effect.

7.11.7 The permanent construction of infrastructure including any increase in the vertical alignment of the road may possibly degrade the setting of listed buildings, scheduled monuments and conservation areas and may constitute an adverse significant effect. This includes the setting of the Newark Conservation Area, in particular the entrance to Newark-on-Trent from the Great North Road.

7.11.8 The permanent construction of the scheme is unlikely to result in adverse significant effects on the historic landscape.

Operation

7.11.9 There will be no operational effects on buried archaeological remains.

7.11.10 Further assessment is required to establish any significant effects from noise and vibration from traffic on the Causeway Arches as a result of the widening of the junction at Cattle Market roundabout.

7.11.11 Further assessment is also required to establish significant effects from noise and vibration from traffic upon designated and non-designated built heritage which could impact the setting of these assets. Further assessment will be provided within the ES.

7.11.12 There is unlikely to be operational effects on historic landscape.

7.12 Monitoring requirements for significant adverse effects

7.12.1 A draft Archaeological Management Plan (AMP) has been produced and will be updated at each phase of archaeological works to ensure best practice and to limit impacts on heritage assets.

7.12.2 Plans for any additional monitoring, such as noise and vibration monitoring for designated assets, will be developed as the scheme design and heritage assessment progresses.

7.13 Conclusions

7.13.1 This chapter provides a summary assessment, based on the information currently available, of the potential cultural heritage effects of the scheme in accordance with DMRB.

7.13.2 While limited in depth archaeological assessment has taken place at this stage, the high potential for medium and high value/sensitivity archaeology has been recognised across the route. This mostly pertains to Prehistoric features at Farndon and Kelham, as well as Roman features in relation to the Fosse Way and Civil War era features across the route, particularly around Cattle Market roundabout.

7.13.3 The assessment has also recognised the likely effect of direct physical impacts on the designated assets of the Grade II listed Causeway arches 500m north-west of the level crossing (NHLE: 1228733), Causeway culvert 420 metres north-west of the level crossing (NHLE: 1297727) and Causeway culvert 135 metres north-west of the level crossing (NHLE: 1228791), which form the Causeway Arches.

7.13.4 The potential degradation of the settings of designated assets may also impact their value. This includes the setting of the scheduled monument of the Civil War redoubts at Cattle Market and the Newark Conservation Area, in particular viewpoints such as the entrance to Newark-on-Trent from the Great North Road.

7.13.5 In depth desk-based analysis, archaeological fieldwork and setting assessment will be undertaken in line with the development of the scheme design. The initial fieldwork will include fieldwalking, metal detecting and geophysical survey alongside geoarchaeological investigations to provide a comprehensive archaeological baseline. The setting of designated assets will be assessed in detail. The assessment will determine the effects on the setting of heritage assets from the scheme and enable appropriate mitigation to be designed. This assessment will be documented fully in the ES. Should substantial harm or loss of significance to heritage receptors remain after further design development and assessment work is completed, it will be necessary for the DCO application to demonstrate that all reasonable alternatives have been considered and that their loss or harm is necessary in order to deliver substantial public benefits that outweigh that loss or harm. This information will be submitted with the DCO application.

8 Landscape and Visual Effects

8.1 Introduction

8.1.1 The potential landscape and visual effects have been considered following the requirements set out in Design Manual for Roads and Bridges (DMRB) LA 107⁶¹. Further detailed assessment is currently in progress and will be reported within the ES to be submitted to support the Development Consent Order (DCO) application.

8.1.2 Landscape encompasses many more elements than the common association which focuses merely upon the view or appearance of the land. The term 'landscape' applies to capture the assessment of environmental factors such as topography, drainage, land use and management, vegetation and ecology, as well as historical and cultural associations (in accordance with DMRB LA 107 paragraph 1.3, Note 1). The notion of landscape can be applied to both rural and urban environments with the term 'townscape' frequently adopted within the urban context (in accordance with DMRB LA 107 paragraph 1.3, Note 2).

8.1.3 This chapter presents the current status of on-going work for the assessment of potential effects associated with the proposed scheme, upon surrounding landscape character and visual amenity, during both construction and operation.

8.2 Legislation and policy context

8.2.1 The following legislation and policy are relevant to the landscape and visual aspects of the proposed scheme.

Legislation

8.2.2 The European Landscape Convention (ELC) promotes the protection, management and planning of European landscapes and organises European co-operation on landscape issues⁶². The UK Government became a signatory to the ELC in 2006, introducing it in March 2007. The ELC is a convention of the Council of Europe and is therefore not affected by Brexit. The ELC contains 18 articles which, collectively, promote landscape protection, management and planning and organising European cooperation on landscape issues. Articles 5 and 6 commit signatory states to a number of actions which are designed to help compliance with the overarching aims of the ELC. These include the need to recognise landscapes in law, to establish policies aimed at landscape planning,

⁶¹ National Highways (2020) DMRB LA 107 – Landscape and visual effects, Revision 2 [online] available at: [bc8a371f-2443-4761-af5d-f37d632c5734 \(standardsforhighways.co.uk\)](https://www.nationalhighways.co.uk/standardsforhighways.co.uk) (last accessed June 2022).

⁶² GOV.UK (November 2010) Corporate report, European Landscape Convention: guidelines for managing landscapes [online] available at: [European Landscape Convention: guidelines for managing landscapes - GOV.UK \(www.gov.uk\)](https://www.gov.uk/european-landscape-convention-guidelines-for-managing-landscapes) (last accessed June 2022).

protection and management, and the integration of landscape into other policy areas. The ELC does not advocate the same measures and policies for all landscapes. Instead, it encourages approaches that are adaptable to particular landscape types and which respond to their unique characteristics⁶³.

8.2.3 The Environment Act 2021⁶⁴ sets out measures to protect and improve the UK's environments, including biodiversity, water, and habitats. The Act introduces a requirement for developments to deliver a 10% increase in biodiversity. The Act also introduces local nature recovery strategies (LNRS), a system of spatial strategies in England. Appointed authorities will be tasked with creating opportunities to improve local habitats and aid their recovery.

National policy

National Policy Statement for National Networks (NPSNN)

8.2.4 Paragraphs 4.28-4.35 of the NPSNN⁶⁵ set out the principles of good design for national network infrastructure, outlining the importance of integrated design, with visual appearance “a key factor in considering the design of new infrastructure, as well as functionality, fitness for purpose, sustainability and cost.”

8.2.5 Paragraphs 5.143-5.1 of the NPSNN consider how landscape and visual impact assessments should be undertaken and how landscape impacts should be considered within the decision-making process in order to “avoid adverse effects on landscape or to minimise harm to the landscape, including by reasonable mitigation”. Paragraphs 5.120 to 5.142 set out the approach for impact assessment, decision making and recording for the historic environment.

National Planning Policy Framework (NPPF)

8.2.6 The NPPF⁶⁶ sets out the Government's planning policies for England, with Section 15, Paragraphs 174-188 setting out the framework with respect to conserving and enhancing the natural environment. Section 16, Paragraphs 189-208, sets out a framework for the management of the historic environment.

8.2.7 Section 13, paragraphs 137-151 of the NPPF relate to Protecting Green Belt land, with paragraph 138 outlining the five purposes of Green Belt.

⁶³ Landscape Institute (2022) The European Landscape Convention (ELC) [online] available at: The European Landscape Convention (ELC) | Landscape Institute (last accessed June August 2022).

⁶⁴ UK Government (2021). Environment Act 2021 [online] available at: Environment Act 2021 (legislation.gov.uk) (last accessed June August 2022).

⁶⁵ Department for Transport (2014) National Policy Statement for National Networks [online] available at: https://www.gov.uk/Government/uploads/system/uploads/attachment_data/file/387223/NNNPS-web.pdf (last accessed August 2022).

⁶⁶ Communities and Local Government (2021) National Planning Policy Framework [online] available at: https://www.gov.uk/Government/uploads/system/uploads/attachment_data/file/60777/2116950.pdf (last accessed August 2022).

Paragraphs 147 to 151 address proposals affecting the Green Belt and set out the parameters for appropriate and inappropriate development. Paragraph 150 states that “Certain other forms of development are also not inappropriate in the Green Belt provided they preserve its openness and do not conflict with the purposes of including land within it.” The list of these developments include “local transport infrastructure which can demonstrate a requirement for Green Belt location”.

25 Year Environment Plan

8.2.8 The Department for Environment, Food & Rural Affairs (Defra) 25 Year Environment Plan (2018)⁶⁷ is a policy paper setting out what Government will do to improve the environment, including restoring and safeguarding wildlife habitats. This plan is being treated as the first Environmental Improvement Plan required under the Environment Act 2021. Chapter 2: Recovering nature and enhancing the beauty of landscapes relates to the development of a Nature Recovery Network to protect and restore wildlife, as well as a review of nationally designated landscape areas. The plan also introduces a new environmental land management system (ELMS) to incentivise land managers to restore and improve natural capital and rural heritage. The three ELMS schemes include a Local Nature Recovery scheme and a Landscape Recovery scheme, both piloting in 2022 and launching in 2024.

Local policy

8.2.9 The scheme and surrounding context fall within the administrative area of Newark and Sherwood District Council. Relevant policies and strategy documents are listed below.

Newark and Sherwood Plan Review - Amended Core Strategy DPD⁶⁸

8.2.10 Core Policy 12 Biodiversity and Green Infrastructure includes the following:

- “The District Council will seek to conserve and enhance the biodiversity and geological diversity of the District by working with partners to implement the aims and proposals of the Nottinghamshire Local Biodiversity Action Plan, the Green Infrastructure Strategy and the Nature Conservation Strategy”.

8.2.11 Core Policy 13 Landscape Character states the following:

- “Based on the comprehensive assessment of the District’s landscape character, provided by the Landscape Character

⁶⁷ HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online] available at: 25 Year Environment Plan - GOV.UK (www.gov.uk) (last accessed April 2022).

⁶⁸ Newark and Sherwood District Council (2019) Amended Core Strategy DPD. Accessible at: <https://www.newark-sherwooddc.gov.uk/media/nsdc-redesign/documents-and-images/your-council/planning-policy/local-development-framework/amended-core-strategy-dpd/amended-core-strategy-DPD.pdf>

Assessment Supplementary Planning Document, the District Council will work with partners and developers to secure:

- New development which positively addresses the implications of relevant landscape Policy Zone(s) that is consistent with the landscape conservation and enhancement aims for the area(s) ensuring that landscapes, including valued landscapes, have been protected and enhanced”.

8.2.12 Core Policy 14 Historic Environment states that the following should be secured:

- “The continued conservation and enhancement of the character, appearance and setting of the District’s heritage assets and historic environment, in line with their identified significance as required in national policy”.
- The preservation and enhancement of the special character of Conservation Areas including that character identified through Conservation Area Character Appraisals which will form the basis for their management. Important open spaces and features identified through the Conservation Area Appraisal process will be protected through subsequent allocation in the Allocations & Development Management DPD’.

Newark and Sherwood Green Infrastructure Strategy

8.2.13 The strategy⁶⁹ “will allow for the expansion of settlements whilst ensuring that the District, its assets and landscapes suffer no negative effects and instead prosper from new development ... the need to respond to the threats and challenges of climate change for communities and wildlife has also shaped the Strategy’s development”.

National Highways’ policy and guidance

8.2.14 Landscape is one of the environmental topic areas where the six strategic levers of National Highways’ Environment Strategy⁷⁰ will be applied. The strategic levers will make a contribution towards the organisation’s environment vision.

8.2.15 National Highways’ ‘People, places and processes: A guide to good design at National Highways’ (2022)⁷¹ sets out a vision, which aims to put people at the heart of National Highways’ work, by designing an inclusive, resilient and sustainable road network. This road network should be appreciated for its usefulness but also its elegance, reflecting in its design the beauty of the natural, built and historic environment through which it

⁶⁹ Newark and Sherwood District Council (2010) A Green Infrastructure Strategy for Newark & Sherwood [online] available at: [Microsoft Word - 2134.023 contents pages etc.doc \(newark-sherwooddc.gov.uk\)](#) (last accessed July 2022).

⁷⁰ National Highways (2015) National Highways Environment Strategy [online]. Available at: [Environment_Strategy__21____.pdf \(publishing.service.gov.uk\)](#) (last accessed April 2022).

⁷¹ National Highways (2022) People, places and processes: A guide to good design at National Highways [online] available at: [People, places and processes \(nationalhighways.co.uk\)](#) (last accessed August 2022).

passes, and enhancing it where possible. The accompanying set of principles for good road design follow the themes of people, places and processes. The focus on good design seeks to make a difference to both road users and the communities through which the roads pass, while being sensitive to the context of a road's surroundings. The road should contribute to higher quality of life, greater economic vitality and a more efficient use of resources.

8.3 Assessment methodology

Proposed level and scope of assessment

8.3.1 The Landscape and Visual Impact Assessment (LVIA) produced as part of the ES, will accord with the methodology and significance criteria outlined in DMRB LA 107 Landscape and Visual Effects. Industry best practice will also be followed, with particular reference to:

- Guidelines for Landscape and Visual Impact Assessment Third Edition⁷².
- An Approach to Landscape Character Assessment⁷³.
- Landscape Institute Technical Guidance Note- TGN 06/19 Visual Representation of Development Proposals⁷⁴.

Proposed methodology including significance

8.3.2 The ongoing assessment uses structured, informed and reasoned professional judgement, taking into account data derived from desk study and walkover survey, to review and update the baseline information gathered in previous assessments. Site surveys to be undertaken in preparation for the ES will include visits to each visual receptor identified, to establish baseline views and descriptions during both winter and summer months. Photography will be used to record baseline views and local landscape character, with summer and winter baseline photography captured to help inform the assessment. The photography will be undertaken in accordance with the Landscape Institute TGN 06/19.

8.3.3 A digital zone of theoretical visibility (ZTV) produced at a previous stage was used to inform the selection of viewpoints at the scoping stage. A ZTV is a computer-generated map which illustrates the areas from which the project could theoretically be visible. A ZTV based on existing baseline conditions without the scheme (Figure 8.1 contained in Volume 2) has been produced. An additional ZTV accounting for the scheme (Figure 8.4 contained in Volume 2) has been produced for this preliminary assessment.

⁷² Landscape Institute and the Institute for Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment Third Edition (GLVIA 3).

⁷³ Natural England Guidance 2014: An approach to Landscape Character Assessment [online] available at: [landscape-character-assessment.pdf](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/271112/landscape-character-assessment.pdf) (publishing.service.gov.uk) (last accessed July 2022)

⁷⁴ Landscape Institute Technical Guidance Note- TGN 06/19 Visual Representation of Development Proposals [online] available at: [TGN-06-19-Visual_Representation \(windows.net\)](https://www.landscapeinstitute.com/technical-guidance-note-tgn-06-19-visual-representation-of-development-proposals/)

The ZTV has been modelled in Geographical Information System (GIS) using topographical Light Detection and Ranging (LiDAR) data and assumes heights of intervening vegetation and built form, to identify the likely areas that will be visually affected when considering intervening features. The ZTV assumes heights of intervening vegetation and built form and also assumes a maximum height of passing traffic at 4.2 metres to represent Heavy Goods Vehicles. It should be noted that at this stage, the likely removal of existing vegetation has not been accounted for within the production of the ZTV, however the final ZTV produced as part of the ES will do so, once clearance plans have been confirmed. The updated ZTV enables the clarification of both the study area and likely areas from which the scheme may be visible.

8.3.4 A review of local landscape character will also be undertaken as part of the ongoing assessment, which will be presented within the ES. This will include a review of information presented within the Newark and Sherwood Landscape Character Assessment published in 2013. In circumstances where it is considered that the published data is no longer current, a standalone assessment will be undertaken for the relevant character area to capture the present landscape baseline conditions, including judgements about landscape sensitivity to change. Where it has been necessary to undertake this additional assessment of Landscape Character, the information will be used to inform the assessment of potential landscape effects associated with the scheme which will be presented within the ES.

8.3.5 In accordance with DMRB LA 107 Section 2.6, the assessment of the potential effects of the scheme, compared with the baseline, will examine and assess:

- Seasonal differences with or without the project including summer with foliage and winter without foliage.
- Both day and night time situations with or without the project.
- A winter scenario in the year of opening (Year 1), and a summer scenario (Year 15 of operation to traffic).
- Landscape character types and/or landscape character areas.
- The opinions and consensus of the local public and different interest groups, their perception of the landscape, the value they place it and assessment of the change the project will incur.

8.3.6 Site surveys will be undertaken in preparation for the assessment to inform the ES which will include visits to each visual receptor identified, to confirm baseline views and descriptions during both winter and summer months. Photography will be used to record baseline views and local landscape character, with summer and winter baseline photography captured to help inform the assessment. The photography will be undertaken in accordance with the Landscape Institute Technical Guidance

Note (TGN) 06/19 Visual Representation of Development Proposals⁷⁵. Additional site survey will be undertaken from publicly accessible areas. Views would be captured from the closest publicly accessible location at the curtilage of property boundaries, unless specifically agreed otherwise in isolated cases. Not every individual residential property will be addressed in its own right. Instead, representative viewpoints will be used to capture groups or receptors where appropriate, and where similar views are afforded. Where lack of access is encountered, representative viewpoints will also be used to best capture the visual baseline for a particular given receptor.

8.3.7 Whilst numerous receptors fall within the study area, only those receptors identified as falling within the visual envelope of the scheme, as indicated by the ZTV, will be assessed.

Sensitivity (susceptibility and value) of resource

Landscape

8.3.8 The value and susceptibility of landscape receptors presented as part of the ES is based on the descriptions in Table 8.1. The assessment of value is based on a combination of factors including importance and quality/condition, as well as professional judgement. The assessment of susceptibility takes into account the ability of this area to accommodate change without fundamentally changing key landscape characteristics. It is also recognised that receptors may have a lower or higher sensitivity within a localised area, taking into account local conditions that may influence landscape character.

⁷⁵ Landscape Institute (2019) Technical Guidance Note 06/19 Visual Representation of Development Proposals [online] available at: [TGN-06-19-Visual Representation \(windows.net\)](https://www.landscapeinstitute.com/technical-guidance-note-06-19-visual-representation-of-development-proposals/) (last accessed September 2022).

Table 8.1: Landscape sensitivity (susceptibility and value) and typical descriptions

Landscape sensitivity (susceptibility and value) of receptor/resource	Typical Description
Very High	Landscapes of very high international/national importance and rarity or value with no or very limited ability to accommodate change without substantial loss/gain (for example: national parks, internationally acclaimed landscapes - UNESCO World Heritage Sites).
High	Landscapes of high national importance containing distinctive features/elements with limited ability to accommodate change without incurring substantial loss/gain (for example: designated areas, areas of strong sense of place - registered parks and gardens, country parks).
Medium	Landscapes of local or regional recognition or importance, able to accommodate some change (for example features worthy of conservation, some sense of place or value through use/perception).
Low	Local landscape areas or receptors of low to medium importance with ability to accommodate change (for example non-designated or designated areas of local recognition or areas of little sense of place).
Negligible	Landscapes of very low importance and rarity able to accommodate change.

Source: LA 107, DMRB, 2020 (Table 3.22)

Visual

8.3.9 The value and susceptibility of visual receptors is based on the descriptions in Table 8.2. The assessment of susceptibility is based on a combination of the type of visual receptors experiencing the view, the activity they are engaged in and the degree to which their attention is focused on the view. Value takes into account designations or value attached to a view by visitors, the condition of the elements in the view and presence of detracting/valued features. Value and susceptibility are then considered together to make judgements about visual sensitivity. It is also recognised that receptors may have a lower or higher sensitivity within a localised area, taking into account local conditions that may influence existing views.

Table 8.2: Visual sensitivity (susceptibility and value) and typical descriptions

Sensitivity (susceptibility and value)	Typical descriptions
Very High	<p>Static views from and of major tourist attractions.</p> <p>Views from and of very important national/international landscapes, cultural/historical sites (for example National Parks, UNESCO World Heritage sites).</p> <p>Receptors engaged in specific activities for enjoyment of dark skies .</p>
High	<p>Views by users of nationally important Public Rights of Way (PRoW)/recreational trails (for example national trails, long distance footpaths).</p> <p>Views by users of public open spaces for enjoyment of the countryside (for example country parks).</p> <p>Static views from dense residential areas, longer transient views from designated public open space, recreational areas.</p> <p>Views from and of rare, designated landscapes of national importance.</p>
Moderate	<p>Static views from less populated residential areas, schools and other institutional buildings and their outdoor areas.</p> <p>Views by outdoor workers.</p> <p>Transient views from local/regional areas such as public open space, scenic roads, railways or waterways, users of local/regional designated tourist routes of moderate importance.</p> <p>Views from and of landscapes of regional importance</p>
Low	<p>Views by indoor workers.</p> <p>Views by users of main roads (for example, trunk roads) or passengers in public transport on main arterial routes.</p> <p>Views by users of recreational facilities where the purpose of that recreation is not related to the view (for example, sports facilities).</p> <p>Views by users of local public open spaces of limited importance with limited variety or distinctiveness.</p>
Negligible	<p>Quick transient views such as from fast moving vehicles.</p> <p>Views from industrial areas, land awaiting re-development.</p> <p>Views from landscapes of no importance with no variety or distinctiveness.</p>

Source: LA 107, DMRB, 2020 (Table 3.41)

Magnitude of effect (change)

Landscape

8.3.10 In accordance with DMRB LA 107 (paragraph 3.19), assessment of magnitude of effect (change) on the landscape considers a combined judgement of the following:

- The size and scale of effect.
- Year 1 (opening year) and year 15 (design year) including summer and winter.
- Geographical extent of the area to be affected.
- The duration of the effect and its reversibility.

8.3.11 The magnitude of landscape effect (change) is reported in accordance with the typical descriptions in Table 8.3.

Table 8.3: Magnitude and nature of the effect (change) on the landscape and typical descriptions

Magnitude of effect (change)		Typical Descriptions
Major	Adverse	Total loss or large-scale damage to existing landscape character or distinctive features or elements; and/or addition of new uncharacteristic, conspicuous features or elements (for example road infrastructure).
	Beneficial	Large scale improvement of landscape character to features and elements; and/or addition of new distinctive features or elements, or removal of conspicuous road infrastructure 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 (for example road infrastructure).
	Beneficial	Partial or noticeable improvement of landscape character by restoration of existing features or elements; or addition of new characteristic features or elements or removal of noticeable features or 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
	Beneficial	Slight improvement of landscape character by the restoration of one (maybe more) key existing features and elements; and/or the addition of new characteristic features.
Negligible	Adverse	Very minor loss, damage or alteration to existing landscape character of one or more features and elements.
	Beneficial	Very minor, but noticeable improvement of character by the restoration of one or more existing features and elements.
No change	-	No noticeable alteration or improvement, temporary or permanent, of landscape character of existing features and elements.

Source: LA 107, DMRB, 2020 (Table 3.24)

Visual

8.3.12 Visual receptors will be visited during the site survey to identify the nature of existing view and the likely magnitude of change upon that receptor as result of the scheme. In accordance with DMRB LA 107 (paragraph 3.42), the establishment of the magnitude of visual impacts is informed by the following criteria:

- Scale, nature and duration of change
- Distance
- Screening
- Direction and focus of the view
- Year 1 (opening year) and Year 15 (design year) including summer and winter
- Removal of past mitigation or existing vegetation
- Whether the receptor is static or moving

8.3.13 The magnitude of visual effect (change) is reported in accordance with the criteria in typical descriptions in Table 8.4.

Table 8.4: Magnitude (change) of visual effect and typical descriptions

Magnitude (change) of visual effect	Typical descriptions
Major	The project, or a part of it, would become the dominant feature or focal point of the view.
Moderate	The project, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor.
Minor	The project, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the project would be discernible, or being at such a distance that it would form a barely noticeable feature or element of the view.
No Change	No part of the project, or activity would be discernible.

Source: LA 107, DMRB, 2020 (Table 3.43)

Assessment of significance

8.3.14 The assessment of the significance of effect is undertaken by combining sensitivity to change of a receptor with an assessment of the magnitude of change put upon it. These effects can be beneficial or adverse, and temporary or permanent, depending on the nature of the development and the mitigation and any enhancement measures proposed. The output of this function is detailed within Table 5.3 in Chapter 5.

8.4 Study area

8.4.1 In accordance with the DMRB LA 107 (paragraphs 3.11 and 3.31), the study area for the scoping of landscape and visual effects considers the following:

- Areas anticipated to be used for the scheme and its construction works and their visual footprint.
- The wider landscape setting and visual envelope which may be influenced by the scheme.
- The extents of the area visible by the scheme and the extent of representative viewpoints visible of the scheme.
- Where applicable, the full extent of adjacent or affected landscape receptors of special value where the setting may be influenced by the scheme.
- The extent of adjacent or affected visual receptors and the visual amenity of the area that may be influenced by the scheme.

8.4.2 The current ZTV indicates that the vast majority of receptors lie within 500m of the scheme alignment, with many situated within 200 metres. A

small number of receptors have been identified up to 1 kilometre from site, with one receptor beyond 1 kilometre at South Muskham.

8.4.3 The study area for the landscape assessment has been determined as 2 kilometres from the scheme alignment. It is not considered that significant effects upon landscape character would be likely beyond this distance due to the intervening built form and existing vegetation.

8.5 Existing baseline

Data sources

8.5.1 The relevant baseline conditions of the scheme location and study area have been established using the following sources of information:

- Previous published assessments of the landscape and visual effects during the options appraisal stages of the scheme
- Environmental Constraints Plan (Figure 2.1 of Volume 2)
- Newark & Sherwood Core Strategy DPD (Adopted March 2019)
- A Green Infrastructure Study for Newark & Sherwood
- Natural England's National Character Area (NCA) profiles⁷⁶
- Newark and Sherwood Landscape Character Assessment Supplementary Planning Document⁷⁷
- Natural England's MAGIC interactive map⁷⁸
- Conservation Areas are identified on Newark and Sherwood District Council's Conservation Area Maps and Character Appraisals⁷⁹
- Nottinghamshire County Council's online Definitive Map⁸⁰

Landscape designations

8.5.2 Designations relevant to the assessment of landscape and visual effects are illustrated on the environmental constraints drawing contained in Volume 2. Table 8.6 below presents designations within the study area and their distance from site. Further information is provided in Chapter 7 Cultural Heritage, Section 7.5.

Table 8.6: Relevant designations within the study area

⁷⁶ Natural England (2014) National Character Area profile: 48. Trent and Belvoir Vales [online] available at: NCA Profile: 48: Trent and Belvoir Vales - NE429 (naturalengland.org.uk) (last accessed June 2022).

⁷⁷ Newark and Sherwood District Council (2013) Landscape Character Assessment Supplementary Planning Document [online] available at: Landscape character assessment SPD | Newark and Sherwood District Council (newark-sherwooddc.gov.uk) (last accessed June 2022).

⁷⁸ Natural England (2017) MAGIC Interactive Map [online] available at: <http://magic.defra.gov.uk/MagicMap.aspx> (last accessed June 2022).

⁷⁹ Newark and Sherwood District Council (2017) Conservation Areas [online] available at: Conservation areas | Newark & Sherwood District Council (newark-sherwooddc.gov.uk) (last accessed June 2022).

⁸⁰ Nottinghamshire County Council (2017) Definitive Map [online] available at: PRoW data | Nottinghamshire County Council (last accessed June 2022).

Designations within the study area	Distance from the scheme
Winthorpe Conservation Area	Within the draft Order Limits to the northern extents of scheme at Winthorpe.
Newark Conservation Area	Within the draft Order Limits to the east of the A46 mainline.
Averham Conservation Area	Immediately adjacent to the draft Order Limits (proposed floodplain compensation area only).
Kelham Conservation Area	Immediately adjacent to the draft Order Limits (proposed floodplain compensation area only).
Farndon Conservation Area	1 kilometre west of draft Order Limits at Farndon junction.
Listed Buildings - various	Numerous within the study area: 387 Grade II, 15 Grade II* and seven Grade I (within 1 kilometre), closest listed building lies within the draft Order Limits and is Grade II listed.
Scheduled Monuments - various	17 within 1 kilometre; closest within the 10 metres of the draft Order Limits at Cattle Market junction.
Newark Castle Gardens Grade II listed Registered Park and Garden	580 metres to the south of the A46 Cattle Market junction.
Veteran and notable trees	4 veteran and 10 notable trees within, or directly adjacent to, the draft Order Limits (the majority of which, 1 veteran and 9 notable trees, are located at Kelham). 3 veteran trees are currently in conflict with the scheme footprint.
Tree Preservation Orders (TPO)	4 group TPOs within the draft Order Limits (TPOs 56, 116, 152 and 153). 3 of which will be in partial conflict with the scheme footprint (TPOs 116, 152 and 153).

There are no Areas of Outstanding Natural Beauty (AONB), National Parks, or local landscape designations, located within or adjacent to the study area of the scheme.

Landscape character

National level

8.5.3 The scheme and study area are located within National Character Area (NCA) 48 Trent and Belvoir Vales.

8.5.4 NCA 48 is characterised by “undulating, strong rural and predominantly arable farmland, centred on the River Trent. A low-lying rural landscape with relatively little woodland cover, the NCA offers long open views.

8.5.5 Newark-on-Trent lies at the centre with Grantham, Nottingham, Lincoln and Gainsborough on the peripheries. The area’s generally fertile soils and good quality agricultural land have supported a diversity of farming over a long period but, because of this, little semi-natural habitat remains...The powerful River Trent and its floodplain provide a strong feature running through the landscape...It is the greatest biodiversity resource, being a major corridor for wildlife moving through the area and supporting a variety of wetland habitats. It also provides flood storage as well as large amounts of cooling water for local power stations.”

County level

8.5.6 At a county level, the study area sits within three regional character areas (RCA) defined by the Newark and Sherwood Landscape Character Assessment Supplementary Planning Document (SPD):

- Trent Washlands RCA which covers Landscape Character Types River Meadowlands and Village Farmlands.
- East Nottinghamshire Sandlands RCA, which covers the Landscape Character Type Village Farmlands.
- South Nottinghamshire Farmlands RCA, which covers the Landscape Character Type Meadowlands and Village Farmlands.

8.5.7 Figure 8.2 contained in Volume 2 presents the locations of each of these character areas. Key characteristics, as described within the Newark and Sherwood LCA include:

8.5.8 Trent Washlands RCA

- Broad flat river terraces with meandering river channels.
- Predominantly arable, with permanent pasture around settlements and roads. Flood meadow in some parts.
- Regular pattern of medium-to large-sized fields, breaking down and becoming open in many areas.
- Sparsely populated with few buildings or with nucleated villages of traditional red brick and pantile roofed buildings.
- Long sinuous hedgerows, with hedgerow trees forming main component of tree cover.
- Willow pollards and holts.
- Sand and gravel quarries.
- Steep wooded bluffs.

8.5.9 East Nottinghamshire Sandlands RCA

- Free-draining sandy soils.
- Variable pattern of land use and land holding.
- Mixed, small-scale geometric plantations with birch, oak and Scots pine.

- Acidic grassland and grass heaths.
- Bracken, gorse and broom along hedgerows and roadside verge.

8.5.10 South Nottinghamshire Farmlands RCA

- Flat low-lying topography.
- Seasonally wet alluvial and peaty soils.
- Open, spacious views, sometimes enclosed by rising ground.
- Remnant pattern of large, hedged fields defined by thorn hedges or ditches.
- Small broad-leaved plantations.
- Absence of farmsteads or other buildings.
- Gently rolling topography.
- Simple pattern of large arable fields.
- Neatly trimmed hawthorn hedges.
- Nucleated villages with traditional red brick and pantile roofed buildings.
- Suburbanised commuter villages and small towns.
- Small-scale pastoral landscapes along village edges.

8.5.11 The Newark and Sherwood LCA divides each RCA into smaller 'policy zones', with landscape analysis undertaken for each. Further information is provided in Section 8.6.

Landscape baseline – the local landscape

8.5.12 The existing A46 runs through the centre of the study area. The existing road is single carriageway and generally elevated on embankment due to the low-lying alluvial floodplain of the nearby River Trent.

8.5.13 The River Trent is a strong natural influence within an otherwise manmade landscape, flowing sinuously in two channels located either side of the A46. There is a mixed geology of river terrace sand and gravel in Newark-on-Trent, and Riverine Clay, Sands and Gravels to the west, overlying various mudstone strata.

8.5.14 Several roundabouts form key junctions along the A46, linking with a number of A roads locally. The Nottingham to Lincoln Railway Line and East Coast Mainline traverse the area, bringing further infrastructure to the landscape. The Nottingham to Lincoln line crosses the existing A46 twice, once at the south-western extent and the second at the north-east end of the scheme extent. The East Coast Mainline intersects the A46 once to the east of the Sugar Factory.

8.5.15 The A46 road infrastructure is softened by roadside vegetation in places. Exceptions are the railway and watercourse crossings. To the north of the A46, farmland of irregular field patterns dominate, interspersed with small-scale settlement. To the south of the road, the town of Newark-on-Trent has developed from a long and rich history to form a notable urban settlement. The CPRE interactive map which presents England's Light Pollution and

Dark Skies⁸¹, identifies Newark-on-Trent as having some of the brightest night lighting levels, gradually reducing away from Newark-on-Trent, moving into a more rural landscape.

Visual baseline

8.5.16 At this stage, potential visual receptors have been identified through a desk top study, including reference to the most current ZTV for the scheme, as well as an initial site visit. Visual receptors currently proposed for inclusion within the assessment are presented in the Visual Receptor Plan (Figure 8.3 contained in Volume 2). A list of the receptors including the type of receptor addressed is presented in Appendix A of this report. The ZTV for the current scheme proposal is also presented in Figure 8.4 of Volume 2. Receptors currently include residential properties, PRow, roads users, businesses and recreational facilities. The identification of visual receptors will be reviewed as the LVIA progresses, taking into consideration scheme design development and the findings of field studies, and will be reported within the ES.

8.6 Value (sensitivity of resources and receptors)

8.6.1 As set out in Section 8.3, and defined in DMRB LA 107, value and susceptibility of receptors are first established individually, prior to being considered together to make judgements regarding landscape and visual sensitivity.

Landscape

8.6.2 A summary of the landscape analysis undertaken for each policy zone (PZ) that are included within the Newark and Sherwood LCA SPD and that also fall within the study areas is set out below.

Trent Washlands RCA (TW)

TW PZ 11 Cromwell, North and South Muskham, Kelham, Averham, Staythorpe and Rolleston Village Farmlands

8.6.3 Cromwell, North and South Muskham, Kelham, Averham, Staythorpe and Rolleston Village Farmlands is a large policy zone covering a number of village settlements and surrounding countryside to the west of Newark-on-Trent). The landscape condition is defined as 'moderate'. The landscape has been fragmented in places by transport routes, including the busy A1 to the northeast of the area. There are some detracting features which include the National Grid power station to the south of Averham, pylons, the railway line and busy roads. Some historic elements have been degraded by intensive arable farming, transport routes and mineral extraction, however the historic settlements are characteristic of Trent Washlands RCA. The

⁸¹ CPRE (2016) Interactive Map [online] available at: England's Light Pollution and Dark Skies (cpre.org.uk) (last accessed July 2022).

historic parkland landscape still exists around Kelham Hall. Villages at Averham and Kelham are designated Conservation Areas. There is some commercial development, not always in keeping with a rural landscape. Overall, the area is considered to have a 'moderate' sense of place, with a 'moderate' degree of visibility leading to 'moderate' landscape sensitivity.

8.6.4 As a result of the analysis, the landscape actions are to 'conserve and create', conserving and restoring historic field patterns and conserving the historic woodland and parkland landscape around Kelham Hall, as well as to seek opportunities to restore arable land to permanent wet alluvial grassland close to the River Trent.

TW PZ 12 Farndon Village Farmlands

8.6.5 Farndon Village Farmlands PZ is a small area located at the south-west edge of Newark-on-Trent. The landscape condition is defined as 'poor' with a coherent pattern of landscape elements with some detracting features which include power lines, commercial buildings, busy roads and road junctions. Overall, the area is visually coherent. The character assessment concludes a 'very weak' sense of place with features that are characteristic of the Trent Washlands which would give the area its local distinctiveness having largely been removed. The landform is apparent and generally there is little tree cover which leads to 'high' visibility. The 'very weak' sense of place with a 'high' degree of visibility leads to landscape sensitivity being defined as 'low'. As a result of the analysis, the landscape actions are to 'create' by recreating historic fields boundaries, restore arable land to permanent pasture and reinforce hedgerows.

8.6.6 As a result of the analysis, the landscape actions for PZ 12 are to 'create', including seeking opportunities to recreate historic field boundaries where lost and restore arable land to permanent pasture. There is also an action to restore hedgerows where necessary and reinforce and strengthen ecology along water courses with native planting.

TW PZ 13 Manor Farm River Meadowlands

8.6.7 Manor Farm River Meadowlands PZ is located to the west of the Trent Valley and is a predominately flat arable landscape becoming gently undulating to the south and west. The landscape condition is described as being 'good', albeit the landscape has been fragmented by rail infrastructure running on a north-south axis through the area. There are few detracting features, and overall the area is considered visually coherent. Cultural integrity is variable as a result of the degradation of field patterns in the north, but they remain in place in the south. Landscape condition is described as 'good', with a 'moderate' sense of place. This along with a moderate degree of visibility leads to 'moderate' landscape sensitivity.

8.6.8 As a result of the analysis, the landscape actions are to 'conserve and reinforce' including conserving and restoring traditional field patterns and

associated hedgerows, restoring arable to permanent pasture, and reinforcing continuity and ecological diversity of water courses.

TW PZ 29 Upton Hall River Meadowlands

8.6.9 Upton Hall River Meadowlands sits within part of the Upton Hall former Mature Landscape Area. The landscape is dominated by improved pasture, with areas of arable farmland in the east. Fields are generally regular in form and small to medium in size. Strong hedgerows including hedgerows with trees define field boundaries. Trees are also present along watercourses. The overall condition is defined as 'very good'. The unified pattern combined with few detracting features gives a 'strongly visually unified' areas overall. Landscape features are characteristic of the wider Trent Washlands RCA. Historic features are evident, including historic field boundaries running on a north-south axis through the area, contributing to a 'moderate' sense of place. This combined with a 'moderate' degree of visibility leads to a 'moderate' landscape sensitivity.

8.6.10 The analysis concludes a need to 'conserve' landscape features. This includes conserving historic field boundaries and associated hedgerows, conserving ecological diversity including along water courses, and conserving pastoral character. Actions also include considering enhancements through small scale tree and woodland planting as well as conserving the sparsely settled character of the landscape.

TW PZ 30 Farndon River Meadowlands

8.6.11 Farndon River Meadowlands PZ is a small area located on the south-west edge of Farndon. The landscape condition is defined as 'very good' with the pattern of landscape elements described as being unified with few detracting features, which gives a strongly visually unified area. The features which give the area its local distinctiveness are characteristic of the Trent Washlands, leading to a 'moderate' sense of place. This combined with the 'low' degree of visibility leads to landscape sensitivity being defined as 'low'.

8.6.12 As a result of the analysis, the landscape actions are to 'conserve and reinforce' by conserving the traditional pattern of hedged fields and to reinforce historic field pattern with new hedgerow planting where appropriate, conserve pastoral character and reinforce the species diversity of alluvial grasslands, conserve and maintain willow holts and enhance visual unity through small scale tree and woodland planting.

TW PZ 31 Battle Bridge River Meadowlands

8.6.13 Battle Bridge River Meadowlands is a small area dominated by species rich pasture and some areas of arable farmland. It forms part of Micklebarrow Hill former Mature Landscape Area. The field pattern is defined by small regular layout with strong mixed species

hedgerows. The area is well enclosed by mature field boundary vegetation, limiting views. The overall landscape condition is defined as 'very good'. Landscape pattern is considered to be coherent with few detracting features. Landform is 'apparent' and the strong tree cover providing enclosure leads to a low degree of visibility. This combined with the 'moderate' sense of place leads to a 'low' landscape sensitivity.

8.6.14 The analysis concludes a landscape action to 'conserve and reinforce'. Landscape features to be conserved include traditional hedged fields and ridge and furrow features, and those to be reinforced include historic field patterns. Actions also include seeking opportunities to convert arable land to permanent pasture, enhancements to the river environment, enhancements through small scale tree and woodland planting, and conserving the sparsely settled character of the landscape.

TW PZ 32 Kelham Hills River Meadowlands

8.6.15 Kelham Hills River Meadowlands forms part of the Kelham Hills former Mature Landscape Area. The area is characterized by mixed farmland with small to medium sized fields of largely improved or semi-improved grassland. Historic field patterns also remain, delineated by tall mixed hedgerows. The overall landscape condition is defined as 'very good', with a unified pattern and few detracting features. This leads to a strong visually unified area. Landscape features which provide the area's sense of place are characteristic of the wider Trent Washlands RCA. Views are restricted by the strong mature hedgerows and woodland to the west, leading to a moderate visibility of the area from outside the policy zone. This combined with the 'moderate' sense of place leads to a 'moderate' landscape sensitivity.

8.6.16 The analysis concludes the need to 'conserve' landscape features, including the traditional pattern of hedged fields and meadowland, and 'reinforce' the historic field pattern where possible. Additional actions include seeking opportunities to return arable land to pasture, conserving pastoral character and promoting ecological diversity, as well as enhancing visual unity through small scale tree and woodland planting and conserving the sparsely settled character of the area.

TW PZ 33 Newark West River Meadowlands

8.6.17 Newark West River Meadowlands PZ is a small area located on the western edge of Newark-on-Trent. The landscape condition is defined as 'very poor'. The pattern of landscape elements is incoherent and the area has many detracting features including the A46 roundabout and associated roads, railway line and other detracting features such as caravan park,

industrial and residential development giving rise to a significantly visually interrupted area. Despite cultural integrity being poor due to a loss of features, historic sites do still remain. This area has a 'very weak' sense of place as it has been highly fragmented by provision of major roads, the railway, and recent industrial and residential developments. Few distinctive features of the Trent Washlands RCA are evident. The very weak sense of place with 'moderate' degree of visibility results in a 'very low' landscape sensitivity.

8.6.18 As a result of the analysis, the landscape actions are to 'create' by recreating the traditional pattern of hedged fields to reinforce the historic field pattern and seek opportunities to enhance visual unity through planting of small-scale trees and woodland, as well as enhancing tree cover with planting of hedgerow trees.

TW PZ 34 Sconce and Devon Park River Meadowlands

8.6.19 Sconce and Devon Park River Meadowlands PZ is a small area located on the south-west edge of Newark-on-Trent. The landscape condition is defined as 'very good'. The pattern of the landscape elements is coherent with few detracting features with an overall visually unified area. The features which give this area its local distinctiveness are characteristic of the Trent Washlands. Views within the area are restricted by Newark-on-Trent's urban area. The landform is apparent and intermittent tree cover provides a limited degree of enclosure which leads to a 'moderate' visibility of the area from outside the policy zone. The area has a moderate sense of place which when combined with the moderate visibility leads to a 'moderate' landscape sensitivity.

8.6.20 As a result of the analysis, the landscape actions are to 'conserve' by recreating the traditional pattern of hedged fields to reinforce the historic pattern, conserve and protect pollarded willows and seek opportunities to re-pollard existing willows and conserve and enhance the pattern and special features of meadowland hedgerows.

TW PZ 37 Winthorpe and West River meadowlands

8.6.21 Winthorpe and West River meadowlands PZ is a small area located on the western edge of Winthorpe. The landscape condition is defined as 'very good' with a unified pattern of elements and few detracting features. The historic field pattern is well maintained, and hedgerows are in a good condition with the exception to the far west where field patterns have been lost to arable farmland. The policy zone includes the historic Winthorpe Hall which lies within Winthorpe village Conservation Area. Features that give rise to the local sense of place are characteristic of the RCA. Views within the areas are restricted due to strong hedgerows and vegetation along watercourses. There are open views to the south-west and south-east. The

'moderate' sense of place combined with the 'moderate' degree of visibility results in a 'moderate' landscape sensitivity.

8.6.22 As a result of the analysis, the landscape actions are to 'conserve' by conserving the traditional pattern of hedged fields to reinforce the historic pattern, conserve and renew ornamental parkland planting and individual parkland trees, and conserve and enhance the pattern and special features of meadowland hedgerows.

TW PZ 53 Averham Weir River Meadowlands

8.6.23 Averham Weir River Meadowlands PZ is a large area spanning from the south of Farndon to north of Winthorpe on the western edge of Newark-on-Trent. The landscape condition is defined as 'moderate'. This is a landscape made up of large-scale arable fields with some detracting features such as the Sugar beet factory and part of the Staythorpe power station. However, visual unity is coherent due to the large-scale elements found throughout the area. The landscape has an overall 'moderate' condition. Recent gravel extraction and intensive arable farming have left a highly modified landscape with an indistinct feel and weak sense of place. This combined with a 'high' degree of visibility along the Trent Valley leads to landscape sensitivity being defined as 'low'.

8.6.24 As a result of the analysis, the landscape actions are to 'create and reinforce' by reinforcing and strengthening the continuity and ecological diversity of stream and water courses by native planting or allowing natural regeneration, and conserve and reinforce pattern and special features of meadowland hedgerows. Weir River Meadowlands PZ is a large area spanning from the south of Farndon to north of Winthorpe on the western edge of Newark-on-Trent. The landscape condition is defined as 'moderate'. This is a landscape made up of large-scale arable fields with some detracting features such as the Sugar beet factory and part of the Staythorpe power station. However, visual unity is coherent due to the large-scale elements found throughout the area. The landscape has an overall 'moderate' condition. Recent gravel extraction and intensive arable farming have left a highly modified landscape with an indistinct feel and weak sense of place. This combined with a 'high' degree of visibility along the Trent Valley leads to landscape sensitivity being defined as

Mid Nottinghamshire Farmlands RCA

MN30 PZ Knapthorpe Village Farmlands with Ancient Woodland

8.6.25 The Knapthorpe Village Farmlands with Ancient Woodland PZ is characterised by a gently undulating topography set to a mix of intensive arable fields with well managed hedgerow and areas of lower intensity permanent improved pasture. Landscape pattern is coherent and there are a small number of detracting features including the A616 and A617. Farmland is interspersed with numerous blocks of

mixed deciduous woodland, often forming wooded skylines. The presence of woodland along with hedgerows lead to a 'moderate' visibility. Landscape condition is considered to be 'very good' and the sense of place is 'moderate'. This leads to a 'moderate' landscape sensitivity overall.

8.6.26 The landscape analysis concludes the need to 'conserve' landscape features. This includes conserving and maintaining historic field patterns, hedgerows and blocks of woodland, as well as conserving and enhancing biodiversity within riparian habitats.

MN32 PZ Upton Village Farmlands

8.6.27 Upton Village Farmlands PZ is gently undulating in the north, before flattening to the south of Upton. The PZ is dominated by the historic settlement of Upton, a designated Conservation Area. Small geometric pastoral fields surround the village. In other areas, farmland take the form of intensive arable land use. Hedgerows and woodland create a sense of enclosure in many areas. Some agricultural and leisure development also exists. The landscape condition is considered as 'very good'. There are a few detracting features such as the A617 and electricity pylons, as well as poultry houses. Given the historic fabric of the landscape the sense of place is determined to be 'moderate'. Visibility is generally 'high' within the PZ, although views are intermittent due to intervening blocks of woodland and hedgerows. The 'moderate' sense of place and high visibility leads to a 'high' landscape sensitivity overall.

8.6.28 The analysis concludes the need to 'conserve' landscape features. This includes conserving hedgerows and preventing fragmentation, as well as conserving the associated historic field patterns. There is also an action to maintain use of vernacular materials, style and scale in any new developments.

East Nottinghamshire Sandlands RCA

ES PZ 04 Winthorpe Village Farmlands

8.6.29 Winthorpe Village Farmlands PZ is a large area spanning from the south-east edge of Newark-on-Trent to the north of Collingham. The landscape condition is defined as 'moderate'. The area has a coherent pattern of elements composed of predominantly arable fields and isolated farms with some detracting features. The landscape sensitivity is defined as 'moderate' with components of the landscape characteristic to the East Nottinghamshire Sandlands RCA. The landform is apparent with intermittent areas of woodland giving a generally moderate visibility value within the policy zone. Views are intermittent due to blocks of woodland and networks of hedgerows. A 'moderate' sense of place and 'moderate' visibility leads to a 'moderate' landscape sensitivity overall.

8.6.30 As a result of the analysis, the landscape actions are to ‘conserve and create’ by creating new hedgerows and conserve existing, conserve field patterns and conserve and enhance tree cover and landscape planting generally to increase visual unity across the policy zone.

ES PZ 06 Bowbridge Lane Village Farmlands

8.6.31 Bowbridge Lane Village Farmlands PZ is a small area located on the southern boundary of Newark-on-Trent. The landscape condition is defined as ‘good’ with a coherent pattern of elements composed of predominantly arable fields and isolated farms with few detracting features. Overall, this gives a visually unified area. The landscape sensitivity is defined as ‘low’. The components of the landscape are characteristic to the East Nottinghamshire Sandlands LCA. The landform is insignificant with intermittent tree cover giving a generally low visibility value with the policy zone. This ‘low’ visibility value combined with a ‘moderate’ sense of place leads to a ‘low’ sensitivity overall.

8.6.32 As a result of the analysis, the landscape actions are to ‘reinforce’ including fragmented hedgerows with new planting to infill and replace post and rail fencing and enhance visual unity and soften surrounding built development through landscape planting.

South Nottinghamshire Farmlands RCA

SF PZ 07 Elston Village Farmlands

8.6.33 Elston Village Farmlands PZ is located to the south of Newark-on-Trent and Farndon. The landscape condition is defined as ‘moderate’. The area has a coherent pattern of elements composed of predominantly arable fields and isolated farms with some detracting features; including sewage works, industrial works, the busy A46 and pylons. The components of the landscape are characteristic to the south Nottinghamshire Farmlands RCA. The landform is apparent with intermittent tree cover giving a generally ‘moderate’ visibility value within the policy zone. The moderate visibility combined with the ‘moderate’ sense of place results in ‘moderate’ landscape sensitivity.

8.6.34 As a result of the analysis, the landscape actions are to ‘conserve and create’ by creating new hedgerows and restore existing, enhance tree cover and landscape planting generally, in particular along the A46, to create increased visual unity and habitat across the policy zone.

8.6.35 When considering the landscape analysis presented for each policy zone within the Newark and Sherwood Landscape Character Assessment, the overall landscape sensitivity to this type of scheme is considered to be ‘moderate’ at this stage.

Visual

8.6.36 At this stage of assessment, the full establishment of view value, susceptibility and resulting sensitivity for each visual receptor identified, has yet to be fully detailed. However, an outline is provided below, building on the work undertaken at previous stages and the scoping assessment presented within the Environmental Scoping Report⁸².

Visitors to outdoor recreation facilities and users of Public Rights of Way

8.6.37 Visual receptors considered to have a high or very high sensitivity to change include users of recreational facilities such as visitors to Newark Castle Scheduled Monument and Registered Park and Garden, Newark Air Museum, Newark Cricket Club and Newark Rugby Club.

8.6.38 In addition, users of the River Trent, as well as the extensive Public Rights of Way (PRoW) network within the study area, are also likely to have a high sensitivity to change. The PRoW include footpath, bridleways and National Cycle Route 64.

8.6.39 At this stage, all are considered to have a high or very high sensitivity to change predicated on a high susceptibility to change given the activity the viewer is partaking in and likely interest in views to the surrounding landscape. This, along with the value of each view, will be corroborated during further site survey from each receptor location and documented within the ES.

Residential receptors

8.6.40 There are a large number of residential receptors within the study area, particularly given the dense development that has occurred over many centuries in Newark-on-Trent to the south of the A46. Directly south and east of the A46, residential properties form the north, western and southerly boundaries on the edge of Newark-on-Trent.

8.6.41 To the north and west of the A46, residential properties are found in well-established village settlements as well as a small number of isolated properties.

8.6.42 Susceptibility to change is considered to be high due to the nature of the receptor and activity undertaken, with residents considered likely to have strong interest in views from their properties. As such, residential receptors are generally considered to have a high sensitivity to change, however the value of the view from each selected visual receptor will be corroborated on site as the assessment work progresses and documented within the ES.

Road users

8.6.43 Road users are generally considered to have a low susceptibility to change given the nature of their visual experience. The value of the view

⁸² National Highways (August, 2022) A46 Newark Bypass Environmental Scoping Report [online] available at: [TR010065-000002-A46N - Scoping Report.pdf \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/tr010065-000002-A46N-Scoping-Report.pdf) (last accessed October 2022).

will be corroborated further on site, however it is currently considered that road users will, in many cases, have a low or medium sensitivity to change. This sensitivity will be confirmed within the ES.

Local business users

8.6.44 The majority of local business users such as those at the Sugar Factory, large scale distribution centres to the east of the A1, industrial estates and shed format retail developments within Newark-on-Trent, are considered to have a low susceptibility to change due to the fact that users will be focusing on the task in hand rather than seeking outwardly facing views to the surrounding landscape. The value of the view will vary with each receptor and shall be confirmed during ongoing assessment. However, it is currently anticipated that the majority of local business users will have a low sensitivity to change. This sensitivity will be confirmed within the ES.

8.7 Potential impacts

8.7.1 Potential construction and operation impacts applicable to the scheme are summarised in the following sections.

Construction

8.7.2 Construction impacts may be short-term, long term, temporary or permanent in nature. The sources of potential impacts considered in relation to landscape and visual amenity during construction include:

- Presence and movement of construction traffic, plant and equipment.
- Construction compounds and haul routes, particularly if sited within areas of farmland.
- Temporary fencing and hoardings.
- Demolition and site clearance, including vegetation clearance along the route.
- Introduction of temporary structures and signage.
- Earthworks and changes in the landform of the site, particularly along the length of the north bound carriageway widening.
- Storage of earth and other materials.
- Presence and views of lighting for works during low daylight levels or for night work, as well as compounds.
- The progressive construction of the permanent built elements including above grade structures such as the rail and river crossings and the grade separated junction at Cattle Market.
- Vegetation removal, including that which currently offers landscape character and visual screening value, or which have TPO, notable or veteran status.
- Bare soil of newly formed earthworks.

8.7.3 The detracting elements of construction that would be introduced into the landscape and urban areas are expected to be located in close proximity to the existing road infrastructure as far as practicable. This is with the

exception of possible requirements for floodplain compensation areas which would be up to 1.4 kilometres from the scheme alignment. Current proposals for a floodplain compensation area at Kelham would likely bring temporary detracting features to the landscape during construction. However, the exact areas required to construct the scheme, hours of working and extent of vegetation clearance have yet to be determined.

Operation

8.7.4 Sources of potential impacts considered in relation to landscape character and visual amenity during operation include:

- Additional road infrastructure, notably hard surfacing and new at height structures such as the grade separated junction at Cattle Market. These elements would increase the extents, vertical scale and perception of the highway network.
- Potential increase in the number of, or scale of, related infrastructure such as signs, traffic signals, lighting, CCTV, technology elements, servicing or power units; also, any new maintenance access platforms/routes and associated hard surfacing and pedestrian guardrails.
- Permanent loss of vegetation within and outside the existing highway boundary, which in turn may reduce physical containment and open up views to the A46.
- New or modified earthworks and drainage elements that may require additional land take, including ponds, swales and flood compensation areas.

8.8 Consultation

8.8.1 A meeting was held on 16 March 2021 with representatives from Newark and Sherwood District Council where the potentially affected Tree Protection Orders (TPOs) and conservation areas were discussed. It was established that the TPO status was applied to safeguard trees along the original A46 relief road scheme constructed in the 1990s to retain screening for local residents.

8.8.2 The importance of mitigation measures was reinforced throughout the meeting with the focus on retaining as much existing vegetation as possible, and at worst replacing any affected TPO with like for like species or suitable alternatives, noting that many of the trees were ash and would potentially be lost through ash die-back. The replacement strategy will be based on an assessment of all trees within the DCO boundary undertaken in accordance with BS 5378. The assessment will also define construction exclusion zones to protect existing trees.

8.8.3 A meeting was held on 21 July 2022 with the Senior Conservation Officer at Newark and Sherwood District Council to discuss the proposed visual receptors. The inclusion of additional receptors was discussed and an agreement was reached on the visual receptors to inform the Landscape

and Visual Impact Assessment (LVIA). The Tree Officer at Newark and Sherwood District Council was also in attendance. There was further discussion on trees within the scheme footprint, as well as dialogue on proposed tree surveys to inform the ongoing Environmental Impact Assessment (EIA) and design. Further consultation with the Tree Officer will take place as the arboricultural surveys progress.

8.8.4 Consultation with Newark and Sherwood District Council will continue throughout the design and EIA process, to be undertaken as part of the ES, to develop the landscape design and mitigation strategy for the scheme.

8.9 Assumptions and limitations

8.9.1 Full details of the final design and construction methods, timescales and spatial requirements are currently being developed. Further baseline assessment is also ongoing, including additional site surveys.

8.9.2 The development of the scheme design, and continued establishment of detailed baseline information will further inform the LVIA.

8.9.3 The assessment of likely significant effects is therefore currently predicated on limited information and preliminary designs only at this time.

8.10 Design, mitigation and enhancement measures

Design measures

8.10.1 The development of the scheme design will be an iterative process, undertaken as part of an integrated design team. The design will adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA 104. The first principle will be to avoid potential adverse effects where possible, before seeking to minimise or mitigate any unavoidable impacts. This will form a well-developed essential mitigation strategy. The landscape design strategy for the scheme will seek to respond to the local landscape character and physical topography of the area, aiding the settlement of the scheme within the receiving environment. It will seek to limit visual clutter and detracting features as far as possible, whilst mitigating impacts and enhancing biodiversity as part of a holistic design approach. Embedded mitigation incorporated into the scheme design development to date is outlined in Chapter 2 Section 2.7 of this report, with an Indicative Environmental Masterplan shown in Figure 2.3 of Volume 2.

8.10.2 There are a number of opportunities for further embedded mitigation that will be considered during the development of the ongoing scheme design. These include:

- Careful integration of earthworks into the landscape, shaping the proposed new landform sympathetically to integrate the scheme into the receiving landscape.

- The use of earth landscape bunds to further aid landscape integration and reduce the prominence of the scheme as appropriate.
- Earthworks to be designed to minimise conflicts with existing vegetation as well as PRoW.
- Rounding off the crests and toes of all embankments and the floodplain compensation areas design to achieve a more natural appearance for slope profiles, allowing greater integration with the surrounding landform.
- Slope profiles graded out and returned to agricultural use to retain the open character of the area.
- Limit increase of vertical alignment of the new road, junctions, structures and associated infrastructure as far as practicable to minimise landscape and visual impacts. Measures would include seeking to avoid placement of fence lines at the top of any embankment slopes where they could dominate the skyline.
- Lighting columns should be kept to the minimal height necessary and be directional to minimise impact on nearby properties and the wider night sky. This would need to be considered in conjunction with operational safety requirements.
- New structures should be designed with a low solid to void ratio wherever practicable, with consideration given to colour, form, and materials to minimise the visual prominence of these new features.

Mitigation measures - Construction

8.10.3 Mitigation measures of relevance during construction, to be included within the Second Iteration Environmental Management Plan, include the following:

- Keeping a well ordered and tidy site, including keeping stockpiles to a minimum, with delivery of goods on an as needed basis.
- Limiting works to daylight hours in the most part, with any night works to be kept to a minimum where practicable.
- Using minimal, low level and directional lighting for compound security and night works, whilst successfully meeting safety requirements.
- Retention and avoidance of impact upon existing trees and vegetation wherever possible, including the sensitive consideration of trees protected by TPOs and other veteran and notable trees within and adjacent to the works boundary.
- Protecting existing trees and vegetation to be retained with protective fencing, where deemed necessary, in accordance with BS 5837:2012
- Restoration of land used temporarily to construct the scheme, as soon as practicable.
- Constructing screening mounds, where they are proposed as part of the permanent works, to as early as is practicable to provide screening to the construction work.

Mitigation measures - Operation

8.10.4 Mitigation measures of relevance during operation, to be included within the Second Iteration Environmental Management Plan, include the following:

- New and replacement planting should be native, whilst being cognisant of climate change resilience, and reflect the local vernacular, including those species listed in the Newark and Sherwood Landscape Character Assessment SPD.
- Retention and enhancement of hedgerows and linear belts of vegetation along the highway boundary where possible, to ensure that existing field boundaries and highways planting remains intact and wildlife corridors are not severed.
- Where drainage ditches, balancing ponds and attenuation areas are required, opportunities for habitat creation will be incorporated into the environmental design with an aim to increase biodiversity.

Enhancement measures

8.10.5 Enhancement measures will seek to improve and/or restore local landscape character and visual amenity where possible, aligning with the Landscape Actions specified for the relevant policy zones established by the Newark and Sherwood Landscape Character Assessment Supplementary Planning Document (SPD). These enhancement measures will be considered during the integrated scheme design development and reported within the ES. However, these enhancement measures will not be taken into account when determining whether effects are significant or not.

8.11 Assessment of effects

Construction

Landscape character

8.11.1 The presence of construction plant, materials, machinery, construction compounds and the provision of construction lighting is likely to have a direct impact on landscape features within the study area. These elements would alter the landscape setting of the A46, in particular the predominantly open, rural, less developed landscape to the north and west of the road.

8.11.2 Similarly, the removal of vegetation where required to facilitate the works, such as along the existing A46, has the potential to impact directly on key characteristics of the local landscape character within the study area. For example, the loss of hedgerows which currently define local field pattern. These changes are likely to lead to significant effects upon local landscape character for a temporary period.

8.11.3 Earthworks required for the construction of off-site floodplain compensation area would also lead to the introduction of detracting features in an otherwise rural landscape. These works could occur up to 1.4

kilometres northwest of the main scheme alignment at Kelham. There would be no direct impacts upon the Kelham or Averham Conservation Area. However, indirect impacts may occur within the setting of the Conservation Area during construction depending upon the final design and location.

8.11.4 Direct impacts and resulting possible significant effects are predicted for the following policy zones within two of the three RCAs within the study area. Direct impacts are not predicted within the South Nottinghamshire Farmlands RCA:

- Trent Washlands RCA: TW PZ 12, TW PZ 33, TW PZ 53 (on very periphery).
- East Nottinghamshire Sandlands RCA: ES PZ 04.

8.11.5 Direct impacts are not predicted within the South Nottinghamshire Farmlands RCA or Mid Nottinghamshire Farmlands.

8.11.6 Indirect impacts may also lead to significant effects where intervisibility with construction in the neighbouring policy zone is afforded. This is possible for the following policy zones within all three RCAs:

- Trent Washlands RCA: TW PZ 11, TW PZ 31 and TW PZ 32, where intervisibility is afforded with the Kelham Flood Compensation Area. TW PZ 37 where intervisibility is afforded from the policy zone between Brownhills Junction and Winthorpe Junction, towards the south and west; including from Winthorpe Conservation Area.
- Mid Nottinghamshire Farmlands RCA: MN PZ 30 and MN PZ 32.
- East Nottinghamshire Sandlands RCA: ES PZ 06 - intervisibility likely between and scheme to the north west at Farndon.
- South Nottinghamshire Farmlands RCA: SF PZ 07- intervisibility likely between the policy zone and scheme to the north west at Farndon.

8.11.7 In addition to the potential effects within the policy zones, direct effects upon Newark-on-Trent are predicted during construction. This would include effects resulting from works within the Newark Conservation Area between the A46 and the East Coast Mainline railway. Direct impacts would be limited to the area around Netherlock Viaduct and despite being within the Conservation Area, would be in an area of disused ex-industrial land in poor condition, adjacent to the East Coast Mainline railway. The works also have the potential to bring adverse effects upon the setting of the townscape of Newark-on-Trent, given the intervisibility of neighbouring detracting construction elements in and around the A46 to the northwest.

8.11.8 Efforts to retain the existing southbound carriageway extents and existing vegetation on the eastern edge of the A46 where possible would help to limit the effects upon the settlement. The greatest effect upon landscape character is likely to result from the impact associated with the grade separated junction at Cattle Market.

8.11.9 Construction works also have the potential to reduce both audible and visual tranquility in the area, particularly in close proximity to the scheme.

8.11.10 Any landscape effects arising from impacts associated with the temporary addition of detracting features within the landscape, would however, be set in the context of the existing A46, wider road and rail network, and other detracting features associated with industry such as the Sugar Factory and local industrial and commercial developments.

8.11.11 When considering the moderate sensitivity of the landscape, overall, a moderate adverse effect upon landscape character is currently anticipated during construction. This effect would reduce in areas where only indirect effects are afforded, in particular in areas more distant from the scheme, or where there is limited visual connectivity between character areas and the construction site.

Visual amenity

8.11.12 Short distance views are likely to be afforded from a number of properties in close proximity to the scheme construction works. Views would include those capturing at-height works associated with the construction of new bridge structures along the route, and the grade separated junction at Cattle Market.

8.11.13 Receptors would include a number of residential properties and PRoW users, with the potential for short distance views to construction activity and compounds. In addition, the removal of any existing trees and screening vegetation may result in the opening up of views of the A46 as well as of construction activity, bringing further visual change to local receptors. There would be the potential for short term impacts and resulting adverse visual effects upon views from the following areas:

- Residential properties on the northern and western edges of Newark-on-Trent between Newark Crossing and the A46/B6166 junction. This would include properties within Sandhills Park, with open views across adjacent temporary works areas to the construction of Cattle Market junction.
- Properties on Crees Lane affording direct impacts within residential boundaries.
- Residential properties at villages of Winthorpe, Kelham and Averham.
- Users of the PRoW network, including Trent Valley Way Long Distance Footpath and National Cycle Route 64.
- Users of recreational facilities including Newark Showground, Newark Rugby Club and Newark Cricket Club.
- Visitors enjoying the areas historical heritage, most notably at Newark Castle.
- Users of the A46 and nearby roads during construction.

Operation

Landscape character

8.11.14 During operation, the widened A46 and associated highway features, including a number of at-height bridge structures and retaining walls, would increase the prominence of the A46 within the receiving landscape. This would particularly be the case to the north and west of the existing A46, where the rural landscape is open, affording greater intervisibility with the road.

8.11.15 In addition to the widening of the A46 and introduction of associated infrastructure, there would be a loss of existing landscape features. Effects upon landscape character during operation would arise from loss of existing hedgerow field boundaries and linear belts of trees adjacent to the A46. However, the essential mitigation strategy seeks to reinstate field boundaries and screening vegetation lost during construction wherever practicable. This would aid containment of the scheme and reflect the existing vegetation cover and landscape pattern within the local landscape where possible.

8.11.16 The introduction of the floodplain compensation area at Kelham may also bring a change in local topography and land use, with opportunities for biodiversity enhancements to be explored. There is potential for short term indirect impacts and resultant significant effects upon the setting of Kelham and Averham Conservation Areas in this location.

8.11.17 Indirect effects upon the conservation areas at Winthorpe and Newark-on-Trent are also likely in the early years of operation prior to the establishment of mitigation planting to both reinstate and enhance visual screening. Further information will be provided as the LVIA progresses as part of the ES.

Visual amenity

8.11.18 Visual amenity would also be affected as a result of the increased visual prominence of the widened A46. This would arise from impacts associated with an additional lane of traffic movements and new or enlarged structures and junctions. Visual impacts would also arise due to views of signage, lighting at junctions and vehicle headlights during hours of darkness. Visual impacts would particularly be associated with the grade separated Cattle Market junction. Significant visual effects are considered likely as a result of these impacts.

8.11.19 Vegetation removal is planned to be kept to a minimum on the southern side of the A46, allowing the retention of existing screening planting between the A46 and visual receptors in Newark-on-Trent. However, where current open views are afforded such as adjacent to the

new Cattle Market junction, or vegetation clearance is unavoidable, views may be opened up to the operational newly widened A46. This would, potentially increase detracting features, including at-height structures within local views.

- 8.11.20 The A46 will consequently appear more dominant in views, particularly from those receptor locations affording short distance open views towards the scheme. Receptors identified as likely to experience the greatest effects during construction, would similarly be most affected during the early years of operation, particularly residential properties at Crees Lane and Sandhills Park where longer term significant adverse effects are possible.
- 8.11.21 Views to the new floodplain compensation area at Kelham are also likely to be afforded from local residential receptors on the edge of Kelham and Averham, and from the local PRow network during operation. However, given the nature of the works in this area, it is not considered that long term adverse visual effects are likely in this location.
- 8.11.22 In line with the essential mitigation strategy, reinstatement of vegetation will be proposed wherever possible, to aid screening of views and integration of the scheme within the surrounding landscape. Whilst not immediately effective in the early years of operation, the establishment of vegetation would aid visual screening over time.
- 8.11.23 As such, it is currently considered likely that a number of visual receptors, including those with a high sensitivity to change, would be afforded significant adverse effects during the early stages of operation, with the magnitude of change and resulting significance of effect reducing over time for the majority of receptors.

8.12 Monitoring requirements for significant adverse effects

- 8.12.1 Details regarding monitoring requirements during construction will be detailed within the Landscape and Visual effects chapter of the ES. It is likely that this will include the requirement for monitoring of construction practices to ensure all necessary controls are in place to protect the environment, including existing landscape features to be retained. These measures will be detailed within the First Iteration Environmental Management Plan.
- 8.12.2 Post construction, monitoring should be undertaken to ensure that mitigation planting is developing to provide the visual screening, landscape integration or biodiversity value as intended within the environmental design, and as reported within the LVIA, as well as other affected disciplines such as cultural heritage and biodiversity. Monitoring of vegetation establishment during the aftercare period will ensure successful mitigation of potentially significant adverse effects in the immediate periods

after scheme opening. In the event of plant failure, action can be taken during the monitoring to rectify failures and ensure mitigation measures come to fruition.

8.13 Conclusions

8.13.1 This chapter provides a summary of the assessment undertaken so far, relating to the potential landscape character and visual effects of the scheme. At the time of writing, the landscape and visual impact assessment is currently being progressed in accordance with DMRB LA 107. This assessment will continue to be updated for inclusion within the ES, to be submitted as part of the DCO application. The assessment will build upon the information presented within this chapter based on scheme design development, and additional site surveys.

8.13.2 Significant effects upon landscape character are likely during both construction and operation, with the project having the potential to directly affect local character, including alterations to existing local pattern and land cover, as well as changes to the setting of an open, rural landscape including local Conservation Areas.

8.13.3 Significant effects are also predicted upon views and visual amenity during construction and operation, including sensitive receptors and designated sites in close proximity to the scheme alignment.

8.13.4 The majority of the scheme would be online or in close proximity to the existing A46, and therefore lessening the potential impacts upon the wider landscape and surrounding visual receptors. With the use of embedded mitigation and essential mitigation included within the landscape design of the scheme, it is expected that over time there would a reduction in the number of potential significant visual effects during operation. At this stage it remains likely that long term significant effects at Year 15 of operation may still be possible for a very small number of receptors.

9 Biodiversity

9.1 Introduction

- 9.1.1 This chapter presents the on-going work for the assessment of the potential effects associated with the proposed scheme upon ecology and nature conservation during both construction and operation.
- 9.1.2 The potential effects have been assessed in accordance with Design Manual for Roads and Bridges (DMRB) LA 108, DMRB LA 115 and DMRB LD 118. Further detailed assessment is currently under way, and will be reported within the ES that will be submitted to support the Development Consent Order (DCO) application.

9.2 Legislation and policy context

- 9.2.1 The construction and operational activities must comply with UK nature conservation legislation, and with national and local biodiversity policies. The key national legislation and policies which influence the ecology and nature conservation assessments can be found below:

Legislation

Conservation of Habitats and Species Regulations 2017 (as amended) 'the Habitats Regulations'

- 9.2.2 The Habitats Regulations provide protection for European Protected Species (EPS) and deliver measures to establish and maintain a network of sites protecting habitats which are valuable in themselves and for the species they support. These sites form a network across Europe known as Natura 2000 that is domestically now known as the National Site Network (NSN). Within the UK, this network consists of Special Protection Areas (SPAs) and Special Areas of Conservation (SACs), 'candidate' SACs (cSACs), 'possible' SACs (pSACs), and 'potential' SPAs (pSPAs). Ramsar sites (wetlands of international importance) are also treated equally within this Habitat Regulations framework.

Wildlife and Countryside Act 1981 (as amended) 'the 1981 Act'

- 9.2.3 The 1981 Act is the principal means of legislative protection for wildlife and the countryside in England, Wales and Scotland. It is divided into 17 Schedules which detail the protection of birds, some animals and plants, Public Rights of Way (PRoWs), National Parks, and the designation of protected areas including, but not limited to, Sites of Special Scientific Interest (SSSI).

Hedgerow Regulations 1997

- 9.2.4 This legislation sets the criteria for determining the importance of hedgerows and provides controls for the protection of “important” hedgerows.

Protection of Badgers Act 1992

- 9.2.5 This legislation sets out the criteria for activities and behaviours that constitute an offence in relation to badgers to support their conservation.

Countryside and Rights of Way Act 2000 ('the CRoW Act')

- 9.2.6 The CRoW Act, amongst other elements, details further measures for the management and protection of Sites of Special Scientific Interest (SSSI) and strengthens wildlife enforcement legislation

The Environment Act 2021

- 9.2.7 The Environment Act provides a legal framework for environmental governance and makes provision for targets, plans and policies for improving the natural environment. Section 99 and Schedule 15 of the Environment Act relate to the provision of a biodiversity net gain (BNG) assessment for nationally significant infrastructure projects (NSIPs). However, these sections of the Environment Act have not yet come into force, and there is currently no relevant secondary legislation in force. Similarly, the National Networks National Policy Statements (NNNPS) has not yet been updated to include a requirement to provide BNG or to include a “biodiversity gain statement”. As such, it is not yet a legislative or policy requirement to provide BNG in new nationally significant developments.
- 9.2.8 Although legislation in respect of the BNG requirement for NSIPs is not yet in force, National Highways is already incorporating the concept of BNG into its design for the scheme.

The Natural Environmental and Rural Communities (NERC) Act 2006

- 9.2.9 The NERC Act, 2006 requires public bodies, including local authorities, ‘to have regard to the conservation of biodiversity in England’ when carrying out their normal functions. Under Section 41 of this Act a list of species and habitats of ‘principal importance to biodiversity within England’ was drawn up which acts as an aid to guide public bodies in implementing their duty. These are referred to as ‘priority habitats’ and ‘priority species’ within this assessment.

National policy

National Policy Statement for National Networks (NPSNN)

- 9.2.10 The NPSNN sets out the biodiversity policies against which decisions on major road projects will be made.
- 9.2.11 The policy requires measures to:
- Halt biodiversity loss.
 - Support healthy well-functioning ecosystems and establish coherent ecological networks.
 - Benefit wildlife and people by generating more and better places for nature.
- 9.2.12 As a general principle, and subject to specific policies outlined in 5.27 – 5.35 of the NPSNN, development should avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives. In taking decisions, the Secretary of State should ensure that appropriate weight is attached to designated sites of international, national and local importance, protected species, habitats (including irreplaceable habitats such as ancient woodland and ancient and veteran trees) and priority species for the conservation of biodiversity, and to biodiversity and geological interests within the wider environment. Consent should not be granted where it cannot be shown that the harm to such sites, species, habitats and interests is clearly outweighed by the national need for and benefits of the development and, in the case of irreplaceable habitats, that their loss is unavoidable.

National Planning Policy Framework (NPPF) 2021

- 9.2.13 The NPPF requires local authorities in England to take measures to:
- Conserve and enhance biodiversity
 - Protect habitats and species from further decline
 - Protect the natural environment from the adverse effect of development
 - Refuse planning permission for development if significant harm resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated or compensated for.
- 9.2.14 In addition, NPPF paragraph 174 states that “Planning policies and decisions should contribute to and enhance the natural and local environment by: [...]
- Minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures
- 9.2.15 NPPF 180 states that “When determining planning applications, local planning authorities should apply the following principles: [...]

- Development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate.”

UK Post-2010 Biodiversity Framework

9.2.16 The country strategies for biodiversity and the environment in each of the four countries of the United Kingdom underpin the UK Post-2010 Biodiversity Framework. The UK Biodiversity Framework sets out the overarching vision, strategic goals and priority activities for the UK’s work towards international biodiversity targets. The Framework’s overall vision is that “by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people”.

9.2.17 Objectives include, but are not limited to:

- Halt the loss of biodiversity and continue to reverse previous losses through targeted actions for species and habitats
- Restore and enhance biodiversity in urban, rural and marine environments through better planning, design and practice
- Develop an effective management framework that ensures biodiversity is considered in wider decision making

25 Year Environment Plan

9.2.18 The Department for Environment, Food & Rural Affairs (Defra) 25 Year Environment Plan (2018)⁸³ is a policy paper setting out what Government intends to do to improve the environment, including restoring and safeguarding wildlife habitats. This plan is being treated as the first Environmental Improvement Plan required under the Environment Act 2021. The plan aims to achieve a growing and resilient network of land, water and sea that is richer in plants and wildlife than at present. Of relevance to this scheme are those elements of the plan relating to land and freshwater networks which the scheme will address by contributing towards:

- Restoring 75% of the UK's one million hectares of terrestrial and freshwater protected sites to favourable condition, securing their wildlife value for the long term
- Creation or restoration of 500,000 hectares of wildlife-rich habitat outside the protected site network, focusing on priority habitats as part of a wider set of land management changes
- Action to recover threatened, iconic or economically important species of animals, plants and fungi, and where possible

⁸³ HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online] available at: 25 Year Environment Plan - GOV.UK (www.gov.uk) (last accessed October 2022).

prevention of human induced extinction or loss of known threatened species in England

- An increase in the extent of woodland in England in line with our aspiration of 12% cover by 2060: this would involve planting 180,000 hectares by end of 2042

Local policy

Nottinghamshire Local Biodiversity Action Plan

9.2.19 The Nottinghamshire Biodiversity Action Plan outlines the approach to biodiversity in Nottinghamshire and sets out the habitats and species of conservation concern in the county . Species relevant to this assessment include barbastelle bat *Barbastella barbastellus*, Leisler's Bat *Nyctalus leisleri*, noctule bat *Nyctalus noctula*, soprano pipistrelle bat *Pipistrellus pygmaeus*, brown long-eared bat *Plecotus auritus*, water vole *Arvicola terrestris*, hedgehog *Erinaceus europaeus*, brown hare *Lepus europaeus*, otter *Lutra lutra*, slow-worm *Anguis fragilis*, grass snake *Natrix natrix*, adder *Vipera berus*, and common lizard *Zootoca vivipara*.

National Highways policy

9.2.20 The protection of biodiversity is firmly embedded Government's Road Investment Strategy and National Highways' Strategic Business Plan. In particular, the Road Investment Strategy states that by 2020, the company must deliver no net loss of biodiversity, and that by 2040 it must deliver a net gain in biodiversity.

9.2.21 Our Plan to Protect and Increase Biodiversity (2015)⁸⁴ sets out how National Highways will work with service providers to halt overall biodiversity loss, and to maintain and enhance habitats and ecological networks.

9.2.22 The National Highways Biodiversity Action Plan⁸⁵ identifies National Highways' approach to meeting the challenge of the national decline in biodiversity. National Highways has identified five specific outcomes and related actions that will provide the most support for biodiversity across the network:

- Outcome 1: National Highways and its suppliers are equipped to produce good biodiversity performance
- Outcome 2: The Strategic Road Network (SRN) is managed to support biodiversity
- Outcome 3: National Highways has delivered biodiversity enhancements whilst implementing a capital programme of network improvement

⁸⁴ National Highways (2015) Our plan to protect and increase biodiversity [online]. Available at: [biodiversity-plan.pdf \(nationalhighways.co.uk\)](#) (Last accessed September 2022).

⁸⁵ National Highways Biodiversity Action Plan [online]. Available at: [biodiversity-plan.pdf \(nationalhighways.co.uk\)](#) (Last accessed September 2022).

- Outcome 4: National Highways has addressed the legacy of biodiversity problems on their network via a targeted programme of investment
- Outcome 5: National Highways is fully transparent about its biodiversity performance

9.3 Assessment methodology

- 9.3.1 The survey and assessment to report the likely significance of effects has been undertaken in accordance with National Highways' *Design Manual for Roads and Bridges* (DMRB) LA 108⁸⁶, LD 118⁸⁷ and LA 115⁸⁸, and the Guidelines for Ecological Impact Assessment (EclA)⁸⁹ produced by the Chartered Institute of Ecology and Environmental Management (CIEEM). This requires an assessment of the receptor or resource's environmental value (or sensitivity) and the magnitude of the scheme's impacts (change).
- 9.3.2 Valuing ecological features involves the use of professional judgement, 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.
- 9.3.3 Valuing of ecological features of relevance to the study area (defined in Section 9.4) been undertaken in Table 9.4. The value (sensitivity) of ecological features and resources of nature conservation value has been assessed using the criteria outlined in Table 9.1 below, in accordance with DMRB LA 108 Table 3.9.

⁸⁶ National Highways (2020) DMRB LA 108 – Biodiversity [online] available at: [LA 108 - Biodiversity - DMRB \(standardsforhighways.co.uk\)](#) (last accessed October 2022)

⁸⁷ National Highways (2020) DMRB LD 118 – Biodiversity design [online] available at: [LD 118 - Biodiversity design - DMRB \(standardsforhighways.co.uk\)](#) (last accessed October 2022)

⁸⁸ National Highways (2020) DMRB LA 115 – Habitat Regulations Assessment [online] available at: [LA 115 - Habitats Regulations assessment - DMRB \(standardsforhighways.co.uk\)](#) (last accessed October 2022)

⁸⁹ Chartered Institute of Ecology and Environmental Management (CIEEM) (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland. Available at: [Combined-EclA-guidelines-2018-compressed.pdf](#). (Last accessed October 2022).

Table 9.1: Criteria for determining the conservation value of an ecological receptor

Resource importance		Typical descriptors
International or European Importance	Sites	<p>Sites including:</p> <ul style="list-style-type: none"> • SPAs; potential SPAs (pSPAs); SACs; candidate or possible SACs (cSACs or pSACs); Sites of Community Importance (SCIs) and Wetlands of International Importance (Ramsar sites). • Biogenetic Reserves, World Heritage Sites and Biosphere Reserves. • Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.
	Habitats	N/A
	Species	<p>Resident, or regularly occurring, populations of species which may be considered at an International or European level where:</p> <ul style="list-style-type: none"> • The loss of these populations would adversely affect the conservation status or distribution of the species at this scale • The population forms a critical part of a wider population at this scale • The species is at a critical phase of its life cycle at this scale
UK or National Importance	Sites	<p>Designated sites including:</p> <ul style="list-style-type: none"> • Sites of Special Scientific Interest (SSSIs); Marine Protected Areas (MPAs) including Marine Conservation Zones (MCZs); and National Nature Reserves (NNRs). • Areas which meet the published selection criteria e.g. Joint Nature Conservation Committee (JNCC) (1998) for those sites listed above but which are not themselves designated as such.
	Habitats	<p>Habitats including:</p> <ul style="list-style-type: none"> • Areas of UK Biodiversity Action Plan (BAP) priority habitats, including those published in accordance with Section 41 of the Natural Environment and Rural Communities Act (2006)

Resource importance		Typical descriptors
		<p>and those considered to be of principal importance for the conservation of biodiversity.</p> <ul style="list-style-type: none"> • Areas of irreplaceable habitats including: <ul style="list-style-type: none"> ○ Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory ○ Ancient or veteran trees ○ Lowland fen • Areas of habitat which meet the definition for habitats listed above but which are not themselves designated or listed as such.
	Species	<p>Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where:</p> <ul style="list-style-type: none"> • The loss of these populations would adversely affect the conservation status or distribution of the species at this scale. • The population forms a critical part of a wider population at this scale. • The species is at a critical phase of its life cycle at this national scale.
Regional Value	Sites	Non-statutory designated sites, including heritage coasts.
	Habitats	Areas of priority habitats identified (including for restoration) in regional plans or strategies (where available). For example, areas of key/priority habitat identified as being of Regional value in the Natural Character Area Profile 46 Trent and Belvoir Vales.
	Species	<p>Species including:</p> <ul style="list-style-type: none"> • Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: <ul style="list-style-type: none"> ○ the loss of these populations would adversely affect the conservation status or distribution of the species at this scale ○ the population forms a critical part of a wider regional population; or ○ the species is at a critical phase of its life cycle

Resource importance		Typical descriptors
		<ul style="list-style-type: none"> Species identified in regional plans or strategies. For example, areas of key/priority habitat identified as being of Regional value in the Natural Character Area 'Profile 46: Trent and Belvoir Vales'.
County or Unitary Authority Area Value	Sites	Wildlife/nature conservation sites designated at a county (or equivalent) level, including: Local Wildlife Sites (LWS); Local Nature Conservation Sites (LNCS); Local Nature Reserves (LNRs); Sites of Importance for Nature Conservation (SINCs); Sites of Nature Conservation Importance (SNCl); County Wildlife Sites (CWSs);
	Habitats	Areas of habitats identified in county or equivalent authority plans or strategies (where applicable) e.g. Nottingham BAP and areas of habitat identified in the Natural Character Area 'Profile 46: Trent and Belvoir Vales'.
	Species	Species including: <ul style="list-style-type: none"> Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: <ul style="list-style-type: none"> the loss of these populations would adversely affect the conservation status or distribution of the species across the County or Unitary Authority Area; or the population forms a critical part of a wider population; or the species is at a critical phase of its life cycle Species identified in county or equivalent authority area plans or strategies e.g. Nottingham Local BAP.
Local Value	Sites	Wildlife/nature conservation sites designated at a local level, including: LWS; LNCS; LNRs; SINCS; SNCl and Sites of Local Nature Conservation Importance (SLNCl).
	Habitats	Areas of habitat considered to appreciably enrich the habitat resource within the local context,

Resource importance		Typical descriptors
		including features of importance for migration, dispersal, or genetic exchange.
	Species	Populations/communities of species considered to appreciably enrich the habitat resource within the local context, including features of importance for migration, dispersal or genetic exchange.

Source: DMRB LA 108, Table 3.9

9.3.4 The characterisation of each ecological impact considers:

- The integrity and conservation status of the resource affected.
- The probability of the impact occurring.
- The nature and complexity of the impact (direct, indirect, cumulative).
- The extent of the impact (for example the percentage of the resource affected).
- The size of the impact (for example complete loss or the proportion of a protected species population affected).
- The reversibility of the impact.
- The duration of the impact (permanent or temporary).
- The timing and frequency of the impact (considering seasonal/life cycle constraints).

9.3.5 The magnitude of impact (change) as a result of the scheme has been determined using the criteria in Table 9.2, in accordance with DMRB LA 108 Table 3.11.

Table 9.2: Magnitude of impact and typical description

Magnitude of impact (change)		Typical descriptions
Major	Adverse	<ul style="list-style-type: none"> • Permanent/irreversible damage to a biodiversity resource; and • The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.
	Beneficial	<ul style="list-style-type: none"> • Permanent addition of, improvement to, or restoration of a biodiversity resource; and • The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Moderate	Adverse	<ul style="list-style-type: none"> • Temporary/reversible damage to a biodiversity resource; and • The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.

Magnitude of impact (change)		Typical descriptions
	Beneficial	<ul style="list-style-type: none"> • Temporary addition of, improvement to, or restoration of a biodiversity resource; and • The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Minor	Adverse	<ul style="list-style-type: none"> • Permanent/irreversible damage to a biodiversity resource; and • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
	Beneficial	<ul style="list-style-type: none"> • Permanent addition of, improvement to, or restoration of a biodiversity resource; and • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
Negligible	Adverse	<ul style="list-style-type: none"> • Temporary/reversible damage to a biodiversity resource; and • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
	Beneficial	<ul style="list-style-type: none"> • Temporary addition of, improvement to, or restoration of a biodiversity resource; and • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity of key characteristics of the resource.
No Change		No observable impact, either positive or negative.

Source: DMRB LA 108, Table 3.11

9.3.6 The level of significance of effects has then been established using the matrix shown in Table 9.3 below which has been transposed from Table 3.13 from DMRB LA 108. The assessment considers mitigation measures required and assesses the significance of effects of residual impacts. For the purposes of this assessment, effects of Moderate Adverse or Beneficial and above are considered to be significant.

Table 9.3: Significance matrix

	Level of Impact					
	No Change	Negligible	Minor	Moderate	Major	
Resource importance	International or European importance	Neutral	Slight	Moderate or large	Large or very large	Very large
	UK or national importance	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Regional importance	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	County or equivalent authority importance	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Local importance	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Source: DMRB LA 108, Table 3.13

9.4 Study area

9.4.1 The following study areas were used to gather information on ecological receptors with the potential to be affected by the scheme, known as the zone of influence (ZOI). Consideration has been given to the sensitivity of receptors to environmental change and the likely potential impacts.

9.4.2 The following study areas for designated sites have been used:

- 2 kilometres from the draft Order limits for sites within the National Site Network (including: SACs, SPAs, cSACs, pSACs, pSPAs), and Ramsar sites in line with the DMRB LA 115;
- 30 kilometres from the draft Order Limits for SACs designated for bat populations in line with the DMRB LA 115;
- 2 kilometres from the draft Order Limits for nationally designated nature conservation sites, including Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), National Parks, Marine Protected Areas (MPAs) and Marine Conservation Zones (MCZs).

9.4.3 Designated nature conservation sites with hydrological links to the scheme including:

- Sites which intersect, are adjacent to, or lie upstream or downstream of a watercourse that is impacted by the scheme.
- Sites with hydrological or hydrogeological features within the National Site Network and Ramsar sites containing a groundwater terrestrial ecosystem.
- For surface water quality and hydrological connectivity, a study area of 1 kilometre from the draft Order Limits is considered appropriate for identifying both statutory and non-statutory designated conservation sites. Following the simple assessment to establish potential hydrological or hydrogeological linkage to biodiversity resources supporting a groundwater terrestrial ecosystem, a study area of 1 kilometre from the scheme is also considered appropriate.
- 1 kilometre from the draft Order Limits for locally designated nature conservations sites, including Local Nature Reserves (LNRs) and Local Wildlife Sites (LWS).
- 1 kilometre from the draft Order Limits for ancient woodland.
- 250 metres from the draft Order Limits for the extended phase 1 habitat survey⁹⁰ and priority habitats. Data gathered during the extended phase 1 habitat survey informs the requirements for protected species surveys, including habitat suitability index (HSI) assessments of waterbodies for great crested newts (GCN), badgers, water vole, breeding and wintering birds.
- 2 kilometres upstream and downstream along the River Trent from draft Order Limits for otter.
- 1.5 kilometres from the draft Order Limits for barn owl.
- 200 metres from the scheme Affected Road Network (ARN) for sites within the National Site Network, Ramsar sites, SSSIs, LNRs, LWSs, ancient woodland and ancient and veteran trees with the potential to be impacted by increases in nitrogen deposition.

9.4.4 This Biodiversity chapter uses the ARN for the assessment undertaken at options appraisal stages, while traffic forecasts for the ES are currently being updated. The ARN used in this Biodiversity chapter is consistent with the ARN used in the Air quality, Noise and Vibration and Climate chapters of this PEI Report. It is anticipated that the updated ARN to be used in the assessment presented within the ES will cover a similar extent to that assessed at options appraisal stages. The above study areas have been determined based on a proportionate and reasonable approach to the likely to be influenced by the proposed scheme.

⁹⁰ Joint Nature Conservation Committee (JNCC) (2010) Handbook for Phase 1 Habitat Survey. Available at: [hHandbook-Phase1-HabitatSurvey-Revised-2016.pdf](#) (last accessed October 2022).

9.5 Existing baseline

Designated sites

Sites within the National Site Network and Ramsar sites

9.5.1 No sites within the National Site Network or Ramsar sites have been identified within 2 kilometres of the draft Order Limits or within 200 metres of the ARN. No sites within the National Site Network where bats are a qualifying feature have been identified within 30 kilometres of the scheme.

Sites of Special Scientific Interest

9.5.2 There are no SSSIs within 2 kilometres of the scheme. One SSSI has been identified within 200 metres of the ARN: Twenty Acre Piece SSSI which is designated for its lowland neutral grassland. The SSSI is located adjacent to the existing A46 approximately 35 kilometres south-west of the scheme.

Local Nature Reserves

9.5.3 Two LNRs have been identified within 1 kilometre of the scheme and are summarised in Table 9.4 below. The location of the LNRs can also be seen on Figure 9.1 contained in Volume 2.

Table 9.4: Summary of LNRs within 1 kilometre of the scheme

Site Name	Reason for Designation	Size (ha)	Approximate distance from scheme
Devon Park Pastures	Declared by Newark and Sherwood District Council, the site covers a range of habitats including grassland, marginal river vegetation and an area of deciduous woodland.	3.61	500 metres east of Farndon roundabout
Farndon Ponds	Declared by Farndon Parish Council, the area provides an opportunity for fishing, bird watching, walking and generally enjoying being outdoors.	4.55	800 metres west of Farndon roundabout

Local Wildlife Sites

9.5.4 There are 33 LWSs called Sites of Importance for Nature Conservation (SINCs) (referred to as LWSs in this document) within 1 kilometre of the scheme (summarised in Table 9.5 below). The location of the LWSs can also be seen on Figure 9.1 contained in Volume 2. If the LWS is designated for habitat that is sensitive to nitrogen deposition and adjacent to the ARN, this is also recorded by stating it is adjacent to the ARN in Table 9.5 below.

Table 9.5: Summary of LWSs within 1 kilometre of the scheme

Site name	Reason for designation	Size (ha)	Approximate distance from draft Order Limits
Kelham Hall Shingle Bank	A point bar in the River Trent with developing scrub and ruderal communities.	3.76	Within draft Order Limits and adjacent to ARN
Valley Farm Grassland	Designated for its botanical interest: 'damp grassland with notable species'.	3.76	Within draft Order Limits and adjacent to ARN
Kelham Road Grassland II	Designated for its botanical interest: 'a notable horse grazed species-rich neutral grassland'.	3.06	Within draft Order Limits and adjacent to ARN
Trent Banks/Wharves, Newark	Designated for its botanical interest: 'a mosaic of emergent, ruderal and tall herb communities along the banks of the River Trent'.	7.18	Within draft Order Limits and adjacent to ARN
River Trent, Staythorpe	Designated for its botanical interest: 'a good representative stretch of the River Trent with broad aquatic margins'.	25.72	Within draft Order Limits and adjacent to ARN
Great North Road Grasslands	Designated for its botanical interest: 'a series of diverse meadows with damp hollows'.	3.01	Within draft Order Limits and adjacent to ARN
Newark Dismantled Railway	Designated for its botanical interest: 'a dismantled railway line with a characteristic flora'.	0.71	Within draft Order Limits and adjacent to ARN
Newark (Beet Factory) Dismantled Railway	Designated for its botanical interest: 'noteworthy track-side communities along a disused railway line'.	1.18	Within draft Order Limits and adjacent to ARN
Dairy Farm Railway Strip, Newark	Designated for its botanical interest: 'a notable damp community of woodland, scrub and wetland species'.	1.69	Within draft Order Limits and adjacent to ARN
Kelham Road Redoubt Grassland	Designated for its botanical interest: 'a hay meadow with	1.21	Within draft Order Limits and adjacent to ARN

	a diverse grassland community'.		
Newark Grassland	Designated for its botanical interest: 'species-rich unimproved grassland on river gravel'.	2.32	Within scheme footprint draft Order Limits jacent to ARN
Old Trent Dyke	Designated for its botanical and water beetles/ invertebrate assemblage: 'a species-rich aquatic community in a secondary channel of the River Trent'.	1.14	Adjacent to draft Order Limits
Newark Trent Grassland	Designated for its botanical interest: 'a grazed pasture with several depressions supporting notable inundation communities'.	4.73	Adjacent to the draft Order Limits and the ARN
River Trent - Kelham	A section of the River Trent of interest for water beetles.	6.78	8 metres
River Devon, North of Cotham	Designated for its botanical interest: 'a historically interesting water course with valuable riparian features and a locally diverse aquatic flora'.	7.40	120 metres east
Kelham Hills	Designated for mature, deciduous woodland, largely of zoological interest.	24.08	170 metres
The Fleet, Winthorpe	Designated for its botanical interest: 'a notable mosaic of aquatic, marginal and marshy grassland habitats'.	5.70	170 metres north-west
Long Lane Grassland, Farndon	Designated for its botanical interest: 'a good association of common grassland species'.	1.12	185 metres west
South Muskham Gravel Pits	Designated for its botanical interest: 'an excellent complex of pools, scrub and ruderal habitats among old gravel workings, of particular ornithological value'.	34.41	220 metres west

Devon Grasslands, Newark	Designated for its botanical interest: 'a sequence of notable wet riverside pastures'.	5.20	245 metres east
Trentside Meadows Grassland	Designated for its botanical interest: 'a characteristic neutral floodplain meadow'.	1.06	255 metres west
Kelham Road Grassland	Designated for its botanical interest: 'a herb-rich grassland'.	2.03	395 metres west and within ARN
Kelham Trent and Island	A valuable community of scrub, ruderals and notable gravel colonists on a Trent river island.	1.94	405 metres
Devon Park, Newark	Designated for its botanical interest: 'a sequence of neutral grassland, marsh, woodland and scrub along the banks of the River Devon'.	2.17	410 metres east and within ARN
Queen's Sconce, Newark	Designated for its botanical interest: 'notable unimproved acidic and neutral grassland communities on a civil war earthwork'.	1.91	500 metres east and within ARN
Hawton Civil War Fort	A notable pasture community on an archaeological site.	3.71	555 metres
Fardon Gravel Pit and Marina	Designated for its botanical interest: 'mature gravel pits of botanical interest'.	4.67	585 metres west
Kelham Road Redoubt	Civil war redoubt supporting a notable flora.	1.21	605 metres
Kelham Pool	A seasonal pool of interest for water beetles and invertebrate assemblage.	0.49	835 metres
Wyke Lane Grassland and Ponds	Meadows with dry and wet areas and old retting ponds of botanical interest.	3.3	910 metres
Farndon Willow Holt	An excellent wet woodland plant community.	4.87	915 metres

Ollerton Road Grasslands	Notable neutral grassland on a slope.	3.36	950 metres and within ARN
Beacon Hill Gypsum Workings	A mosaic of grassland and scrub on old gypsum workings.	14.45	985 metres and within ARN.

9.5.5 The ARN of the scheme extends along the A46 into Lincolnshire and Leicestershire. An additional 21 LWSs, which are assumed to support habitats sensitive to nitrogen deposition based on the LWS description, are within 200 metres of the ARN, as summarised in Table 9.6 below.

Table 9.6: Summary of additional non-statutory designated sites within 200 metres of the ARN

Site Name	Reason for Designation	Size (ha)
Balderton Dismantled Railway South	A dismantled railway with substantial areas of grassland and scrub.	3.97
Lowfield Grassland, Balderton	A small species-rich remnant of a once notable grassland.	0.84
Newark Golf Course	A good mixed habitat association of acidic grassland, heath and deciduous woodland.	55.48
Langord Moor Area	Valuable plant and animal communities along rides and in drainage ditches throughout this coniferous forestry plantation'.	93.59
The Fleet, South Muskham	A linear strip of open water and swamp with notable aquatic and emergent plant communities.	1.02
Moorhouse Lane Drain	A drain with a notable pant community.	0.26
South Scaffold Lane, Collingham	A green lane with a characteristic grassland flora and species-rich hedgerow.	1.42
Flintham Park	A mature estate incorporating a variety of habitats of botanical and zoological interest.	100.90
Coneygre Wood	Woodland.	11.70
Saxondale Railway	A length of active railway and a disused side branch displaying an excellent calcareous flora along its tracksides and supporting a butterfly of conservation priority in Nottinghamshire.	8.75
Grantham Canal (Hollygate Bridge to Kinoulton)	A long stretch of disused canal providing a good variety of aquatic, marsh, and dry grassland communities.	15.24
Borders Wood	A sizeable area of mature mixed woodland.	59.99

Site Name	Reason for Designation	Size (ha)
Jerico Farm Grassland	A notable neutral grassland.	5.86
Roehoe wood	A substantial wet deciduous woodland with a noteworthy flora.	15.24
Roehoe Wood Grassland	Neutral grassland.	2.80
Crossroads Meadow, Hickling	A large species-rich hay meadow.	7.53
A606 Woodland	A noteworthy deciduous woodland.	1.21
Stanton Railway (including Stanton Tunnel Top)	A valuable section of railway with calcareous grassland and scrub, and great zoological interest.	13.37
Thrussington Wolds Gorse – Scrub/Woodland	Woodland.	5.82
Potter Hill Plantation	Woodland.	10.16
Hill Holt	Woodland.	14.39
Old Dalby, Abattoir Hedgerow	Hedgerow.	N/A
Six Hills Golf Course Hedgerows	Hedgerow.	N/A

Ancient woodland and ancient and veteran trees

9.5.6 No ancient woodland has been identified within either 1 kilometre of the scheme extent or 200 metres of the wider ARN.

9.5.7 The Woodland Trust's Ancient Tree Inventory website⁹¹ has been reviewed to locate records of ancient and veteran trees within 200 metres of the ARN. A pedunculate oak of 'veteran' status is located approximately 170 metres north of the ARN at Coddington, east of Newark-on-Trent, at OS grid reference (GR) SK8258054455. In total four veteran and 10 notable trees were identified during earlier arboricultural surveys within, or directly adjacent to, the draft Order Limits (of which 1 veteran and 9 notable trees are located at Kelham). Three veteran trees are currently in conflict with the draft Order Limits. The locations of the veteran trees are shown on the Environmental Constraints Plan (Figure 2.1, contained in Volume 2).

Habitats

⁹¹ Woodland Trusts Ancient Tree Inventory. Available at: ati.woodlandtrust.org.uk (last accessed October 2022)

9.5.8 Extended phase 1 habitat surveys were undertaken between January and June 2022 inclusive. Priority habitats identified within the surveyed area consist of wood pasture, traditional orchard, eutrophic standing water, lowland meadows, coastal and floodplain grazing marsh and lowland fen. The complete list of habitats identified are presented in Appendix B.

9.5.9 Further surveys are planned to be conducted from April 2023 consisting of:

- National Vegetation Classification (NVC) surveys of species-rich habitats including good quality semi-improved grassland. The output of these NVC surveys and the extended phase 1 habitat surveys will be converted into the UK Habitat (UKHabs) Classification categories. These UKHab classification categories of habitat will inform the BNG calculations.
- Habitat condition assessments⁹² (to be conducted on all habitats classified using UKHabs and Modular River Physical (MoRPh) survey methodology) to inform BNG calculations, in line with Defra's Biodiversity Metric 3.1.

9.5.10 These surveys will be completed to inform the ES.

Protected and notable species

9.5.11 Surveys for the following species were undertaken:

- GCN Habitat Suitability Index surveys (January and February 2022)
- Wintering bird surveys (January and February 2022)
- Badger field surveys (January and February 2022)
- Bat preliminary roost assessments (January and February 2022)
- A desk study for terrestrial invertebrates was undertaken in March 2022.

9.5.12 The findings are presented within Appendix C.

9.5.13 Surveys currently planned to be completed (November 2022 – October 2023) include the following:

- Further preliminary roost assessments on trees and externally on buildings will be required to identify bat potential roosting features. Features suitable for roosting bats will be subjected to further surveys, such as climb inspections by a suitably licensed person or a series of post-dusk/pre-dawn emergence/re-entry surveys to determine presence or likely absence of bat roosts.
- Bat activity surveys including walking transects and deployment of static bat detectors.

⁹² Department for Environment, Food & Rural Affairs (Defra) (2021) Biodiversity Metric 3.1 – Habitat Condition Assessment Sheets. Available at: publications.naturalengland.org.uk/publication/6049804846366720 (last accessed October 2022).

- Otter and water vole surveys, specifically an extensive search for suitable field signs in areas identified to have suitable habitat for these species.
- GCN HSI surveys and, where appropriate, eDNA and population surveys of additional waterbodies identified due to increased land access.
- Wintering bird surveys in areas where eutrophic standing water habitat has been identified (to date survey data has been collected in January and February 2022).
- Aquatic invertebrate surveys at 12 points along linear features, seven pond surveys and eight rapid pond surveys.
- River habitat survey and MoRPh surveys along the River Trent.
- Terrestrial invertebrate surveys on LWSs.
- Barn owl walkover surveys and nest verifications on sites where suitable habitat has been identified.
- Presence and likely absence surveys for reptiles.

9.5.14 These surveys will be completed to inform the ES.

Kelham and Averham Floodplain Compensation Area

9.5.15 The Kelham and Averham Floodplain Compensation Area has recently been incorporated into the draft Order Limits and therefore, surveys have only recently commenced in this area. A desk study of the area has been undertaken utilising MAGIC Interactive Map and aerial photography. A data request from Nottinghamshire Biological and Geological Records Centre (NBGRC) will be required to ascertain which non-statutory designated sites and protected species fall within the study area. The area primarily consists of arable fields, with sporadic areas of deciduous woodland. Multiple waterbodies have also been identified within the area. One veteran tree has been identified from the ancient tree inventory, approximately 60 metres north of the site. Nine notable trees have also been identified within or directly adjacent to the compensation area. Further surveys will be required of the area to establish a detailed baseline. These will include:

- An extended phase 1 habitat survey
- Badger field surveys
- Preliminary roost assessments of trees and buildings present for potential bat roosts
- GCN HSI of waterbodies in the area

9.5.16 Arboricultural surveys will identify and provide further context on the veteran and notable trees and may identify ancient trees and further veteran trees.

9.5.17 Further surveys may be required based on the findings of the baseline surveys and will be completed to inform the ES.

9.6 Value (sensitivity of resources and receptors)

9.6.1 An evaluation of the biodiversity receptors within or adjacent to the study area has been undertaken to inform this assessment. Table 9.7 below provides a list of the biodiversity receptors and their assigned value.

Table 9.7: Sensitivity of biodiversity receptors

Feature		Evaluation	Rationale
Designated sites	LNR	Local importance	Devon Park Pastures was designated by Newark and Sherwood District Council whilst Farndon Ponds was designated by Farndon Parish Council, for a range of common but species-rich habitats and the opportunities they provide for people to interact and connect with nature.
	LWSs (SINCs)	Local importance	33 LWSs (SINCs) designated at a local level for rich assemblages of notable floral and aquatic invertebrate communities, sensitive to nitrogen deposition.
Habitats	Wood pasture	County importance	Listed as a habitat of principal importance (priority habitat) under section 41 of the NERC Act 2006 and Nottinghamshire LBAP, with limited potential for substitution.
	Traditional orchard	County importance	Listed as a habitat of principal importance (priority habitat) under section 41 of the NERC Act 2006 and Nottinghamshire LBAP, with limited potential for substitution.
	Eutrophic standing water	County importance	Listed as a habitat of principal importance (priority habitat) under section 41 of the NERC Act 2006 and Nottinghamshire LBAP, with limited potential for substitution.
	Lowland meadows	County importance	Listed as a habitat of principal importance (priority habitat) under section 41 of the NERC Act 2006, with limited potential for substitution.
	Lowland fen	National importance (precautionary)	Some types of lowland fen habitat are irreplaceable and a precautionary basis it is assumed this is.

Feature		Evaluation	Rationale
			Listed as a habitat of principal importance (priority habitat) under section 41 of the NERC Act 2006 and 'Fens, Marshes and Swamps' are listed in the Nottinghamshire LBAP, with limited potential for substitution.
	Coastal and floodplain grazing marsh	County importance	Listed as a habitat of principal importance (priority habitat) under section 41 of the NERC Act 2006 and 'Fens, Marshes and Swamps' are listed in the Nottinghamshire LBAP, with limited potential for substitution.
	Veteran and notable trees	National importance	Irreplaceable habitat and uncommon across the survey area. As a precaution, notable trees are also valued as national importance. Further arboricultural surveys will inform their status. No ancient trees have been identified.
Species	Bats	County importance (precautionary)	<p>Predominantly widespread and common species recorded from surveys to date. Species Action Plan (SAP) for bats within the Nottinghamshire LBAP, has a record of one tree roost and one hibernation site in a cave for brown long-eared bat <i>Plecotus auratus</i>. This species is listed as a species of principal importance (priority species) under section 41 of the NERC Act 2006.</p> <p>Further surveys will be undertaken including initial ground based inspection of trees and buildings and tree climbing surveys in November – January 2022, and subsequent emergence and re-entry surveys in April – October 2023. Surveys will be used to confirm the species assemblages (no records of brown long-eared bats from surveys currently undertaken), presence of bat roosts and whether their loss would adversely affect the conservation status or distribution at county scale. Importance of bats to be reassessed in ES.</p>

Feature		Evaluation	Rationale
	Breeding birds	County importance (precautionary)	Commonly and widely dispersed bird species. Data analysis of breeding bird surveys is being undertaken to confirm the species assemblages and whether their loss would adversely affect the conservation status or distribution at county scale. Once this data analysis has been completed, the importance of breeding birds will be reassessed in the ES.
	Barn owl	County importance (precautionary)	Widely distributed but populations in decline in the UK and Nottinghamshire. Species Action Plan within the Nottinghamshire LBAP. Surveys are scheduled to be undertaken (November 2022 – July 2023) to confirm the distribution including nest sites and whether their loss would adversely affect the conservation status or distribution at county scale. Importance of barn owls to be reassessed in the ES.
	Wintering birds	County importance (precautionary)	Medium to high priority areas as recorded by BTO Wetland Bird Data. Surveys are scheduled to be undertaken (November 2022 – February 2023) to confirm the species assemblages and whether their loss would adversely affect the conservation status or distribution at county scale. Importance of wintering birds to be reassessed in the ES.
	Reptiles	Local importance (precautionary)	Common species likely, reptile SAP in production by Nottinghamshire BAP. Further surveys have been undertaken (March – September 2023). This data will be used to confirm the species assemblages and whether their loss would adversely affect the conservation status or distribution at local scale. Importance of reptiles to be reassessed in the ES.

Feature		Evaluation	Rationale
	Great Crested Newts	Local importance (precautionary)	<p>Surveys undertaken to date have not confirmed the presence of GCN although smooth newts are present. If present, waterbodies are likely to support a small population at the most.</p> <p>Further surveys are scheduled to be undertaken (habitat assessment surveys in November 2022, further population surveys on suitable waterbodies in March – June 2023) to confirm presence and whether their loss would adversely affect the conservation status or distribution at a local scale. Importance of GCN to be reassessed in the ES.</p>
	Badgers	Local importance (precautionary)	<p>Common species, widely distributed but no active setts recorded during surveys to date.</p> <p>Surveys are scheduled to be undertaken alongside the extended phase 1 surveys (between April – September 2023) to confirm whether their loss would adversely affect the conservation status or distribution at a local scale. Importance of badger to be reassessed in the ES.</p>
	Otters	County importance (precautionary)	<p>Listed as a species of principal importance (priority habitat) under section 41 of the NERC Act 2006 and Nottinghamshire LBAP.</p> <p>Surveys are scheduled to be undertaken (October 2022 – July 2023) to confirm the distribution including resting sites and whether their loss would adversely affect the conservation status or distribution at county scale. Importance of otter to be reassessed in the ES following completion of surveys.</p>
	Water voles	County importance (precautionary)	<p>Common species in decline across the UK, and scarce records across Nottinghamshire show pockets of healthy local populations. Listed as a species of principal importance (priority habitat)</p>

Feature		Evaluation	Rationale
			<p>under section 41 of the NERC Act 2006 and LBAP.</p> <p>Surveys are scheduled to be undertaken (April – September 2023) to confirm whether their loss would adversely affect the conservation status or distribution at county scale. Importance of water vole to be reassessed in the ES.</p>
	Brown hare	Local importance	Common species widespread.
	Hedgehogs	Local importance	Common species widespread, but serious declines nationally. Vulnerable on Red List, hedgehog SAP in production by Nottinghamshire BAP. No records of hedgehogs during surveys to date.
	White clawed crayfish	Local importance	Listed as a species of principal importance (priority habitat) under section 41 of the NERC Act 2006 and Nottinghamshire LBAP. Absent from data search records and no suitable habitat identified within the survey area.
	Invertebrates	County importance (precautionary)	<p>Dingy skipper, grizzled skipper and hazel pot beetle are listed as a species of principal importance (priority habitat) under section 41 of the NERC Act 2006. The two skippers above and green hairstreak have SAP within Nottinghamshire LBAP, with a SAP for hazel pot beetle in production.</p> <p>Data analysis of aquatic and terrestrial invertebrate surveys is being undertaken, further surveys are also planned (April – July 2023) to confirm the species assemblages and whether their loss would adversely affect the conservation status or distribution at local scale. Importance of invertebrates to be reassessed in the ES.</p>

9.7 Potential impacts

Construction

Designated sites

9.7.1 The scheme has the potential to cause damage and the loss of habitats within LWSs. Nine LWSs, designated as SINCs, are located within draft Order Limits. Construction activities could increase the risk of a pollution incident, such as contaminated land run-off or spills/leaks of oils and fuels and increased airborne pollutants. This has potential to impact the primary reason for the sites' designation through degradation of habitats and therefore of the protected species which they support.

Habitats

9.7.2 There is the potential for priority habitat, non-priority habitat and veteran and notable trees to be damaged or lost as a result of the construction activities and vegetation clearance required for the scheme. Additional indirect impacts may also impact habitats through airborne pollution, run-off and compaction of root systems.

Protected and notable species

9.7.3 Vegetation clearance to facilitate construction and temporary construction compounds could result in the permanent and temporary loss, respectively, of aquatic or terrestrial habitats for protected and notable species. This could include habitat that provides shelter, an area for breeding or rearing young, a food resource or commuting corridors for badgers, bats, barn owls, reptiles, birds, GCNs, water voles and terrestrial invertebrates. Construction related run-off could indirectly impact the water quality of local watercourses inhabited by species such as water vole, otter and GCN, if present. Night works could directly disturb nocturnal species such as bats, badger, barn owl and terrestrial invertebrates as a result of increased lighting pollution, noise and vibration. This disturbance could potentially contribute to the displacement of a number of species from the area, including the abandonment of badger setts, and bat and bird roosts. Additional impacts on species include mortality or injury through construction activities and indirect impacts, for example changes to water quality that may affect prey abundance. Changes in water levels have the potential to alter how bankside habitat can be utilised for water vole burrowing and otter resting sites.

Operation

Designated sites

- 9.7.4 During operation potential impacts from traffic emissions could lead to increased levels of nitrogen deposition at the LWSs and adversely impact sensitive habitats, veteran trees and species.

Habitats

- 9.7.5 Once operational, the scheme would result in the permanent fragmentation of habitats of biodiversity value. In the absence of mitigation, the permanent fragmentation of habitat suitable to support protected and notable species has the potential to adversely affect individual species and their conservation status.

Protected and notable species

- 9.7.6 Any permanent increase in artificial lighting could adversely affect protected species including bats, barn owl and terrestrial invertebrates. Any potential changes in the drainage regime as a result of all options have the potential to damage GCN, otter and water vole habitat. The creation of a new flyover across a potential bat and barn owl commuting route could result in bat and barn owl mortality from collisions with traffic.

9.8 Consultation

- 9.8.1 As shown in Table 4.1, initial consultation is ongoing with Natural England on survey effort and limitations on survey areas due to land access. Natural England have stated that the amendments to the bat and GCN surveying methodology are broadly appropriate and justifiable. Further consultation with Natural England and the Environment Agency will be required to inform the ES.

9.9 Assumptions and limitations

- 9.9.1 The following assumptions and limitations apply to this PEI Report:
- Some areas of land within the scheme are currently inaccessible for surveys on health and safety grounds. The stakeholder team are working with agents and landowners to resolve access restrictions. Ongoing discussions with Natural England are underway to agree an acceptable level of survey effort in areas where access issues cannot be resolved.
 - Due to the requirements of the scheme, the phase 1 habitat survey was completed earlier in the botanical growing season when some botanical species may not have been in flower. However, surveys undertaken earlier in the season targeted habitats of lower ecological value and it is not considered that key indicator species have been missed. This is therefore not considered to be a constraint.

- The Kelham and Averham Floodplain Compensation Area identified in section 8.5.15 has only been reviewed from a desk study, therefore habitat surveys are required to establish the baseline condition for this area. Further surveys may be required based on the presence of and suitability for designated habitats and protected species.

9.10 Design, mitigation and enhancement measures

9.10.1 The 'mitigation hierarchy' has been applied to avoid and minimise impacts to ecological features and harm to biodiversity wherever possible. At this stage, it is not possible to fully identify the design, mitigation and compensation measures that are required, as survey data to inform the baseline is still ongoing. However, based on the results of the desk study and surveys to date, embedded design and mitigation measures have been identified. Further surveys and assessment, focusing on protected and priority habitats and species will be required to identify all likely ecological constraints and associated avoidance, mitigation and where necessary compensation measures.

Design

9.10.2 The development of the scheme design will be an iterative process undertaken by an integrated design team to adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA 104; the first principle being to avoid potential adverse effects if at all possible before seeking to minimise or mitigate any unavoidable impacts through a well-developed mitigation strategy. Embedded mitigation incorporated into the scheme design development to date is outlined in Chapter 2 Section 2.6 of this report.

9.10.3 There are a number of opportunities for further embedded mitigation that will be considered during the development of the ongoing scheme design. These include:

- An environmental design that seeks to maintain and enhance habitat connectivity within the wider landscape, maximising biodiversity opportunities within the draft Order Limits, particularly in respect to LWSs and priority habitats.
- Where technically feasible, Sustainable Drainage Systems (SuDS) should be implemented to effectively manage pollution risk associated with road run-off.
- Drainage systems should be designed in accordance with industry standards, with particular emphasis on appropriate pollution prevention and control measures.
- Provision of mammal tunnels or bridges under/over roads, such as otter passes within/alongside new culverts on watercourses, and safe routes for deer and badgers.

- The incorporation of directional fencing and planting could also safely direct badgers and other mammals to use existing safe passages (including farmers tracks and culverts) to cross the A46 road network.
- Consideration of potential barn owl vehicle collision; where possible incorporating design measures to reduce the likelihood of this occurring, including provision of suitable nest locations and boxes at a minimum of 500–1000 metres from the road.
- The retention of ancient or veteran trees.
- The provision of a sensitive lighting design that takes bats, otters and other nocturnal wildlife into account.
- The retention of features, where possible, that have potential to support roosting bats (for example mature trees and suitable built structures).
- Consideration of the interaction of the scheme with the River Trent and other watercourses, including bed and bank substrate. The design of river crossings that would have the least impact on fluvial systems where safe and practical to do so.
- Avoidance or reduction of impacts to high value habitats, where possible.

9.10.4 Further to these measures which will be embedded in the scheme design, National Highways have a target of Biodiversity Net Gain by 2040 according to their Biodiversity Plan. The scheme aims to achieve a biodiversity net gain (see Section 2.3 Scheme objectives). To achieve this, the design will aim to include the creation of an equal or greater area of similar habitat to that lost. If this cannot be accommodated within the final Order Limits (for example land within the new highway boundary) then the scheme will seek to provide compensatory habitats adjacent to, or as close to the affected habitats as possible. If suitable compensation areas are not available close to the affected habitats, then where necessary, compensatory habitat would be created at alternative suitable sites. A plan and programme to ensure effective establishment and continued management of compensatory habitat would also be implemented. Decisions taken on the location of land available for habitat compensation would consider the requirement for access for future maintenance.

9.10.5 Preliminary biodiversity net gain calculations - using the Biodiversity Metric 3.1 calculation tool, based on the assumption that all habitats within the assumed land take boundaries will be lost during construction and based on high level assumptions of which habitats will be created as part of the landscape design - indicate that with the Indicative Environmental Masterplan (Figure 2.3 contained in Volume 2) the scheme will achieve at least a 'No net loss of biodiversity'. The design of the scheme will be further developed to take the scheme from its predicted 'No net loss of biodiversity' outcome to one that yields a net gain in biodiversity, in line with the scheme objectives.

9.10.6 A number of areas for potential ecological mitigation have been incorporated within the draft Order Limits (Figure 2.2 contained in Volume 2). These will be used as potential receptor areas for species such as reptiles and GCN. Other areas will be used for habitat creation, providing areas of foraging and shelter for a number of species. The exact extent and design of ecological mitigation will be determined once the mitigation strategies have been finalised. Completion of surveys will further inform the mitigation methods and design. The findings of these surveys and the mitigation they have informed will be reported in the ES.

Mitigation – construction

9.10.7 Based on the current understanding of the ecological constraints associated with the scheme, the following mitigation measures, including the adoption of construction good practice and measures required to avoid nuisance or to ensure wider legislative compliance, will be included within the Second Iteration Environmental Management Plan:

- Measures to reduce the significance of effects caused by changes to air quality as set out in Chapter 6, including maintaining low speed limits on site to prevent the generation of dust, damping down surfaces in dry conditions and switching off vehicle engines and plant motors when not in use.
- Measures to reduce the significance of effects caused by changes to water quality, as set out in Chapter 14 Road Drainage and the Water Environment, including the adherence to pollution prevention and construction best practice (for example EA Pollution Prevention Guidelines and the Construction Industry Research and Information Association (CIRIA) guidance⁹³ on the control of water pollution from construction sites).
- An Ecological Mitigation Strategy will be prepared and included within the First Iteration EMP, detailing proposals to manage and mitigate for ecological effects associated with the scheme. Measures would include the presence of an ecological clerk of works, toolbox talks, the sensitive timing of works and phased, supervised vegetation clearance and covering of excavations or provision of means of escape such as a wildlife ‘ladder’ and where required visual and noise screening.
- Tree protection measures to minimise the impacts on retained trees, especially ancient and veteran.
- European protected species (EPS) licences granted from Natural England with respect to protected species may also be required. These would contain a method statement giving details of appropriate mitigation to ensure no long-term effects on the species.

⁹³ Best practice methodology includes the correct storage and disposal of waste-water and pollutants, the establishment of dedicated plant and wheel washing areas at least 10ms from any watercourse or surface water drain, collection of run-off water in sumps, and the recycle and reuse of water where possible

- A water vole conservation licence from Natural England may be required. The licence would include a method statement with measures to reduce impacts on the population, such as the enhancement of existing habitat, or creation of new habitat, further away from the A46 road network, and the displacement of water voles from ditches that would be exposed to higher levels of anthropogenic disturbance adjacent to the road.
- A development licence obtained from Natural England may be required for badger sett closure(s). Conditions of this licence may require construction of an alternative sett.
- If works are to take place during the night, any lighting required should be managed to avoid spill onto ecological features. The effects can be minimised through the use of hoods, cowls or shields to prevent back-spill. Measures to reduce the significance of effects on breeding barn owls include excluding barn owls from potential breeding sites outside of the breeding season and providing alternative barn owl breeding sites prior to construction, at least 500-1000 metres from a road. Where possible, works within the vicinity of active breeding sites will be undertaken outside of the breeding season and once owlets have fledged.
- Measures to reduce the significance of effects on other breeding birds by installing bird boxes close to areas of habitat loss.
- Mitigation proposals for aquatic and terrestrial invertebrates could include an expansion in suitable habitat through habitat creation, enhancement of existing suitable habitat and dedicated monitoring of the water quality of connected hydrological sites.

Mitigation – operation

- 9.10.8 To minimise the potential disturbance from lighting in operation, all lighting should be directional and, in close proximity to sensitive receptors, lighting cowls should be used to minimise light spill and avoid lighting directly onto adjacent habitats used by, or with potential to be used by, protected species.
- 9.10.9 Additional screening vegetation around areas of road at height should be implemented where practicable to minimise the chance of collisions between protected species and traffic and to maintain any existing commuting and foraging pathways.

Compensation measures

- 9.10.10 Measures additional to the above mitigation, to compensate for species specific impacts may be required. This requirement is dependent on the outcome of surveys. Compensation could include, for example, bat bricks incorporated into the bridge structure design and post-construction installation of bat boxes in wooded areas once trees have matured. Compensation measures may be required for terrestrial and aquatic invertebrates, water vole, otter and barn owl.

- 9.10.11 The landscape design is also likely to include areas of compensatory habitat, such as areas of tree planting, to minimise the overall loss of habitat that will occur due to the operation of the scheme. As well as compensating for habitat loss, this will also compensate for species specific impacts, such as bird nesting habitat loss.

Enhancement measures

- 9.10.12 Enhancement measures for biodiversity will be considered as part of the ongoing design development, and will be reported in the ES.
- 9.10.13 Options to provide betterment, rather than like for like replacement of habitats, as well as improvement and enhancement to existing habitats will be explored where practical and appropriate, although these will not be taken into account when determining whether effects are significant or not.

9.11 Assessment of effects

- 9.11.1 An overall assessment of the significance of effects on biodiversity receptors during construction and operation is included within Table 9.8. A description of the effects is provided below.

Construction

Designated sites

- 9.11.2 Devon Park Pastures and Farndon Ponds Local Nature Reserves are located 500 and 800 metres from the draft Order Limits respectively. Both of these sites are upstream watercourses which intersect the works. Both sites are considered to be a sufficient distance from the site to not be directly or indirectly impacted by the scheme. Therefore, they are not considered any further within this assessment. Traffic management routes have not yet been confirmed, therefore a review of routes will be undertaken against these sites when available and reported within the ES.
- 9.11.3 The scheme will result in permanent habitat loss and fragmentation at two LWSs including Dairy Farm Railway Strip, Newark and Great North Road Grasslands, as a result of land take required for construction. The scheme will result in temporary habitat loss and fragmentation at LWSs in works areas associated with construction including Newark Dismantled Railway and Newark (Beet Factory) Dismantled Railway. It is currently anticipated that approximately 0.95 hectares of LWS habitat will be lost as a result of the scheme, primarily from the Great North Road Grassland (approximately 0.83 hectares lost). As a result, further assessment will be undertaken as the scheme design and associated compensation habitat are refined and will be presented within the ES.

- 9.11.4 The scheme is also adjacent to the River Trent, Staythorpe, Newark Trent Grassland, Old Trent Dyke, Kelham Road Redoubt Grassland, Kelham Road Grassland II, Valley Farm Grassland, Newark Grassland, and Trent Banks/Wharves, Newark LWSs. Kelham Hall Shingle Bank LWS is located within the boundary of the Kelham Floodplain Compensation area and River Trent – Kelham LWS is located directly downstream of the area. Construction activities could increase the risk of a pollution incident, such as contaminated land run-off or spills/leaks of oils and fuels.
- 9.11.5 Old Trent Dyke and the River Trent – Kelham are designated LWSs because of interest for water beetle with the former also designated for its botanical interest. Vegetation clearance along the carriageway embankments adjacent to Old Trent Dyke LWS and upstream of the River Trent – Kelham LWS to facilitate the works would result in reduced leaf litter and therefore lower nutrients entering the water in these LWSs. The works could also result in siltation and increase water turbidity. These changes combined have the potential to impact the riparian and aquatic habitat suitable for water beetles as well as indirectly affecting foraging (reduction in prey abundance and biodiversity). Therefore, the integrity of these sites for which they are designated are likely to be adversely impacted by the scheme during construction.
- 9.11.6 The River Devon, North of Cotham, Kelham Hills, The Fleet, Winthorpe, Long Lane Grassland, Farndon, South Muskham Gravel Pits, Devon Grasslands, Newark and Trentside Meadows Grassland LWSs are all located within 300 metres of the draft Order Limits. These sites are designated for botanical interest and are not hydrologically connected downstream of the scheme. Therefore, they are not considered any further within this PEI Report.
- 9.11.7 South Muskham Gravel Pits LWS, located within 300 metres of the draft Order Limits, comprises of habitats that are of particular ornithological value (although not the reason for designation). Whilst the site is located at a sufficient distance not to be directly impacted by habitat loss during construction, increased levels of noise and light disturbance may still occur, which is likely to have an adverse effect on the resident bird population. This may indirectly impact the vegetation structure within the LWS due to changes in wildfowl grazing and therefore indirectly impact the integrity of this site's designation.
- 9.11.8 The remaining LWSs, located over 300 metres from the draft Order Limits, are not hydrologically connected downstream and are not designated for features whose zone of influence would be directly or indirectly impacted by the scheme. Therefore, they are not considered any further within this PEI Report.

Habitats

- 9.11.9 Loss of broadleaved woodland, scrub, grassland and hedgerows is anticipated as a result of the scheme. Wildlife using these areas would also likely be subjected to increased disturbance.
- 9.11.10 Habitats could also be impacted by pollution from mobilised suspended solids and spillages of materials associated with routine run-off or spillages and increased levels of airborne pollutants during the construction phase. Any trees in close proximity to construction works could be adversely affected through ground compaction, thereby causing damage to the root system.
- 9.11.11 There is potential for direct damage, permanent loss of priority habitats such as lowland mixed deciduous woodland, lowland meadow, lowland fen and coastal and floodplain grazing marsh. Additional indirect impacts may also impact habitats through airborne pollution, run-off and compaction of root systems. Therefore, these are considered further in the assessment presented within this PEI Report.
- 9.11.12 Three trees of veteran status, an irreplaceable resource, are within the draft Order Limits and are anticipated to be lost as part of the scheme. Ten notable trees are within or adjacent to the draft Order Limits. Further veteran or ancient trees which may be identified adjacent to the draft Order Limits could be impacted by pollution events and airborne pollutants or be adversely affected by ground compaction, causing damage to the root system, which could lead to the premature death of the tree.

Protected species

Bats

- 9.11.13 The vegetation clearance required to construct the scheme would result in the loss of small areas of broadleaved woodland and hedgerows located in close proximity to the existing A46. The removal of vegetation would be likely to temporarily disrupt foraging areas, but the extent of this is considered small scale as there is an abundance of other foraging areas available. Removal of woodland and trees within hedgerows could remove roosting sites. There will likely be fragmentation of vegetation along the carriageway embankments used as a linear feature for commuting bats, which provides connectivity to the wider landscape, for example dispersal routes along the River Trent.
- 9.11.14 The existing A46 is considered to be a semi-permeable barrier to bats due to the frequent use of HGVs even at night-time. Currently, vegetated embankments are considered to allow safe flight for bats over the railway line parallel to the A46 and under the intersecting A46

carriageway. The wide-span bridge over the river will maintain access for bats commuting and foraging along the river through construction.

- 9.11.15 During construction, it is anticipated that bat species and suitable habitat would also be exposed to increased disturbance from lighting and noise. Impacts on bats are considered likely, due to the following factors:
- Artificial lighting used during construction could affect the foraging behaviour of some bat species, including pipistrelle and serotine (feeding on insects attracted to external lighting with a high ultraviolet content). This behaviour is not common to all bat species, as the slower flying broad-winged species such as long eared bats, myotis species, barbastelle and greater and lesser horseshoe bats generally avoid light.
 - Insects may be attracted to lit areas from a distance, potentially reducing the food source for bats feeding in naturally darker locations.
 - Artificial lighting is thought to increase the chances of bats being preyed upon by avian predators such as owls, sparrow hawks and great tits.
 - Artificial lighting disrupts the normal 24-hour pattern of light and dark which is likely to affect the natural behaviour of bats. Bright lighting may reduce social flight activity and cause bats to move away from the lit area. Studies have shown that continuous lighting along roads creates barriers which some species cannot cross.
- 9.11.16 Ongoing surveys will establish the presence of bat roosts. This will inform further impact assessment, suitable mitigation and whether compensation will be required. The further assessment will be presented within the ES, and mitigation could include elements included within section 9.9 of this report.

Breeding birds

- 9.11.17 If works are to commence during the bird nesting season, breeding birds are likely to be displaced by noise, lighting (where there are night works) and vibration due to suitable habitat located adjacent to the works. Wooded areas along the A46 carriageway embankment currently act as a buffer against light exposure to the wider area. Vegetation clearance will reduce the habitat available for breeding birds, and will degrade retained habitat by allowing light splays to extend further at night in areas where trees have been felled. Clearance works will also increase sight lines for bird species resulting in visual disturbance of some bird species at a greater distance from the works.
- 9.11.18 On completion of ornithological surveys, the impact on specific bird species will be assessed based on each species' ZoI and reported within the ES.

Barn owl

- 9.11.19 If works are to commence during the barn owl breeding season, there is potential for disturbance to breeding barn owl. Vegetation clearance of barn owl foraging sites and construction activities on or near breeding sites and foraging sites could reduce food available and disrupt foraging activities through visual and noise disturbance. This has the potential to impair the breeding success of barn owls. Completion of barn owl surveys will verify where breeding sites are present and inform suitable mitigation and compensation..
- 9.11.20 Establishing nest locations will inform likely sight line, timings and locations to avoid impacts, particularly from night-time works.

Badger

- 9.11.21 Ongoing badger surveys have recorded two single-entrance outlier setts to date, with no evidence of recent use by badgers. One of these setts had evidence of use by rabbits, which may have occupied the disused sett. Anecdotal evidence for residents and observed road kills indicate badgers are active in the area. Construction works within 30 metres of existing badger setts has the potential to disturb badgers and potentially damage setts.

Great crested newts

- 9.11.22 To date, all current GCN surveys, which include presence and absence surveys on several ponds and eDNA on other suitable waterbodies, , have found no evidence of GCN residing within 250 metres of the draft Order Limits. This indicates that GCN are unlikely to be impacted by the construction of the scheme.
- 9.11.23 However, the construction of the scheme will result in the loss of terrestrial habitat that may have foraging, resting and commuting value to GCN. This includes areas of woodland, hedgerow and grassland. Seven ponds with HSI suitability are located within the footprint of the scheme, two of which have a HSI suitability rating of good. These ponds may be adversely affected by the construction of the works, with some even being potentially lost as a result of the widening of the carriageway. Disturbance to these ponds and clearance of vegetation deemed as suitable for GCN has a potential to adversely affect the species as a result of disturbance or direct injury, potentially leading to death. In addition, the works have potential to cause noise, vibration and light (where there are night works) disturbance during construction.

Otters

- 9.11.24 Surveys to indicate the presence of otters within the Zol have not yet commenced, so their presence cannot be ruled out. The results of

these surveys will be used to inform any mitigation and compensation required for the species.

- 9.11.25 The desk study data indicated the presence of otters within 1 kilometre of the scheme. Due to this, the construction of the scheme may result in adverse impacts to aquatic and terrestrial habitat which has the potential to support otters via direct disruption of habitats within the draft Order Limits, and from pollution from the run-off of materials and other contaminants. The construction of the works will also increase the levels of disturbance these species will be subject to through increases of vibrational, noise and light (if night works) disturbance.

Water vole

- 9.11.26 Surveys to indicate the presence of water voles within the Zol were undertaken between April to September 2022 with further surveys planned to be conducted between April to September 2023. From surveys conducted between April to September 2022, multiple ditches have been assessed as being suitable for water voles, with evidence of foraging by water voles recorded on several ditches and streams within the Zol. Aquatic and terrestrial habitat that has the suitability to support water voles may be affected by the construction of the works via direct disruption or pollution from the run-off of construction materials and other contaminants. In addition to this, the construction of the works will also increase the levels of disturbance to these species through increased vibration, noise and light (where there are nightworks).
- 9.11.27 The further results of the ongoing water vole surveys will help guide and inform any avoidance, mitigation and compensation proposals for the species.

Reptiles

- 9.11.28 Surveys to indicate the presence of reptile within the Zol were undertaken between August to September 2022 with further surveys planned to be conducted between March to September 2023. From surveys conducted between August to September 2022, three records of grass snake have been recorded across two reptile survey locations. Suitable habitat for reptiles is found throughout the Zol, with some areas being present within the footprint of the scheme. Reptile populations present are likely to be directly impacted through the loss of suitable reptile habitat. The construction of the scheme is also likely to increase the levels of disturbance to these species through increased vibration, noise and light (where there are night works).
- 9.11.29 If any evidence of reptiles are found, the results will help inform the avoidance and mitigation proposals for the different species.

Invertebrates

- 9.11.30 Aquatic and terrestrial invertebrate surveys are planned to be conducted in November 2022 with further surveys planned in the Kelham and Averham Floodplain Compensation Area between April to July 2023. Therefore, presence of any notable assemblages cannot be ruled out. Several LWS and sites of potentially valuable habitat for notable aquatic and terrestrial invertebrate assemblages can be found within the Zol. This includes three LWS sites that are designated for water beetles, one of which is adjacent to the draft Order Limits. The construction of the scheme may result in the loss of habitat in these potentially suitable sites and the reduction in the functionality and quality of the habitats present. These sites are also likely to be subject to higher levels of disruption due to increased vibration, noise and light (where there are any night works) as a result of the construction activities.
- 9.11.31 The results of the aquatic and terrestrial invertebrate surveys will help inform the avoidance, mitigation and compensation proposals for any notable invertebrate assemblages. and terrestrial invertebrate surveys are currently ongoing, so the presence of any notable assemblages cannot be ruled out. Several LWS and sites of potentially valuable habitat for notable aquatic and terrestrial invertebrate assemblages can be found within the Zol. This includes three LWS sites that are designated for water beetles, one of which is adjacent to the scheme. The construction of the scheme may result in the loss of habitat in these potentially suitable sites and the reduction in the functionality and quality of the habitats present. These sites are also likely to be subject to higher levels of disruption due to increases in vibration, noise and light (if any night works) disruption as a result of the construction activities.

Operation

Designated sites

- 9.11.32 In addition to the areas of permanent habitat loss at the two LWS listed in section 8.11.2 above, there is the potential for changes to hydrology and water quality at LWSs as a result of potentially increased road run-off (as a result of increased traffic) during operation of the scheme. Sites that may be affected include Old Trent Dyke, the River Trent, Staythorpe, Trent Banks/Wharves, and Newark and Kelham Hall Shingle Bank. Traffic modelling and assessment work is currently ongoing, the results of which will be used to inform an assessment of the likely impact on water quality as a result of changes to traffic during operation. This assessment will be presented within the ES.
- 9.11.33 There is the potential for changes in air quality at LWSs. Increased emissions from traffic could lead to increased levels of nitrogen

deposition at the sites which could have a detrimental effect on habitats by changing the species composition. Further traffic modelling and assessment is needed to determine the likelihood of significant effects on the sites. This assessment is ongoing and will be complete in advance of the DCO application, to be presented within the ES.

Habitats

- 9.11.34 There is the potential for changes in air quality which could affect habitats and veteran and notable trees. Increased emissions from traffic could lead to increased levels of nitrogen deposition affecting nearby habitats, including grassland and woodland, by changing the species composition of these habitats. Further traffic modelling and assessment is needed to determine the likelihood of significant effects on these habitats. This assessment is ongoing and will be complete in advance of the DCO application, to be presented within the ES.

Protected species

Bats

- 9.11.35 Wooded areas, trees lines and hedgerows along the existing A46 carriageway embankments will be retained wherever possible to maintain existing commuting corridors for bats. Though landscape planting will mitigate for the loss of suitable bat habitat, this will take years to establish to provide like-for-like landscape features of pre-construction ecological importance. Whilst the development of the scheme will not create new barriers to dispersal, the first few years of operation are likely to see temporary fragmentation of some existing bat commuting routes leading to an adverse impact. It is considered that there will be a beneficial effect on bats in the long-term, due to climate-resilient landscape designs such as wetland attenuation basins with swales and waterbodies, and improvement to habitat connectivity and structure.
- 9.11.36 Ongoing surveys will establish the presence of bat roosts and confirm bat flight lines. This will inform further impact assessment, suitable mitigation and whether compensation will be required.
- 9.11.37 Artificial lighting can be particularly harmful if used along river corridors, near woodland edges and near hedgerows used by bats, and may result in the fragmentation and isolation of bat colonies.

Breeding birds

- 9.11.38 Areas of habitat loss in wooded areas, tree lines and hedgerows along the existing A46 carriageway embankments will be retained where possible to minimise the amount of suitable habitat loss for breeding birds. However, short-term adverse effects may be experienced in

areas of habitat loss along the boundaries of the scheme whilst replacement habitat establishes.

- 9.11.39 Ongoing ornithological surveys will help establish the impact of the operation of the scheme on specific bird species populations within the Zol.

Barn owls

- 9.11.40 Short-term adverse effects may occur to barn owls during the operation of the scheme whilst the replacement habitat establishes along the breadth of the scheme.
- 9.11.41 The construction of the new fly-over section of the route may also increase the mortality rate of barn owls due to collisions with live traffic resulting in a long-term adverse impact.

Badger

- 9.11.42 Once operational, the scheme is likely to pose an increased risk of mortality to badgers due to collisions with live traffic. The existing A46 road is already likely to act as a barrier to badger dispersal, but an expansion to this road network may increase pressures on the local badger population.
- 9.11.43 Embedded design mitigation proposals could allow badgers to disperse safely across the A46 road network, reducing the risk of mortality due to live traffic collisions and therefore reducing the overall significance of effect upon the badger population.

Great crested newts

- 9.11.44 In line with current survey evidence, it is unlikely that GCN are present within 250 metres of the draft Order Limits. Therefore, it is unlikely that the operation of the scheme will affect GCN.
- 9.11.45 If GCN are found to be present, they may be adversely affected on a short-term basis whilst suitable terrestrial habitat in the form of woodland, scrub and grassland re-establishes throughout the scheme.

Otters

- 9.11.46 Otter surveys have not yet commenced, but once they have been completed the surveys will help establish the effect of the operation of the scheme on the local otter populations (if they are found to be present).
- 9.11.47 The scheme will include two river crossings of the River Trent which may be used by otters for foraging and commuting. Once operational, there is a potential for indirect effects on otters due to pollution events and sediment changes, which may filter through the ditch and watercourse network. The operation of the scheme may also lead to a reduction in the functionality and quality of hydrologically connected

habitats that may be of value for resting, commuting and foraging otters. The operation of the scheme may also result in changes to hydrology, water quality and nitrogen deposition that could affect habitats of value to otter.

- 9.11.48 Embedded design mitigation proposals for otters will reduce the overall significance of effect on the otter population.

Water vole

- 9.11.49 Ongoing surveys will help establish the effect of the operation of the scheme on the local water vole population.
- 9.11.50 The scheme footprint lies in close proximity to several ditches and watercourses that have been assessed as being suitable for water voles. If water voles are confirmed to be present within the ZoI, they may be adversely affected during the operational phase due to increased levels of disturbance from higher levels of traffic. There is also the potential for indirect effects due to pollution events and sediment changes, which may filter through the ditch and watercourse network. The operation of the scheme may also lead to a reduction in the functionality and quality of hydrologically connected habitats that may be of value for breeding, commuting and foraging water vole. The operation of the scheme may also result in changes to hydrology, water quality and nitrogen deposition that could affect habitats of value to water vole
- 9.11.51 Mitigation proposals for water voles would reduce the overall significance of effects on water vole population, should they be present.

Reptiles

- 9.11.52 Ongoing surveys will help establish the effect of the operation of the scheme on the local reptile population.
- 9.11.53 Some small areas of low-quality habitat for reptiles such as arable field margins, grassland and areas of wooded verges will be lost due to the operation of the scheme. This has the potential to impact the local populations of relevant species due to a reduction in available habitat. However, the loss of this habitat is likely to be compensated for by the replacement of like-for-like habitat.

Invertebrates

- 9.11.54 Ongoing aquatic and terrestrial invertebrate surveys will help to establish the effect of the operation of the scheme on local notable invertebrate assemblages.
- 9.11.55 If any notable terrestrial invertebrate assemblages are present within habitat adjacent to the draft Order Limits, they are likely to be affected by the operation of the scheme due to increased levels of traffic

activity along the road and a degradation in the quality of the habitat they reside in.

- 9.11.56 Three LWS within the Zol are designated for their assemblages of water beetle, one of which is directly adjacent to the draft Order Limits, the Old Trent Dyke LWS. The operation of the scheme may adversely affect this site by reducing the functionality and quality of the habitats present due to changes in hydrology, water quality and nitrogen deposition. In addition to this, hydrologically connected sites may also be at an increased risk of pollution events and sediment change.

Table 9.8: Summary of assessment of significance of effect

Receptor	Summary of effects	Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation	
Receptors and impacts						
Locally designated sites	Devon Park Pastures LNR Fardon Ponds LNR	No adverse effects anticipated at this stage. No adverse effects anticipated.	N/A	Local Importance	Construction Phase: No change Operation Phase: No change	Neutral (Construction and Operation).
	Kelham Hall Shingle Bank LWS Trent Banks/Wharves, Newark LWS River Trent, Staythorpe LWS	Construction Phase: Potential for pollution incidents and changes in airborne pollutants. Operation Phase: Potential for changes to hydrology and water	To mitigate against construction dust effects at receptors, the construction works will be carried out in accordance with Best Practicable Means (BPM) to reduce emissions which may affect air quality.	Local Importance	Construction Phase: Minor Adverse Operation Phase: Minor Adverse	Construction Phase: Slight Adverse Operation Phase: Slight Adverse

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		quality as a result of additional traffic.	Adherence to pollution prevention and construction best practice (for example EA Pollution Prevention Guidelines and the Construction Industry Research and Information Association (CIRIA) guidance on the control of water pollution from construction sites)			
	Valley Farm Grassland LWS Kelham Road Grassland II LWS Newark Dismantled Railway LWS Newark	Construction Phase: Potential for pollution incidents and changes in airborne pollutants	To mitigate against construction dust effects at receptors, the construction works will be carried out in accordance with	Local Importance	Construction Phase: Minor Adverse	Construction Phase: Slight Adverse Operation Phase: Slight Adverse

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	(Beet Factory) Dismantled Railway LWS Kelham Road Redoubt Grassland LWS Newark Grassland LWS	<p>Operation Phase: Potential for increased levels of nitrogen deposition at the sites as a result of additional traffic.</p>	<p>Best Practicable Means (BPM) to reduce emissions which may affect air quality. Adherence to pollution prevention and construction best practice</p>		<p>Operation Phase: No change</p>	
	Newark Trent Grassland LWS	<p>Construction Phase: Direct (temporary) habitat loss. Potential for pollution incidents and changes in airborne pollutants. Operation Phase: Potential for increased levels of nitrogen deposition at the sites as a</p>	<p>To mitigate against construction dust effects at receptors, the construction works will be carried out in accordance with BPM to reduce emissions which may affect air quality. Adherence to pollution prevention</p>	Local Importance	<p>Construction Phase: Major Adverse Operation Phase: Minor Adverse</p>	<p>Construction Phase: Moderate Adverse (Significant) Operation Phase: Slight Adverse</p>

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		result of additional traffic. likelihood of significant effects.	and construction best practice			
Great North Road Grasslands LWS Dairy Farm Railway Strip, Newark LWS	Construction Phase: Direct (permanent) habitat loss. Potential for pollution incidents and changes in airborne pollutants. Operation Phase: Potential for increased levels of nitrogen deposition at the sites as a result of additional traffic. likelihood of significant effects.	Loss of any habitat of conservation value would be replaced like-for like as a minimum requirement or enhanced where this is not feasible	Local Importance	Construction Phase: Major Adverse Operation Phase: Minor Adverse	Construction Phase: Moderate Adverse (Significant) Operation Phase: Slight Adverse	
Old Trent Dyke LWS	Construction Phase:	To mitigate against construction dust effects at	Local Importance	Construction Phase:	Construction Phase:	

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	River Trent – Kelham LWS	Reduced leaf litter and therefore lower nutrients entering the water. Siltation and increase water turbidity. Operation Phase: Potential for changes to hydrology and water quality as a result of additional traffic.	receptors, the construction works will be carried out in accordance with Best Practicable Means (BPM) to reduce emissions which may affect air quality. Adherence to pollution prevention and construction best practice.		Minor Adverse Operation Phase: Minor Adverse	Slight Adverse Operation Phase: Slight Adverse
	South Muskham Gravel Pits LWS	Construction Phase: Increased levels of noise and light disturbance. Operation Phase: No Change	Measures would include the presence of an ecological clerk of works, toolbox talks, the sensitive timing of works and phased, supervised vegetation	Local Importance	Construction Phase: Minor Adverse Operation Phase: No Change	Construction Phase: Slight Adverse Operation Phase: Neutral

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
			clearance and visual and noise screening.			
Priority habitats	Wood pasture Traditional orchard Eutrophic standing water Lowland meadows Coastal and floodplain grazing marsh	<p>Construction Phase: Potential for pollution incidents and changes in airborne pollutants.</p> <p>Operation Phase: Potential for increased levels of nitrogen deposition at the sites as a result of additional traffic.</p>	Loss of any habitat of conservation value would be replaced like-for like as a minimum requirement.	County Importance	<p>Construction Phase: Minor Adverse</p> <p>Operation Phase: Minor Adverse</p>	Slight Adverse (Construction and Operation)
	Lowland fen	<p>Construction Phase: Limited loss of some habitat to facilitate construction works and to</p>	Loss of any habitat of conservation value would be replaced like-for like as a minimum requirement.	National Importance	<p>Construction Phase: Moderate Adverse</p>	<p>Construction: Moderate Adverse (Significant)</p> <p>Operation: Slight Adverse</p>

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		<p>accommodate design.</p> <p>Potential for pollution incidents and changes in airborne pollutants.</p> <p>Operation Phase:</p> <p>Potential for increased levels of nitrogen deposition at the sites as a result of additional traffic.</p>			<p>Operation Phase:</p> <p>Minor Adverse</p>	
<p>Non-priority habitat</p>	<p>Woodland</p> <p>Scrub</p> <p>Grassland</p> <p>Hedgerows</p>	<p>Construction Phase:</p> <p>Removal of small areas of woodland, scrub and grassland and hedgerows to facilitate construction works, and loss of habitats</p>	<p>Habitats removed to facilitate the works, to be replaced.</p> <p>Habitats to be incorporated into landscape design, including native</p>	<p>Local Importance</p>	<p>Construction Phase:</p> <p>Minor Adverse</p> <p>Operation Phase:</p> <p>Minor Adverse</p>	<p>Slight Adverse (Construction and Operation)</p>

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		<p>to accommodate design.</p> <p>Potential for pollution from mobilised suspended solids and spillages of materials associated with routine run-off or spillages and increased levels of airborne pollutants.</p> <p>Operation Phase:</p> <p>Potential for increased levels of nitrogen deposition at the sites as a result of additional traffic. Further traffic modelling and assessment is required to determine the</p>	<p>and locally sourced species.</p> <p>Additional woodland, hedgerow and grassland planting may be required for protected species mitigation.</p> <p>This will be addressed as part of the ES, once protected species surveys are complete.</p>			

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		likelihood of significant effects.				
Trees	Veteran and notable trees	<p>Construction Phase:</p> <p>Loss of veteran and notable trees. Pollution events and airborne pollutants causing reduction in tree health, making it more susceptible to disease. Ground compaction, causing damage to the root system, which could lead to the premature death of the tree.</p> <p>Operation Phase:</p> <p>Potential for increased levels of nitrogen deposition</p>	<p>Tree protection measures for retained trees.</p> <p>Compensation tree planting where avoidance is not possible. Potential to 'veteranise' retained trees. This is a process where young trees are purposefully damaged to create decay and structural features typically associated with older trees.</p>	National Importance	<p>Construction Phase: Major Adverse</p> <p>Operation Phase: Minor Adverse</p>	<p>Construction Phase: Large Adverse (significant)</p> <p>Operation Phase: Slight Adverse</p>

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	<p>at the sites as a result of additional traffic causing reduction in tree health, making it more susceptible to disease.</p> <p>Ground compaction, causing damage to the root system, which could lead to the premature death of the tree.</p>					
Protected and Notable Species	Bats	<p>Construction Phase:</p> <p>Fragmentation of foraging and commuting routes, due to vegetation clearance, lighting and noise disturbance.</p>	If bat roosts are found, requirements of the EPS licence conditions will guide the landscape planting and other mitigation (to avoid	County Importance (precautionary)	<p>Construction Phase:</p> <p>Moderate Adverse</p> <p>Operation Phase:</p>	Slight Adverse (Construction and Operation)

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		<p>Potential for disturbance, damage to or loss of bat roosts.</p> <p>Operation Phase: short-term adverse effects may be experienced in areas of habitat loss along the boundaries of the scheme whilst replacement habitat establishes.</p>	<p>disturbing bat roosts).</p> <p>Mitigation for foraging and commuting routes would include habitat enhancement and compensation; offsetting habitat loss.</p> <p>Landscaping design would provide a barrier between active road and retained vegetation.</p>		<p>Moderate Adverse</p>	
	<p>Breeding birds/Wintering birds</p>	<p>Construction Phase: Loss of vegetation and disturbance reduces nesting</p>	<p>The specific areas for mitigation will be informed by the survey results and</p>	<p>County Importance (precautionary)</p>	<p>Construction Phase: Moderate Adverse</p>	<p>Slight Adverse (Construction and Operation)</p>

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		<p>potential within construction and operational area</p> <p>Vegetation clearance could result in the destruction of nests and eggs, and killing/injuring of birds.</p> <p>Operation Phase:</p> <p>Short-term adverse effects may be experienced in areas of habitat loss along the boundaries of the scheme whilst replacement habitat establishes.</p>	<p>will be presented within the ES.</p> <p>Vegetation clearance (including reedbeds) to be undertaken outside of breeding bird season (March to September inclusive) or sensitive working methods within this season.</p> <p>Loss of suitable nesting bird habitat mitigated by landscape planting incorporating breeding bird habitats and installation of bird boxes in woodland</p>		<p>Operation Phase:</p> <p>Moderate Adverse</p>	

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
			that experienced partial loss.			
	Barn owl	<p>Construction Phase: Loss of foraging habitat, loss of nesting sites.</p> <p>Operation Phase: Direct mortality through vehicle collisions. Short-term adverse effects may be experienced in areas of habitat loss along the boundaries of the scheme whilst replacement habitat establishes.</p>	<p>The specific areas for mitigation will be informed by the survey results and will be presented within the ES.</p> <p>Provision of barn owl nest boxes should be located over 500-1000m away from any major highway.</p> <p>High levels of mortality are caused by barn owls attempting to cross roads. To minimise this risk, screen planting of closely spaced trees should be</p>	County Importance (precautionary)	<p>Construction Phase: Moderate Adverse</p> <p>Operation Phase: Moderate Adverse</p>	Slight Adverse (Construction and Operation)

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
			<p>used along as much of the highway as practicable.</p> <p>Areas of rough grassland should be created for foraging. These should be within 500m of the nest boxes or existing nest sites. If the areas are within close proximity of the road, continuous screening should be employed.</p>			
	Badger	<p>Construction Phase:</p> <p>Vegetation clearance resulting in the disturbance or</p>	The specific areas for mitigation will be informed by the survey results and	Local Importance (precautionary)	<p>Construction Phase:</p> <p>Moderate Adverse</p>	Slight Adverse (Construction and Operation)

Receptor	Summary of effects	Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	<p>direct injury/death of badger. Noise, vibration and light (if night works) disturbance during construction and operation. Damage, or permanent exclusion from setts.</p> <p>Operation Phase: The scheme is likely to pose an increased risk of mortality to badgers due to collisions with live traffic. The existing A46 road is already likely to act as a barrier to badger dispersal, but an</p>	<p>will be presented within the ES.</p> <p>If sett closure is required, requirements of the mitigation licence conditions will guide the need for sett creation, landscape planting and other mitigation.</p> <p>If a main sett would be lost, provision of an artificial sett is required.</p> <p>Badger proof fencing and tunnels should be incorporated into the landscape design.</p>		<p>Operation Phase: Moderate Adverse</p>	

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	expansion to this road network may increase pressures on the local badger population.		<p>Sett closure, vegetation clearance and earthworks to be supervised by a suitably experienced ecologist.</p> <p>Lighting and noise disturbance will be minimised through implementation of method statement.</p>			
Great crested newts	<p>Construction Phase:</p> <p>To date, all current GCN surveys, which includes presence and absence surveys on several ponds and eDNA on other suitable waterbodies have</p>	<p>Construction Phase:</p> <p>The specific areas for mitigation will be informed by the survey results and will be presented within the ES.</p> <p>If GCN are found, requirements of the EPS licence conditions will</p>	Local Importance (precautionary)	<p>Construction Phase:</p> <p>Moderate Adverse</p> <p>Operation Phase:</p>	Slight Adverse (Construction and Operation)	

Receptor	Summary of effects	Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	<p>found no evidence of GCN residing within 250m of the scheme boundaries. Further assessments are required due to increased land access. Should GCN be identified, the scheme may result in:</p> <ul style="list-style-type: none"> • The loss of terrestrial habitat that may have foraging, resting and commuting value to GCN. • Disturbance or direct injury, potentially 	<p>guide the landscape planting and other mitigation.</p>		<p>Moderate Adverse</p>	

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		<p>leading to death. Noise, vibration and light (if night works) disturbance.</p> <p>Operation Phase:</p> <p>If GCN are found to be present, they may be adversely affected on a short-term basis whilst suitable terrestrial habitat in the form of woodland, scrub and grassland re-establishes throughout the scheme..</p>				
	Otters	Construction Phase:	The specific areas for mitigation will be informed by the survey results and	County Importance (precautionary)	Construction Phase:	Slight Adverse (Construction and Operation)

Receptor	Summary of effects	Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	<p>Surveys to indicate the presence of otters within the Zol have not yet commenced, so their presence cannot be ruled out. The scheme may result in:</p> <ul style="list-style-type: none"> • Direct disruption of supporting habitats within the footprint of the scheme, and from pollution from the run-off of materials and other contaminants . Increases of vibrational, 	<p>will be presented within the ES.</p>		<p>Moderate Adverse</p> <p>Operation Phase:</p> <p>Moderate Adverse</p>	

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		<p>noise and light (if night works) disturbance.</p> <p>Operation Phase:</p> <p>If otters are found to be present, they may be adversely affected on a short-term basis whilst suitable terrestrial habitat in the form of woodland, scrub and grassland reestablishes throughout the scheme.</p> <p>Waterbodies within the footprint of the scheme are likely to also be affected by increased levels of</p>				

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		disturbance due to higher traffic levels.				
	Water vole	<p>Construction Phase:</p> <p>Further water vole surveys are required to understand the presence or likely absence in the study area. The scheme may result in:</p> <ul style="list-style-type: none"> • Direct disruption of supporting habitats within the footprint of the scheme, and from pollution from the run-off of materials and other 	The specific areas for mitigation will be informed by the survey results and will be presented within the ES.	County Importance (precautionary)	<p>Construction Phase:</p> <p>Moderate Adverse</p> <p>Operation Phase:</p> <p>Moderate Adverse</p>	Slight Adverse (Construction and Operation)

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		<p>contaminants</p> <ul style="list-style-type: none"> Increases of vibrational, noise and light (if night works) disturbance. <p>Operation Phase:</p> <p>If water voles are confirmed to be present within the Zol, they may be adversely affected during the operational phase due to increased levels of disturbance due to higher levels of traffic. There is also the potential for indirect effects due to pollution events</p>				

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	<p>and sediment changes, which may filter through the ditch and watercourse network. The operation of the scheme may also lead to a reduction in the functionality and quality of hydrologically connected habitats that may be of value for breeding, commuting and foraging water vole.</p>					
Reptiles		<p>Construction Phase: Further reptile surveys are required to understand the presence or likely</p>	<p>The specific areas for mitigation will be informed by the survey results and will be presented within the ES.</p>	<p>Local Importance (precautionary)</p>	<p>Construction Phase: Minor Adverse</p>	<p>Construction Phase: Slight Adverse Operation Phase: Neutral</p>

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		<p>absence in the study area. If reptiles around found, there is the potential to kill and injure reptiles during earthworks and vegetation clearance. Habitat loss and noise, vibration and light (if night works) disturbance could also impact reptile populations and reduce available habitat.</p> <p>Operation Phase:</p> <p>Reptiles may be adversely affected on a short-term basis whilst suitable terrestrial habitat in</p>	<p>If required, sensitive working methods, possible translocation to a receptor site and ecological supervision.</p> <p>Landscaping would provide replacement habitat.</p>		<p>Operation Phase:</p> <p>No Change</p>	

Receptor	Summary of effects		Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
		the form of woodland, scrub and grassland re-establishes throughout the scheme.				
	Invertebrates	<p>Construction Phase:</p> <p>Loss of terrestrial habitat.</p> <p>Potential for pollution incidents, infilling and earthworks creates potential for change in sediment dynamics to impact on the flora and invertebrate community due to hydrological links.</p> <p>Operation Phase:</p>	<p>Both terrestrial and aquatic Invertebrate surveys required to assess impact and inform appropriate mitigation: could include translocation of invertebrates.</p> <p>Species rich grassland, hedgerows and woodland incorporated into the landscape design, would be of</p>	County Importance (precautionary)	<p>Construction Phase:</p> <p>Moderate Adverse</p> <p>Operation Phase:</p> <p>Moderate Adverse</p>	Slight Adverse (Construction and Operation)

Receptor	Summary of effects	Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	<p>If any notable terrestrial invertebrate assemblages are present within habitat adjacent to the scheme, they are likely to be affected by the operation of the scheme due to increased levels of traffic activity along the road and a degradation in the quality of the habitat they reside in.</p> <p>Three LWS sites within the Zol are designated for their assemblages of water beetle, one of which is directly adjacent to the</p>	<p>benefit to invertebrate species.</p>			

Receptor	Summary of effects	Mitigation	Sensitivity	Magnitude (with mitigation)	Overall significance of effect with mitigation
	<p>scheme, the Old Trent Dyke LWS. The operation of the scheme may adversely affect this site by reducing the functionality and quality of the habitats present due to changes in hydrology, water quality and nitrogen deposition. In addition to this, hydrologically connected sites may also be at an increased risk of pollution events and sediment changes.</p>				

9.12 Monitoring requirements for significant adverse effects

9.12.1 The completion of outstanding ecological surveys for protected species is required to understand the full effects of the scheme on local biodiversity. Upon completion of the required surveys and establishment of the baseline, the potential significant adverse effects will be assessed for all receptors. Monitoring requirements will be determined within the ES once significance of effects have been fully assessed.

9.13 Conclusions

9.13.1 Overall, during the construction phase significant effects are currently anticipated for Newark Trent Grassland LWS, Great North Road Grasslands LWS and, Dairy Farm Railway Strip Newark LWS due to the loss of habitat within LWSs required for construction.

9.13.2 On a precautionary basis, based on the current design and understanding of baseline conditions, during construction a significant adverse effect is anticipated for lowland fen due to habitat loss. A significant adverse effect is anticipated due to the loss of veteran and notable trees. Effects on other priority and non-priority habitats are not significant.

9.13.3 Adverse effects on populations of protected species within the Zol during construction due to losses of habitat used for foraging, commuting, breeding and rearing will not be significant.

9.13.4 The operation of the scheme is likely to result in a reduction of the quality and functionality of adjacent habitat due to increased levels of disturbance and potential changes to air quality. Aquatic sites that are adjacent or hydrologically connected to the scheme may also be subject to changes in hydrology, water quality and nitrogen deposition. Local protected species populations may also be adversely affected by the operation of the scheme, due to increased traffic levels and thus levels of disturbance. The introduction of the new proposed fly-over may also increase the risk of killing and injuring aerial species such as bats and birds through collisions with traffic. The increased traffic levels may also increase the risk of killing or injuring terrestrial mammals due to collisions with vehicles. No significant effects are anticipated during the operation of the scheme.

9.13.5 The overall significance of the effects for each ecological receptor is reliant on effective avoidance, mitigation and compensation measures being adopted. Conclusions of these preliminary assessments as well as ongoing ecological surveys will feed into further design development to help shape and inform the avoidance, mitigation and compensation proposals that are developed. In addition to this,

biodiversity net gain calculations will also be conducted with the aim of determining precise areas of loss for each habitat and informing proposals for appropriate habitat enhancement and creation. The future ecological surveys along with the BNG calculations will provide further confidence to the assessment of the scheme's overall effect on biodiversity. The results of these assessments and surveys will be presented as part of the biodiversity assessment to be included with the ES, which will reconfirm the significance of the effects for biodiversity receptors. Should significant adverse effects on ecological receptors remain after further design development and assessment work is completed, it will be necessary for the DCO application to demonstrate that all reasonable alternatives have been considered and that their loss or harm is unavoidable. Similarly, it will be necessary to demonstrate that the harm to such sites, species, habitats and interests is clearly outweighed by the national need for and benefits of the development. This information will be submitted as part of the DCO application.

10 Geology and Soils

10.1 Introduction

10.1.1 This chapter presents the on-going work for the assessment of the potential effects associated with the proposed scheme upon geology and soils, including groundwater and contaminated land.

10.1.2 The potential effects have been considered in accordance with the Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils⁹⁴. Further detailed assessment is currently under way and will be reported within the Environmental Statement (ES) that will be submitted to support the Development Consent Order (DCO) application.

10.2 Legislation and policy context

10.2.1 The legislation and policy relevant to the scheme is presented in the paragraphs below.

Legislation

10.2.2 The overarching legislation in relation to geology and soils is provided by:

- The Town and Country Planning Act 1990 (as amended)
- The Building Regulations 2010
- The Pollution Prevention and Control Regulations 2000 (as amended 2003)
- The Control of Pollution (Oil Storage) (England) Regulations 2001
- The Control of Substances Hazardous to Human Health 2002 (as amended 2004)
- The Contaminated Land (England) Regulations 2006 (as amended)
- Environmental Quality Standards Directive 2008/105/EC
- DEFRA: Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance
- The Control of Asbestos Regulations 2012 Guidance
- The Environmental Damage (Prevention and Remediation) Regulations 2015
- The Waste Framework Directive 2008/98/EC
- The Hazardous Waste (England and Wales) Regulations 2005 (as amended by The Waste (England and Wales) Regulations 2011)
- The Environmental Permitting (England and Wales) Regulations 2016 (as amended)
- The Industrial Emissions Directive 2010/75/EU
- Groundwater Daughter Directive 2006/118/EC
- The Groundwater Regulations 2009

⁹⁴ Highways England (2019). LA 109 – Geology and Soils Revision 0 [online] available at [LA 109 - Geology and soils - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk) (last accessed August 2022)

- The Environmental Damage (Prevention and Remediation) (England) Regulations 2015.

National policy

10.2.3 No formal policy exists that outlines how to undertake an assessment of contaminated or potentially contaminated land specifically for an EIA. The policy background is not intended to provide a full and exhaustive account of legislation relating to land contamination with the EU, or UK. However, it is intended to provide a thematic background to recent key policy and applicable regulations in force at the time of writing this PEI Report.

National Policy Statement for National Networks (NPSNN)

10.2.4 The NPSNN sets out the policy which the scheme should comply with. Although it is also the basis for informing a judgement on the impacts of a scheme, for example is the scheme consistent with the needs of the NPSNN. The NPSNN includes the following in relation to soil and contaminated land:

10.2.5 Paragraph 5.168 – “Applicants should also identify any effects, and seek to minimise impacts, on soil quality, taking into account any mitigation measures proposed. Where possible, developments should be on previously developed (brownfield) sites provided that it is not of high environmental value. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this”.

10.2.6 Paragraph 5.168 makes reference to Model Procedures for Management of Land Contamination (CLR11), which has subsequently been withdrawn and replaced with Environment Agency Land Contamination Risk Management (LCRM)⁹⁵ guidance.

10.2.7 Paragraph 5.176 – “The decision-maker should take into account the economic and other benefits of the best and most versatile agricultural land. The decision maker should give little weight to the loss of agricultural land in grades 3b, 4 and 5, except in areas (such as uplands) where particular agricultural practices may themselves contribute to the quality and character of the environment or the local economy”.

National Planning Policy Framework (NPPF)

10.2.1 The NPPF text relevant to contaminated land is outlined below.

10.2.2 Paragraph 118 – “Planning policies should give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land”.

⁹⁵ Environment Agency (2021). Land Contamination Risk Management [online] available at: [Land contamination risk management \(LCRM\) - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/land-contamination-risk-management-lcrm) (last accessed August 2022)

10.2.3 Paragraph 170 – “Planning policies and decisions should contribute to and enhance the natural and local environment by:

- Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.
- Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate”.

10.2.4 Paragraph 178 – “Planning policies and decisions should ensure that:

- A site is suitable or its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation).
- After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990.
- Adequate site investigation information, prepared by a competent person, is available to inform these assessments”.

10.2.5 Paragraph 179 – “Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner”.

10.2.6 The glossary of the NPPF states the following in relation to “site investigation information”:

- “Site investigation information: Includes a risk assessment of land potentially affected by contamination, or ground stability and slope stability reports, as appropriate. All investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 Investigation of Potentially Contaminated Sites – Code of Practice”.

10.2.7 The glossary further states that a “Competent person” involved in the preparation of site investigation information is “a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation”.

10.2.8 In addition to national planning policies, the remediation design should take into account the requirements of local planning policies and planning conditions in the assessment and management of land contamination.

Local policy

10.2.9 The local planning framework comprises a number of documents, which include reference to geology, mineral resources and soils, that form the statutory development plans for the local planning authority area in which the scheme is located:

- Nottinghamshire County Council Nottinghamshire Minerals Local Plan (Adopted 2021)⁹⁶ with particular reference to the following policies:
 - Policy DM3 – Agricultural Land and Soil Quality
 - Policy DM15 – Borrow Pits
- Nottinghamshire County Council Waste Core Strategy (Adopted 2013)⁹⁷.

10.2.10 The Newark and Sherwood Local Development Framework Core Strategy (adopted 2019)⁹⁸ Spatial Policy 3 – Rural Areas deals with agriculture, stressing the need to protect agriculture in developments within a rural setting.

10.2.11 Newark and Sherwood District Council's contaminated land strategy is in the process of being updated at the time of writing. The Newark and Sherwood District Council's website⁹⁹ states that a link to the new contaminated land strategy will be provided once it is complete.

National Highways policy

10.2.12 National Highways policies of particular relevance to the assessment of geology and soils include:

- National Highways Environment Strategy¹⁰⁰ seeking to help protect, manage, and enhance the quality of the surrounding environment.
 - National Highways Sustainable Development Strategy¹⁰¹ sets out National Highways' approach and priorities related to sustainable development including carbon management to achieve efficiency in raw material consumption and waste generation, responsible sourcing of resources and circular economy.

⁹⁶ Nottinghamshire County Council (2021) Nottinghamshire Minerals Local Plan 2021 [online]. Available at: [adopted-minerals-local-plan.pdf](#) (last accessed August 2022) 2022).

⁹⁷ Nottinghamshire County Council (2013) Waste Core Strategy 2020 [online]. Available at: [waste-core-strategy-1.pdf \(nottinghamshire.gov.uk\)](#) (last accessed August 2022) accessed June 2022).

⁹⁸ Newark & Sherwood Local Development Framework Core Strategy Development Plan Document (adopted March 2019) available at <https://www.newark-sherwooddc.gov.uk/media/newark-and-sherwood/images-and-files/planning-policy/pdfs/core-strategy/ACS2019.pdf> (last accessed August 2022)

⁹⁹ Newark and Sherwood District Council website available at: <https://www.newark-sherwooddc.gov.uk/landpollution/> (last accessed August 2022).

¹⁰⁰ National Highways (2018) Environmental Strategy [online] available at: [Highways England Environment Strategy - GOV.UK \(www.gov.uk\)](#) (last accessed October 2022).

¹⁰¹ National Highways (2018) Sustainable Development Strategy and Action Plan [online] available at: [\[Withdrawn\] Highways England Sustainable Development Strategy and Action Plan - GOV.UK \(www.gov.uk\)](#) (last accessed October 2022).

10.3 Assessment methodology

10.3.1 This section describes the assessment of geology and soils (including groundwater and contaminated land) which may affect or be affected by the construction of the scheme.

10.3.2 The assessment excludes the following aspects that broadly relate to geology, soils, contamination, and groundwater but are considered separately in other chapters:

- The effects of materials import and export in relation to earthworks construction are considered in Chapter 11 Material Assets and Waste.
- Assessment of potential effects on hydrology and flood risk, fluvial geomorphology and surface water quality is provided in Chapter 14 Road Drainage and the Water Environment.

10.3.3 In line with the Environmental Scoping Report¹⁰² the operational phase of the scheme has been scoped out of the assessment. This is because there are no anticipated direct effects on geology and soils during the operational period. Only the construction phase remains scoped into this assessment.

10.3.4 The assessment has been undertaken in accordance with DMRB LA 109 Geology and Soils¹⁰³. The environmental assessment covers geology, soil resources, as well as the effects from contamination on human health, surface water and groundwater as outlined in Section 1.4 of DMRB LA 109. The outcome has been used to aid the development of appropriate mitigation measures in order to avoid or reduce potential significant adverse effects

10.3.5 The assessment has been undertaken in accordance with the principles set out in Chapter 5 Environmental Assessment Methodology.

Assessment of sensitivity

10.3.6 The sensitivity (value) of receptors has been determined according to descriptions provided within Table 10.1.

¹⁰² National Highways (August, 2022) A46 Newark Bypass Environmental Scoping Report [online] available at: [TR010065-000002-A46N - Scoping Report.pdf \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/tr010065-000002-A46N-Scoping-Report.pdf) (last accessed October 2022).

¹⁰³ DMRB LA109 Geology and Soils Available at: [LA 109 - Geology and soils - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/LA-109-Geology-and-soils-DMRB)
Last accessed: August 2022

Table 10.1: Criteria for evaluating the value (sensitivity) of receptors

Receptor value (sensitivity)	Criteria	Description
Very high	International scale: Very high importance and rarity and very limited potential for substitution	<p>Geology: Very rare and of international importance with no potential for replacement (e.g. UNESCO World Heritage Sites, UNESCO Global Geoparks, (SSSIs) and Geological Conservation Review (GCR) sites where citations indicate features of international importance). Geology meeting international designation citation criteria which is not designated as such.</p> <p>Contamination:</p> <ol style="list-style-type: none"> 1) Human health: very high sensitivity land use such as residential or allotments. 2) Surface water: Watercourse having a Water Framework Directive (WFD) classification shown in a River Basin Management Plan (RBMP) and Q95 $\geq 1.0\text{m}^3/\text{s}$. Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water)/species protected by EC legislation LA 108 (from Table 3.70 in Road drainage and water environment LA 113¹⁰⁴). 3) Groundwater: Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation LA 108 (from Table 3.70 in Road drainage and water environment LA 113). Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTE). Source Protection Zone 1 (SPZ1). <p>Soils:</p> <ol style="list-style-type: none"> 1) Soils directly supporting a site within the National Site Network (e.g. Special Area of Conservation (SAC), Special Protected Area (SPA)), or a Ramsar. 2) Agricultural Land Classification (ALC) grade 1 & 2 or Land Capability for Agriculture (LCA) grade 1 & 2.
High	National scale: High	Geology:

¹⁰⁴ DMRB LA113 Road Drainage and the Water Environment available at: [LA 113 - Road drainage and the water environment - DMRB \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk), last accessed August 2022

Receptor value (sensitivity)	Criteria	Description
	importance and rarity, limited potential for substitution	<p>Rare and of national importance with little potential for replacement (e.g. geological SSSI, Area of Special Scientific Interest (ASSI), National Nature Reserves (NNR)). Geology meeting national designation citation criteria which is not designated as such.</p> <p>Soils:</p> <ol style="list-style-type: none"> 1) Soils directly supporting a UK designated site (e.g. SSSI). 2) ALC grade 3a, or LCA grade 3.1. <p>Contamination:</p> <ol style="list-style-type: none"> 1) Human health: high sensitivity land use such as public open space. 2) Surface water: Watercourse having a WFD classification shown in a RBMP and Q95 <1.0m³/s. Species protected under EC or UK legislation LA 108 (from Table 3.70 in Road drainage and water environment LA 113). 3) Groundwater: Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a (GWDTE). Source Protection Zone 2 (SPZ2) (from Table 3.70 in Road drainage and water environment LA 113).
Medium	Regional scale: Medium quality and rarity	<p>Geology:</p> <p>Of regional importance with limited potential for replacement (e.g. RIGS). Geology meeting regional designation citation criteria which is not designated as such.</p> <p>Soils:</p> <ol style="list-style-type: none"> 1) Soils supporting non-statutory designated sites (e.g. Local Nature Reserves (LNR), LGSs, Sites of Nature Conservation Importance (SNClS)). 2) ALC grade 3b or LCA grade 3.2. <p>Contamination:</p> <ol style="list-style-type: none"> 1) Human health: medium sensitivity land use such as commercial or industrial 2) Surface water: Watercourses not having a WFD classification shown in a RBMP and Q95

Receptor value (sensitivity)	Criteria	Description
		<p>>0.001m³/s (from Table 3.70 in Road drainage and water environment LA 113).</p> <p>3) Groundwater: Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3 (from Table 3.70 in Road drainage and water environment LA 113).</p>
Low	District scale: Low quality and rarity	<p>Geology: Of local importance/interest with potential for replacement (e.g. non designated geological exposures, former quarries/mining sites).</p> <p>Soils:</p> <ol style="list-style-type: none"> 1) ALC grade 4 & 5 or LCA grade 4.1 to 7. 2) Soils supporting non-designated notable or priority habitats. <p>Contamination:</p> <ol style="list-style-type: none"> 1) Human health: low sensitivity land use such as highways and rail. 2) Surface water: Watercourses not having a WFD classification shown in a RBMP and Q₉₅ ≤0.001m³/s (from Table 3.70 in Road drainage and water environment LA 113). 3) Groundwater: Unproductive strata (from Table 3.70 in Road drainage and water environment LA 113).
Negligible	Local scale: Very low importance and rarity	<p>Geology: No geological exposures, little or no local interest.</p> <p>Soils: Previously developed land formerly in 'hard uses' with little potential to return to agriculture.</p> <p>Contamination:</p> <ol style="list-style-type: none"> 1) Human health: undeveloped surplus land or no sensitive land use proposed. 2) Surface water: use sensitivity criteria in Road drainage and water environment LA 113. 3) Groundwater: use sensitivity criteria in Road drainage and water environment LA 113.

Source: Table 3.11 of LA109 Geology and Soil

Magnitude of impact

10.3.7 The magnitude of impact includes consideration of its timing, scale, size, and duration. The qualitative magnitude of each impact (in the absence of quantitative data) has been determined according to the descriptions provided in Table 10.2.

Table 10.2: Magnitude of impact and typical descriptions

Magnitude of impact (change)	Typical description	
Major	<p>Geology: Loss of geological feature, designation, quality or integrity, severe damage to key characteristics, features or elements.</p> <p>Soil: Physical removal or permanent sealing of soil resource or agricultural land.</p> <p>Contamination: Human health: Significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels) SP1010 with potential for significant harm to human health. Contamination heavily restricts future use of land.</p>	
	<p>Major Adverse Surface Water: Failure of acute-soluble and chronic-sediment related pollutants in Highways England Water Risk Assessment Table (HEWRAT) and compliance failure with Ecological Quality Standards (EQS) value. Calculated risk of pollution from a spillage $\geq 2\%$ annually (spillage assessment). Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification.</p> <p>Groundwater: Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Potential high risk of pollution to groundwater from routine runoff – risk score >250 (Groundwater quality and runoff assessment). Calculated risk of</p>	<p>Major Beneficial Surface Water: Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification.</p> <p>Groundwater: Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body WFD classification.</p>

Magnitude of impact (change)	Typical description					
	<p>pollution from spillages >2% annually (spillage assessment). Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification. Loss of significant damage to major structures through subsidence or similar effects.</p>					
Moderate	<p>Geology: Partial loss of geological feature or designation, potentially adversely affecting the integrity; partial loss of or damage to key characteristics, features or elements. Soils: Permanent loss or reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource.) Contamination: Human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category 4 screening levels) SP1010. Significant contamination can be present. Control or remediation measures are required to reduce risks to human health and make land suitable for intended use.</p> <table border="1"> <thead> <tr> <th>Moderate Adverse</th> <th>Moderate Beneficial</th> </tr> </thead> <tbody> <tr> <td> <p>Surface water: Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually. Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification.</p> <p>Groundwater: Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant</p> </td> <td> <p>Surface water: HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk $> 1\%$ annually). Contribution to improvement in water body WFD classification.</p> <p>Groundwater: Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $> 1\%$ annually). Contribution to</p> </td> </tr> </tbody> </table>		Moderate Adverse	Moderate Beneficial	<p>Surface water: Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually. Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification.</p> <p>Groundwater: Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant</p>	<p>Surface water: HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk $> 1\%$ annually). Contribution to improvement in water body WFD classification.</p> <p>Groundwater: Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $> 1\%$ annually). Contribution to</p>
Moderate Adverse	Moderate Beneficial					
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Magnitude of impact (change)	Typical description					
	<p>commercial/ industrial/ agricultural supplies. Potential medium risk of pollution of groundwater from routine runoff – risk score 150 – 250. Calculated risk of pollution from spillages $\geq 1\%$ annually and $< 2\%$ annually. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.</p> <p>improvement in water body WFD classification. Improvement in water body catchment abstraction management Strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE.</p>					
Minor	<p>Geology: Minor measurable change in geological feature or designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.</p> <p>Soils: Temporary loss or reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource).</p> <p>Contamination: Human health: contaminant concentrations are below relevant screening criteria (e.g. category 4 screening levels) SP1010. Significant contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health.</p> <table border="1"> <thead> <tr> <th>Minor Adverse</th> <th>Minor Beneficial</th> </tr> </thead> <tbody> <tr> <td> <p>Surface water: Failure of either acute-soluble or chronic-sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on water supplies.</p> <p>Groundwater: Potential low risk of pollution to groundwater from routine runoff – risk score < 150. Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on aquifer, GWDTEs, abstraction, and structures.</p> </td> <td> <p>Surface water: HEWRAT assessment of either acute-soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $< 1\%$ annually).</p> <p>Groundwater: Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage</p> </td> </tr> </tbody> </table>		Minor Adverse	Minor Beneficial	<p>Surface water: Failure of either acute-soluble or chronic-sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on water supplies.</p> <p>Groundwater: Potential low risk of pollution to groundwater from routine runoff – risk score < 150. Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on aquifer, GWDTEs, abstraction, and structures.</p>	<p>Surface water: HEWRAT assessment of either acute-soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $< 1\%$ annually).</p> <p>Groundwater: Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage</p>
Minor Adverse	Minor Beneficial					
<p>Surface water: Failure of either acute-soluble or chronic-sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on water supplies.</p> <p>Groundwater: Potential low risk of pollution to groundwater from routine runoff – risk score < 150. Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. Minor effects on aquifer, GWDTEs, abstraction, and structures.</p>	<p>Surface water: HEWRAT assessment of either acute-soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $< 1\%$ annually).</p> <p>Groundwater: Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage</p>					

Magnitude of impact (change)	Typical description	
		risk <1% annually). Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.
Negligible	<p>Geology: Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature or designation. Overall integrity of resource not affected.</p> <p>Soils: No discernible loss or reduction of soil function(s) that restrict current or approved future use.</p> <p>Contamination: Human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. Category 4 Screening Levels) SP1010. No requirement for control measures to reduce risks to human health or to make land suitable for intended use.</p> <p>Surface water: No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%.</p> <p>Groundwater: No measurable impact on aquifer and/or groundwater receptors and risk of pollution from spillages.</p>	
No change	<p>Geology: No temporary or permanent loss/disturbance of characteristics features or elements.</p> <p>Soils: No loss/reduction of soil function(s) that restrict current or approved future use.</p> <p>Contamination: Human health: reported contaminant concentrations below background levels.</p> <p>Surface water: No loss or alteration of characteristics, features, or elements; no observable impact in either direction.</p> <p>Groundwater: No loss or alteration of characteristics, features, or elements; no observable impact in either direction.</p>	

Source: Adapted from Table 3.12 of LA109 Geology and Soil

Significance of effect

10.3.8 In accordance with DMRB LA 109 Geology and Soils Section 3.14, deriving the significance of effect from the receptor value and the magnitude of impact is to be undertaken in accordance with DMRB LA 104 'Environmental Assessment and Monitoring'. Subsequent to identifying an appropriate receptor sensitivity and magnitude of impact using Table 10.1

and Table 10.2, the likely significance category and overall significance of effects has been assessed by the principals set out in Chapter 5 Environmental Assessment Methodology. The approach to assigning significance of effect relies on reasoned argument, the professional judgement of competent experts and using effective consultation to ensure the advice and views of relevant stakeholders are taken into account. Effects of moderate significance and above (adverse and beneficial) are considered 'significant'.

10.4 Study area

10.4.1 This chapter provides a description of the geology and soils baseline conditions within 500 metres of the scheme. The study area for the assessment of geology and soils encompasses the area over which the scheme could be reasonably expected to have an effect. With respect to geology and soils, this generally only relates to the areas anticipated to be directly disturbed by the proposed physical works and ground disturbance. However, consideration of the wider 500 metre study area outside the scheme extent, is deemed necessary for the following reasons:

- The presence of potential contamination sources outside the scheme area which have the potential to migrate to the scheme area (areas of landfill or historical potentially contaminative land use, for example) and any sensitive receptors which may feasibly be affected by the uncontrolled migration of contaminants outside the scheme area. Methods of contaminant transport may include migration of soil/landfill leachates and ground gases. Therefore, 500 metres from the scheme extent is considered to be appropriate to capture the likely extent of impact pathways.
- BS 10175:2011+A2:2017, Investigation of Potentially Contaminated Sites Code of Practice states "the extent of research into the history of the site will depend upon a number of factors including the complexity of past potentially contaminative uses on and adjacent to the site, the vulnerability of the site geology and local water environment". Therefore, the study area extends 500 metres from the scheme extent to encompass sources outside the scheme area, and sensitive receptors outside the scheme area, including important geological sites, underlying groundwaters and surrounding surface waters. This includes localised perched groundwaters, any aquifer units located below or down-gradient of the study area and any designated groundwater source protection zones (SPZs).

10.5 Existing baseline

10.5.1 The relevant baseline conditions of the scheme and study area have been established from a combination of desktop information, a ground investigation (GI) and an agricultural land classification (ALC) survey. Both surveys were completed by Atkins in 2021. The GI comprised 130

exploratory holes along the scheme alignment. The ALC survey was also undertaken along the scheme alignment. At the time of the surveys the borrow pit and floodplain compensation sites were unknown and therefore there is currently no intrusive data from these areas. Supplementary surveys, including GI, ALC and soil nutrient sampling, will be undertaken at the borrow pit and floodplain compensation sites to further inform the baseline and assessment of effects. The additional GI survey will also aim to delineate an existing contamination hotspot identified at one exploratory hole from the Atkins GI. Following the additional GI, an outline of the likely evolution of the baseline and future baseline scenario will be reported within the ES.

10.5.2 The relevant baseline conditions of the scheme and study area have been established using the following sources of information:

- British Geological Survey (BGS) Geology of Britain Viewer¹⁰⁵
- The Coal Authority website¹⁰⁶
- Department for Environment, Food & Rural Affairs' (Defra) MAGIC website¹⁰⁷
- Natural England Designated Sites View¹⁰⁸
- Nottinghamshire Insight Mapping¹⁰⁹
- Old Maps Online¹¹⁰
- Landmark Information Group, Envirocheck Report (order no:172582399_1_1 dated 9/07/2018, received June 2018)
- Natural England Agricultural Land Classification map East Midlands Region¹¹¹
- Atkins (2021) A46 Newark Northern Bypass Preliminary Sources Study Report
- Atkins (2021) A46 Northern Newark Northern Bypass Environmental Assessment Report Volume I Chapter 9 Geology and Soils
- Atkins (2021) A46 Newark Northern Bypass – Agricultural Land Classification Survey Technical Note
- Zetica UXO website (2022) risk mapping¹¹²

¹⁰⁵ British Geological Survey Map available at: [Geology of Britain viewer | British Geological Survey \(BGS\)](#) (last accessed August 2022)

¹⁰⁶ Coal Authority Interactive Map available at: [Interactive Map Viewer | Coal Authority \(bgs.ac.uk\)](#) (last accessed August 2022)

¹⁰⁷ Defra, Magic (2021). Interactive Map [online] available at: [MAGIC \(defra.gov.uk\)](#) (last accessed August 2022)

¹⁰⁸ Natural England Designated Sites View available at: [Site Search \(naturalengland.org.uk\)](#) (last accessed August 2022)

¹⁰⁹ Nottinghamshire Insight Mapping available at: [Nottingham City Council - Insight Mapping GIS Mapping](#) (last accessed August 2022)

¹¹⁰ Old Maps online available at: [Old Maps Online](#) (last accessed August 2022)

¹¹¹ Agricultural Land Classification Map East Midlands Region (ALC005) available at: <http://publications.naturalengland.org.uk/publication/143027?category=5954148537204736> (Last Accessed June 2022)

¹¹² Zetica UXO Risk Maps available at: [Risk Maps | Zetica UXO](#) (last accessed June 2022)

- Newark and Sherwood District Council website – Contaminated Land¹¹³
- Atkins (2021) Technical Note GI: Summary of key Geological/Geotechnical Findings
- TetraTech (2022) A46 North Newark Bypass Draft Factual Ground Investigation Report

Geology

10.5.3 Made Ground¹¹⁴ is not mapped within the scheme alignment¹¹⁵, and is not recorded in historic boreholes. However, engineered fill for the existing A46 embankments was encountered within 43 boreholes and 4 trial pits during the 2021 ground investigation. The embankment fill typically comprised both cohesive and granular deposits. The cohesive material was typically described as compacted stiff mid grey slightly sandy silt pulverised fuel ash (PFA). The granular material was described as brown sandy gravel. The gravel content comprised sub-rounded to rounded fine to coarse siltstone, quartz, chert and flint. The use of PFA as an embankment fill material was also confirmed by Travers Morgan One Ltd historic cross sections provided by Atkins¹¹⁶. The maximum recorded thickness of Engineered Fill was 14.90 metres at one location, but it was typically 4.00 metres to 6.00 metres thick at the other exploratory hole locations.

10.5.4 According to the British Geological Survey (BGS)¹¹⁷, superficial deposits of Alluvium, associated with the River Trent, are present across the majority of the south-western half of the study area. The Balderton Sand and Gravel Member underlies much of the north-eastern section of the study area. Small areas of Holme Pierrepont Sand and Gravel Member are also present mainly located just west of the A1, north of Cattle Market and at the south-western extent of the study area. During the ground investigation, Alluvium and the Balderton Sand and Gravel Member were encountered between ground level (GL) and 13.40 metres below ground level (bgl). Both granular and cohesive alluvial deposits were recorded across the scheme. The Balderton Sand and Gravel Member generally comprises dense reddish brown slightly gravelly fine to coarse sand. The Holme Pierrepont Sand and Gravel Member was not encountered in the 2021 ground investigation.

¹¹³ Newark and Sherwood District Council website available at: <https://www.newark-sherwooddc.gov.uk/landpollution/> (last accessed July 2022).

¹¹⁴ An area where the pre-existing (natural or artificial) land surface is raised by artificial deposits. The purpose of the made ground is unspecified.

¹¹⁵ British Geological Survey Map Available at: [Geology of Britain viewer | British Geological Survey \(BGS\)](#) (last accessed August 2022)

¹¹⁶ TetraTech Factual Ground Investigation Report , Final Report V1.1 March 2022

¹¹⁷ British Geological Survey Map available at: [Geology of Britain viewer | British Geological Survey \(BGS\)](#) (last accessed June 2022)

10.5.5 According to the BGS, bedrock deposits of Mercia Mudstone is recorded underlying the scheme. The Edwalton Member is recorded underlying the southwest extent of the scheme, whilst the Gunthorpe Member underlies the southeast extent. During the 2021 ground investigation the Mercia Mudstone Group was encountered between (1.0 - 17.0 metres bgl). Generally, Weathered Mercia Mudstone was recorded at shallow depths, comprising soft to firm reddish brown silty clay. Competent Mercia Mudstone was also recorded at greater depths and generally comprised weak to medium strong very thinly bedded reddish brown and bluish grey mudstone.

10.5.6 No scheme-specific ground investigation has been undertaken at the proposed floodplain compensation/borrow pit areas to date. Following a review of available BGS mapping and historical exploratory hole logs for these areas, the following geology is anticipated:

- The proposed Kelham and Averham Floodplain Compensation Area is underlain by the Holme Pierrepont Sand and Gravel Member with the Mercia Mudstone Group forming the bedrock beneath. Made Ground is not mapped within the area.
- The proposed Farnon Borrow Pits / Floodplain Compensation Area is underlain by Alluvium superficial deposits with the Edwalton Member Mudstone forming the bedrock beneath. Made Ground is not mapped within the area. However, a large area of Made Ground is located approximately 300 metres to the west of the proposed borrow pit location, at Staythorpe Power Station.

10.5.7 There are no designated or non-designated geological sites/features of interest within 500 metres of the scheme. No Regionally Important Geological Sites (RIGS) are located within 500 metres of the scheme¹¹⁸.

Soils

10.5.8 The only available map covering the whole study area is the 1:250,000 soil map of Eastern England, published by the Soil Survey of England and Wales in 1983¹¹⁹. The soils in the scheme area belong to three broad groups:

- Coarse textured soils found on the terraces of the River Trent in the north of the survey area;
- Where the terrace gravels thin out, the coarse loamy deposits overlie the red clay of Mercian Mudstone that occurs below 60cm; and
- The low-lying Trent floodplain supports loamy and clayey alluvium.

¹¹⁸ Nottinghamshire Insight Mapping Available at: [Nottingham City Council - Insight Mapping GIS Mapping](#) (last accessed August 2022)

¹¹⁹ Soil Survey of England and Wales (1983). 1:250,000 scale Soil Map of Eastern England. Rothamsted Experimental Station, Harpenden

10.5.9 Based on an intrusive ALC survey conducted in spring 2021¹²⁰ and desktop information, the ALC grades identified in the study area include subgrade 3a (20% of study area), 3b (36% study area) and non-agricultural land (44% study area). Grade 3a is deemed 'best and most versatile'. Two areas were inaccessible for the survey, but available information was used to determine the ALC grade reliably.

10.5.10 No ALC survey has been undertaken in the proposed floodplain compensation/borrow pit areas to date. Following a review of available mapping¹²¹ for these areas, the subsequent agricultural land grades are anticipated:

- The Kelham and Averham Floodplain Compensation Area is predicted to be grade 2, deemed 'best and most versatile'.
- The Farndon Borrow Pits / Floodplain Compensation Area is a predicted grade 3 (good to moderate). It is not possible to differentiate between subgrades 3a (deemed 'best and most versatile', BMV) and 3b (not deemed BMV) without a soil survey.

10.5.11 Further soil surveys are proposed at the location of the borrow pits and flood compensation areas to determine the ALC grade.

Land contamination

10.5.12 Newark and Sherwood District Council has not designated any land as contaminated under the definition in Part 2A of the Environmental Protection Act 1990 and as such does not have any entries on the Contaminated Land Register.

10.5.13 Data obtained from the Environment Agency and the local authority that is contained in the Envirocheck Report¹²², along with historical Ordnance Survey mapping, and aerial mapping have been reviewed to identify current and historical possible contaminative land uses. Potential contamination sources identified within the study area include: Made Ground, the railway lines (active and historical), the active British Sugar Factory, active sewage treatment works, former chemical works, historic landfill, active fuel filling stations, ADR automotive site, Newark-on-Trent lorry wash, an old bleaching house and former petrol station. These potential sources of contamination were targeted as part of the scheme specific ground investigation undertaken by Atkins (2021) and are shown on Figure 10.1 contained in Volume 2. There are approximately 130

¹²⁰ Atkins Regional Investment Programme A46 Newark-on-Trent Northern Bypass - Agricultural Land Classification Survey Technical Note 27th April 2021

¹²¹ Agricultural Land Classification Map East Midlands Region (ALC005) Available at: <http://publications.naturalengland.org.uk/publication/143027?category=5954148537204736> (last accessed August 2022)

¹²² Landmark Information Group, Envirocheck Report (order no:172582399_1_1 dated 9/07/2018, Atkins received June 2018).

exploratory holes along the proposed scheme, which provide information on geotechnical and geo-environmental conditions.

10.5.14 The Envirocheck Report indicated there are four significant substantiated pollution incidents recorded within 500 metres of the scheme, outlined as follows:

- 117 metres north of A46 near Robert Dukeson Avenue – September 2009 Significant land pollution incident from soot.
- 165 metres southwest of A46 near Fleming Play Area – October 2012 – Significant land pollution incident from tyres.
- 249 metres east of A1/A46 Junction – August 2005 – Significant water pollution and minor land pollution from suspended solids.
- 290 metres west of the A46 near Old Trent Dyke – October 2014 Significant land pollution incident caused from smoke and commercial waste.

10.5.15 There are a further 28 recorded pollution incidents to controlled waters recorded within 500 metres of the southern and central areas of the scheme, all of which were designated Category 3 – Minor Incidents caused by pollutants including oils, organic wastes, sewage, and chemicals to surface watercourses within the Trent catchment area.

10.5.16 During Atkins (2021) ground investigation, olfactory evidence of contamination was identified at the exploratory hole location of WS46, at the base of the Made Ground layer in the Alluvium between 2.5 metres bgl and 3.65 metres bgl, where a chemical odour was observed. The location of exploratory hole WS46 is shown on Figure 10.1 contained in Volume 2. No other exploratory hole locations from the 2021 ground investigation noted visual or olfactory evidence of contamination.

10.5.17 Preliminary screening of the geo-environmental data from the 2021 Atkins GI survey identified two significant contaminant concentrations, both at the location of WS46, for aromatic hydrocarbons and naphthalene. No other significant concentrations of contaminants were noted in soil, soil leachate or groundwater samples from the 2021 Atkins GI survey.

10.5.18 No ground investigation has been undertaken in the areas identified for the proposed borrow pits and floodplain compensation. Following a review of available Ordnance Survey historical mapping, these areas have been identified as having had no contaminative use and have remained undeveloped. Therefore, the risk of encountering contaminated soils and contaminated groundwater at these locations is very low.

10.5.19 There are two recorded active landfills within 500 metres of the scheme. They are dedicated for factory curtilage waste and are operated by British Sugar Plc, located to the northwest of the scheme.

10.5.20 There is one small area noted as a historical landfill located approximately 215 metres east of the Great North Road and approximately 0.164 hectares in area. The landfill is recorded as having accepted inert and

industrial waste and was operated by the British Sugar Company. There are no other historical landfill sites recorded within the study area¹²³. The recorded active landfills and the historical landfill are shown on the Environmental Constraints Plan (Figure 2.1 contained in Volume 2).

10.5.21 Zetica has produced freely available risk maps¹²⁴ indicating the potential risk of air dropped World War Two unexploded ordnance (UXO) to be present in the study area. The mapping classifies the ground directly underlying the study area as 'Low Risk' with less than 15 surveyed bomb strikes per 1000 acres. It should be noted that this risk map is not a risk assessment and does not consider other sources of UXO such as enemy or allied ground ordnance.

Groundwater

10.5.22 According to the Environment Agency (EA) online mapping¹²⁵, the bedrock geology present across the site is classed as a Secondary B Aquifer, defined as the presence of "lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering".

10.5.23 The overlying drift deposits, where present, are classified as a Secondary A Aquifer: "Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers".

10.5.24 The area is not located within an EA designated groundwater source protection zone (SPZ), Drinking Water Protected Area or Drinking Water Safeguard Zone for groundwater (or surface water). For further information on the groundwater of the area, refer to Chapter 14 Road Drainage and the Water Environment.

Surface water

10.5.25 The River Trent flows through the centre of the study area flowing in a northerly direction. The A46 crosses the river near Crankley Point and Farndon Junction. The Old Trent Dyke also crosses the south-western part of the route in two locations, near Newark Cricket Ground and west of Hiram's Paddocks. In addition, there are several field drains and smaller unnamed watercourses within the study area.

10.5.26 There are several lakes/ponds located north of the A46, approximately 50 metres at their closest point, between the A1 and A616 Great North Road and adjacent to the railway line in the south-western part

¹²³ Landmark Information Group, Envirocheck Report (order no:172582399_1_1 dated 9/07/2018, Atkins received June 2018)

¹²⁴ Zetica UXO Risk Maps available at: [Risk Maps | Zetica UXO](#) (last accessed August 2022)

¹²⁵ Defra, Magic (2021). Interactive Map [online] available at: [MAGIC \(defra.gov.uk\)](#) (last accessed August 2022).

of the route. Kings Marina is located just west of Northgate Retail Park, approximately 70 metres south of the A46 at its closest point.

10.5.27 For further information on hydrology, see Chapter 14 Road Drainage and the Water Environment.

10.6 Value (sensitivity of resources and receptors)

10.6.1 Each receptor identified has been assigned a sensitivity, in accordance with the assessment methodology described in Section 10.3 and DMRB LA 109 Geology and Soils. The sensitivity of receptors is show in Table 10.3 below.

Table 10.2: Sensitivity of receptors

Receptor		Sensitivity
Soil	ALC grade 2	Soil
	ALC grade 3a	
	ALC grade 3b	
Contaminated Land receptors	Human receptors: Construction workers	Contaminated Land receptors
	Human receptors: Site end users (National Highways staff and maintenance workers)	
	Surface water: River Trent, Old Trent Dyke, Several field drains and smaller unnamed watercourses	
	Groundwater: Superficial deposits - EA designated Secondary A Aquifer	
	Groundwater: Bedrock – EA designated Secondary B Aquifer	
Buried Concrete Structures	Piled structures, foundations, drainage	Buried Concrete Structures
Receptor	Sensitivity	Receptor

10.7 Potential impacts

10.7.1 The potential impacts of the proposed scheme are presented below.

Construction

Geology

10.7.2 The effect of mineral resources, material import and export in relation to earthworks construction are considered in Chapter 11 Material Assets and Waste.

Soils

10.7.3 There is potential for permanent compaction or removal of anticipated BMV agricultural soils or topsoil/ sub soil material. Soil deterioration and compaction may occur due to vehicle movements and loading, leading to adverse impacts.

10.7.4 The scheme proposes an area of land take at Brownhills Junction in the north of the scheme adjacent to the A46 and A1, crossing agricultural land classification Grade 3 (good to moderate).

10.7.5 There is potential for removal of ALC Grade 3 (good to moderate) soils for utilisation of a borrow pit area located south of Nottingham to Lincoln Railway.

10.7.6 There is potential for removal of ALC Grade 2, deemed 'best and most versatile' soils in the Kelham Floodplain Compensation Area Floodplain Compensation Area. The construction of the Floodplain Compensation Areas are likely to create a significant volume of materials which will need to be either reused or disposed of on or off-site.

Contamination

10.7.7 Potential contamination impacts may relate to the following receptors:

- Human health
- Groundwater
- Surface water

10.7.8 Potential impacts are likely to relate to disturbance of existing ground contamination and its interaction with the scheme during construction.

10.7.9 Construction works could result in localised fuel spillages and leakages. There is the potential for the creation of contamination pathways/driving down of contaminants presenting a risk to groundwater and surface waters, at one location identified during the 2021 GI. Screening of the geo-environmental data from the 2021 draft Factual Ground Investigation Report, identified two significant contaminant concentrations, both at the location of WS46. Further GI is planned at this location to delineate the extent of the contamination.

10.7.10 No other significant concentrations of contaminants were noted in soil, soil leachate and groundwater samples.

- 10.7.11 Given the nature of their work, construction workers may come into contact with potentially contaminated soils, leachates, and reduced oxygen conditions in excavations.
- 10.7.12 The removal or remediation of any areas of contaminated soils identified would have a potential benefit.

10.8 Consultation

10.8.1 Direct consultation with the Environment Agency and Newark and Sherwood District Council has currently not been undertaken regarding this topic. However, the purchase of an Envirocheck report has been completed, which contains information held by the Environment Agency and Newark and Sherwood District Council, pertinent to this chapter. In line with the Contaminated Land Risk Assessment, the Environment Agency and Newark and Sherwood District Council will be consulted during preparation of the DCO application.

10.8.2 In line with DMRB LA 109 and Technical Information Note 049¹²⁶, consultation will be undertaken with Natural England if more than 20 ha of BMV land is likely to be affected. The scale of BMV land likely to be affected by the scheme will be confirmed once the supplementary ALC surveys are completed at the proposed borrow pit sites and floodplain compensation areas.

10.9 Assumptions and limitations

10.9.1 This chapter is based on the current scheme alignment, known ground conditions and knowledge of any potential contamination. The findings may be subject to change following further GI and again during scheme development, should any previously unidentified contamination or unforeseen ground conditions become evident.

10.9.2 The assessment is based on ALC survey data for the main scheme alignment only at present, and an additional ALC survey is required at supplementary areas including the proposed borrow pit sites and floodplain compensation areas. For the purposes of the assessment of effects identified in Table 10.4, as a precautionary approach soil receptors have been assumed ALC grade 3a.

10.9.3 The supplementary GI and ALC survey will inform the production of the Soil Management Plan (SMP), enabling the differentiation between ALC grades 3a and 3b at the proposed flood compensation area, aid geotechnical design, and delineate a contamination hotspot identified at one historic exploratory hole location. Any potential requirement for remediation

¹²⁶ Technical Information Note 049, Agricultural Land Classification: protecting the best and most versatile agricultural land, Natural England, (2012) available at: <http://publications.naturalengland.org.uk/publication/35012?category=23033> (last accessed August 2022)

of land contamination is currently unknown. An ALC, SMP and Contaminated Land Risk Assessment (where required) will be submitted as part of the application of the ES.

- 10.9.4 The currently available Envirocheck data does not include coverage for the full extent of the study area. There are currently data gaps in the proposed borrow pit and floodplain compensation areas. This additional data will be obtained and included in the ES, and where appropriate referenced in the Second Iteration Environmental Management Plan (EMP).

10.10 Design, mitigation and enhancement measures

Design

Contamination

- 10.10.1 A phase of pre-construction intrusive ground investigation has been undertaken in accordance with regulatory standards and current best practice including but not limited to Land Contamination Risk Management (LCRM), BS5930 and BS10175, to inform engineering design and earthworks, characterise potential excavated materials and identify the appropriate mitigation measures.
- 10.10.2 The assessment and possibly the remediation of land contamination will be a requirement of the DCO application process to ensure that the scheme is suitable for its proposed use. The LCRM guidance details the steps that will need to be followed as the scheme is progressed through the DCO process. These steps include the production of a Preliminary Risk Assessment and completion of an appropriate ground investigation, tiered stages of risk assessments together with an assessment of unacceptable pollutant linkages. Where such linkages are found then a remediation options appraisal and strategy will be produced and would be documented within the Contaminated Land Risk Assessment, First and Second Iteration EMP as required.
- 10.10.3 A supplementary ground investigation will be carried out at the proposed floodplain compensation and borrow pit sites to characterise ground conditions, inform the baseline and to delineate an identified contamination hotspot from one exploratory hole from the historic ground investigation. The survey data will be used to assess the geotechnical properties of the soil to influence earthworks and foundation design, as well as inform concrete specification and the nature and extent of remediation required at the location of the identified contamination hotspot.
- 10.10.4 Design measures will consist of features inherent in the scheme design which will act as mitigation, such as the inclusion of surface water management/drainage systems to control surface water run-off and mitigating against potential leachate generation in the unsaturated zone. Highways drainage will be designed in accordance with DMRB standards to

ensure collection of potentially contaminated site run off from vehicle fuel leakage.

- 10.10.5 Determined Design Sulphate and Aggressive Chemical Environment for Concrete classes for each stratum are to be used from existing survey data and from the proposed GI survey at the flood compensation and borrow pit sites, to inform the design of appropriate concrete foundations/structures.

Soils

- 10.10.6 An Agricultural Land Classification Survey and Soil Nutrient Sampling will be carried out at the proposed floodplain compensation and borrow pit sites in order to confirm existing baseline conditions and inform the Agricultural Land Classification and Soil Management Plan. An outline Soil Management Plan(s) will be submitted with the scheme DCO application.

Mitigation – construction

Contamination

- 10.10.7 Mitigation measures will be detailed within the First Iteration EMP which will be submitted as part of the DCO application. The EMP will then be further developed into the Second Iteration EMP in advance of construction. All construction works will be carried out in accordance with the Second Iteration EMP, detailing the reasonable and practicable steps to be undertaken to prevent pollution of the surrounding environment including geological materials, site soils, groundwaters and surface waters.
- 10.10.8 A potential risk may exist from unexpected contamination, which may be encountered during construction. Should any areas of previously unidentified visual and or olfactory evidence of contamination be encountered, this will be managed in accordance with the details specified within the EMP (including refined details in the Second Iteration EMP), for the scheme.
- 10.10.9 Any remediation works required to manage contamination risk will be agreed with Newark and Sherwood District Council and the Environment Agency. Remediation will need to be completed and verified before completion of the scheme. Acute risks to construction and maintenance workers resulting from short-term exposure to potentially contaminated soils/groundwater will be mitigated by the contractor, through appropriate design of the works and compliance with health and safety legislation.
- 10.10.10 For the protection of controlled waters, the EMP (and updated Second Iteration EMP) should cover all necessary requirements, for example guidance on storage requirements of hazardous substances, the use of cut-off ditches and settling tanks where necessary. The discharge of potentially contaminated groundwater from dewatering should be

appropriately managed and may require an Environmental Permit/Discharge Consent. To prevent the contamination of the Secondary A and B aquifers the contractor must take precautions, in line with all associated pollution prevention guidelines. Where piling or penetrative ground improvement is required into aquifers, the works should be carried out in accordance with the latest guidance. A Foundation Works Risk Assessment may need to be undertaken.

- 10.10.11 The works areas will be well delineated and kept secure to prevent public access and trespass. The acute risks to construction workers resulting from short-term exposure to soils will be mitigated by the contractor, through appropriate design of the works and compliance with health and safety legislation. Potential risk from ground gases to construction workers working in excavations and other confined spaces will be dealt with by the contractor, in-accordance with current Confined Spaces Regulations.

Soils

- 10.10.12 The Agricultural Land Classification and Soil Management Plan included within the EMP (with the Kelham flood compensation area and borrow pit area surveys to be included within the Second Iteration EMP) would see works undertaken in accordance with appropriate guidelines such as:

- Defra's 2009 'Code of Practice for the Sustainable Use of Soils on Construction Sites'
- BS2882: 2015 'Specification for Topsoil'

- 10.10.13 Other possible mitigation measures may include (but not be limited to), stockpile management: topsoils and subsoils should be stripped first, segregated and stockpiled appropriately for re-use across the site where possible and where appropriate the use of a temporary running surface to protect existing ground conditions.

Enhancement measures

- 10.10.14 Enhancement measures for geology and soils will be considered as part of the ongoing design development, and will be reported in the ES. However, these enhancement measures will not be taken into account when determining whether effects are significant or not.

10.11 Assessment of effects

Construction

- 10.11.1 The scheme will include a range of construction activities that have the potential to result in adverse effects on soils and contaminated land. Principal construction activities are anticipated to include:

- Shallow excavation works – resulting in the permanent removal of shallow deposits (soils, Engineered Fill, Made Ground and superficial deposits), potential for contaminated materials to be disturbed.
- Earthworks – resulting in waste generation and disturbance of groundwaters, surface waters and generation of excavations which will require dewatering, and potential ground/ground gas risks.
- General construction works – the movement of materials, construction plant and storage of materials may lead to compaction of agricultural soils and the storage of hazardous chemicals leading to secondary effects on soils and groundwater.
- Foundation Works – piling or penetrative ground improvement as part of foundation construction may pose risks to controlled waters along with environmental risks relating to the use of concrete in construction.

10.11.2 Table 10.4 summarises the assessment of effects, detailing the potential effect identified and appropriate mitigation measure for a particular receptor. The receptor sensitivity and magnitude of impact has been estimated followed by the identification of the significance category after mitigation, as detailed in Section 10.3 above.

Table 10.4: Assessment of effects

Receptor		Summary of effects	Mitigation measures	Receptor sensitivity	Magnitude	Significance category (with mitigation)
Soils	ALC grade 2	<p>There is potential for removal of ALC Grade 2, deemed 'best and most versatile' soils in the Kelham/Averham Flood Compensation Area (FCA).</p> <p>General construction works, shallow excavation and earthworks have the potential for soil deterioration and consolidation due to poor storage and handling or vehicle movement and loading.</p>	<p>Supplementary Agricultural Land Classification Survey</p> <p>Soil nutrient sampling</p> <p>Soil Management Plan (SMP)</p> <p>Materials Management Plan (MMP)</p>	Very High	<p>Moderate</p> <p>Permanent loss or reduction of one or more soil function(s) and restriction to current or approved future use</p>	Moderate Adverse
	ALC grade 3a	<p>There is potential for the removal of ALC Grade 3 (good to moderate) soils at Brownhills Junction in the north of the scheme adjacent to the A46 and A1.</p>		High	<p>Moderate</p> <p>Permanent loss or reduction of one or more soil function(s) and restriction to current or</p>	Slight Adverse

Receptor		Summary of effects	Mitigation measures	Receptor sensitivity	Magnitude	Significance category (with mitigation)
	ALC grade 3b	<p>There is potential for removal of ALC Grade 3 (good to moderate) soils for utilisation of a borrow pit area located south of Nottingham to Lincoln Railway.</p> <p>There is potential for soil deterioration and compaction due to general construction, shallow excavation and earthworks.</p> <p>An ALC survey is required at the proposed locations of the flood compensation area and borrow pits area, to determine the ALC grade and to differentiate between subgrades 3a (deemed 'best and most versatile', BMV) and 3b (not deemed BMV).</p>		Medium	<p>approved future use</p> <p>Moderate</p> <p>Permanent loss or reduction of one or more soil function(s) and restriction to current or approved future use</p>	Slight Adverse

Receptor		Summary of effects	Mitigation measures	Receptor sensitivity	Magnitude	Significance category (with mitigation)
Human receptors	Construction workers	Shallow excavation works and earthworks during construction, with potential for contaminated materials to be disturbed with human uptake pathways presented.	Contractor(s) should ensure standard health and safety procedures are in place and best practices are followed during construction and maintenance works.	Low	Minor	Neutral
	Site end users (National Highways staff and maintenance workers)	Highway maintenance in areas of soft landscaping.	Site will be predominantly hardstanding on completion of works, breaking potential source-pathway-receptor linkage. Only materials assessed as suitable for use will be used in areas	Low	Minor	Neutral / Slight Beneficial (following remediation)

Receptor		Summary of effects	Mitigation measures	Receptor sensitivity	Magnitude	Significance category (with mitigation)
			of soft landscaping. Remediation of areas of identified contamination.			
Buried Concrete Structures	Piled structures, foundations, drainage	Direct contact of buried material with contaminated or corrosive soils	The potential risk to buried cementitious structures in direct contact with underlying ground material will be mitigated by the assessment of GI data, to determine the selection of the appropriate concrete specification for the Site.	Low	Moderate	Slight Adverse
Controlled Waters	Surface Water	Main Rivers, Ordinary Watercourses, lakes/ponds and several field drains are present in the vicinity of the scheme. Surface water sensitivity is discussed in Chapter 14	EMP & Second Iteration EMP. Protection of Controlled Waters: cut off ditches, stockpile management and dust suppression Surface water and groundwater management plans	Very High - Low	Minor – Moderate (dependent on extent of pollution and change in chemical quality EQSs)	Neutral/Slight Adverse

Receptor		Summary of effects	Mitigation measures	Receptor sensitivity	Magnitude	Significance category (with mitigation)
		<p>Road Drainage and Water Environment.</p> <p>Potential for surface water run-off to become entrained with sediment and pollute nearby watercourses.</p> <p>Discharge of potentially contaminated/sediment laden groundwater to watercourses following dewatering of excavations/foundation works.</p>	<p>Dewatering of excavations if water is encountered</p> <p>Contaminated Land Risk Assessment</p> <p>Protection of controlled waters: foundation works</p> <p>Foundations Work Risk Assessment</p> <p>Highways drainage will be designed in accordance with DMRB standards to ensure collection of potentially contaminated site run off from vehicle fuel leakage, does not impact surface water.</p>			

Receptor		Summary of effects	Mitigation measures	Receptor sensitivity	Magnitude	Significance category (with mitigation)
	Groundwater	<p>The bedrock geology present across the scheme forms a Secondary B Aquifer. The superficial deposits, where present, form a Secondary A Aquifer.</p> <p>The WFD groundwater body is considered a low productivity aquifer, and there are no SPZs.</p> <p>Potential for creation of contamination pathways/driving down of contaminants during GI/foundation works, presenting a risk to groundwater.</p>	<p>EMP & Second Iteration EMP</p> <p>Protection of Controlled Waters: cut off ditches, stockpile management and dust suppression</p> <p>Groundwater management plans</p> <p>Dewatering of excavations if water is encountered</p> <p>CLRA</p> <p>Protection of controlled waters:</p> <p>Foundations Work Risk Assessment</p> <p>Highways drainage will be designed in</p>	Medium	Minor	Neutral/Slight Adverse

Receptor		Summary of effects	Mitigation measures	Receptor sensitivity	Magnitude	Significance category (with mitigation)
			accordance with DMRB standards to ensure collection of potentially contaminated site run off from vehicle fuel leakage, does not impact groundwater.			

10.12 Monitoring requirements for significant adverse effects

- 10.12.1 For the purpose of this assessment, effects of Moderate Adverse or Beneficial and above have been considered to be significant.
- 10.12.2 After incorporating the mitigation measures as outlined in section 10.10, significant effects have been identified on 'ALC grade 2 soils' in the Kelham/Averham Floodplain Compensation Area.
- 10.12.3 A supplementary agricultural land classification survey will be undertaken to determine the reliability of the predicted grade 2 ALC in the Kelham and Averham Floodplain Compensation Area to determine the ALC grade at the proposed Farndon Borrow Pits / Floodplain Compensation Area and the effects of the scheme on these soils. Monitoring requirements will be detailed in the Agricultural Land Classification and Soil Management Plan Report and reported in the ES, as necessary.

10.13 Conclusions

- 10.13.1 This chapter provides a summary of the assessment that has been undertaken to date for geology and soils, including contaminated land in accordance with DMRB.
- 10.13.2 It is considered that the scheme has the potential to result in significant adverse effects on ALC grade 2 soils in the Kelham and Averham Floodplain Compensation Area during construction. Further surveys are to be undertaken to confirm this potential adverse effect, and ongoing design development and the development of mitigation and/or compensation strategies will address this potential loss of agricultural land.
- 10.13.1 Where necessary, further work required has been identified both in relation to ground investigation, soil surveys and reporting. Findings will be reported in required documents such as the Contaminated Land Risk Assessment (CLRA), Ground Investigation Report (GIR), EMP, Second Iteration EMP, Site Waste Management Plan (SWMP), MMP and SMP.
- 10.13.2 It is considered necessary to undertake further assessment which will incorporate the results of additional surveys including supplementary GI, ALC survey and soil nutrient survey. The assessments and any necessary mitigation and compensation measures will be reported within the ES, to be submitted as part of the DCO application.

11 Material Assets and Waste

11.1 Introduction

- 11.1.1 This chapter presents the on-going work for the assessment of the potential effects on material assets and waste as a result of the scheme, that has been undertaken to date. The assessment presented in this chapter concentrates on the use of primary, secondary, recycled, and manufactured materials, and the generation and management of waste.
- 11.1.2 The potential effects have been considered following the requirements set out in Design Manual for Roads and Bridges (DMRB) LA 110 Material assets and waste¹²⁷. Further detailed assessment is currently under way and will be reported within the ES that will be submitted to support the Development Consent Order (DCO) application.
- 11.1.3 For the purposes of the assessment, materials are defined as comprising:
- The use of material resources
 - The generation and management of waste

11.2 Legislation and policy context

- 11.2.1 The following legislation and policy are relevant to the proposed scheme. There are a number of other statutes which may govern material resource use and waste management, including legislative changes. However, it is unlikely these would alter the outcome of the assessment.

European Legislation

- 11.2.2 The overarching European Directives that are applicable to the assessment of material resource use and waste generation are set out below. Whilst it is acknowledged that the UK has left the European Union (EU) it should be noted that existing legislation which transposes these Directives remains in force.

Waste Framework Directive (2008/98/EC)¹²⁸

- 11.2.3 The Waste Framework Directive sets the basic concepts and definitions related to waste management, such as definitions of waste, recycling and recovery. It defines when waste ceases to be waste and becomes a secondary raw material (so called end-of-waste criteria),

¹²⁷ Highways England (2019) Design Manual for Roads and Bridges, LA 110 Material assets and waste [online]. Available at: [6a19a7d4-2596-490d-b17b-4c9e570339e9 \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk) (Last accessed August 2022).

¹²⁸ Waste Framework Directive (2008/98/EC) [online]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098> (Last accessed August 2022).

and how to distinguish between waste and by-products. The Waste Framework Directive lays down some basic waste management principles: it requires that waste is managed without endangering human health and harming the environment, and in particular, without risk to water, air, soil, plants or animals, without causing a nuisance through noise or odours, and without adversely affecting the countryside or places of special interest.

11.2.4 The Waste Framework Directive sets out a five-step waste hierarchy as to how waste should be managed which applies to anyone who produces or manages waste. The waste hierarchy requires that waste is dealt with in the following order of priority:

- Prevention
- Preparing for reuse
- Recycling
- Other recovery (for example energy recovery)
- Disposal, only as a last resort

11.2.5 The following considerations must be taken into account:

- Environmental protection principles of precaution and sustainability
- Proximity principle for treatment and disposal of waste to be as close to its source as possible
- Technical feasibility and economic viability
- Protection of resources
- The overall environmental, human health, economic and social impacts

11.2.6 The Waste Framework directive stipulates the requirement for Member States to reuse, recycle or recover a minimum of 70% of non-hazardous construction and demolition waste by weight by 2020.

Landfill Directive (1999/31/EC)¹²⁹

11.2.7 The Landfill Directive aims to prevent, or reduce as far as possible, negative effects on the environment from the landfilling of waste.

Hazardous Waste Directive (91/689/EEC)¹³⁰

11.2.8 This Directive lays down strict controls and requirements for controlling hazardous wastes. Hazardous waste is any waste with hazardous properties that may make it harmful to human health and the environment and is defined by the European Waste Catalogue.

¹²⁹ Landfill Directive (1999/31/EC) [online]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31999L0031> (Last accessed August 2022).

¹³⁰ Hazardous Waste Directive (91/689/EEC) [online]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:01991L0689-20081212&from=EN> (Last accessed August 2022).

National legislation

The Environment Act 2021¹³¹

11.2.9 The Act makes provision about targets, plans and policies for improving the natural environment; for statements and reports about environmental protection; for the Office for Environmental Protection; about waste and resource efficiency; about air quality; for the recall of products that fail to meet environmental standards; about water; about nature and biodiversity; for conservation covenants; about the regulation of chemicals; and for connected purposes. The Act contains several provisions in Part 3 relating to waste which includes:

- Producer responsibility obligations
- Producer responsibility for disposal cost
- Managing waste by separation of waste for domestic collection
- Managing hazardous waste
- Electronic waste tracking

The Environmental Protection Act 1990 (as amended)¹³²

11.2.10 This Act defines the fundamental structure and authority for waste management and control of emissions into the environment. It legislates for:

- The meaning of waste
- The requirements of the duty of care in respect of waste and transferral of waste
- A prohibition on the unauthorised or harmful depositing, treatment, or disposal of waste on land
- Waste collection and waste disposal authorities and their roles

European Union (Withdrawal) Act 2018¹³³

11.2.11 The Act introduces the concept of retained EU law. The Act ensures that the whole body of existing EU environmental law continues to have effect in UK law. Essentially any EU regulation or decision addressed to the UK in operation before the date of exit from EU will remain a part of the UK law. This includes the Landfill Directive and the Hazardous Waste Directive.

¹³¹ Her Majesty's Government (2021) The Environment Act 2021 [online]. Available at: [Environment Act 2021 \(legislation.gov.uk\)](#) (Last accessed August 2022).

¹³² Her Majesty's Government (1990) Environmental Protection Act 1990 [online]. Available at: [Environmental Protection Act 1990 \(legislation.gov.uk\)](#) (Last accessed August 2022)

¹³³ Her Majesty's Government (2018) European Union (Withdrawal) Act 2018 [online]. Available at: [European Union \(Withdrawal\) Act 2018 \(legislation.gov.uk\)](#) (Last accessed August 2022).

Waste (Circular Economy) (Amendment) Regulation 2020¹³⁴

11.2.12 The legislation specifies details on waste prevention programs, waste management plans and duties in relation to waste management and improved use of waste as a resource. English and Welsh law was updated on 01 October 2020 to include changes to the Waste Framework Directive (WFD) made in 2018. This was done through the Waste (Circular Economy) (Amendment) Regulations 2020.

The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020¹³⁵

11.2.13 These regulations were laid before Parliament on 16 December 2020 and are made in exercise of powers in section 8(1) of the European Union (Withdrawal) Act 2018 in order to ensure that the waste and environmental permitting regimes continue to operate effectively as of the 1st January 2021.

The Waste (England and Wales) Regulations (2011) as amended¹³⁶

11.2.14 These regulations make provision for waste prevention programmes and impose duties in relation to the improved use of waste as a resource, including the application of the waste hierarchy. Site Waste Management Plans¹³⁷ (SWMPs) are no longer mandatory for projects commencing after 1 December 2013. They are, however, recommended and the principles behind the regulations remain best practice.

The Hazardous Waste (England and Wales) Regulations (2005) as amended¹³⁸

11.2.15 These regulations provide for the control of hazardous wastes and their movements. A consignment note is required prior to the removal of any hazardous waste. Hazardous waste is waste that exhibits certain properties (for example, it is potentially flammable, toxic or carcinogenic) such that it is or may (at or above certain concentrations) be detrimental to human health or the environment.

¹³⁴ Her Majesty's Government (2020) The Waste (Circular Economy) (Amendment) Regulations 2020 [online]. Available at: [Legislation.gov.uk](https://www.legislation.gov.uk) (Last accessed August 2022).

¹³⁵ Her Majesty's Government (2020) The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 [online]. Available at [The Waste and Environmental Permitting etc. \(Legislative Functions and Amendment etc.\) \(EU Exit\) Regulations 2020 \(legislation.gov.uk\)](https://www.legislation.gov.uk/uksi/2020/12/12/1) (Last accessed August 2022).

¹³⁶ Her Majesty's Government (2011) The Waste (England and Wales) Regulations 2011, No.988 [online]. Available at: <https://www.legislation.gov.uk/uksi/2011/988/contents> (Last accessed August 2022).

¹³⁷ Department for Environment, Food and Rural Affairs (2008) non-statutory guidance for site waste management plans [online] Available at: <https://www.ihsti.com/CIS/document/267008> (Last accessed August 2022).

¹³⁸ Her Majesty's Government (2005) The Hazardous Waste (England and Wales) Regulations 2005, No. 894 [online]. Available at: <https://www.legislation.gov.uk/uksi/2005/894/contents/made> (Last accessed August 2022).

The Environmental Permitting (England and Wales) Regulations (2016), as amended¹³⁹

11.2.16 These regulations introduce a streamlined system of environmental permitting in England and Wales for certain installations, waste operations and mobile plants. It is an offence to operate a regulated facility or to cause or knowingly permit a water discharge or groundwater activity except under and in accordance with an environmental permit.

Waste Electrical and Electronic Equipment (WEEE) (England and Wales) Regulations, 2013¹⁴⁰

11.2.17 The WEEE Regulations 2013 apply to all electrical and electronic equipment placed on the market in the UK covered by the scope of the regulations. There are 10 broad categories of WEEE currently outlined within the regulations (see Schedules 1 and 2 of the regulations).

Relevant categories for the scheme are:

- Lighting equipment, for example straight and compact fluorescent tubes and high intensity discharge lamps.
- Electrical and electronic tools, for example drills, saws and electric lawnmowers.
- Monitoring and control equipment, for example smoke detectors, thermostats, heating regulators.

Controlled Waste (England and Wales) Regulations 2012 (SI 2012/811)¹⁴¹

11.2.18 The Controlled Waste (England and Wales) Regulations 2012 came into force in April 2012, replacing the Controlled Waste Regulations 1992. They define household, industrial and commercial waste for environmental permitting purposes. The regulations replaced Schedule 1 of the 1992 regulations with an updated schedule defining household waste, still by reference to its origin, but introducing some exceptions.

11.2.19 The regulations also specify that waste from construction or demolition works, including preparatory works, should be “treated as household waste for the purposes of section 34(2) and (2A) of the [EPA 1990] only (disapplication of section 34(1) and duty on the occupier of domestic property to transfer household waste only to an authorised person or for authorised transport purposes)”.

¹³⁹ Her Majesty's Government (2016) The Environmental Permitting (England and Wales) Regulations 2016 No. 1154 [online]. Available at: <https://www.legislation.gov.uk/uksi/2016/1154/contents/made> (Last accessed August 2022).

¹⁴⁰ Her Majesty's Government (2013) Waste Electrical and Electronic Equipment (WEEE) (England and Wales) Regulations, 2013 [online]. Available at: <https://www.legislation.gov.uk/uksi/2013/3113/made> (Last accessed August 2022).

¹⁴¹ Her Majesty's Government (2012) Controlled Waste (England and Wales) Regulations 2012 [online]. Available at: www.legislation.gov.uk/uksi/2012/811/contents/made (Last accessed August 2022).

National policy

National Policy Statement for National Networks (NPSNN), 2014¹⁴²

11.2.20 The NPSNN includes the following in relation to material assets and waste:

- Paragraph 5.39: States Government policy on hazardous and non-hazardous waste and its intention to protect human health and the environment by reducing waste production and using waste as a resource.
- Paragraph 5.40: sustainable waste management should be implemented through using the waste hierarchy, focusing on preventing waste as a priority and using disposal methods as a last resort.
- Paragraph 5.42: Arrangements should be made for waste produced by a development with the aim of seeking to minimise the volume of waste produced and the volume of waste disposed of unless it can be demonstrated that the alternative is the best overall environmental outcome.
- Paragraph 5.43: Effective processes and waste management of non-hazardous and hazardous waste must be established to manage waste arising from the construction and operation of a proposed development, including ensuring waste is managed both on and off-site, assessing waste infrastructure for sufficient facilities and taking steps to reduce volumes of waste produced and waste sent to disposal facilities.
- Paragraph 5.44: Where required, any requirements or planning obligations should be abided by in regards to implementing appropriate measures of the management of waste.
- Paragraph 5.45: All waste sent to an external facility for recovery or disposal must be compliant with Environment Agency permitting requirements.

National Planning Policy Framework (NPPF), 2021¹⁴³

11.2.21 The NPPF sets out policies for development and how these should be implemented but makes specific reference to the Government's policy for sustainable use of minerals and waste (paragraphs 4 and 20).

¹⁴² Department for Transport (2014) National Policy Statement for National Networks [online]. Available at [National Policy Statement for National Networks \(publishing.service.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/281222/national-policy-statement-for-national-networks.pdf) (Last accessed August 2022).

¹⁴³ Ministry of Housing, Communities & Local Government (2021) National Policy Planning Framework [online]. Available at: [National Planning Policy Framework \(publishing.service.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/978222/national-planning-policy-framework.pdf) (Last accessed August 2022).

National Planning Policy for Waste 2014¹⁴⁴

- 11.2.22 The National Planning Policy for Waste sets out detailed waste planning policies and maintains the core principles of the ‘plan led’ approach with a continued focus of moving waste up the waste hierarchy.
- 11.2.23 The document sets out detailed waste planning policies to facilitate a more sustainable and efficient approach to resource use and management. When determining planning applications for non-waste development, the policy requires that local planning authorities should, to the extent appropriate to their responsibilities, ensure that:
- The likely impact of proposed, non-waste related development on existing waste management facilities, and on sites and areas allocated for waste management, is acceptable and does not prevent the implementation of the waste hierarchy and/or the efficient operation of such facilities.
 - New, non-waste development makes sufficient provision for waste management and promotes good design to secure the integration of waste management facilities with the rest of the development and, in less developed areas, with the local landscape.
 - The handling of waste arising from the operation of developments maximises reuse/recovery opportunities and minimises off-site disposal.

The Waste Management Plan for England, 2021¹⁴⁵

- 11.2.24 The Department for Environment, Food & Rural Affairs (Defra) published the latest Waste Management Plan for England in January 2021, superseding the 2013 version¹⁴⁶. The plan provides an overview of waste management in England. It outlines the waste hierarchy as a guide to sustainable waste management and sets out the Government’s ambition to work towards a more sustainable and efficient approach to resource use and management. Positive planning plays a pivotal role in delivering England’s waste ambitions through ensuring the reuse, recovery or disposal of waste is undertaken without endangering human health or harming the environment and delivering sustainable development and resource efficiency through all schemes.

¹⁴⁴ Department for Communities and Local Government (2014), National Planning Policy for Waste. [online]. Available at:

https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/364759/141015_National_Planning_Policy_for_Waste.pdf (Last accessed August 2022).

¹⁴⁵ Department for Environment Food & Rural Affairs (2021) Waste Management Plan for England [online]. Available at: [Waste Management Plan for England \(publishing.service.gov.uk\)](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/100000/waste-management-plan-2021.pdf) (Last accessed August 2022)

¹⁴⁶ Department for Environment Food & Rural Affairs (2013) Waste Management Plan for England. [online] Available at: https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/265810/pb14100-waste-management-plan-20131213.pdf (Last accessed August 2022).

The Waste Prevention Programme for England 2013¹⁴⁷

11.2.25 The Waste Prevention Programme for England 2013 sets out the roles and actions for Government and others to reduce the amount of waste produced in England. It was updated in July 2020 by the Waste and Resources Action Programme (WRAP) on behalf of Defra. The Waste Prevention Programme for England 2013 review¹⁴⁸ evaluates the actions taken in the six years since the Waste Prevention Programme was published. It also outlines progress on the ongoing programme of work as part of the Resources and Waste Strategy for England, 2018. This strategy will be supplemented by a new waste prevention programme, to help move to a more circular economy model.

Waste Prevention Programme for England – Consultation Version, 2021¹⁴⁹

11.2.26 The revised Waste Prevention Programme will help embed the five principles outlined in the Resources and Waste Strategy by setting out steps towards:

- Transforming product design and supporting factors such as spare part provision.
- Making it easier for consumers to make sustainable purchasing decisions.
- Using extended producer responsibility and other financial incentives to ensure the polluter pays principle is embedded.
- Aligning the regulatory framework with a circular economy approach.
- Integrating the strategic principles into industrial policy and giving first movers the recognition they deserve.

Our Waste, Our Resources: A Strategy for England, 2018¹⁵⁰

11.2.27 The strategy complements and helps deliver the 25-Year Plan, the Clean Growth Strategy, the Industrial Strategy, and the Litter Strategy. It is guided by two overarching objectives:

- To maximise the value of resource use
- To minimise waste and its impact on the environment

11.2.28 The strategy features the Government's approach to sustainable production, consumer participation, recovering resources, and managing waste, waste crime, food waste, international leadership,

¹⁴⁷ WRAP (2020) Review of the waste prevention programme for England 2013: Summary report [online]. Available at: [WRAP-review-waste-prevention-programme-england-summary-report.pdf](#) (Last accessed August 2022)

¹⁴⁸ Waste and Resources Action Programme (2020), Review of the Waste Prevention Programme for England 2013: Summary Report [online]. Available at: <https://wrap.org.uk/sites/default/files/2021-03/WRAP-review-waste-prevention-programme-england-summary-report.pdf> (Last accessed August 2022).

¹⁴⁹ Department for Environment, Food & Rural Affairs (2021) Waste Prevention Programme for England – Consultation Version. [online] Available at: [Waste Prevention Programme for England consultation document.pdf \(defra.gov.uk\)](#) (Last accessed August 2022).

¹⁵⁰ Department for Environment Food & Rural Affairs (2019) Resources and waste strategy: at a glance [online]. Available at: [Resources and waste strategy: at a glance - GOV.UK \(www.gov.uk\)](#) (Last accessed August 2022)

research and innovation, and monitoring and evaluation of the strategy.

11.2.29 The strategy will be delivered through policies, actions and commitments, and it will contribute to the delivery of the following strategic ambitions:

- Working towards all plastic packaging placed on the market being recyclable, reusable or compostable by 2025
- Eliminating food waste to landfill by 2030
- Zero avoidable plastic waste by 2042
- Doubling of resource productivity by 2050
- Zero avoidable waste by 2050

25 Year Environment Plan¹⁵¹

11.2.30 The Government's 25 Year Environment Plan sets out Government action to help the natural world regain and retain good health. The proposals aim to tackle a number of growing problems including waste. It aims to champion sustainable development, lead in environmental science, innovate to achieve clean growth and increase resource efficiency to provide benefits to both our environment and economy. In doing so, the Government's 25 Year Environment Plan has identified six key areas on which to focus action. The policy area relevant to the assessment of waste and material resource is set out in Chapter 4 of the 25-Year Plan on increasing resource efficiency and reducing pollution and waste.

11.2.31 A number of goals and targets are set out in the 25-Year Plan. These include the aim of minimising waste, reusing materials as much as possible, and managing materials at the end of their life to minimise the impact on the environment. This is intended to be done by:

- Working towards the ambition of zero avoidable waste by 2050.
- Working to a target of eliminating avoidable plastic waste by the end of 2042.
- Meeting all existing waste targets – including those on landfill, reuse and recycling – and developing ambitious new future targets and milestones.
- Seeking to eliminate waste crime and illegal waste sites over the lifetime of the plan, prioritising those of highest risk. Delivering a substantial reduction in litter and littering behaviour.
- Substantially reducing and, where possible, preventing all kinds of marine plastic pollution – in particular material that came originally from land.

¹⁵¹ Her Majesty's Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online]. Available at: [25-year-environment-plan.pdf](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/721412/25-year-environment-plan.pdf) (publishing.service.gov.uk (Last accessed June 2022))

Local policy

11.2.32 The local planning framework comprises a number of documents that form the statutory development plans for the local planning authority area in which the scheme is located. The relevant planning policies relating to resources and waste are summarised in Table 11.1.

Table 11.1: Summary of current local policies

Policy Number	Title	Policy Summary
Nottinghamshire and Nottingham Local Aggregates Assessment (2020 sales data), published 2021¹⁵²		
N/A	N/A	<p>The Nottinghamshire and Nottingham Local Aggregates Assessment (LAA) is a document that is to be produced under the requirements set out in the NPPF and covers the geographical area of Nottinghamshire, including the Nottingham City unitary authority area.</p> <p>It monitors annual sales data for aggregate minerals between 2010 and 2019 as well as identifying other relevant local information to enable the Mineral Planning Authorities to plan for a steady and adequate supply of minerals.</p>
Nottinghamshire Minerals Local Plan (adopted March 2021)¹⁵³		
SP1	Mineral Provision	<p>The priority is to make the best use of the County's finite mineral resources through supporting extensions to existing sites, where environmentally acceptable, encouraging the use of secondary and recycled aggregates as far as possible.</p> <p>All proposals for mineral development must demonstrate that they have prioritised the avoidance of adverse social, economic and environmental impacts of the proposed development.</p>
SP7	Minerals Safeguarding, Consultation Areas and	The Minerals Safeguarding Areas (MSA) identify the mineral resources which are worthy of safeguarding and the Minerals Consultation

¹⁵² Nottinghamshire County Council (2021) Nottinghamshire and Nottingham Local Aggregates Assessment 2021 [online]. Available at: [nottinghamshire-laa-2020-sales-data.pdf](#) (Last accessed August 2022).

¹⁵³ Nottinghamshire County Council (2021) Nottinghamshire Minerals Local Plan 2021 [online]. Available at: [adopted-minerals-local-plan.pdf](#) (Last accessed August 2022).

	Associated Minerals Infrastructure	Area (MCA) identify the areas within Nottinghamshire where the District and Borough authorities are required to consult the Mineral Planning Authority (MPA) over non-minerals development. The NPPF encourages the prior extraction of minerals before alternative uses are permitted.
MP1	Aggregate Provision	<p>The National Planning Policy Framework requires MPAs to produce a Local Aggregates Assessment (LAA) on an annual basis. This assesses both the demand for and supply of aggregates based on the average of the last 10 and 3 year sales data.</p> <p>To meet identified levels of demand for aggregate mineral over the plan period (2018-2036) the following provision will be made:</p> <ul style="list-style-type: none"> • 32.30 million tonnes of Sand and Gravel • 7.03 million tonnes of Sherwood Sandstone • 0.09 million tonnes of crushed rock <p>The County Council will make provision for the maintenance of landbanks of at least 7 years for sand and gravel, 7 years for Sherwood Sandstone and 10 years for crushed rock, whilst maintaining a steady and adequate supply over the plan period.</p>
MP2	Sand and Gravel Provision	An adequate supply of sand and gravel will be identified to meet expected demand over the plan period using the extraction of remaining reserves at ten permitted quarries, extensions to five existing permitted quarries and a new sand and gravel quarry. As a result, Policy MP2, and the five extensions to existing quarries and one new quarry will provide a total of 11.8 million tonnes.
MP3	Sherwood Sandstone Provision	An adequate supply of Sherwood Sandstone will be identified to meet expected demand over the plan period from the extraction of remaining reserves at the following permitted quarries and extensions to two existing quarries which will provide a total of 2.43 million tonnes.

MP4	Crushed Rock (limestone) Provision	Based on the limestone requirements set out in the aggregate provision policy (MP1), the plan does not need to provide any further limestone as current permitted reserves are adequate to cover the plan period. The quarry has planning permission until 2035 at a planned output of 250,000 tonnes per annum, however actual output has been much lower and it has not been worked for a number of years.
MP5	Secondary and Recycled Aggregates	<p>Development proposals which will increase the supply of secondary and/or recycled aggregates will be supported where it can be demonstrated that there are no significant environmental, transport or other unacceptable impacts.</p> <p>Although, there is considerable potential for using certain waste materials as secondary aggregates, large quantities either remain on site or end up in landfill. Making greater use of by-products and other waste materials will therefore also help to meet the Government's aim of reducing waste disposal to landfill. The Nottinghamshire and Nottingham Replacement Waste Local Plan sets out strategic policies to promote both temporary and permanent facilities for aggregates recycling facilities.</p>
<p>Nottinghamshire and Nottingham County Council Waste Core Strategy (Adopted 2013)¹⁵⁴</p>		
WSC1	Presumption in favour of sustainable development	<p>When considering development proposals a positive approach will be taken that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework.</p> <p>Any adverse impacts of granting permission which would significantly and demonstrably outweigh the benefits, when assessed against the policies in the National Planning Policy Framework taken as a whole should be restricted.</p>
WCS2	Waste awareness, prevention and re-use	All new development should be designed, constructed and implemented to minimise the

¹⁵⁴ Nottinghamshire County Council (2013) Waste Core Strategy 2020 [online]. Available at: [waste-core-strategy-1.pdf](https://www.nottinghamshire.gov.uk/waste-core-strategy-1.pdf) ([nottinghamshire.gov.uk](https://www.nottinghamshire.gov.uk)) (Last accessed August 2022).

		creation of waste, maximise the use of recycled materials and assist the collection, separation, sorting, recycling and recovery of waste arising from the development. The underlying aim is to move waste up the waste hierarchy and maximise recycling.
WCS3	Future waste management provision	<p>The Waste Core Strategy aims to provide sufficient waste management capacity for its needs; to manage a broadly equivalent amount of waste to that produced within Nottinghamshire and Nottingham.</p> <p>Future waste management proposals should accord with the aim to achieve 70% recycling or composting of all waste by 2025.</p>
WCS5	Disposal sites for hazardous, non-hazardous and inert waste	<p>Where it is shown that additional non-hazardous or inert landfill capacity is necessary, priority will be given to sites within the main shortfall areas around Nottingham, and Mansfield/Ashfield. Development outside this area will be supported where it can be shown that there is no reasonable, closer, alternative.</p> <p>Proposals for hazardous waste will need to demonstrate that the geological circumstances are suitable and that there are no more suitable alternative. locations in, or beyond, the Plan area.</p>
WCS8	Extensions to existing waste management facilities	The extension, or redevelopment or improvement of existing waste management facilities will be supported where this would increase capacity or improve existing waste management methods, and/or reduce existing environmental impacts
WCS10	Safeguarding waste management sites	<p>The following sites will be safeguarded for waste management facilities:</p> <p>Existing authorised waste management facilities including potential extensions and sites which have a valid planning permission that has not yet been implemented</p> <p>Sites allocated in the Site Allocations Document.</p>

- 11.2.33 Nottinghamshire County Council and Nottingham City council are working together to produce a new Waste Local Plan¹⁵⁵ which will replace the previous adopted Waste Local Plan¹⁵⁶ and the Waste Core Strategy¹⁵⁴. A draft plan has been written and was published for stakeholder review between February – April 2022. A final version of this plan is expected to be reported to the council towards the end of 2022.
- 11.2.34 The policies in the draft Waste Local Plan aim to guide the future development and management of waste. The Plan reflects guidance and legislation that sets out waste policy at the international, and national level. There are two key principles that underpin waste planning which aim to promote the concept of waste as a resource to be used which are the Circular Economy and the Waste Hierarchy. Table 11.2 reflects the policies of relevance to the scheme in the draft Waste Local Plan.

Table 11.2: Summary of the Nottinghamshire County Council draft Waste Local Plan (2022)¹⁵⁵

Policy Number	Title	Policy Summary
SP1	Waste prevention and re-use	All new development should be designed, constructed, and operated to minimise the creation of waste, maximise the use of recycled materials, and assist with the collection, separation, sorting, recycling and recovery of waste arising from the development during its use.
SP2	Future Waste Management Provision	The policy aims to provide sufficient waste management capacity to meet identified needs and will support proposals for waste management facilities which help to move waste management up the waste hierarchy.
SP4	Residual Waste Management	Proposals for the recovery of inert waste to land will be permitted where it can be demonstrated that: This will provide a significant benefit or improvement which cannot practicably or reasonably be met in any other way.

¹⁵⁵ Nottinghamshire County Council (2022) Waste Local Plan [online]. Available at: [Waste Local Plan 2022 \(nottinghamshire.gov.uk\)](https://www.nottinghamshire.gov.uk/waste-local-plan-2022) (Last accessed August 2022).

¹⁵⁶ Nottinghamshire County Council (2002) Nottinghamshire and Nottingham Waste Local Plan [online]. Available at: [Adopted Waste Local Plan - Complete Document \(nottinghamshire.gov.uk\)](https://www.nottinghamshire.gov.uk/adopted-waste-local-plan-complete-document) (Last accessed August 2022).

Policy Number	Title	Policy Summary
		<p>The waste cannot practicably and reasonably be re-used, recycled or processed in any other way</p> <p>The use of inert waste material replaces the need for non-waste materials</p> <p>The development involves the minimum quantity of waste necessary to achieve the desired benefit or improvement</p> <p>It will not prejudice the restoration of permitted mineral workings and landfill site</p>
SP8	Safeguarding Waste Management Sites	The policy will seek to avoid the loss of existing authorised waste management facilities, having regard to the long term need for the facility and the wider benefits of any redevelopment proposal.

National Highways policy

11.2.35 The Sustainable Development Strategy¹⁵⁷ sets out National Highways' approach and priorities for sustainable development to their key stakeholders. Of the ambitions outlined in the Strategy, the following are of relevance to this materials and waste assessment:

- To more actively manage carbon emissions: by examination and focus on business areas where efficiencies can be achieved through reducing fuel, energy and raw material consumption, and all waste generation.
- To increase knowledge of where our goods and materials are sourced from. Ensuring that responsibly sourced resources is essential, as their production and handling can have local, national and global impacts – on human and social health and also on the environment and climate change.
- To push towards a 'circular' approach to our management of resources: minimising demand for primary resources extracted from the ground, and maximise the reuse of the resources already in use on the network. Reutilising them in as high a value function as possible.

¹⁵⁷ National Highways (2017) Sustainable Development Strategy: Our Approach [online] available at: https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/605079/Sustainable_Development_Strategy_6.pdf (Last accessed September 2022).

Other policy and guidance

Construction Code of Practice for the Sustainable Use of Soils on Construction Sites¹⁵⁸

11.2.36 This code of practice provides relevant advice on the use of soil in construction projects.

Contaminated Land: Applications in Real Environments (CL:AIRE) Definition of Waste: Development Industry Code of Practice¹⁵⁹

11.2.37 CL:AIRE is an independent, non-profit organisation that aims to encourage the sustainable remediation of contaminated land and groundwater throughout the UK, for effective social and economic use. This is achieved by increasing awareness and confidence in practical, sustainable remedial solutions.

11.3 Assessment methodology

11.3.1 The methodology is in line with the requirements set out in DMRB LA 110 Material Assets and Waste. The methodology is also in line with the following guidance and best practice for material assets and waste:

- Construction Code of Practice for the Sustainable Use of Soils on Construction Sites¹⁵⁸
- CL:AIRE Definition of Waste: Development Industry Code of Practice¹⁵⁹

11.3.2 The assessment considers the following:

- Types and quantities of materials required for the scheme, where known.
- Details of the source or origin of materials, site-won materials to replace virgin materials, materials from secondary or recycled sources, or virgin or non-renewable sources, if known.
- The type and volume of materials that will be recovered from off-site sources.
- Cut and fill balance.
- Details of on-site storage and stockpiling arrangements.
- Forecast of non-hazardous, hazardous, and inert waste arisings.
- Surplus materials and waste falling under regulatory controls.
- Wastes that require storage on-site prior to re-use, recycling and disposal.
- Wastes to be pre-treated on-site for re-use within the scheme.
- Wastes requiring treatment or disposal off-site.

¹⁵⁸ Department for Environment, Food and Rural Affairs (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites [online]. Available at: [Construction Code of Practice for the Sustainable Use of Soils on Construction Sites \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/214442/construction-code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites.pdf) (Last accessed August 2022)

¹⁵⁹ Contaminated Land: Applications in Real Environments (2011) The Definition of Waste: Development Industry Code of Practice [online]. Available at: [Definition of Waste. Development Industry Code of Practice.pdf](https://www.aire.org.uk/sites/default/files/2011-01/CL:AIRE%20Definition%20of%20Waste%20Development%20Industry%20Code%20of%20Practice.pdf) (Last accessed August 2022)

- The impacts that will arise from the issues identified in relation to materials and waste.
- Identification of mitigation measures based on identified impacts.
- Conclusion based on nature and magnitude of impacts.

11.3.3 The Environmental Scoping Report¹⁶⁰ highlighted the potential for significant effects on material assets and the generation of waste produced during the construction phase. Use of materials and generation of waste for the operational phase of the scheme has been scoped out of further assessment as it is anticipated that there would be minimal requirement for material resources and minimal waste generation. As such, no operational stage assessment has been undertaken.

11.3.4 The assessment of effects on material resources and waste generation encompasses effects arising during the construction of the scheme up until the point when the scheme opens.

Significance criteria

11.3.5 The categories for significance are provided in Table 11.3 and 11.4 which define the significance category description and significance criteria. For these tables “Region” means the authority comprising the study area, in this case Nottinghamshire. “Primary materials” describes materials that are from a non-renewable source.

Table 11.3: Significance categories and descriptions for material assets and waste generation

Significance category	Description
Very Large	<p>Material assets:</p> <ul style="list-style-type: none"> • No criteria: use criteria for large categories. <p>Waste:</p> <ul style="list-style-type: none"> • >1% reduction or alteration in national capacity of landfill, construction of new (permanent) waste infrastructure is required to accommodate waste from a project.
Large	<p>Material assets:</p> <ul style="list-style-type: none"> • Project achieves <70% overall material recovery/recycling (by weight) of non-hazardous Construction and Demolition Waste (CDW) to substitute use of primary materials; and • Aggregates required to be imported to site comprise <1% re-used/recycled content and

¹⁶⁰ National Highways (August, 2022) A46 Newark Bypass Environmental Scoping Report [online] available at: [TR010065-000002-A46N - Scoping Report.pdf \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/tr010065-000002-A46N-Scoping-Report.pdf) (last accessed October 2022).

Significance category	Description
	<ul style="list-style-type: none"> • Projects sterilises >1 mineral safeguarding site and/or peat resource <p>Waste:</p> <ul style="list-style-type: none"> • Project achieves 1% reduction in the regional capacity of landfill as a result of accommodating waste from a project; and • >50% of project waste for disposal outside of the region.
Moderate	<p>Material assets:</p> <ul style="list-style-type: none"> • Project achieves less than 70% overall material recovery/recycling (by weight) of non-hazardous CDW to substitute use of primary materials; and • Aggregates required to be imported to site comprise re-used/recycled content below the relevant regional percentage target <p>Waste:</p> <ul style="list-style-type: none"> • >1% reduction or alteration in the regional capacity of landfill as a result of accommodating waste from a project; and • 1-50% of project waste for disposal outside of the region.
Slight	<p>Material assets:</p> <ul style="list-style-type: none"> • Project achieves 70-99% overall material recovery/recycling (by weight) of non-hazardous CDW to substitute use of primary materials; and • Aggregates required to be imported to site comprise re-used/recycled content in line with the relevant regional percentage target. <p>Waste:</p> <ul style="list-style-type: none"> • ≤1% reduction or alteration in the regional capacity of landfill; • Waste infrastructure has sufficient capacity to accommodate waste from a project, without compromising integrity of the receiving infrastructure (design life or capacity) within the region.
Neutral	<p>Material assets:</p> <p>Project achieves >99% overall material recovery/recycling (by weight) of non-hazardous Construction Demolition Waste (CDW) to substitute use of primary materials; and</p> <p>Aggregates required to be imported to site comprise >99% re-used/recycled content.</p>

Significance category	Description
	Waste: No reduction or alteration in the capacity of waste infrastructure within the region.

Source: Design Manual for Roads and Bridges: LA 110 Material assets and waste (2019)

Table 11.4: Significance criteria for material assets and waste

Significance	Description
Significant (one or more criteria met)	Material assets: category description met for moderate or large effect. Waste: category description met for moderate, large or very large effect
Not significant	Material assets: category description met for neutral or slight effect. Waste: category description met for neutral or slight effect.

Source: Design Manual for Roads and Bridges: LA 110 Material assets and waste (2019)¹²⁷

11.4 Study area

- 11.4.1 The DMRB LA 110¹²⁷ standard defines two geographically different study areas to examine and assess the use of material assets (and resource use) and waste generation.
- 11.4.2 The first study area is based on the construction of the area within the draft Order Limits, as this constitutes the area within which construction materials would be consumed (used, reused and recycled) and waste would be generated.
- 11.4.3 The second study area focuses on an area sufficient to identify the suitable waste infrastructure that could accept arisings or waste generated by the scheme, and feasible sources and availability of construction materials typically required for the works.
- Construction materials: For the purpose of this assessment the study area will focus primarily on Nottinghamshire County Council and where required, the East Midlands region within which the scheme is located.
 - Waste generation and management: For the purpose of this assessment the study area focuses on an area sufficient to identify suitable waste infrastructure including landfills, considering the proximity principle and value for money. Where sufficient capacity is not available the search area has been extended accordingly,

based on professional judgment, but kept within the boundaries of the East Midlands region. An initial search area of 10 kilometres from the scheme has been assessed to support the proximity principle by highlighting appropriate waste management and disposal sites within a reasonable proximity to the scheme. Only two permitted landfills with remaining capacity have been identified within 10 kilometres of the scheme, consequently the range of the search area has been extended to 50 kilometres. The waste management and disposal facilities listed in Table 11.12 (within the 50 kilometre search area) are presented in ascending order showing the closest facilities to the scheme first.

11.5 Existing baseline

Material resources

11.5.1 Aggregates (sand, gravel and crushed rock) are the raw materials used to make construction products. There are three main sources of aggregate in the UK, these are as follows:

- Land-won (often referred to as natural or primary aggregates) – these are extracted directly from the ground in quarries or pits.
- Marine-dredged – these comprise of sand and gravel dredged from the sea floor.
- Secondary/recycled – secondary aggregates are a by-product from mineral operations or industrial processes, and recycled aggregates are materials produced by treatment of construction and demolition waste.

Current local aggregate reserves

11.5.2 Information on the demand for key construction materials within the UK and within the Nottinghamshire sub-region has been used to provide the baseline for material resources. This information has been determined through a desk-study using a number of readily available resources, in particular from the British Geological Society's (BGS) Minerals UK¹⁶¹, World Steel Association¹⁶², and Nottinghamshire County Council.

11.5.3 The Nottinghamshire and Nottingham Local Aggregate Assessment 2021¹⁶³ and Nottinghamshire Minerals Local Plan (adopted 2021)¹⁶⁴ assess the demand for and supply of aggregates in the region of the scheme. The Nottinghamshire and Nottingham Local Aggregate

¹⁶¹ British Geological Society (2021) United Kingdom Minerals Yearbook 2021 [online]. Available at: [United Kingdom Minerals Yearbook 2021 \(bgs.ac.uk\)](https://www.bgs.ac.uk/minerals-yearbook-2021/) (Last accessed August 2022).

¹⁶² World Steel Association (2022) Steel Statistical Yearbook 2021 [online]. Available at: [2021-World-Steel-in-Figures.pdf \(worldsteel.org\)](https://www.worldsteel.org/2021-World-Steel-in-Figures.pdf) (Last accessed August 2022).

¹⁶³ Nottinghamshire County Council (2021) Local Aggregate Assessment [online]. Available at: [Local Aggregate Assessment | Nottinghamshire County Council](https://www.nottinghamshire.gov.uk/Local-Aggregate-Assessment) (Last accessed August 2022).

¹⁶⁴ Nottinghamshire County Council (2021) Nottinghamshire Minerals Local Plan 2021 [online]. Available at: [adopted-minerals-local-plan.pdf](https://www.nottinghamshire.gov.uk/adopted-minerals-local-plan.pdf) (Last accessed June 2022).

Assessment covers the geographical areas of Nottinghamshire, including the Nottingham City unitary authority area.

- 11.5.4 Table 11.5 outlines the demand within the UK, in terms of sales, of minerals and mineral products in 2020, unless otherwise stated. Table 11.6 outlines the production of minerals within England in 2020 and available mineral workings. Table 11.7 references aggregate sales and reserves within the Nottinghamshire region for the period of 2020.

Table 11.5: UK demand of materials and minerals/mineral products

Mineral/ mineral product	UK demand (2020, unless otherwise stated)
<i>Primary aggregates</i> , of which:	174.8 million tonnes
Crushed rock	107.9 million tonnes
Sand and gravel	57.7 million tonnes
Recycled and secondary aggregates (2018)	71 million tonnes
<i>Cementitious products</i> (UK), of which:	15 million tonnes
Cement clinker	6.9 million tonnes
Cement finished	8.0 million tonnes
Ready-mixed concrete (UK)	19.4 million cubic meters
Asphalt (GB, 2019)	25.2 million tonnes
Dimension stone (2014)	1 million tonnes
China Clay (2018)	0.996 million tonnes
Slag (2018)	2.5 million tonnes
Apparent steel use	11.2 million tonnes

Source: British Geological Society (2021)¹⁶¹ Mineral Products Association (2020)¹⁶⁵ and World Steel Association (2020)¹⁶²

¹⁶⁵ Mineral Products Association (2020) Profile of the UK Mineral - Products Industry [online]. Available at: https://mineralproducts.org/MPA/media/root/Publications/2021/Profile_of_the_UK_Mineral_Products_Industry_2020_Spread.pdf (Last accessed August 2022).

Table 11.6: England production of minerals in 2021

Mineral	UK Production in Tonnes	Number of Mineral Workings in England	Number of Mineral Workings in the East Midlands
Igneous rock	129.3 million*	34	7
Limestone and dolomite		229	58
Sandstone		156	16
Sand and gravel	57.7 million	267	36

Source: British Geological Society (2021)¹⁶¹

Note: *Includes marine-dredged landings at foreign ports

Table 11.7: Aggregate sales and reserves in for 2020 for Nottinghamshire and Nottingham

Aggregate	2020 Sales (Mt)	Average 10-year sales 2011 – 2020 (Mt)	Average 3-year sales 2018 – 2020 (Mt)	LAA* Rate (Mtpa)	Permitted Reserves (Mt)	Land-bank (years)
Sand and gravel	0.91	1.41	1.31	1.7	17.97	12.74
Sherwood Sandstone	0.15	0.35	0.34	0.37	8.98	25.66
Crushed rock (limestone)	0.00	0.00	0.00	0.005	3.34	N/A

Source: Nottinghamshire and Nottingham Local Aggregates Assessment (2021)¹⁵² Nottinghamshire Minerals Local Plan (2021)¹⁵³.

Mt = million tonnes

11.5.5 Table 11.8 lists the available aggregate sites in Nottinghamshire for the period of 2020. There are currently eight sand and gravel quarries in Nottinghamshire, of which six were fully active sites in 2020. There are also four permitted Sherwood Sandstone quarries in Nottinghamshire, three out of the four were fully active in 2020.

11.5.6 Nottinghamshire County has a permitted site to extract crushed rock (limestone) however the site has been inactive since 2007 due to the

seasonal working of the site and abundance of limestone worked in Derbyshire and Leicestershire.

- 11.5.7 Limestone resources in Nottinghamshire and Nottingham are limited, therefore all crushed rock is imported. The 2014 Full East Midlands Annual Minerals Survey states that 1.26 million tonnes of crushed rock was imported into Nottinghamshire, whilst no mineral was exported. The survey also identified Leicestershire, Derbyshire (including the Peak District National Park Authority) and Yorkshire and Humberside (predominately Doncaster Metropolitan Borough Council) as the main sources of crushed rock¹⁵².
- 11.5.8 The stock of reserves with planning permission is known as the landbank. Government policy requires landbanks to be maintained for all primary aggregate minerals, with a required landbank of at least seven years.
- 11.5.9 At the end of 2020 permitted reserves within Nottinghamshire totaled 17.97 million tonnes for sand and gravel and 8.98 million tonnes for Sherwood Stone. Reserves for both sand and gravel and Sherwood Stone are above the minimum 7-year landbank requirement standing at 12.74 years and 25.66 years respectively.
- 11.5.10 Crushed rock sales remain at zero with the county's needs being met by imports from adjoining counties. The Nottinghamshire and Nottingham Local Aggregate Assessment (LAA) states that Leicestershire LAA, Derbyshire LAA, The Doncaster and Rotherham LAA and The Humber LAA have adequate reserves remaining to meet future demand¹⁵².
- 11.5.11 There are six aggregate recycling sites in Nottingham, Mansfield, Sutton and Retford to provide capacity to recycle up to one million tonnes of aggregate materials¹⁵⁴.
- 11.5.12 Peat resources and Mineral Safeguarding Areas (MSA) have been reviewed using Nottinghamshire's Mineral Local Plan¹⁵³ and information provided by Natural England¹⁶⁶. No peat resources or MSA's were identified within 500 metres of the scheme.

¹⁶⁶ Natural England (2021) Natural England, BGS, NSRI copyright. Contains Ordnance Survey data © Crown copyright and database right 2021. [online]. Available at: [Great Britain Open Data Map \(mottmac.com\)](https://mottmac.com)

Table 11.8: Permitted aggregate sites in Nottinghamshire in 2020

Site name	Operator name	Facility type	Status	Permitted reserves (mt)
Langford Lowfields	Tarmac	Sand and gravel	Active	4.01
Girton	Tarmac	Sand and gravel	Inactive	3.71
Besthorpe	Tarmac	Sand and gravel	Active	0.72
Sturton Le Steeple	Tarmac	Sand and gravel	Yet to be worked	7.1
East Leake	CEMEX	Sand and gravel	Active	1.41
Cromwel	CEMEX	Sand and gravel	Active	0.53
Scrooby	Rotherham Sand & Gravel (RGS)	Sand and gravel	Active	0.19
Misson Bawtry Road	Rowley	Sand and gravel	Active	0.30
Burntstump	Tarmac	Sherwood sandstone	Active	1.86
Bestwood 2	Tarmac	Sherwood sandstone	Active	3.15
Two Oaks Farm	Mansfield Sand Company	Sherwood sandstone	Active	3.46
Scrooby Top	Rotherham Sand & Gravel	Sherwood sandstone	Inactive	0.51

Source: Nottinghamshire County Council (2021)¹⁵²

Recycled and secondary aggregate

11.5.13 Nottinghamshire Minerals Local Plan references Government policy encouraging the use of secondary and recycled materials in construction in order to reduce the need for materials from traditional sources. The Mineral Local Plan also states that in order to conserve natural resources aggregates should be recycled where possible¹⁵³.

11.5.14 DMRB LA 110 sets the recycled aggregate target for the East Midland region (2005 – 2020) as 14%¹²⁷. The percentage was calculated based on the figure of 874 million tonnes requirement for the East

Midlands region set in the national and regional guidelines for aggregates provision in England (2005 – 2020) published from the Ministry of Housing, Communities & Local Government¹⁶⁷.

Generation and management of waste

11.5.15 The most recent information available relating to current waste generation and operational waste facilities in Nottinghamshire and the East Midlands region has been gathered to provide the baseline for this assessment. Information on the current waste arisings, and the waste management facilities have been determined through a desk-top study, using a number of readily available resources, in particular data from the Environment Agency, Defra and Nottinghamshire County Council.

Waste generation in the East Midlands region and England

11.5.16 The latest data from the Environment Agency¹⁶⁸ indicates that England produced over 220 million tonnes of waste in 2020, which was managed in 6,026 permitted waste facilities. The waste facilities in the East Midlands region received over 17 million tonnes of waste in 2020, and Nottinghamshire County Council received over 3 million tonnes¹⁶⁸ (as shown in Table 11.9).

Table 11.9: Waste breakdown by site type (2020)

Site Type	Nottinghamshire (tonnes)	East Midlands (tonnes)	England (tonnes)
Landfill	311,359	3,566,637	40,034,198
Transfer	612,000	4,245,297	42,439,790
Treatment (excluding metal recycling sector)	1,930,863	7,229,890	86,817,098
Metal Recovery	348,827	772,038	14,318,173
Incinerated	306,060	997,400	16,271,706
Use of Waste	0	0	147,921
Land Disposal	300,732	779,942	9,859,302
Total*	3,815,720	18,122,720	220,440,796

¹⁶⁷ Ministry of Housing, Communities & Local Government (2009). National and regional guidelines for aggregates provisions in England 2005 – 2020 [online]. Available from: [The Empowerment Fund \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/414444/national-and-regional-guidelines-for-aggregates-provision-in-england-2005-2020.pdf) (Last accessed August 2022)

¹⁶⁸ Environment Agency (2022) Waste Data Interrogator 2020 – Wastes received – version 4 [online]. Available at: <https://environment.data.gov.uk/portalstg/home/item.html?id=f4adcd438cb144f8ad2b24529bbec78f> (Last accessed August 2022)

Site Type	Nottinghamshire (tonnes)	East Midlands (tonnes)	England (tonnes)
Use of Waste			
In construction	0	0	5800
In reclamation	0	0	52,912
To manufacture timber	0	0	89,209
Land Disposal			
Deposited in landfill for recovery/benefit	300,732	768,875	9,488,541
lagoon inputs	0	11,067	370,761
Hazardous Waste**			
Managed	593,586	117,962	4,982,661
Deposited	913,700	87,856	5,838,847

Source: Environment Agency (2022)^{168, 169}

Notes:

*Mobile plant, processing, combustion, mining and storage of waste are included in the overall waste arisings figures

** The data is a summary of the registered hazardous waste movements. The same waste may have been moved between multiple facilities and each separate movement is recorded.

- 11.5.17 With respect to construction and demolition (C&D) waste in 2020, the Environment Agency recorded that 6,418,300 tonnes of inert (C&D) waste was received in permitted waste facilities in the East Midlands region, with 1,560,010 tonnes received in those in the Nottinghamshire sub-region¹⁶⁸.
- 11.5.18 The Environment Agency recorded that no waste material was used in construction, reclamation or to manufacture timber (under permits) within the East Midlands region. However, 768,875 tonnes were deposited in landfill for recovery/land benefit with 300,732 tonnes deposited in Nottinghamshire (Table 11.6).
- 11.5.19 Regarding non-hazardous waste, the Waste Data Interrogator (WDI) reported that 1,014,749 tonnes of inert C&D waste was removed from permitted waste facilities in the East Midlands region with 230,485 tonnes removed from those in the Nottinghamshire sub-region. Of the 76.6 million tonnes of non-hazardous C&D waste received in permitted

waste facilities in England in 2020, 14.7 million tonnes were removed^{168,169}.

11.5.20 Excavation and site clearance activities generate a significant quantity of waste arisings. The baseline target for recovery of C&D waste is 70% by weight, as set out in the EU Waste Framework Directive 2008/98/EC. According to Defra¹⁷⁰, the recovery rate of non-hazardous C&D waste in 2018 was 92.3% and 93.8% in the UK and England respectively.

Hazardous waste

11.5.21 Table 11.10 summarises the quantities of hazardous waste received and removed from permitted waste facilities in 2020 in England, the East Midlands region and Nottinghamshire sub-region. According to the WDI^{168,169}, 122,288 tonnes of hazardous waste was received in permitted waste facilities in the Nottinghamshire sub-region in 2020, of which 5,976 tonnes (4.8%) comprised C&D waste. 435,431 tonnes of hazardous waste was removed from permitted waste facilities in the Nottinghamshire sub-region, of which 901 tonnes were classified as C&D waste.

Table 11.10: Hazardous waste received and removed in 2020

Hazardous waste	Nottinghamshire sub-region (tonnes)	East Midlands (tonnes)	England (tonnes)
Received	122,288	1,000,943	6,992,926
Removed	435,431	851,613	5,873,434

Source: Environment Agency (2021)^{168, 169}

Potential Hazardous waste arisings

11.5.22 To identify potential sources of contamination an initial review of authorised and historical landfill sites that are in close proximity of the scheme has been undertaken using the Environment Agency's 'Historic Landfill Sites' web map¹⁷¹ and 'Permitted Waste Sites - Authorised Landfill Site Boundaries' web maps¹⁷².

¹⁶⁹ Environment Agency (2022). Waste Data Interrogator 2020 – Wastes removed – Version 4 [online]. Available at: <https://environment.data.gov.uk/portalstg/home/item.html?id=1f2e26cd5897440495e184f46fe69cd5> (Last accessed August 2022).

¹⁷⁰ Defra (2021) UK Statistics on Waste [online]. Available at: [UK statistics on waste - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/statistics/uk-statistics-on-waste) (Last accessed August 2022).

¹⁷¹ Environment Agency (2021) Historic Landfill Sites [online]. Available at: <https://data.gov.uk/dataset/17edf94f-6de3-4034-b66b-004ebd0dd010/historic-landfill-sites> (Last accessed August 2022).

¹⁷² Environment Agency (2021) Permitted Waste Sites - Authorised Landfill Site Boundaries [online] Available at: <https://data.gov.uk/dataset/ad695596-d71d-4cbb-8e32-99108371c0ee/permited-waste-sites-authorized-landfill-site-boundaries> (Last accessed August 2022).

11.5.23 There are two authorised landfill sites within 500 metres of the draft Order Limits which are designated for factory curtilage as shown in Table 11.11. There is also one small area noted as a historical landfill. Potential sources of contamination that are greater than 500 metres away from the scheme have not been considered, as these are considered unlikely to affect the scheme.

Table 11.11: Permitted landfill sites within 500 metres of the scheme

Site name	Operator	Status	Treatment facility type	Easting	Northing	Distance from scheme (metres)
Muskham Road	British Sugar Corporation	Historic	The landfill is recorded as having accepted inert and industrial waste	479400	355100	215 metres
Newark Sugar Factory	British Sugar Plc	Active	A7: Industrial Waste Landfill (Factory curtilage)	479070	355420	Adjacent to the boundary of the scheme
Newark Sugar Factory	British Sugar Plc	Active	A7: Industrial Waste Landfill (Factory curtilage)	479600	355200	305 metres from the scheme (at the closets point)

Source: Environment Agency (2022)^{172,175}.

Waste facilities

11.5.24 The Environment Agency reported that in 2020, 621 sites accepted waste in the East Midlands region, and at the end of 2020, 859 sites in the East Midlands had environmental permits to accept waste (Table 11.12). There were 124 active sites receiving waste in the Nottinghamshire sub-region in 2020. Waste should be treated in compliance with the waste hierarchy, eliminating waste as a priority

and recycling and recovering unavoidable waste as a next step, with waste disposal methods such as landfill only used as a last resort.

Table 11.12: Permitted waste facilities (2020)

Site Type	East Midlands		England	
	Number of sites with an environmental permit at end 2020	Number of sites that accepted waste in 2020	Number of sites with an environmental permit at end 2020	Number of sites that accepted waste in 2020
Landfill	56	32	531	295
Land Disposal	35	18	409	185
Incineration	16	10	183	104
Transfer	251	214	2,708	2,177
Treatment	317	229	2,941	2,142
Metal Recovery	184	118	2,063	1,114
Use of Waste	-	-	20	9
Total	859	621	8,855	6,026

Source: Environment Agency 2022¹⁷³

Waste disposal sites

11.5.25 Table 11.13 outlines the remaining capacity of landfills within the Nottinghamshire, the East Midland region and England at the end of 2020. There are currently 11 permitted landfills in the Nottinghamshire sub-region with eight landfills having remaining capacity at the end of 2020. The sub-region has four inert landfills and four non-hazardous landfills.

Table 11.13: Landfill capacity at the end of 2020

Landfill type	Nottinghamshire sub-region (m ³)	East Midlands (m ³)	England (m ³)
Hazardous Merchant	-	962,110	15,571,171
Hazardous Restricted	-	7,550	809,640
Non-Hazardous with SNRHW* cell	-	16,437,873	66,969,897
Non-Hazardous	3,839,981	18,830.328	164,824,065

¹⁷³ Environment Agency (2021) Waste Summary Tables [online]. Available at: [2020 Waste Summary Tables for England - Version 2 \(data.gov.uk\)](#) (Last accessed August 2022).

Landfill type	Nottinghamshire sub-region (m ³)	East Midlands (m ³)	England (m ³)
Non-Hazardous Restricted	-	-	-
Inert	4,392,331	8,779,556	140,191,731
Total	8,232,312	26,205,919	388,366,504

Source: Environment Agency¹⁷⁴

*SNRHW is an acronym for Stable Non Reactive Hazardous Waste

11.5.26 The remaining capacity for the Nottinghamshire sub-region at the end of 2020, was 3,839,981 m³ for non-hazardous landfill and 4,392,331 m³ for inert landfill. Details of landfills in the sub-region with remaining capacity are listed in Table 11.14.

Table 11.14: Permitted landfills accepting inert and non-hazardous waste in the Nottinghamshire region

Facility name	Operator name	Local Authority	Site Type	Remaining capacity at the end of 2020 (m ³)
Serlby Landfill	WRG Waste Services Ltd	Bassetlaw	L05 – Inert Landfill	135,0000
Harrycroft Quarry Landfill Site	Lafarge Aggregates Ltd	Bassetlaw	L05 – Inert Landfill	688,653
Borrow Pits Landfill	British Sugar Plc	Newark and Sherwood	L05 – Inert Landfill	390,565
Vale Road Quarry	Midland Landfill Ltd	Mansfield	L05 – Inert Landfill	1,963,113
Staple Quarry Landfill Site	FCC Recycling (UK) Ltd	Newark and Sherwood	L04 - Non-Hazardous	35,579
Cottam Ash Lagoons	EDF Energy (West Burton Power) Ltd	Bassetlaw	L04 - Non-Hazardous	1,571,776
Ratcliffe on Soar Power Station	Uniper UK Ltd	Rushcliffe	L04 - Non-Hazardous	797,480

¹⁷⁴ Environment Agency (2022) 2020 Remaining Landfill Capacity v2 [online] Available at: <https://environment.data.gov.uk/portalstg/home/item.html?id=7c316868000146ab8a5b2d07bff82368> (Last accessed August 2022).

Facility name	Operator name	Local Authority	Site Type	Remaining capacity at the end of 2020 (m ³)
Bole Ings Ash Disposal Site	EDF Energy (West Burton Power) Ltd	Bassetlaw	L04 - Non-Hazardous	1,435,146

Source: Environment Agency (2021)¹⁷⁴

11.5.27 There are two appropriate permitted landfills within 10 kilometres of the scheme and an additional 13 landfills with remaining capacity that lie within a 50 kilometres radius of the scheme. The volumes of waste generated by the scheme will be assessed against the capacities of the relevant waste infrastructure to identify if there is sufficient capacity available.

Table 11.15: Permitted landfill sites with remaining capacity within 50 kilometres of the scheme for C&D waste

Landfill facility name	Operator name	Landfill type	Remaining capacity at the end of 2020 (m ³)	Distance from the scheme (kilometres)
Borrow Pits Landfill	British Sugar Plc	L05 - Inert Landfill	390,565	2.8
Staple Quarry Landfill Site	FCC Recycling (UK) Ltd	L04 - Non-Hazardous	35,579	9.6
Lincwaste Ltd	Whisby Landfill	L04 - Non-Hazardous	2,595,652	18.5
Lincwaste Ltd	North Hykeham Landfill Site	L04 - Non-Hazardous	322,742	20.3
Lincwaste Ltd	Leadenham Landfill	L04 - Non-Hazardous	1,624,337	20.5
Brauncewell Quarries	Brauncewell Quarry	L05 - Inert Landfill	1,216,562	26.8
Harmston Waste Management Ltd	Harmston Quarry	L05 - Inert Landfill	114,188	27
EDF Energy (West Burton Power) Ltd	Cottam Ash Lagoons	L04 - Non-Hazardous	1,571,776	31.4

Landfill facility name	Operator name	Landfill type	Remaining capacity at the end of 2020 (m ³)	Distance from the scheme (kilometres)
Midland Landfill Ltd	Vale Road Quarry	L05 - Inert Landfill	1,963,113	36.3
Lincwaste Ltd	Gainsborough Landfill	L04 - Non-Hazardous	1,604,238	37
EDF Energy (West Burton Power) Ltd	Bole Ings Ash Disposal Site	L04 - Non-Hazardous	1,435,146	42.5
WRG Waste Services Ltd	Serlby Landfill	L05 - Inert Landfill	1,350,000	47.2
Uniper UK Ltd	Ratcliffe on Soar Power Station	L04 - Non-Hazardous	797,480	49.1
Saint-Gobain Construction Products UK Ltd	Welby Tip	L04 - Non-Hazardous	22,943	49.4
Tarmac Trading Ltd	Brooksby Quarry	L05 - Inert Landfill	256,428	49.8

Source: Environment Agency (2021) ^{174, 175}

Waste management facilities

- 11.5.28 A search on the Environment Agency's public register¹⁷⁵ was undertaken for all permitted waste facilities within 10 kilometres of the scheme, measured from postcode NG24 1HN. This single location was selected as it is located centrally along the scheme. The search on the public register showed that there are 22 waste facilities, nine of which can treat or transfer C&D waste, within a 10 kilometres distance.
- 11.5.29 Table 11.16 outlines the available facilities for recycling and recovery which manage C&D waste, either through transfer, treatment, crushing and screening, and storage, within 10 kilometres of the scheme. Not all treatment facilities may be suitable for the waste generated by the scheme during construction, but it demonstrates that sufficient treatment facilities are available for the waste that will be generated by the scheme.
- 11.5.30 Reuse, recycling and recovery of wastes will be prioritised. However, if these options are not available or feasible the following alternative is to adopt the Proximity Principle.

Table 11.16: Suitable licensed waste facilities within 10 kilometres of the existing scheme

Site name	Operator	Treatment Facility Type	Postcode	Distance from the scheme (kilometres)
Newark Waste Transfer Station	Veolia E S Nottinghamshire Ltd	S0805 No 5: 75kte HCI Waste TS + asbestos	NG24 2DZ	1.1
Briggs Metals Ltd	Briggs Metals Ltd	A20: Metal Recycling Site (mixed MRS's)	NG24 1DP	1.2
Quarry Farm	Nubeau Holdings Ltd	S0803 No 3: 75kte HCI Waste TS + treatment	NG24 3BZ	3.8
Quarry Farm Transfer Station	Regional Waste Recycling (Commercial) Ltd	A11: Household, Commercial & Industrial Waste T Stn	NG24 3BZ	4.0
Newark Mini Skips	Ivan Hall	S1504 No 4: 75kte HCI Waste TS	NG24 3BZ	4.1
Laffey's	Laffey's Ltd	S0906 No 6: Inert & Excavation WTS with treatment	NG23 5AJ	6.4
Cromwell Quarry	Tarmac Aggregates Ltd	S0803 No 3: 75kte HCI Waste TS + treatment	NG23 6JE	7.2
British Waterways Hazelford Lock	Canal and River Trust	A11: Household, Commercial & Industrial Waste T Stn	NG14 7FT	8.8

Source: Environment Agency (2021)¹⁷⁵

- 11.5.31 In addition to permitted C&D waste management sites, inert material is also managed on sites that have an Environment Agency Environmental Permit exemption. These exempt sites generally comprise of land restoration activities such as restoring mineral voids, engineering/landscaping schemes and for agricultural improvements on farmland. These sites are an important part of the provision of the capacity for managing inert materials. Although small tonnages of waste from other waste streams (for example biodegradable waste) may be managed at locations with an exemption, the largest tonnage of exempt activities is likely to involve C&D material.
- 11.5.32 There are 310 waste exempt sites listed by the Environment Agency within 10 kilometres of the scheme, of which 146 are 'use of waste in construction' (U1) exempt sites. U1 exempt sites utilise waste for the purpose of construction, such as buildings or engineering work, and are often short-lived, and therefore should be identified upon commencement of construction.

Future Baseline

- 11.5.33 The future waste baseline has been assessed on the basis of a desktop review of the waste forecasts presented in Nottinghamshire and Nottingham Waste Core Strategy¹⁵⁴ for dealing with future waste arisings and is provided in Table 11.17.

Table 11.17: Forecast waste arisings (million tonnes) to 2030 in the Nottinghamshire sub-region

Waste stream	2015	2020	2025	2030
Municipal	637	653	669	683
Commercial/ Industrial	1,472	1,472	1,472	1,472
Construction/ Demolition	2,725	2,725	2,725	2,725
Total	4,834	4,850	4,867	4,880

Source: Nottinghamshire County Council (2013)¹⁵²

- 11.5.34 Any future changes to this permitted capacity and throughput of waste management facilities are uncertain.
- 11.5.35 Exact quantities of materials required for the scheme are not known at this point however, the landbank requirements for Sherwood Sandstone and sand and gravel quarries are above the minimum

¹⁷⁵ Environment Agency (2022) Public Registers [online]. Available at: [Environmental Permitting Regulations – Waste Operations \(data.gov.uk\)](#) (Last accessed August 2022).

seven-year requirement set out in the Nottinghamshire and Nottingham Local Aggregate Assessment¹⁵². Therefore, it can be assumed that the scheme will not place pressure on resource availability.

11.6 Value (sensitivity of resources and receptors)

11.6.1 In accordance with DMRB LA 110, the receptors of Material Assets and Waste are the quarries and mineral sites that resources required for construction will be sourced from and the waste management sites and landfills that will accept waste from the scheme. Section 11.11 evaluates the effect on both minerals and waste sites as a result of the use of materials and generation of waste from the scheme.

11.7 Potential impacts

Construction

11.7.1 This section provides an overview of potential impacts relating to material resource use and waste generation as a result of the scheme during its construction. The construction phase considers site preparation, demolition and construction. No operational stage assessment has been undertaken (refer to 11.3.3).

Use of Material resources

11.7.2 The types of material resources likely to be required are as follows (although the list is not exhaustive):

- Steel
- Concrete
- Plastic
- Wood
- Cement
- Aggregate

11.7.3 The receptors likely to be subject to impacts as a result of the requirement for material resources during the construction of the scheme include quarries and other sources of minerals, and other finite raw material resources. The potential impacts associated with the use of material resources on these receptors include:

- The availability of material resources and the subsequent impact on the demand for materials. Materials would need to be imported to the site as it is assumed that the scheme would be unlikely to recover/reuse site won material.
- The depletion of non-renewable resources. The majority of materials used on the scheme would comprise primary materials as the scheme is unlikely to be able to source all required materials from recycled/secondary materials.
- Sterilisation of Mineral safeguarding areas and/or peat resources.

Generation and management of waste

11.7.4 Waste generation during the construction phase may result in adverse impacts. These impacts include the temporary increased use of waste management facilities and permanent reduction in landfill capacity. Waste is likely to be generated primarily from site-won materials from excavations of natural and Made Ground but is also expected from the demolition of existing structures and from materials brought to site which are not used for their original purpose. Waste produced from the scheme must be managed in compliance with the waste hierarchy, promoting waste prevention and maximising recycling/recovery of waste that cannot be prevented. Waste arisings likely to be generated during the construction phase include:

- Debris and litter lying on the ground.
- Soil which may be contaminated or unsuitable for reuse without treatment.
- Inert waste from site preparation and excavation.
- Surplus excavated materials.
- Green waste from vegetation clearance and small quantities of unsorted non-hazardous waste like timber.
- Hazardous waste.
- Surplus material from site preparation (including any remediation) and excavation works.
- Damaged stock or cut-offs.

11.7.5 The receptors likely to be subject to impacts as a result of waste generation and its management are landfills and other waste management infrastructure. The potential impacts relating to the generation and management of waste on these receptors include:

- Temporary occupation of waste management infrastructure capacity (from treatment of waste).
- Temporary occupation of land for the storage of waste awaiting transfer off-site.
- Permanent reduction in landfill capacity (from disposal of waste).

11.7.6 Specific data is not available at the time of writing this report, however, it is expected that as the scheme is located within a floodplain zone, a significant cut and fill balance is likely to be created by the removal of fill material in floodplain compensation areas. The cut and fill balance must be managed in accordance with the waste hierarchy to reduce the impact of the waste arisings, prioritising reuse and recycling over disposal methods.

11.8 Consultation

11.8.1 No consultation specific to material assets and waste has been undertaken to date. Consultation with the Environment Agency and

Newark and Sherwood District Council will be progressed if required during the development of the scheme design and ES.

11.9 Assumptions and limitations

- 11.9.1 Cut and fill volumes that include the floodplain compensation area was not available at the time of writing this Preliminary Environmental Information Report (PEI Report). Therefore, the assessment is limited to identifying activities that are likely to require significant quantities of materials or are likely to generate significant quantities of waste. Conclusions and recommendations may be revised within the ES, on the basis of updated information following further research, quantitative analysis and investigation.
- 11.9.2 Baseline information and potential effects identified are based on publicly available information. At this stage there are no material or waste quantities available, therefore, assumptions such as existing arrangements in respect of operational waste have been considered sufficient for the scheme.
- 11.9.3 Information on permitted capacity of waste management facilities has been used in the assessment, based on current publicly available data (at the time of writing). The permitted capacity of waste management facilities indicate that the waste generated from the scheme should not pose a significant effect, however, as waste types and quantities are unknown at this stage, waste during construction will be further assessed within the ES.
- 11.9.4 This PEI Report chapter has not considered the environmental effects associated with the off-site extraction of raw materials used for the off-site manufacture of products. These stages of the products or materials' lifecycles are outside of the scope of the assessment due to the range of unknown variables associated with the processes involved and are not considered to form part of the scheme. In most cases, it can also be assumed that these processes would have already been subject to EIAs in securing consents for the facilities' operation.
- 11.9.5 There is potential for change to permitted capacities, opening of additional waste management facilities and closure of existing facilities. Given the indicated remaining capacities for the Nottinghamshire sub-region at the end of 2020, there is potential for there to be sufficient availability to handle waste generated from the construction of the scheme, however, as waste types and quantities are unknown at this stage, waste during construction will be further assessed in the ES.

11.10 Design, mitigation and enhancement measures

Design

- 11.10.1 A Design for Resource Efficiency (D4RE) online workshop was held on 01 April 2022 with the design team. The aim of the workshop was to identify opportunities to improve resource efficiency during the design of the scheme options. This would ensure cost savings are maximised by considering waste minimisation initiatives and identifying opportunities to reduce, reuse or recycle waste materials and improve resource efficiency.
- 11.10.2 A Resource Management Opportunities Matrix was used during the D4RE workshop to identify suitable opportunities. The matrix utilises the D4RE Tool which assists designers, through the workshop format which is based on a stepped approach of identify, evaluate, capture and implement, to develop mitigation measures for resource use and waste management.
- 11.10.3 Opportunities were identified in the D4RE workshop, to enable resource efficiency and reduce waste. Not all of the opportunities identified during the D4RE workshop have been integrated into the scheme design yet, but will continue to be explored and integrated where feasible. Opportunities identified include:
- Repair and reuse of existing drainage.
 - Use of precast drainage solutions.
 - Source local fill material.
 - Identify uses for recycled aggregate and utilise.
 - Use of warm mix asphalt.
 - Reduce verge width of structure at the chainages.
 - Opportunity to reduce cross section and the volume of concrete of the central barrier whilst maintaining safety and structural integrity.
 - Low height modular gravity wall systems to reduce earthwork footprint along embankment widening.
 - Reuse of site won stone in Sustainable Drainage System (SuDS).
 - Use of electric, hydrogen or hydrotreated vegetable oil power.
 - Minimise thickness of starter layers.
 - Minimise footprint of works.
 - Low carbon concrete kerbs, drainage outfalls and drainage chambers.
 - Retain as much soil as possible utilising soil restoration for carbon sequestration.
 - Recycle of planings for use in construction.
 - Explore potential for 'green' steel with manufacturers.
 - Use geo-membrane as back of wall drainage instead of individual blocks.

Mitigation – construction

11.10.4 Measures would be implemented to reduce the effects of material resource use and waste generation by the scheme during construction. There is substantial overlap in the mitigation for both aspects (material resource use and waste generation), due to the synergy between the reuse of materials and the avoidance of waste generation. Potential mitigation measures identified at this stage include:

- Materials would be delivered on an 'as required' basis to avoid damage or contamination and therefore limit the likelihood of waste.
- All suitable excavated material would be reused in the construction of the scheme and in landscaping features to reduce the requirement to import materials for construction and reducing the need to remove surplus materials from site.
- Temporary stockpiling of fill materials prior to incorporation in the scheme would be avoided where possible, to ensure double handling and damage is minimised and therefore avoidance of waste. However, where required, materials would be stockpiled in accordance with best practice and managed appropriately to limit the likelihood of damage or contamination.
- Locally sourced materials and suppliers would be identified and used where practicable.
- Pre-cast elements would be used where practicable to ensure efficient use of materials and avoid the generation of waste arisings from off-cuts.
- The waste hierarchy would be implemented throughout construction to minimise disposal and maximise reuse and recycling of waste arisings. Opportunities for reuse and recycling waste include (but are not limited to):
 - Re-using excavated soils on-site in the landscaping features of the scheme.
 - Chipping green waste on-site for use in the landscaping for the scheme.
 - Composting of green waste.
 - Recycling of inert material by crushing, blending and subsequent reuse, as an aggregate.
 - Re-using waste for uses with clear benefits to the environment, for example in the remodelling of agricultural land or in the restoration of borrow pits.
 - Facilities would be provided on-site to separate out waste to enable the recovery of material through recycling.
- Where waste must be taken to a recycling or disposal site, appropriate permits will be obtained. In addition, the suitable facility will be located as close to the works as possible to minimise the impacts of transportation, in particular the release of Green House Gas emissions. The closest and relevant treatment and disposal sites would be identified.

- A non-exhaustive list of waste infrastructure sites within 10 kilometers of the scheme is provided in Table 11.16. The ability for waste arisings to be deposited at these sites will be dependent on the conditions imposed on the sites by the relevant licence or permit. There may be other facilities in the vicinity of the scheme that may be used
- A non-exhaustive list of permitted landfill sites that could potentially receive inert waste from the scheme is presented in Table 11.15.
- The sites that have an Environment Agency Environmental Permit exemption can also potentially receive inert waste.
- A Site Waste Management Plan (SWMP) will be developed, which will consider the sourcing, transport and use and disposal of materials in a sustainable manner and take account of, and capture, design changes as the scheme design evolves and would ensure that unavoidable construction waste is identified and able to be managed in accordance with the waste hierarchy and other relevant legislative requirements. The SWMP would be used to derive the management options that would achieve the highest practicable performance levels within the hierarchy.
- A Second Iteration Environmental Management Plan will be produced and will incorporate the mitigation measures proposed.
- A Materials Management Plan (MMP) will also be produced by the contractor for the earthworks. This would ensure that any adverse effects associated with material resource use and waste generation are managed.
- Material and waste audits will be undertaken throughout the construction phase to ensure that re-use and recycling targets are met on-site and to ensure that there is no surplus of materials.

Enhancement measures

11.10.5 Enhancement measures for materials and waste will be considered as part of the ongoing design development, and will be reported in the ES. However, these enhancement measures will not be taken into account when determining whether effects are significant or not.

11.11 Assessment of effects

Construction

Use of material resources

- 11.11.1 Due to the location of the scheme within a floodplain, it is expected the fill volumes required will be substantial and cut volumes available will be limited.
- 11.11.2 It is not anticipated that all site-won material would be reused on the scheme, due to the potential poor quality of the material and its unsuitability for use as structural fill. It is likely, therefore, that backfill to structures would be imported to site, as material meeting the required specification is assumed would not be won from the site.

- 11.11.3 In addition, it is unlikely that suitable materials for the road construction would be available from site-won material, such as capping material and sub-base, which would need to be imported. The volumes of imported material would depend greatly on the characteristics of the existing ground. Elements such as steel for structures and barriers, lighting columns and ducts, signs and communications infrastructure would also need to be imported for use within the scheme.
- 11.11.4 Borrow pits have been identified at Winthorpe, the borrow pits can be used to source topsoil for landscaping use and sub-base material for use within the scheme.
- 11.11.5 It is not anticipated that any peat resources will be sterilised as a result of the scheme as no deposits are located within 500 metres of the scheme's footprint. According to the Nottinghamshire Minerals Local Plan¹⁵³, the site does not lie within an MSA.
- 11.11.6 It is likely that any significant effects due to the quantity of material resources required could be appropriately mitigated through the implementation of mitigation measures outlined in Section 11.10. However, without accurate material quantification at this stage for the preliminary design of the proposed scheme, this assumption cannot be confirmed. This assessment will be undertaken in advance of the DCO application with accurate material quantification and preliminary design information, and presented within the ES. The ES will confirm the likelihood of significant effects (with mitigation).

Generation and management of waste

- 11.11.7 The scheme would aim to minimise the generation of waste as much as possible, through the implementation of the waste hierarchy. Additionally, it is assumed at this stage that where possible the surplus cut materials would be suitable to be re-used in the landscaping for the scheme. Any slop-based material recovered from the cut material will be reused in the non-structural fill and where available any soil-based material will be reused.
- 11.11.8 It is unlikely that the generation and management of waste would result in significant effects, conditional to appropriate waste management and the implementation of mitigation measures suggested in the report. However, due to current uncertainties regarding the quantities of waste anticipated, this conclusion cannot currently be confirmed. Once confirmed, details of the final quantities of waste will be used to update this assessment, which will subsequently be presented within the ES.

11.12 Monitoring requirements for significant adverse effects

- 11.12.1 Without mitigation, there is the potential for significant adverse effects from the quantity of material resources required for the construction of the scheme. Material and waste audits should therefore be undertaken throughout the construction phase. Conducting audits regularly would give an indication of where continual improvements to waste management and minimisation can be made throughout the construction phase.
- 11.12.2 The SWMP will also be used to measure and monitor the types and quantities of waste taken off-site, to ensure that the waste hierarchy is being implemented where practicable.

11.13 Conclusions

- 11.13.1 This chapter provides a summary of the assessments that have been undertaken so far for material assets and waste in accordance with DMRB LA 110 Material assets and waste¹²⁷.
- 11.13.2 At this stage, it is anticipated that a large quantity of material resources would be required to construct the scheme. Mitigation measures would ensure that the re-use of materials is made a priority, and would ensure that preference is given to the use of recycled materials or that materials are in line with the regional percentage target specified in DMRB LA 110. It is likely that significant effects can be appropriately mitigated. However, in the absence of accurate material quantification of the preliminary design, this assumption cannot be confirmed. Therefore, an update to this assessment will be required to confirm this assumption, and will be included as part of the ES.
- 11.13.3 The scheme would be likely to generate waste during construction which would need to be appropriately managed. Consideration will be given to the need for a SWMP, which would consider the sourcing, transport and use and disposal of waste materials in a sustainable manner. Following the implementation of a SWMP and appropriate mitigation measures, the generation and management of waste is not anticipated to result in significant direct or indirect effects. However, in the absence of accurate quantification and a construction strategy, an update to this assessment will be undertaken and reported within the ES to confirm this assumption.

12 Noise and Vibration

12.1 Introduction

- 12.1.1 This chapter presents the on-going work for the assessment of the potential effects associated with temporary noise and vibration impacts during the construction phase and permanent noise and vibration impacts during the operational phase.
- 12.1.2 The potential effects have been considered following DMRB LA 111 Noise and Vibration¹⁷⁶. Further detailed assessment is currently under way and will be reported within the ES that will be submitted to support the Development Consent Order (DCO) application.

12.2 Legislation and policy context

- 12.2.1 The following legislation, policy, standards, and guidelines are considered to be relevant to the assessment of noise and vibration due to the scheme:

Legislation

The Land Compensation Act 1973 Part 1

- 12.2.2 The Land Compensation Act 1973 Part 1¹⁷⁷ includes provision for compensation for loss in property value resulting from physical factors, including noise and vibration, resulting from the use of public works, such as new or improved roads.

The Noise Insulation Regulations 1975 (amended 1988)

- 12.2.3 The Noise Insulation Regulations 1975 (amended 1988)¹⁷⁸ were made under Part 2 of the Land Compensation Act for the obligatory and discretionary provision of noise mitigation measures for dwellings adjacent to new highways. Among the criteria for a property to qualify for insulation in living rooms and bedrooms is the façade noise level is at least 68 decibel (dB) LA_{10,18hr} (the arithmetic average of the 18 LA_{10(1hr)} levels for the period between 0600 hours and 2400 hours on any day), and that noise from the new or altered highway increases by at least 1 dB.

The Control of Pollution Act 1974 (sections 60 and 61)

- 12.2.4 Whilst people that live near to construction activities may accept that there would be some disturbance caused to them, the Control of Pollution Act 1974¹⁷⁹ offers further protection. Section 60 of the Act enables a local authority to serve a notice specifying its noise control

¹⁷⁶ National Highways, Design Manual for Roads and Bridges (DMRB) LA 111 - Noise and Vibration (Revision 2), 2020.

¹⁷⁷ Her Majesty's Stationery Office, Land Compensation Act, 1973.

¹⁷⁸ Her Majesty's Stationery Office, Noise Insulation Regulations. Building and Buildings, 1975.

¹⁷⁹ Her Majesty's Stationery Office, The Control of Pollution Act, 1974.

requirements covering plant or machinery (which is or is not being used), hours of working, and levels of noise that can be emitted. Section 61 relates to prior consent in which the contractor consults with the local authority and provides an application prior to construction works commencing to obtain approval for the methods to be used and the steps proposed to minimise noise resulting from the works.

[The Environmental Noise \(England\) Regulations 2006 \(amended 2018\)](#)

12.2.5 The Environmental Noise (England) Regulations¹⁸⁰ implement European legislation requiring noise action plans to be developed on a five-year rolling programme. Action plans have to be developed for the major noise sources and areas for which maps have been produced and that identified 'Important Areas' for future mitigation. The action plans seek to manage noise issues and effects including noise reduction, if necessary, based on the results obtained through the mapping process.

[The Environmental Protection Act 1990](#)

12.2.6 The Environmental Protection Act 1990¹⁸¹ places a duty on local authorities to serve abatement notices where noise from premises, vehicles and machinery are judged to constitute a statutory nuisance. Compliance with these controls is required, although the requirements fall outside the planning system.

[The Highways Noise Payments and Movable Homes Regulations 2000](#)

12.2.7 The Highways Noise Payments and Movable Homes Regulations 2000¹⁸² makes provision for mobile home noise payments and limitations on these. The regulations define movable homes as being caravans or/and house boats.

National policy

[The National Policy Statement for National Networks \(NPSNN\) 2014](#)

12.2.8 The National Policy Statement for National Networks (NPSNN)¹⁸³ sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks in England. It promotes good health and good quality of life through effective noise management and notes at paragraph 1.193 that "Due regard must have been given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government's associated planning guidance on

¹⁸⁰ Her Majesty's Stationery Office, Environmental Noise Regulations, 2006 (Amended 2018).

¹⁸¹ Her Majesty's Stationery Office, Environmental Protection Act 1990.

¹⁸² The Highways Noise Payments and Movable Homes Regulations 2000.

¹⁸³ Department for Transport, National Policy Statement for National Networks, 2014.

noise”. Government policy is set out in the Noise Policy Statement for England – see below.

- 12.2.9 The NPSNN states at paragraph 5.200, “Applicants should consider opportunities to address the noise issues associated with the Important Areas as identified through the noise action planning process”.
- 12.2.10 Paragraph 5.191 of the NPSNN states that noise should be assessed using the principles of the relevant British Standards and other guidance and that prediction of road traffic noise should be based on the method described in the Calculation of Road Traffic Noise (CRTN).

The National Planning Policy Framework (NPPF) 2021

- 12.2.11 Paragraph 174 of the National Planning Policy Framework¹⁸⁴ (NPPF) states that: “Planning policies and decisions should contribute to and enhance the natural and local environment by...preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.”
- 12.2.12 Paragraph 185 of the NPPF states that planning policy and decisions should aim to: “Mitigate, and reduce to a minimum, potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life; Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.”

The Noise Policy Statement for England (NPSE) 2010

- 12.2.13 The Noise Policy Statement for England (NPSE)¹⁸⁵ purpose is to promote “good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.” The three main aims are to:
1. Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
 2. Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.
 3. Where possible, contribute to the improvement of health and quality of life through the effective management and control of

¹⁸⁴ Department for Levelling Up, Housing and Communities, National Planning Policy Framework (NPPF), 2021.

¹⁸⁵ Department for Environment Food and Rural Affairs. The Noise Policy Statement for England, 2010.

environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

12.2.14 Within the aims stated above there are several key phrases that lead to additional concepts now considered in the assessment of noise impact; these and their definitions are detailed below:

- Lowest Observed Adverse Effect Level (LOAEL): this the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL): this is the level above which significant adverse effects on health and quality of life occur.

12.2.15 There are no pre-defined levels for these effect levels as it is acknowledged that they will be different for different sources, different receptors and at different times.

Planning Practice Guidance 2014

12.2.16 Planning Practice Guidance (PPG)¹⁸⁶ provides guidance on how the policy set out in NPPF may be interpreted in practice for a wide range of issues. There is a subsection of PPG relating specifically to noise:

12.2.17 “Local planning authorities’ plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- Whether or not a significant adverse effect is occurring or likely to occur.
- Whether or not an adverse effect is occurring or likely to occur.
- Whether or not a good standard of amenity can be achieved.

12.2.18 In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during construction wherever applicable) is, or would be, above or below the significant observed adverse effect level...”.

12.2.19 Among the specific factors to consider where relevant the guidance states: “In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur”.

12.2.20 PPG provides a noise exposure hierarchy which describes the perception and outcomes associated with increasing effect levels.

¹⁸⁶ Department for Communities and Local Government, Planning Practice Guidance, 2019.

Local policy

Nottinghamshire Local Transport Plan 2011-2026 (Nottingham Agglomeration Noise Action Plan)

12.2.21 The Nottinghamshire Local Transport Plan 2011-2026¹⁸⁷ presents considerations on road induced noise affecting the health, wellbeing and quality of life of communities, also stating: “...Priority will be given to highway measures that reduce noise in areas where there are high levels of road traffic and significant noise sensitive properties affecting a high number of people. However, greater priority will be given to measures that will lead to both the biggest noise benefits and other transport objectives (such as tackling congestion and encouraging active travel) as it is essential to ensure that resources are targeted appropriately.”

National Highways policy

12.2.22 Noise is one of the environmental topic areas where the six strategic levers of the National Highways’ Environment Strategy¹⁸⁸ will be applied. The strategic levers will make a contribution towards the organisation’s environment vision.

Standards and guidance

DMRB LA 111 Noise and Vibration

12.2.23 The DMRB LA 111 ‘Noise and Vibration’¹⁸⁹ provides the assessment requirements for highways projects in the UK and reflects EIA methodology as applied to highways. It includes requirements for the classification of magnitude of impact, assessment of both long and short-term effects and determination of significance.

Calculation of Road Traffic Noise 1988

12.2.24 Calculation of Road Traffic Noise¹⁹⁰ provides procedures for predicting noise levels for a given flow of road traffic at sensitive receptors. These methodologies are used in the determination of entitlement under the Noise Insulation Regulations and for traffic noise assessment undertaken in accordance with DMRB LA 111.

¹⁸⁷ Nottinghamshire Local Transport Plan 2011-2026, Nottingham County Council.

¹⁸⁸ National Highways (2015) National Highways Environment Strategy [online]. Available at: https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/605063/Environment_Strategy_21_.pdf (Last accessed September 2022)

¹⁸⁹ National Highways, Design Manual for Roads and Bridges (DMRB) LA 111 - Noise and Vibration (Revision 2), 2020.

¹⁹⁰ Department of Transport, Calculation of Road Traffic Noise, 1988.

Transport Research Laboratory 2014

12.2.25 The Transport Research Laboratory (TRL) produced a report¹⁹¹ that sets out a methodology for the conversion of UK traffic noise indices into EU noise indices for noise mapping purposes. This includes TRL method 3, a conversion from the UK road traffic noise index $L_{A10,18h}$ into the night-time noise level.

British Standard 5228:2009+A1:2014

12.2.26 British Standard (BS) 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' Part 1: Noise¹⁹² provides a methodology for calculating noise levels generated by fixed and mobile plant used for a range of typical construction operations.

12.2.27 BS 5228-1 provides guidance for the determination of significance of noise effects due to construction activities which combine both an exceedance of noise level thresholds and time period of works. The guidance also recommends mitigation and measures that can be applied to minimise noise impacts from construction works.

12.2.28 British Standard 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' Part 2: Vibration¹⁹³ details that even when it is of a very low magnitude, vibration generated as the result of construction or operation of a development can be perceptible to people living or working close by. Nuisance associated with vibration is frequently associated with the assumption that, if vibrations can be felt, then damage is inevitable. However considerably greater levels of vibration over the perceptible threshold are required before damage to buildings at either a cosmetic or structural level will occur.

World Health Organisation (WHO) Night Noise Guidelines for Europe, 2009

12.2.29 The WHO Night Noise Guidelines (NNG) for Europe¹⁹⁴ suggest suggest on a very precautionary basis, that the population should not be exposed to a NNG value greater than 40 dB L_{night} , outside (defined as the night noise level outside in free field conditions) during the part of the night when most people are sleeping. However, the precautionary nature of this target is fully appreciated by the WHO and a noise level of 55 dB L_{night} , outside is therefore recommended relating to the onset of heart disease.

¹⁹¹ Transport Research Laboratory, P G Abbott and P M Nelson. TRL PR/SE/451/02, 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping', 2014

¹⁹² British Standards Institution, BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise, 2014.

¹⁹³ British Standards Institution, BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration, 2014.

¹⁹⁴ World Health Organization, Night Noise Guidelines for Europe, 2009.

World Health Organisation (WHO) Environmental Noise Guidelines for the European Region, 2018

- 12.2.30 The WHO Environmental Noise Guidelines (ENG) for the European Region¹⁹⁵ provide evidence-based recommendations on the health effects of noise. The guidelines complement the expert-based recommendations of the WHO ‘Night Noise Guidelines’.
- 12.2.31 The guidelines provide source specific recommendations for road traffic, railway, aircraft and wind turbine noise, and indoor as well as outdoor exposure levels for leisure noise.
- 12.2.32 The recommendations use a risk-based approach and the guidance states that the “guideline exposure levels presented are therefore not meant to identify effect thresholds (the lowest observed adverse effect levels for different health outcomes). This is a difference in approach from prior WHO guidelines, like the night noise guidelines for Europe (WHO Regional Office for Europe, 2009), which explicitly aimed to define levels indicating no adverse health effects.” This means that the recommendations in the guidelines should not be directly associated with adverse effect levels such as LOAEL and SOAEL. It is also noted that, unlike other guidance and the aims of the NPSE, the WHO ENG recommendations do not take context or sustainability policies into account.

12.3 Assessment methodology

- 12.3.1 The assessment of construction noise and vibration, and operational noise impacts has been undertaken in accordance with DMRB LA 111 to identify potential significant effects. Operational vibration has been scoped out in accordance with paragraph 1.4 of DMRB LA 111.
- 12.3.2 Significance has been considered on the basis of magnitude of impact and with respect to the Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL) values which are concepts that were introduced by the Noise Policy Statement for England¹⁹⁶ and referenced by NPSNN¹⁹⁷.

Construction noise

- 12.3.3 DMRB LA 111 sets out an approach for the assessment of construction noise effects at sensitive receptors which utilises the BS5228–1:2009+A1:2014 ‘Example Method 1 – ABC Method’ calculation methodology. DMRB LA 111 sets out an approach for the determination of the magnitude of impact and significance of effects

¹⁹⁵ World Health Organization, Environmental Noise Guidelines for the European Region, 2018.

¹⁹⁶ Department for Environment Food and Rural Affairs. The Noise Policy Statement for England, 2010

¹⁹⁷ National Policy Statement for National Networks

due to construction noise including noise from additional construction activities such as construction traffic and diversion routes. The magnitude of impact is classified as negligible, minor, moderate or major by comparison of the construction noise levels with LOAEL and SOAEL values for all relevant receptor properties as per DMRB LA 111 Table 3.16 and as reproduced in Table 12.1. The LOAEL and SOAEL values for construction noise are defined in Table 12.2: 2.2.

Table 12.1: Magnitude of impact and construction noise descriptions

Magnitude of impact	Construction noise level
Major	Above or equal to SOAEL +5 dB
Moderate	Above or equal to SOAEL and below SOAEL +5 dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

Source: DMRB LA 111 Table 3.16

Table 12.2: Summary of construction noise LOAEL and SOAEL values

Period	LOAEL	SOAEL
Construction Noise		
Day (07:00-19:00) weekday and Saturday morning (07:00-13:00)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and BS 5228-1 Table E.1
Night (23:00-07:00)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and BS 5228-1 Table E.1
Evening and weekends (periods not covered above)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and BS 5228-1 Table E.1
Construction Vibration		
Anytime	0.3mm/s	1.0mm/s

Source: DMRB LA 111 Tables 3.12 and 3.31

12.3.4 The magnitude of impact from noise due to construction traffic and diversion routes is classified by considering changes in the Basic Noise Level (BNL) to be negligible, minor, moderate or major as per DMRB LA 111 Table 3.17 as reproduced in Table 12.3. The BNL is defined by CRTN as the calculated noise level at a reference distance of 10m from the nearside carriageway edge obtained from traffic flow, speed, composition, gradient and road surface.

Table 12.3: Magnitude of impact at receptors for construction traffic and diversion routes

Magnitude of impact	Increase in BNL of closest public road used for construction traffic (dB)
Major	Greater than or equal to 5.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0

Source: DMRB LA 111

12.3.5 Construction noise and construction traffic noise is determined to cause a significant effect where a moderate or major magnitude of impact will occur for a duration exceeding: 10 or more days or nights in any 15 consecutive days or nights; or a total number of days exceeding 40 in any six consecutive months as per DMRB LA 111 section 3.19.

Construction vibration

12.3.6 DMRB LA 111 sets out an approach for the assessment of construction vibration effects at sensitive receptors which refers to BS5228 ‘Code of construction practice for noise and vibration control on construction and open sites – Part 2: Vibration’.

12.3.7 The construction vibration magnitude of impact is determined to be negligible, minor, moderate or major by comparison of construction vibration levels with LOAEL and SOAEL values for all relevant receptor properties as per DMRB LA 111 Table 3.33 and section 3.34 and reproduced in Table . The LOAEL and SOAEL values for construction vibration are defined in Table 12.4.

12.3.8 To put the values in Table 12.2: 2.4 into context, a major impact as defined in Table 12.3 corresponds in BS5228-2 to a vibration level at which “Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments”. A moderate impact at or above SOAEL corresponds in BS5228-2 to a vibration level at which “It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents” A minor impact above or equal to LOAEL corresponds in BS5228-2 to a vibration level at which “Vibration might just be perceptible in residential environments”.

Table 12.4: Construction vibration level – magnitude of impact

Magnitude of impact	Vibration level
Major	Above or equal to 10 mm/s PPV
Moderate	Above or equal to SOAEL and below 10 mm/s PPV
Minor	Above equal to LOAEL and below SOAEL
Negligible	Below LOAEL

Source: DMRB LA 111 Table 3.33

12.3.9 A potential significant effect due to construction vibration is identified where a moderate or major magnitude of impact is predicted to occur for a duration exceeding: 10 or more days or nights in any 15 consecutive days or nights; or a total number of days exceeding 40 in any six consecutive months as per DMRB LA 111 section 3.34.

Operation

12.3.10 The DMRB LA 111 sets out an approach for the assessment of operational noise effects at sensitive receptors. This methodology has been adopted for the quantitative assessment of operational noise effects.

12.3.11 Receptors which are potentially sensitive to noise include dwellings, hospitals, healthcare facilities, education facilities, community facilities, designated sites, public rights of way and cultural heritage assets.

12.3.12 The level of road traffic noise from the road network will be predicted using CRTN methodology from forecast traffic data provided in terms of 18-hour Annual Average Weekday Traffic (AAWT) flow between the hours of 06:00 to 00:00, along with speed pivoted vehicle speed and percentage of heavy vehicles. A correction factor for the road surfacing for each scenario will be included as required and detailed in DMRB LA 111. The factor is dependent on road surface type and speed of traffic and will vary between scenarios. For the purposes of this report, the assessment undertaken at earlier stages has been used in view of forthcoming traffic model updates to facilitate the ES.

12.3.13 Calculations determine road traffic noise levels using noise descriptors LA10,18hr and Lnight. Lnight values are derived from daytime noise levels using TRL Method 3 in accordance with DMRB LA 111.

12.3.14 Calculations of the road traffic noise level are carried out for four scenarios:

- Do-minimum opening year (DMOY)
- Do-minimum future year (DMFY)
- Do-something opening year (DSOY)

12.3.15 Do-something future year (DSFY) In the above scenarios, 'Do-Minimum' means traffic growth with committed development only. 'Do-

Something' means committed growth with the scheme. The future assessment year is opening year +15 years. In accordance with DMRB the assessment of road traffic noise effects requires the following comparisons:

- Do-Minimum scenario in the opening year against Do-Something in the opening year (short-term change with the scheme).
- Do-Minimum scenario in the opening year against Do-Something in the future assessment year (long-term change with the scheme).
- Do-Minimum scenario in the opening year against Do-Minimum in the future assessment year (long-term change without the scheme).

12.3.16 DMRB LA 111 classifies the magnitude of noise level change as negligible, minor, moderate or major and applies different criteria in the short-term and long-term. These changes may be beneficial (noise decrease) or adverse (noise increase). These classifications are as per DMRB LA 111 Tables 3.54a and 3.54b, which are summarised below in Table 12.5:.

Table 12.5: Short term and long term magnitude of change

Magnitude	Short term noise change (dB L_{A10,18hr} or L_{night})	Long term noise change (dB L_{A10,18hr} or L_{night})
Major	Greater than or equal to 5.0	Greater than or equal to 10.0
Moderate	3.0 to 4.9	5.0 to 9.9
Minor	1.0 to 2.9	3.0 to 4.9
Negligible	Less than 1.0	Less than 3.0

Source: DMRB LA 111 Table 3.54a and Table 3.54b

12.3.17 The initial assessment of operational noise significance is based on the short-term magnitude of change as per DMRB LA 111 Table 3.58 which is reproduced in Table 12.6:.. The initial assessment considers negligible and minor short-term change likely not to be significant and moderate and major short-term change to be significant.

Table 12.6: Initial assessment of operational noise significance

Significance	Short term magnitude of change
Significant	Major
Significant	Moderate
Not significant	Minor
Not significant	Negligible

Source: DMRB LA 111 Table 3.58

12.3.18 In all cases where the magnitude of noise level change in the short-term is classified as minor, moderate or major, additional factors described in DMRB LA 111 Table 3.60 are considered to determine the significance. The factors that influence this judgement include the

magnitude of change with respect to minor and moderate boundaries, the magnitude of impact in the long term and short term, the consideration of absolute noise levels with respect to the LOAEL and SOAEL, the location of noise sensitive parts of the receptor, the acoustic context, and the perception of change. Operational noise LOAEL and SOAEL values are provided in Table 12.7: below. DMRB LA 111 Table 3.30 is reproduced below in Table 12.8:.

Table 12.7: Summary of operation noise LOAEL and SOAEL values

Period	LOAEL	SOAEL
Operational Noise		
Daytime (06:00-24:00)	55 dB $L_{A10,18hr}$ (facade)	68 dB $L_{A10,18hr}$ (facade)
Night-time (23:00-07:00)	40 dB $L_{night,outside}$ (free-field)	55 dB $L_{night,outside}$ (free-field)

Source: DMRB LA 111 Table 3.49.1

Table 12.8: Determining final operational significance on noise sensitive buildings

Local circumstances	Influence on significance judgement
Noise level change (is the magnitude of change close to the minor/moderate boundary?)	1) Noise level changes within 1 dB of the top of the 'minor' range can indicate that it is more appropriate to determine a likely significant effect. Noise level changes within 1 dB of the bottom of a 'moderate' range can indicate that it is more appropriate to consider a change is not a likely significant effect.
Differing magnitude of impact in the long term to magnitude of impact in the short term	1) Where the long term impact is predicted to be greater than the short term impact, it can be appropriate to conclude that a minor change in the short term is a likely significant effect. Where the long term impact is predicted to be less than the short term it can be appropriate to conclude that a moderate or major change in the short term is not significant. 2) A similar change in the long term and non-project noise change can indicate that the change is not due to the project and not an indication of a likely significant effect.
Absolute noise level with reference to LOAEL and SOAEL (by design this includes sensitivity of receptor)	1) A noise change where all do-something absolute noise levels are below SOAEL requires no modification of the initial assessment. 2) Where any do-something absolute noise levels are above the SOAEL, a noise change in the short term of 1.0dB or over results in a likely significant effect.
Location of noise sensitive parts of a receptor	1) If the sensitive parts of a receptor are protected from the noise source, it can be appropriate to conclude a moderate or major magnitude change in the short term and/or long term is not a likely significant effect. 2) Conversely, if the sensitive parts of the receptor are exposed to the noise source, it can be more appropriate to

Local circumstances	Influence on significance judgement
	<p>conclude a minor change in the short term and/or long term is a likely significant effect.</p> <p>3) It is only necessary to look in detail at individual receptors in terms of this circumstance where the decision on whether the noise change gives rise to a significant environmental effect is marginal.</p>
Acoustic context	<p>1) If a project changes the acoustic character of an area, it can be appropriate to conclude a minor magnitude of change in the short term and/or long term is a likely significant effect.</p>
Likely perception of change by residents	<p>1) If the project results in obvious changes to the landscape or setting of a receptor, it is likely that noise level changes will be more acutely perceived by the noise sensitive receptors. In these cases it can be appropriate to conclude that a minor change in the short term and/or long term is a likely significant effect.</p> <p>2) Conversely, if the project results in no obvious changes for the landscape, particularly if the road is not visible from the receptor, it can be appropriate to conclude that a moderate change in the short term and/or long term is not a likely significant effect.</p>

Source: DMRB LA 111 Table 3.60

12.4 Study area

12.4.1 DMRB LA 111 requires the definition of study areas during the construction and operational phase of a scheme.

Construction

12.4.2 The construction noise and vibration study area is defined as that which includes all sensitive receptors that are potentially affected by construction noise and vibration or are in areas where there is a reasonable stakeholder expectation that a construction noise and vibration assessment would be undertaken.

- DMRB LA 111 notes that a study area of 300 metres from the closest construction activity is normally sufficient to encompass noise sensitive receptors.
- DMRB LA 111 requires that the construction noise study area will include a 25 metre width from the kerb line of any diversion routes (as a result of a project requiring full carriageway closures during the night (23:00-07:00) to enable construction works to take place).
- DMRB LA 111 requires that a study area of 100 metres from the closest construction activity with the potential to generate vibration is defined.
- DMRB LA 111 requires that the construction traffic noise study area will include a 50 metre width from the kerb line of public roads

with the potential for an increase in basic noise level (BNL)¹⁹⁸ of 1 dB(A) or more as a result of the introduction of construction traffic. The BNL is the noise level at a reference 10 metre distance from the nearest carriageway.

Operation

12.4.3 The operational noise and vibration study area includes noise sensitive receptors that are potentially affected by operational noise changes generated by the scheme (either on the route of the scheme or other roads not physically changed by the scheme), or are in areas where there is a reasonable stakeholder expectation that an operational noise assessment would be undertaken:

- DMRB LA 111 advises the study area to be within 600 metres of new road links or road links physically changed or bypassed by the scheme.
- Beyond 600 metres, the area within 50 metres of other road links with potential to experience a short term BNL change of more than 1.0 dB(A), as a result of the project.

12.4.4 Noise sensitive receptors which will fall within the study area have been identified in Section 12.5.

Noise Important Areas

12.4.5 The Environmental Noise (England) Regulations 2006 implement the Environmental Noise Directive (END)¹⁹⁹ in England. This requires that noise from major sources of environmental noise is mapped to calculate the exposure of populated areas, identifying Noise Important Areas (NIAs) that are at risk of experiencing significant adverse impacts to health and quality of life as a result of their exposure to road traffic noise and that the management of noise is required to promote wellbeing. This is set out in the Noise Action Plans which are developed and implemented by the authorities responsible for the sources of noise affecting the NIAs. Where road schemes have the potential to affect the exposure of populated areas within an NIA, this should be assessed and measured to avoid adverse changes as a result of the scheme or opportunities to create beneficial impacts should be considered.

12.4.6 Several NIAs are located in the vicinity of the scheme and can be seen on Figure 12.1 contained in Volume 2, seven of which are within the study area:

- 7834 (Langford, A46)
- 7838 (Newark-on-Trent, A1)

¹⁹⁸ The Basic Noise Level (BNL) refers to the LA_{10,18hr} noise level from road traffic at 10m from the nearside carriageway edge as defined within the Calculation of Road Traffic Noise (CRTN).

¹⁹⁹ European Commission (2002). Environmental Noise Directive [online] available at: Noise - Environment - European Commission (europa.eu) (Last accessed March 2022).

- 7840 (Newark-on-Trent, A46)
- 7839 (Newark-on-Trent, A46)
- 8220 (Newark-on-Trent, A46/A1)
- 7846 (Farndon, A46)
- 7847 (Farndon, A46)

12.5 Existing baseline

12.5.1 The study area around the proposed scheme consists of discrete groups of residential receptors separated by more rural, agricultural areas with isolated properties. There are also recreational and industrial/commercial receptors in the area. In addition to the existing A46, there are several other trunk roads in the area and two railways, thus the background noise consists largely of road traffic noise, the level being dependent on time of day and distance from the road network, in addition to noise from the railways. The residential areas within the scheme corridor may be grouped as follows:

- The residential area at the southern end of the scheme, between the existing A46 and the B6166, at its closest, approximately 50 metres from the A46.
- A gypsy and traveller community off Tolney Lane, at its closest approximately 130 metres from the A46.
- A residential area between Great North Road, Kelham Lane and the existing A46, at its closest approximately 80 metres from the A46 and 80 metres from the Great North Road.
- Kings Waterside and Marina and dwellings to the east. At its closest, the Marina is approximately 90 metres from the A46 and dwellings to the east approximately 130 metres from the A46.
- A large residential area on the approach to where the existing A46 intersects the A1, at its closest approximately 30 metres from the A46.
- The community of Winthorpe to the north of the A46/A1 junction, at its closest, the main community is approximately 180 metres from the A46 although on Hargon Lane, there are properties approximately 70 metres from the A46. There are also properties within 100 metres of the A1.

12.5.2 In addition, there may be further residential areas adjacent to roads subject to a change in noise level of 1dB or more, these being established once traffic forecasts are available. Outside the main study area the previous stage of assessment identified minor increases in noise levels on South Hykeham Road and Jerusalem Road, close to the A46 at Lincoln, in addition to the route between Long Bennington junction on the A1 and Elston junction, affecting Valley Lane, Staunton Road, Station Road (Cotham) and Top Street (Elston). Additional detail on the affected road network will be provided within the ES once revised traffic forecasts are available.

Construction

12.5.3 BS 5228-1²⁰⁰ provides relevant time periods for construction noise impact assessment, referring to different times of the day, and days of the week to reflect the differences in the sensitivity of receptors. Measurement data has been analysed to consider the time periods accordingly:

- LAeq,daytime
 - LAeq,12h daytime - between 07:00 and 19:00 from Monday to Friday.
 - LAeq,6h daytime - between 07:00 and 13:00 on Saturday.
- LAeq,evening time and weekends
 - LAeq,4h evening - between 19:00 and 23:00 from Monday to Friday.
 - LAeq,10h weekend - between 13:00 and 23:00 on Saturday.
 - LAeq,16h weekend - between 07:00 and 23:00 on Sunday.
- LAeq,8h night time - between 23:00 and 07:00.

Operation

12.5.4 Noise monitoring data include LA_{10,18h} values, the index used in the UK for highway noise assessment, to inform the operational modelling for the scheme. This also enables predicted noise levels from modelled traffic flows to be directly compared against measured data.

Noise monitoring

12.5.5 Baseline noise monitoring for the scheme was undertaken between 29 March and 8 April 2022 and between 5 May and 12 May 2022.

12.5.6 Locations were chosen to represent a spread of locations along the length of the scheme, in general being representative of closest receptors to the scheme. Some locations, especially within Winthorpe, were influenced by stakeholder requests. The aim of the surveys was to:

- Inform baseline noise modelling results by providing a useful cross-check at discrete locations.
- Inform the public consultation process.
- Enable ambient noise levels to be used as the basis of the construction impact assessment.

12.5.7 Eight long term (LT) and two short term (ST) monitoring locations were selected as representative of key areas in the vicinity of the proposed road alignment changes, to facilitate a more complete understanding of the local noise environment in relation to anticipated traffic flow changes, see Figure 12.2 contained in Volume 2. All monitoring locations are considered to be directly affected by noise from the existing road network in their vicinity.

²⁰⁰ British Standards Institution, BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise, 2014.

- 12.5.8 A summary of noise monitoring results at all locations are presented in Table 12.9, Table 12.10 and Table 12.11.
- 12.5.9 LAeq,T values in Table 12.1 shows the data averaged over the periods relevant to the construction noise assessment, while the LA10,18h values are equivalent for those used in operational noise assessment and represent the standard UK index for traffic noise. While the operational noise assessment will be based upon annual average values, the similarity of measured values to adverse effect levels outlined in Section 12.3, indicate that some locations are already exposed to relatively high noise levels.
- 12.5.10 Table 12.10 and Table 12.11 show the LAeq and LA10 values as measured over a 15-minute period in addition to the LAmax and the LA90, respectively representing the maximum levels of background noise; i.e. in the absence of short term events such as dog barking, car horns etc.

Table 12.9: Summary of free field LT data

Location (Please refer to Figure 12.2 in Volume 2 for location)*	Date	Range L _{A10,18h} dB	Range L _{Aeq,12h} daytime dB	Range L _{Aeq,4h} evening dB	Range L _{Aeq,8h} night dB	L _{Aeq,6h} daytime dB	L _{Aeq,10h} weekend dB	L _{Aeq,8h} night dB	L _{Aeq,16h} weekend dB	L _{Aeq,8h} night dB
			Weekdays			Saturday			Sunday	
LT2	29 Mar-7 Apr 2022	55-60	55-59	52-58	49-56	54	53	51	54	56
LT3	30 Mar-7 Apr 2022	62-67	63-66	59-63	58-61	61	59	57	63	61
LT4	30 Mar-7 Apr 2022	66-71	67-69	63-67	60-64	64	62	57	65	62
LT5	29 Mar-7 Apr 2022	52-57	51-56	47-59	45-54	50	50	49	51	52
LT6	30 Mar-8 Apr 2022	62-69	62-69	59-64	60-64	61	60	58	64	64
LT7	5 May- 12 May	66-70	67-69	64-65	62-64	67	64	59	64	63
LT8	5 May- 12 May	56-59	55-60	52-57	50-54	53	54	49	57	53

*Due to 1.5dB drift in field calibration data for LT1, this site has been disregarded

Table 12.10: Summary of free field ST1 data

Location (Please refer to Figure 12.2 for location)	Date	Start time	L _{Aeq,15min} dB	L _{Amax,15min} dB	L _{A10,15min} dB	L _{A90,15min} dB
ST1	30/03/2022	09:30	64	70	67	59
	30/03/2022	11:00	65	72	67	61
	30/03/2022	11:20	66	73	68	61
	07/04/2022	15:25	65	71	67	61
	07/04/2022	15:45	64	71	67	60
	08/04/2022	09:43	65	71	67	59
	08/04/2022	10:01	64	72	67	58

Table 12.11: Summary of free field ST2 data

Location (Please refer to Figure 12.2 for location)	Date	Start time	L _{Aeq,15min} dB	L _{Amax,15min} dB	L _{A10,15min} dB	L _{A90,15min} dB
ST2	05/05/2022	13:53	67	85	71	48
	05/05/2022	14:10	68	83	72	51
	13/05/2022	09:20	69	81	73	55
	13/05/2022	09:36	68	82	73	55

12.6 Value (sensitivity of resources and receptors)

- 12.6.1 Noise and vibration effects people in a number of different ways. This may include factors such as annoyance and sleep disturbance, anxiety, enjoyment of quiet spaces, ability to communicate with others, ability to concentrate at home or at work, and participation in social and community activities.
- 12.6.2 Table 12.12 sets out typical classes of sensitive receptors with varying sensitivity, and Table 12.13 sets out criteria used in this assessment to determine the sensitivity of a receptor.
- 12.6.3 The majority of the receptors that are expected to be affected by noise and vibration impacts arising due to the scheme would be dwellings. Therefore, according to Table 12.13 receptors are considered to be of high sensitivity.

Table 12.12: 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, hospitals, residential care homes 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 the effect of noise and vibration.
Other	Any other premises highly sensitive to noise and vibration such as laboratories etc.

Table 12.13: Receptor Sensitivity

Sensitivity	Criteria
High	Receptors where occupants or activities are particularly susceptible to noise. Examples include: residences, quiet outdoor areas used for recreation, conference facilities, auditoria/studios, schools in daytime, hospitals/residential care homes and religious institutions e.g. churches or mosques.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance. Examples include: offices, restaurants and sports grounds where spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. golf or tennis).
Low	Receptors where distraction or disturbance from noise is minimal. Examples include residences and other buildings not occupied during working hours, factories and working environments with existing high noise levels and sports grounds where spectator noise is a normal part of the event.

Source: Adapted from the Guidelines for Environmental Noise Impact Assessment²⁰¹

²⁰¹ IEMA, Guidelines for Environmental Noise Impact Assessment v1.2 (Nov 2014)

12.7 Potential impacts

Construction

- 12.7.1 During construction, the 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. Principally, this would be in the vicinity of the scheme envelope, although this could extend along elements of the existing road network, depending on haul routes and the quantity of construction-related traffic.
- 12.7.2 Factors which have the potential to affect construction phase noise and vibration impacts include:
- Construction plant inventory and utilisation.
 - The programme and the duration of activities with noise and vibration impacts exceeding relevant thresholds.
 - Hours of work.
 - Proximity of the works to receptors.
 - Frequency and routing of the movement of construction vehicles.
 - The location of compounds.
 - The routing of temporary diversions, the volumes of traffic using them and duration they are applied.
- 12.7.3 A review of construction activities will be undertaken at the ES stage and appropriate mitigation identified as appropriate.

Operation

- 12.7.4 During operation there is the potential for changes to traffic flows and road alignment to result in noise changes at noise sensitive receptors, particularly from increased road traffic. Impacts due to changes in noise may affect residential, and other sensitive receptors (for example commercial or community uses). Impacts can be beneficial or adverse. Factors which have the potential to affect road traffic noise include:
- Overall traffic volume.
 - Proportion of heavy vehicles.
 - Traffic speed i.e. changes in free-flow conditions and waiting times at junctions.
 - Road alignment (vertical and horizontal alignment).
 - The type of carriageway surfacing material.
 - Change to the noise character of the existing area or non-acoustic factors (for example vegetation removal).

12.8 Consultation

- 12.8.1 The Environmental Health team at Nottinghamshire County Council were contacted via email on 17 February 2022 asking for feedback

and comments on the proposed noise monitoring locations; no response has been received to date. Further engagement with relevant stakeholders will be undertaken as required as part of the ES. Relevant stakeholders include:

- The Local Authority Environmental Health Officer to discuss the effects of noise and vibration as part of work associated with the ES.
- Owners and operators of any community resources where effects are predicted.
- Representatives of national and local recreational societies and groups.
- Local elected officials.
- Local police force.
- Others identified by the Overseeing Organisation.

12.9 Assumptions and limitations

- 12.9.1 Assessment of construction noise and vibration is dependent on the availability of detailed construction plans and methodologies to reflect planned works. Information on construction activities to inform this PEI Report is limited to a high-level description of construction activities.
- 12.9.2 Noise predictions are based on representative methodologies in accordance with best practice guidance. However, there is an inherent level of uncertainty associated with the model predictions, for example, in relation to previous and future traffic forecasts. It has been assumed that any baseline data gathered is representative.
- 12.9.3 DMRB based assessments need to be proportionate to the scale of the scheme, accordingly the assessment to support the ES will require detailed topographical data for the proposed scheme and surrounding area. At this stage of assessment, horizontal and vertical alignments of the scheme are incorporated into the current acoustic model, however these may change as the design progresses. Public domain LiDAR topographical data is used within the existing acoustic model.
- 12.9.4 Ordnance Survey address-point data has been used to identify residential receptors.

12.10 Design, mitigation and enhancement measures

Design

- 12.10.1 The development of the scheme design is an iterative process, undertaken as part of an integrated design team to adhere the principles of the design and mitigation hierarchy outlined in DMRB LA 104. The first principle being to avoid adverse effects, if at all possible, before seeking to minimise or mitigate for any unavoidable impacts through a well-developed mitigation strategy. Embedded mitigation

incorporated into the scheme design development to date, such as the use of thin surface courses on new carriageways to provide a reduction in road surface noise, is outlined in Chapter 2 Section 2.6 of this report.

- 12.10.2 Additional opportunities for further embedded mitigation that will be considered during the development of the ongoing scheme design include increasing noise protection through the use of earthworks to protect sensitive noise receptors.

Mitigation measures – construction

- 12.10.3 To mitigate against construction noise and vibration effects mitigation measures could include, but are not limited to, the following:

- Implementation of Best Practicable Means (BPM) as defined by BS5228.
- Control of the timing of works.
- Restrictions on the noisiest of activities.
- Use of acoustic screening or enclosures around noisy items of plant and machinery.
- Careful siting of haul routes.
- Early construction of mitigation or screening where required for operational purposes.
- Careful site layout to minimise noise and vibration impacts (for example location of compounds and compound internal layout).
- Noise and vibration monitoring.
- Noise insulation or temporary rehousing.

- 12.10.4 The effects of potential noise and vibration on affected communities can be mitigated by effective communication between the promoter, contractor and the public. Prior notification of construction works to any potential affected residents will be required. Following that, investigation and remediation of noise issues during construction may also be required.

- 12.10.5 The use of BPM will be applied for noise control at all times during construction. These will include the selection of the most appropriate method and plant for the job, adequate maintenance of plant, optimum siting of stationary plant, local screening and the education of the workforce. Restrictions may also be placed on early/late delivery times.

- 12.10.6 Full details of all mitigation measures will be detailed within the ES and subsequently included in the scheme design and/or the Second Iteration EMP where appropriate.

Mitigation measures – operation

- 12.10.7 Following further assessment, full details of any noise mitigation measures required will be detailed within the ES. Mitigation measures

of relevance during operation may include the use of noise barriers and earth bunds.

- 12.10.8 Sound insulation packages for residences will also be considered where significant impacts remain after incorporation of reasonably practicable mitigation measures. It should be noted that this will have no effect on the surrounding environment.
- 12.10.9 Full details of all mitigation measures will be included within the ES and subsequently included within the scheme design and / or the Second Iteration EMP, where appropriate.

Enhancement measures

- 12.10.10 Enhancement measures will be considered as part of the ongoing design development, and will be reported in the ES. However, these enhancement measures will not be taken into account when determining whether effects are significant or not.

12.11 Assessment of effects

Construction

- 12.11.1 Details of construction activities for the proposed scheme are currently not available. Assumptions on high level construction activities, relevant plant, percentage 'on' times, and associated noise levels have been made using plant information from Annexes C and D of BS 5228-1¹⁹². Information on indicative construction activities and relevant plant is shown in Table 12.

Table 12.14: Indicative construction activities and relevant plant assumptions

Phase of work	Item of plant	Sound pressure level at 10m (dBA)	BS 5228-1 reference	% on-time in any given hour
Site clearance	Tracked excavator	77	C2.2	50
	Wheeled loader	76	C2.28	50
	Roller (rolling fill)	75	C5.20	25
Drainage	Wheeled excavator	70	C5.34	50
	Articulated dump truck	76	C6.27	50
Earthworks	Dozer	77	C5.12	50
	Lorry	79	C2.11	50
	Vibratory roller	75	C5.20	50
	Articulated dump truck	76	C6.27	50
Pavement and footways	Road planer	82	C5.7	25
	Asphalt paver (+ tipper lorry)	77	C5.31	50
	Vibratory roller	75	C5.20	50

	Large lorry concrete mixer	77	C4.21	50
Breaking and planing of existing carriageway	Road planer	82	C5.7	25
	Backhoe mounted hydraulic breaker	88	C5.1	50
	Road Breaker (hand-held pneumatic)	86	C5.4	50
Signing and street lighting	Lorry with lifting boom	77	C4.53	50
Structures	Mobile telescopic crane	78	C4.38	50
	Concrete mixer truck (discharging) & concrete pump (pumping)	75	C4.28	50
	Bored piling/pile cast in place. Crane mounted auger	83	D4.34	25

12.11.2 The plant noise levels and utilisation set out in Table 12 enable indicative construction noise levels to be estimated for each construction activity as a function of distance from the works, as set out in

12.11.3 Table **12.15:** and in line with the ABC method (see Table E.1 in BS 5228-1). The ABC categories and relevant noise levels are described in the following paragraph.

12.11.4 SOAEL for areas within Category A is 65, 55, and 45 dB $L_{Aeq,T}$ respectively for Day (including Saturday 07:00-13:00), Evening/ Weekend, and Night (23:00-07:00). SOAEL for areas within Category B is 70, 60, and 50 dB $L_{Aeq,T}$ respectively for Day (including Saturday 07:00-13:00), Evening/ Weekend, and Night (23:00-07:00). SOAEL for areas within Category C is 75, 65, and 55 dB $L_{Aeq,T}$ respectively for Day (including Saturday 07:00-13:00), Evening/ Weekend, and Night (23:00-07:00).

12.11.5 In the absence of temporary mitigation measures and by reference to

12.11.6 Table **12.15:** :

- Category A day-time SOAEL is not exceeded at distances greater than 100 metres, with the exception of 'Breaking and planing' activities which result in noise levels just above SOAEL at this distance. Night-time SOAEL is generally exceeded at the example distances, however on the assumption that all activities (unaltered) may take place during the night.
- Category B day-time SOAEL is not exceeded at distances greater than 50 metres, with the exception of 'Breaking and planing' activities which at a distance of 100 metres also fall below SOAEL. Night-time SOAEL is generally exceeded at the example distances

(except for particular activities), however on the assumption that all activities (unaltered) may take place during the night.

- Category C day-time SOAEL is not exceeded at distances greater than 25 metres, with the exception of 'Breaking and planing' activities which at a distance of 50 metres also fall below SOAEL. Night-time SOAEL is generally exceeded at distances less than 200 metres (except for particular activities), however on the assumption that all activities (unaltered) may take place during the night.

12.11.7 Note that the need for temporary mitigation measures will be evaluated as necessary once detailed construction information is available. This information will be included within the assessment presented within the ES and where necessary, mitigation measures will be incorporated within the First Iteration Environmental Management Plan.

Table 12.15: Indicative construction noise levels at different distances for example work phases

Phase of work	L _{Aeq,T} @10m	L _{Aeq,T} @25m	L _{Aeq,T} @50m	L _{Aeq,T} @100m	L _{Aeq,T} @200m
Site clearance	77	69	63	56	49
Earthworks and Drainage	81	73	66	60	53
Pavement and footways	80	72	66	59	52
Breaking and planing of existing carriageway	88	80	73	66	60
Signing and street lighting	74	66	59	53	46
Structures	80	72	65	59	52

12.11.8 Construction traffic flows would need to increase by 25% or more to lead to a 1dB increase in noise levels (at which point impacts would no longer be characterised as negligible). There is currently insufficient evidence to suggest this will occur.

12.11.9 Typical vibration levels for general plant (excluding piling) have been predicted for different distances to receptor locations based on the empirical formulae in Table E.1 of BS 5228-2¹⁹³, suggesting the vibration SOAEL of 1 mm/s would not be exceeded for distances greater than 12 metres. Typical vibration levels for piling plant, predicted using the same empirical formulae, suggest the vibration SOAEL of 1 mm/s would not be exceeded for distances greater than 32 metres. Piling activities that are most likely to result in vibration impacts are expected to be undertaken at distances of up to

approximately 55 metres from sensitive receptor locations, for example east of river Trent bridge. In view of BS 5228-2 propagation examples for rotary bored piling, the vibration SOAEL is not expected to be exceeded at these locations during piling activities. The vibration assessment will be further developed for the ES as more detailed construction information becomes available. It is noted vibration inducing works are primarily linear and are accordingly not expected to affect individual receptors for prolonged periods of time.

Operation

12.11.10 Compliance with the Noise Policy Statement for England (NPSE) is assessed in terms of predicted LOAEL and SOAEL exceedances for operational noise, as summarised in Table 12.16, based on traffic data available at the time of this assessment.

12.11.11 The number of properties with noise levels above the SOAEL in the DS scenario is predicted to be less than the DM scenario.

Table 12.16: Potential significance of operational noise

Scenario	Opening Year 2028		Future Year 2043	
	Number of Properties above the LOAEL, and below the SOAEL	Number of Properties above the SOAEL	Number of Properties above the LOAEL, and below the SOAEL	Number of Properties above the SOAEL
Do Minimum (DM)	3413	1227	3266	1243
Do Something (DS)	3566	1123	3569	1192

12.11.12 Results of the road traffic noise predictions for sensitive receptors is presented in Table 12.17 and Table 12.18, in line with DMRB LA 111 formatting requirements.

12.11.13 Table 12.17 shows that during the daytime a negligible change (-0.9 to 0.9 dB) for 9,206 residential receptors (and 138 non-residential), and a minor noise increase (1 to 2.9 dB) for 1,535 residential receptors (and 21 non-residential) is expected in the short-term for receptors within the study area. No moderate (3 to 4.9 dB) or major (5+ dB) increases due to the scheme are anticipated. A minor beneficial reduction (1 to 2.9 dB) in noise level is expected for 121 residential receptors (and three non-residential) during the daytime in the short-term.

12.11.14 Outside of the detailed study area, a minor decrease in noise is predicted on Long Lane, adjacent to Newark-on-Trent Golf Club, as a

result of predicted changes in traffic flows in the short term. Minor decreases are also predicted for Hockerton Road, Caunton Village, Norwell Road, Caunton Road and Vicarage Lane, on the route between the North Muskham junction on the A1 and Hockerton.

- 12.11.15 During the night-time, a negligible change (-0.9 to 0.9 dB) for 9,526 residential receptors (and 142 non-residential), and a minor noise increase (1 to 2.9 dB) for 1,233 residential receptors (and 18 non-residential) is expected in the short term for receptors within the study area. No moderate (3 to 4.9 dB) or major (5+ dB) increases due to the scheme are anticipated. A minor beneficial reduction (1 to 2.9 dB) in noise level is expected for 103 residential receptors (and two non-residential) during the night-time in the short-term.
- 12.11.16 Table 12.18 shows that during the daytime a negligible change (-0.9 to 0.9 dB) for 10,817 residential receptors (and 157 non-residential), and a minor noise increase (3 to 4.9 dB) for 40 residential receptors (and four non-residential) is expected in the long-term for receptors within the study area. A moderate increase (5 to 9.9 dB) in noise level is expected for three residential receptors (and one non-residential) during the daytime in the long-term. This is attributed to changes in traffic, not related to the scheme, on Newark-on-Trent Road. A minor beneficial reduction (1 to 2.9 dB) in noise level is expected for two residential receptors during the daytime in the long-term.
- 12.11.17 Outside of the detailed study area, a minor increase in noise is predicted on South Hykeham Road and Jerusalem Road, close to the A46 at Lincoln, as a result of predicted changes in traffic flows in the long-term. Minor noise increases are also predicted on Valley Lane, Staunton Road, Station Road-Cotham, Elston Lane and Top Street-Elston, between the Long Bennington junction on the A1 and Elston.
- 12.11.18 During the night-time, a negligible change (-0.9 to 0.9 dB) for 10,840 residential receptors (and 157 non-residential), and a minor noise increase (3 to 4.9 dB) for 20 residential receptors (and five non-residential) is expected in the long-term for receptors within the study area. A moderate increase (5 to 9.9 dB) in noise level is expected for two residential receptors in the long-term. This is attributed to changes in traffic, not related to the scheme, on Newark-on-Trent Road. There are no residential receptors were a minor beneficial reduction (1 to 2.9 dB) in noise level is expected during the night-time in the long-term.

Table 12.17: Operational noise assessment - short term (DM2028-DS2028)

Change in noise level dB(A)		Daytime		Night-time	
		Number of dwellings	Number of other noise sensitive receptors	Number of dwellings	Number of other noise sensitive receptors
Increase in noise level dB $L_{A10,18hr}/L_{night}$	<1.0	5,164	80	5,292	82
	1.0-2.9	1,535	21	1,233	18
	3-4.9	0	0	0	0
	>5	0	0	0	0
No Change	0	1,267	20	1,315	15
Decrease in noise level dB $L_{A10,18hr}/L_{night}$	<1.0	2,775	38	2,919	45
	1.0-2.9	121	3	103	2
	3-4.9	0	0	0	0
	>5	0	0	0	0

Table 12.18: Operational noise assessment - long term (DM2043*-DS2043)

Change in noise level dB(A)		Daytime		Night-time	
		Number of dwellings	Number of other noise sensitive receptors	Number of dwellings	Number of other noise sensitive receptors
Increase in noise level dB $L_{A10,18hr}/L_{night}$	<3.0	8,794	138	8,643	137
	3.0-4.9	40	4	20	5
	5-9.9	3	1	2	0
	>10+	0	0	0	0
No Change	0	814	5	880	6
Decrease in noise level dB $L_{A10,18hr}/L_{night}$	<3	1,209	14	1,317	14
	3.0-4.9	1	0	0	0
	5-9.9	0	0	0	0
	>10+	0	0	0	0

* The ES will assess long term impacts by comparing DM2028 against DS2043, in line with DMRB LA 111

12.12 Monitoring requirements for significant adverse effects

- 12.12.1 Any requirement for construction noise and vibration monitoring will be established when full details of the schedule and plant involved have been determined. Construction monitoring guidance is given in Annex G of BS 5228-1¹⁹² for noise, and Section 9 of BS 5228-2¹⁹³ for vibration. The procedure for monitoring operational noise is set out in Section III of CRTN¹⁹⁰.
- 12.12.2 Evaluation of monitoring results will be in accordance with Section 4 of DMRB LA 111 as follows:

- Likely significant effects from noise and/or vibration during construction shall be monitored.
- Likely significant environmental effects from noise during operation shall be monitored.

12.13 Conclusions

- 12.13.1 This chapter provides a summary of the assessments that have been undertaken so far on noise and vibration for the scheme, in accordance with DMRB LA 111. It sets out the criteria to determine the significance of noise and vibration effects of the scheme, and presenting anticipated changes in noise level in the short-term and long-term.
- 12.13.2 Analysis to date shows a small decrease in the number of receptors that would be exposed to noise levels above SOAEL in both the short-term and long-term (noise may still affect health and wellbeing even when noise levels are below SOAEL, since LOAEL is the level at which adverse effects on health and quality of life can be detected). Significant adverse effects due to vibration are not considered likely.
- 12.13.3 During construction, an on-balance Not Significant Adverse effect for both noise and vibration is anticipated with temporary mitigation and best practice measures in place. During operation, an overall Not Significant Adverse effect is anticipated for noise sensitive receptors.
- 12.13.4 An update to this assessment will be undertaken based on updated traffic data for the scheme, which accounts for the final design, once it is available. This will be reported within the ES that will be submitted to support the DCO application.

13 Population and Human Health

13.1 Introduction

13.1.1 This chapter presents the on-going work for the assessment of the potential effects associated with the proposed scheme upon population and human health, both during construction and operation. This includes consideration of the potential for impacts arising with regard to:

- Land use and accessibility, including:
 - Residential property and housing
 - Community land and assets
 - Development land and businesses
 - Agricultural land holdings
 - Walkers, cyclists and horse riders (WCHs)
- Human health, including a range of personal, social, economic and environmental factors that influence human health status, such as:
 - Neighbourhood quality
 - Access to services, health and social care
 - Social capital
 - Employment and income
 - Access to green space, recreation and physical activity

13.1.2 The potential effects have been considered following the guidance contained in the Design Manual for Roads and Bridges (DMRB) LA 112 Population and Human Health and Institute of Environmental Management and Assessment's (IEMA) 'Health in Environment Impact Assessment: A Primer for a Proportionate Approach'. Further detailed assessment is currently under way and will be reported within the ES that will be submitted to support the Development Consent Order (DCO) application.

13.2 Legislation and policy context

13.2.1 The following legislation and policy are relevant to the proposed scheme.

Legislation

13.2.2 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Department for Communities and Local Government, 2017), states that the EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the Proposed Development on population and human health.

- 13.2.3 The Countryside Rights of Way Act, 2000²⁰² is the main legal framework governing public footpaths, bridleways, traffic and restricted byways. The Act makes provision for public access to the countryside; sets out provision for the management and maintenance of Public Rights of Way; and makes allowance for temporary diversions to rights of way in order to carry out certain types of work.
- 13.2.4 The Environment Act 2021²⁰³ is the new framework for environmental protection in the UK, aiming to improve air quality and other environmental pollutions which may have impacts on local human health.
- 13.2.5 The Equality Act 2010 requires decision making to have due regard to the need to remove discrimination and support equality of opportunity for a range of 'protected characteristic' groups. This will be further considered within the Equality Impact Assessment for the scheme.

National Policy

National Policy Statement for National Networks²⁰⁴

- 13.2.6 The NPSNN sets out the Government's vision and strategic objectives for national networks, including improving overall quality of life, journey quality, reliability and safety and linking up communities. The Government deliver national networks that meet the country's long-term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of the wider transport system. Junction improvement is considered as a measure which will be used to enhance the existing national road network towards this vision.
- 13.2.7 Within the NPSNN, the Government has committed to create a more accessible and inclusive transport network that provides a range of opportunities and choice for people to connect with jobs, services and friends and family. It is stated that applicants are expected to deliver improvements that reduce community severance and improve accessibility and inclusivity (Section 3.19 to 3.22).
- 13.2.8 It is acknowledged in the NPSNN that new or enhanced national network infrastructure may have direct and indirect impacts on health, wellbeing and the quality of life of the population. An ES should identify and set out the assessment of likely significant adverse health impacts, where the proposed project is likely to have significant environmental impacts that would have an effect on human beings.

²⁰² UK Government. 2020. Countryside and Rights of Way Act. Available at: <https://www.legislation.gov.uk/ukpga/2000/37/contents>

²⁰³ UK Government. 2021. Environment Act. Available at: <https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted>

²⁰⁴ Department for Transport (2014) National Networks National Policy Statement [online] available at: National Policy Statement for National Networks (publishing.service.gov.uk)

The applicant should identify measures to avoid, reduce or compensate for adverse health impacts as appropriate (Section 4.79 to 4.82).

- 13.2.9 Applicants are required to consider taking appropriate mitigation measures to address adverse effects on PRow and consider opportunities to improve access, in accordance with the requirements associated with the assessment of impact on open space, green infrastructure and Green Belt. Also, consideration needs to be given to the use, character, attractiveness and convenience of the PRow (Section 5.162 to 5.185).

National Planning Policy Framework²⁰⁵

- 13.2.10 The NPPF sets out the Government's planning policies for England and the requirements for the planning system. It provides a framework within which Local Authorities and residents can produce local and neighbourhood plans reflecting the needs and priorities of communities.
- 13.2.11 Section 8 sets out core planning principles of the NPPF to achieve healthy, inclusive and safe places by promoting social interaction, ensuring safety and accessibility of public areas and supporting healthy lifestyles. This also includes addressing identified local health and wellbeing needs through provision of safe and accessible green infrastructure.
- 13.2.12 The same section presents core principles to support access to a network of high quality open spaces and opportunities for sport and physical activity. Planning policies and decisions should protect and enhance PRow and National Trails to support population health.
- 13.2.13 Section 9 encourages developments that provide opportunities for sustainable transport, particularly by giving priority to pedestrian and cycle movements, and providing access to high quality public transport facilities.

Local Policy

- 13.2.14 Local planning policy of relevance to the Proposed Development is outlined below.

²⁰⁵ Communities and Local Government (2012) National Planning Policy Framework [online] available at: Title (publishing.service.gov.uk)

Local Development Framework Amended Core Strategy²⁰⁶

- 13.2.15 This document sets out the key issues that Newark and Sherwood District Council and their partners need to address over the next twenty years. It sets out a vision, a series of objectives and policies to deliver them.
- 13.2.16 As part of the Council's vision, the document notes that 'By 2033, Newark-on-Trent and Sherwood will become: An area providing a high quality of life, made up of thriving sustainable urban and rural communities where people want to and can, live and work' and that 'Access will be improved, key transport improvements will have been secured and non-car use encouraged'.
- 13.2.17 Key strategic objectives include: 'To ensure and sustain a network of sustainable communities which offer a sense of place, that are safe, balanced, socially inclusive and can respond to the needs of local people' and 'To retain and improve accessibility for all, to employment, services, community, leisure and cultural activities, through the integration of development and transport provision, ensuring that most new development will be located where it is accessible to use services and facilities by a range of means of transport'.

Newark and Sherwood District Council Community Plan (2020-2023)²⁰⁷

- 13.2.18 This document sets out the Council's objectives over for 2020-2013, building on previous published plans.
- 13.2.19 As part of the Council's vision, the document notes 'We want to do all we can to enable local residents and businesses to flourish and fulfil their potential as well as encouraging more visitors to enjoy all that Newark-on-Trent and Sherwood has to offer. In order to achieve these, we will be locally focused and nationally connected - driven by what matters most to the people we serve and with a perspective and relationships stretching well beyond our boundaries.' A key objective is to 'improve the health and wellbeing of local residents'. Key ambitions for this Strategy are 'To have healthy and sustainable places' and 'To enable healthier decision making'.

²⁰⁶ Newark and Sherwood District Council, 2019. Local Development Framework Amended Core Strategy. Available at: <https://www.newark-sherwooddc.gov.uk/media/newark-and-sherwood/images-and-files/planning-policy/pdfs/core-strategy/ACS2019.pdf>

²⁰⁷ Newark and Sherwood District Council, 2020. Newark and Sherwood District Council Community Plan (2020-2023) Available at: <https://www.newark-sherwooddc.gov.uk/media/newark-and-sherwood/images-and-files/strategies-and-policies/pdfs/13.10.20---Community-Plan-Appendix---Final.pdf>

Newark-on-Trent and Sherwood Wellbeing Partnership Plan (2019-2022)²⁰⁸

13.2.20 The Newark-on-Trent and Sherwood Health and Wellbeing Partnership acts as the local place-based delivery group of the Nottinghamshire Health & Wellbeing Board, delivering the Strategy's healthy and sustainable places ambitions. The vision for this Strategy is 'Working together to enable the people of Nottinghamshire, from the youngest to the oldest, to live happier and healthier lives in their communities, particularly where the need is greatest.'

Newark and Sherwood District Council Economic Growth Strategy (2021-2026)²⁰⁹

13.2.21 Newark and Sherwood District Council's Economic Growth Strategy 2021-2026 defines how the Council will work with businesses and residents to lead the local economy and 'build a shared prosperity'.

13.2.22 Feeding into the Economic Growth Strategy, the Infrastructure Delivery Plan (2010) identifies the various forms of infrastructure that are required to meet the level of growth anticipated in the area up until 2026²¹⁰. It identifies sections of the A46 as requiring improvements in order to accommodate planned growth in the area.

National Highways policy

National Highways Environment Strategy

13.2.23 Section 1.3.5.2 states that the National Highways Environment Strategy²¹¹ sets out National Highways' vision that will guide its environmental actions and activities over the next five years. The strategy outlines National Highways' commitment to improving its environmental outcomes. The part of the strategy with particular relevance to this chapter is the 'lever' which focusses on protecting the health, safety and wellbeing of people living within the vicinity of NH schemes.

²⁰⁸ Newark and Sherwood District Council, 2019, Newark and Sherwood Wellbeing Partnership Plan (2019-2022). Available at: <https://www.newark-sherwooddc.gov.uk/media/newark-and-sherwood/images-and-files/economic-development/Newark-&-Sherwood-Economic-Growth-Strategy-2021-2026.pdf>

²⁰⁹ Newark and Sherwood District Council, 2023. Economic Growth Strategy. Available at: <https://www.newark-sherwooddc.gov.uk/media/newark-and-sherwood/images-and-files/economic-development/Newark-&-Sherwood-Economic-Growth-Strategy-2021-2026.pdf>

²¹⁰ Newark and Sherwood District Council. 2010. Infrastructure Delivery Plan. Available at: <https://www.newark-sherwooddc.gov.uk/media/newark-and-sherwood/images-and-files/planning-policy/pdfs/infrastructure/infrastructure-delivery-plan/Infrastructure-Delivery-Plan--Main-Text.pdf>

²¹¹ National Highways (2015) National Highways Environment Strategy [online]. Available at: [Environment_Strategy__21____.pdf](https://www.environment.service.gov.uk/publishing/Environment_Strategy__21____.pdf) (publishing.service.gov.uk) (Last accessed September 2022).

National Highways Air Quality Strategy

13.2.24 Section 1.3.5.3 states that the National Highways Air Quality Strategy²¹² sets out National Highways' strategy to improve air quality on and around the strategic network, through to 2021. Air quality is a factor which can impact human health and one which is considered within this chapter.

National Highways Delivery Plan (2020- 2025)

13.2.25 Section 1.3.6 sets out the National Highways Delivery Plan 2020-25²¹³, which details how National Highways will invest in the network over the second road period (2020-25) and have set out deliverables for 2020-21. A key aim of the strategy is to deliver environmental, social and economic benefits both nationally and regionally, highlights its relevance to this chapter.

National Highways sustainable development strategy

13.2.26 Section 1.3.8 sets out the National Highways sustainable development strategy²¹⁴. The strategy states that sustainable development can be put into practice by focussing on the five capitals of sustainability. The pillars of 'human' and 'social' are of particular relevance to this chapter.

13.3 Assessment methodology

13.3.1 The approach used to undertake the Population and Human Health assessment comprises of two methodologies – one for land-use and accessibility (see section 13.3.7 - 13.3.9) and another for human health (see section 13.3.10 - 13.3.15).

13.3.2 The assessment will use desk-based information available from the Office for National Statistics, Addressbase, Public Health (England) and Newark and Sherwood District Council; as well as drawing upon information determined as part of the assessment of other relevant disciplines presented within the ES.

13.3.3 The following standards and guidelines are considered to be relevant to the assessment of population and human health effects.

- The DMRB LA112 Population and Human Health.
- IEMA Health in Environmental Impact Assessment: A primer for proportionate approach.

²¹² National Highways (2017) National Highways Air Quality Strategy [online] available at: Highways England Air Quality Strategy - GOV.UK (www.gov.uk) (Last accessed September 2022).

²¹³ National Highways Delivery Plan 2020-2025 [online] available at: 5-year-delivery-plan-2020-2025-final.pdf (nationalhighways.co.uk) (Last accessed September 2022).

²¹⁴ National Highways Sustainable Development Strategy [online] available at: sustainable_development_strategy.pdf (nationalhighways.co.uk) (Last accessed September 2022).

13.3.4 The assessment will focus on those impacts that are likely to have significant effects on population and human health conditions and will be completed in accordance with the standard on population and human health impact assessment included in DMRB LA 112. Significance is determined by considering the sensitivity of the receptor, as well as the magnitude of the impact on those receptors.

Land-use and accessibility

Sensitivity

13.3.5 Table 13.1 below sets out criteria that will be used to describe and assess the sensitivity of receptors, as outlined in DMRB LA 112 Population and human health, Revision 1.

Table 13.1 Sensitivity criteria

Sensitivity	Sensitivity criteria
Very high	<p>Private property and housing:</p> <ul style="list-style-type: none"> • Existing private property or land allocated for housing located in a local authority area where the number of households are expected to increase by >25% by 2041 (ONS data). • Existing housing and land allocated for housing (e.g. strategic housing sites) covering >5ha and/or >150 houses. <p>Community land and assets where there is a combination of the following:</p> <ul style="list-style-type: none"> • Complete severance between communities and their land/assets, with little/no accessibility provision • Alternatives are only available outside the local planning authority area. • The level of use is very frequent (daily). • The land and assets are used by the majority (>=50%) of the community. <p>Development land and businesses:</p> <ul style="list-style-type: none"> • Existing employment sites (excluding agriculture) and land allocated for employment (e.g. strategic employment sites) covering >5ha. <p>Agricultural land holdings:</p> <ul style="list-style-type: none"> • Areas of land in which the enterprise is wholly reliant on the spatial relationship of land to key agricultural infrastructure. • Access between land and key agricultural infrastructure is required on a frequent basis (daily). <p>WCH:</p> <ul style="list-style-type: none"> • National trails and routes likely to be used for both commuting and recreation that record frequent (daily) use. Such routes connect

Sensitivity	Sensitivity criteria
	<p>communities with employment land uses and other services with a direct and convenient WCH route. Little/no potential for substitution.</p> <ul style="list-style-type: none"> • Routes regularly used by vulnerable travellers such as the elderly, school children and people with disabilities, who could be disproportionately affected by small changes in the baseline due to potentially different needs. • Rights of way for WCH crossing roads at-grade with >16,000 vehicles per day.
High	<p>Private property and housing:</p> <ul style="list-style-type: none"> • Private property or land allocated for housing located in a local planning authority area where the number of households are expected to increase by 16-25% by 2041 (ONS data). • Existing housing and land allocated for housing (e.g. strategic housing sites) covering >1-5ha and/or >30-150 houses. <p>Community land and assets where there is a combination of the following:</p> <ul style="list-style-type: none"> • There is substantial severance between community and assets, with limited accessibility provision. • Alternative facilities are only available in the wider local planning authority area. • The level of use is frequent (weekly). • The land and assets are used by the majority (>=50%) of the community. <p>Development land and businesses:</p> <ul style="list-style-type: none"> • Existing employment sites (excluding agriculture) and land allocated for employment (e.g. strategic employment sites) covering >1 - 5ha. <p>Agricultural land holdings:</p> <ul style="list-style-type: none"> • Areas of land in which the enterprise is dependent on the spatial relationship of land to key agricultural infrastructure. • Access between land and key agricultural infrastructure is required on a frequent basis (weekly). <p>WCH:</p> <ul style="list-style-type: none"> • Regional trails and routes (e.g. promoted circular walks) likely to be used for recreation and to a lesser extent commuting, that record frequent (daily) use. Limited potential for substitution. • Rights of way for WCH crossing roads at-grade with >8,000 - 16,000 vehicles per day.
Medium	<p>Private property and housing:</p> <ul style="list-style-type: none"> • Houses or land allocated for housing located in a local authority area where the number of households are expected to increase by >6-15% by 2041 (ONS data).

Sensitivity	Sensitivity criteria
	<ul style="list-style-type: none"> • Existing housing and land allocated for housing (e.g. strategic housing sites) covering <1ha and/or <30 houses. <p>Community land and assets where there is a combination of the following:</p> <ul style="list-style-type: none"> • There is severance between communities and their land/assets but with existing accessibility provision. • Limited alternative facilities are available at a local level within adjacent communities. • The level of use is reasonably frequent (monthly). • The land and assets are used by the majority (>=50%) of the community. <p>Development land and businesses:</p> <ul style="list-style-type: none"> • Existing employment sites (excluding agriculture) and land allocated for employment (e.g. strategic employment sites) covering <1ha. <p>Agricultural land holdings:</p> <ul style="list-style-type: none"> • Areas of land in which the enterprise is partially dependent on the spatial relationship of land to key agricultural infrastructure. • Access between land and key agricultural infrastructure is required on a reasonably frequent basis (monthly). <p>WCH:</p> <ul style="list-style-type: none"> • Public Rights of Way and other routes close to communities which are used for recreational purposes (e.g. dog walking), but for which alternative routes can be taken. These routes are likely to link to a wider network of routes to provide options for longer, recreational journeys. • Rights of way for WCH crossing roads at-grade with >4,000 – 8,000 vehicles per day.
Low	<p>Private property and housing:</p> <ul style="list-style-type: none"> • Proposed development on unallocated sites providing housing with planning permission/in the planning process. <p>Community land and assets where there is a combination of the following:</p> <ul style="list-style-type: none"> • Limited existing severance between community and assets, with existing Equality Act 2010 compliant accessibility provision. • Alternative facilities are available at a local level within the wider community. • The level of use is infrequent (monthly or less frequent). • The land and assets are used by the minority (>=50%) of the community. <p>Development land and businesses:</p>

Sensitivity	Sensitivity criteria
	<ul style="list-style-type: none"> • Proposed development on unallocated sites providing employment with planning permission/in the planning process. <p>Agricultural land holdings:</p> <ul style="list-style-type: none"> • Areas of land which the enterprise is not dependent on the spatial relationship of land to key agricultural infrastructure. • Access between land and key agricultural infrastructure is required on an infrequent basis (monthly or less frequent). <p>WCH:</p> <ul style="list-style-type: none"> • Routes which have fallen into disuse through past severance or which are scarcely used because they do not currently offer a meaningful route for either utility or recreational purposes. • Rights of way for WCH crossing roads at-grade with <4,000 vehicles per day.
Negligible	<p>Private property and housing:</p> <ul style="list-style-type: none"> • N/A. <p>Community land and assets where there is a combination of the following:</p> <ul style="list-style-type: none"> • No or limited severance or accessibility issues. • Alternative facilities are available within the same community. • The level of use is very infrequent (a few occasions yearly). • The land and assets are used by the minority (>=50%) of the community. <p>Development land and businesses:</p> <ul style="list-style-type: none"> • N/A. <p>Agricultural land holdings:</p> <ul style="list-style-type: none"> • Areas of land which are infrequently used on a non-commercial basis. <p>WCH:</p> <ul style="list-style-type: none"> • N/A.

Source: DMRB LA 112 Population and human health, Revision 1, Table 11 Environmental value (sensitivity) and descriptions.

Magnitude

13.3.6 The magnitude of impacts will be assessed following the principles below. Table 13.2 below sets out criteria that will be used to describe and assess the impact on community and health receptors, as outlined in DMRB LA 112 Population and human health, Revision 1.

Table 13.2: Impact magnitude criteria for receptors

Magnitude	Criteria
Major	<p>Private property and housing, community land and assets, development land and businesses and agricultural land holdings:</p> <ul style="list-style-type: none"> • Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. e.g. direct acquisition and demolition of buildings and direct development of land to accommodate highway assets. • Introduction (adverse) or removal (beneficial) of complete severance with no/full accessibility provision. <p>WCH:</p> <ul style="list-style-type: none"> • >500m increase (adverse)/decrease (beneficial) in WCH journey length.
Moderate	<p>Private property and housing, community land and assets, development land and businesses and agricultural land holdings:</p> <ul style="list-style-type: none"> • Partial loss of/damage to key characteristics, features or elements, e.g. partial removal or substantial amendment to access or acquisition of land compromising viability of property, businesses, community assets or agricultural holdings. • Introduction (adverse) or removal (beneficial) of severe severance with limited/moderate accessibility provision. <p>WCH:</p> <ul style="list-style-type: none"> • >250m - 500m increase (adverse) or decrease (beneficial) in WCH journey length.
Minor	<p>Private property and housing, community land and assets, development land and businesses and agricultural land holdings:</p> <ul style="list-style-type: none"> • A discernible change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements, e.g. amendment to access or acquisition of land resulting in changes to operating conditions that do not compromise overall viability of property, businesses, community assets or agricultural holdings. • Introduction (adverse) or removal (beneficial) of severance with adequate accessibility provision.. <p>WCH</p> <ul style="list-style-type: none"> • >50m - 250m increase (adverse) or decrease (beneficial) in WCH journey length.
Negligible	<p>Private property and housing, community land and assets, development land and businesses and agricultural land holdings:</p> <ul style="list-style-type: none"> • Very minor loss or detrimental alteration to one or more characteristics, features or elements. e.g. acquisition of non-operational land or buildings not directly affecting the viability of property, businesses, community assets or agricultural holdings.

Magnitude	Criteria
	<ul style="list-style-type: none"> • Very minor introduction (adverse) or removal (beneficial) of severance with ample accessibility provision. <p>WCH</p> <ul style="list-style-type: none"> • <50m increase (adverse) or decrease (beneficial) in WCH journey length.
No change	No loss or alteration of characteristics, features, elements or accessibility; no observable impact in either direction.

Source: DMRB LA 112, Revision 1, Table 3.12 Magnitude of impact and typical descriptions

Significance

13.3.7 Subsequent to identifying an appropriate receptor sensitivity and magnitude of impact using Table 13.4 and Table 13.5 above, the likely significance category and overall significance of effects would be assessed by using the matrix provided in Table 5.2, along with professional judgment to consider site specific factors that may be of relevance.

Human health

13.3.8 There is no formal guidance on considering health within the context of EIA. However, the legislation, policy and policy outlined in section 13.2 are considered to be relevant to the assessment of human health effects due to the scheme. The following standards and guidelines have also informed the assessment methodology:

- The Design Manual for Roads and Bridges (DMRB) LA112 Population and Human Health.
- Institution of Environmental Management and Assessment (IEMA) Health in Environmental Impact Assessment: A primer for a proportionate approach.

13.3.9 It is important to note that a health effect does not need to meet all of the sensitivity/magnitude characteristics to be assigned to a specific category.

13.3.10 The sensitivity of a community/population from health point of view shall be reported as²¹⁵:

- Low
- Medium
- High

13.3.11 The likely health outcome(s) will be identified in line with the categories in Table 13.3 below.

²¹⁵ DMRB LA112 Revision 1

Table 13.3: Human health outcome categories

Health outcome category	Health outcome description
Positive	A beneficial health impact is identified
Neutral	No discernible health impact is identified
Negative	An adverse health impact is identified
Uncertain	Where uncertainty exists as to the overall health impact

Source: DMRB LA112 Revision 1, Table 3.32 Human health outcome categories

13.3.12 The magnitude of impacts will be assessed using professional judgement and following the principles below. Table 13.4 below sets out criteria that will be used to describe and assess the impact on community and health receptors, as outlined in DMRB LA 112 Population and human health, Revision 1. The significance matrix referenced in Table 5.2 does not apply to rating effects on human health, because the significance of effect is reported as negligible, minor, moderate or major.

Table 13.4: Impact magnitude criteria

Magnitude of impacts	Criteria
Major (adverse or beneficial)	<ul style="list-style-type: none"> • A strong evidence base that risk factors for a permanent, progressive or irreversible health condition would be affected (positively or negatively) • Permanent or irreversible exposure or change over a long duration • Substantial change (positive or negative) from the baseline position • Highly deprived communities affected • A large widening or narrowing of inequalities • Majority of the population affected (positively or negatively)
Moderate (adverse or beneficial)	<ul style="list-style-type: none"> • A strong evidence base that risk factors for a non-permanent, reversible, non-progressive health condition would be affected (positively or negatively) • A small change (positive or negative) from the baseline position • Severity predominantly related to moderate changes in morbidity • A community with average deprivation affected • A small widening or narrowing of inequalities • Many people in a community affected (positively or negatively)
Minor (adverse or beneficial)	<ul style="list-style-type: none"> • A strong evidence base that risk factors for transient, temporary symptoms (e.g. irritation, nausea or headache) would be affected (positively or negatively) • Short-term duration • Occasional events

Magnitude of impacts	Criteria
	<ul style="list-style-type: none"> • Small minority of population affected • A slight change (positive or negative) from the baseline position with evidence available to demonstrate change • A community with low deprivation affected • A slight widening or narrowing of inequalities with evidence available to demonstrate change • Few people in a community affected (positively or negatively)
Negligible	<ul style="list-style-type: none"> • No discernible change in health or wellbeing within normal variations • Very short-term duration • Very few people affected • Immediate reversal once activity complete • No discernible change (positive or negative) from baseline positions • No discernible widening or narrowing of inequalities

Source: DMRB LA 112: Population and human health

13.3.13 A detailed health profile will be developed in line with the health determinants identified in section 3.21 of DMRB LA 112 in future stages of the EIA by interviewing sensitive receptors and undertaking a desk-based analysis of data.

13.4 Study area

13.4.1 Study areas have been defined in accordance with DMRB LA 112 Population and Human Health²¹⁶ and professional judgement²¹⁷. The population and human health assessment, for both the construction and operational phases, have been conducted at both a Local Impact Area (LIA) level and a Wider Impact Area (WIA) level dependent on the type of impact being assessed. The study areas are defined as follows:

- Local Impact Area (LIA): The area located within 500 metres of the scheme footprint (shown on Figure 13.1 contained in Volume 2).
- Wider Impact Area (WIA): The area covered by the local authority of Newark and Sherwood District Council, which includes the closest settlements of Newark-on-Trent-on-Trent and Winthorpe (shown on Figure 13.2 contained in Volume 2).

13.4.2 The LIA is the primary study area for land-use and accessibility and is designed to capture most potential population and human health effects during construction and operation of the scheme.

²¹⁶ National Highways (2020): DMRB - LA 112 Population and Human Health.

²¹⁷ Professional judgement is used where there is no standard definition of the study area for effects, for example employment.

13.4.3 The WIA includes the extent of the area that may be affected by the construction and operation of the scheme, and is used for the consideration of human health effects and potential effects on economic activity. The WIA also covers the extent of the ARN which ensures that the effects of the scheme upon traffic that may result in an impact upon human health (noise and air quality) are fully assessed. This is important as one of the objectives of the scheme is to support the economic growth aspirations of the district and the region by providing a more reliable road network.

13.5 Existing baseline

13.5.1 A range of publicly available data sources have been used to determine the population and human health baseline. These include statistics on demographics and employment from the Office for National Statistics (ONS), health statistics from Public Health England, and Newark and Sherwood District Council local authority data on land use and resources.

Land use and accessibility

Residential property and housing

13.5.2 There are approximately 420 residential properties within the LIA (see Figure 13.3 contained in Volume 2).

13.5.3 Key communities near to the scheme are Newark-on-Trent-on-Trent to the south west of the scheme, accessed from the A46 via Farndon Road; Great North Road, and Lincoln Road; and the village of Winthorpe, located to the north east of the scheme, accessed via the A1133.

Community land and assets

13.5.4 There are a number of community resources located within the LIA (see Figure 13.4 contained in Volume 2, including those listed below:

- Newark-on-Trent Rugby Club, Kelham Road, located approximately 250m to the north west of the proposed scheme.
- Sconce and Devon Park, Boundary Road, approximately 500m to the south west of the proposed scheme.
- Lovers Lane Primary School, Warburton Street, approximately 500m to the south of the proposed scheme.
- Bishop Alexander Primary School, Alexander Avenue, approximately 270m to the south of the proposed scheme.
- Newark-on-Trent Showground, Lincoln Road, approximately 470m to the south east of the proposed scheme.
- Newark-on-Trent Golf Centre, Drove Lane, approximately 120m to the south east of the proposed scheme.
- Newark-on-Trent Indoor Bowls Centre, Lincoln Road, approximately 36m to the south of the proposed scheme.

- Newark-on-Trent Showground, Lincoln Road, approximately 300m south east of the proposed scheme.
- All Saints' Church Winthorpe, Gainsborough Road, approximately 450m to the north of the proposed scheme.
- Winthorpe Community Centre, Woodlands, approximately 500m to the north east of the proposed scheme
- Winthorpe Primary School, Thoroughfare Lane, approximately 500m to the north east of the proposed scheme.
- Newark-on-Trent, Ransome & Marles Cricket Club, approximately 30m to the south west of the proposed scheme.

Development land and businesses

13.5.5 The Development Plan for the Newark-on-Trent and Sherwood District comprises the Amended Core Strategy (adopted 7 March 2019)²¹⁸ and Allocations & Development Management (adopted 16th July 2013) Development Plan Documents²¹⁹.

13.5.6 Within the LIA the Newark-on-Trent and Sherwood Local Plan outlines plans for strategic sites, open breaks, sites of interest in nature conservation, housing sites with planning permission, public open spaces, employment sites with planning permission, housing allocations, Spatial Policy 7 transport schemes, and mixed-use allocations.

13.5.7 The following sites were identified within the LIA (shown on Figure 13.6 contained in Volume 2:

- three employment sites with planning permission
- four housing sites with planning permission
- two mixed use allocations
- the transport scheme, Newark-on-Trent Flyover which is supported by Policy 7 in the Amended Core Strategy (2019).

²¹⁸ Newark and Sherwood District Council, 2019. Amended Core Strategy. Available at: <https://www.newark-sherwooddc.gov.uk/media/nsdc-redesign/documents-and-images/your-council/planning-policy/local-development-framework/amended-core-strategy-dpd/amended-core-strategy-DPD.pdf>

²¹⁹ Newark and Sherwood District Council, 2013. Allocations & Development Management Plan. Available at: <https://www.newark-sherwooddc.gov.uk/media/nsdc-redesign/documents-and-images/your-council/planning-policy/supplementary-planning-information/allocations-and-development-management-dpd/Allocations-and-Development-Management-Development-Plan-Document.pdf>

Agricultural land holdings

13.5.8 There are approximately 550 agricultural land holdings within the LIA. These are a mixture of freehold and leasehold. Much of the land within the LIA is used for arable production.

Walkers, cyclists and horse riders

13.5.9 According to Newark and Sherwood District Council Public Right of Way data, there are a number of PRow (footpaths and bridleways) in the LIA. These include:

- Newark-on-Trent BW2: Bridleway following the southern side of the River Trent.
- Newark-on-Trent BW5: Bridleway following on from BW5 along the southern side of the River Trent.
- Newark-on-Trent BW6: Bridleway following on from BW6 along the southern side of the River Trent.
- Winthorpe FP2: Footpath through Winthorpe village and crossing the A46.

13.5.10 There are further walking, cycling and horse-riding (WCH) amenities in the LIA study area including long distance routes (such as Lark Valley Path and Trent Valley Long Distance Path), and road crossings which will be identified in further detail in the ES.

13.5.11 According to Sustrans National Cycle Network data, National Cycle Network Route 64 passes within in the LIA.

13.5.12 At this stage information on the level and frequency of use and type of user (for example, whether vulnerable travellers use any routes in the LIA) of different WCH routes is not known.

Human health

Human health profiles of affected communities

Population

13.5.13 Newark-on-Trent-on-Trent is a market town in the Newark-on-Trent and Sherwood district of Nottinghamshire, approximately 27km north-east of Nottingham. The population of the LIA is 11,773. Table 13.5 shows the demographic structure of the LIA, Newark-on-Trent and Sherwood, East Midlands and England.

Table 13.5: Demographic structure of the LIA

	Total population	Children (<16 years)	Young people (16-24 years)	Working age (16-64 years)	Older people (65+ years)
Local impact area	11,773	18%	9%	63%	19%
Newark-on-Trent and Sherwood	123,127	18%	9%	60%	22%
East Midlands	4,865,583	19%	11%	62%	20%
England	56,550,138	19%	11%	62%	19%

Source: ONS 2020 mid-year population estimates

Deprivation

- 13.5.14 The England Indices of Multiple Deprivation (IMD) is used for the measurement and comparison of relative levels of deprivation. Table 13.6 shows the income deprivation quintiles across the LIA, Newark-on-Trent and Sherwood, East Midlands, and England.
- 13.5.15 Most of the LIA (61%) is within the most or second most deprived quintiles, whereas half (50%) of the Newark-on-Trent and Sherwood district is within the third and fourth most deprived quintiles. This indicates that the LIA does not perform as well as the district in terms of deprivation.

Table 13.6: Income deprivation quintiles

Location	Most deprived quintile	Second most deprived quintile	Third most deprived quintile	Fourth most deprived quintile	Least deprived quintile
Local impact area	27%	34%	8%	32%	0%
Newark-on-Trent and Sherwood	14%	19%	28%	22%	17%
East Midlands	18%	20%	19%	21%	22%
England	20%	21%	20%	20%	19%

Source: ONS 2020 mid-year population estimates and MHCLG 2019 Indices of Multiple Deprivation

13.5.16 Table 13.7 shows key unemployment indicators across the LIA, Newark-on-Trent and Sherwood, the East Midlands and England. The percentage of the working age population that are unemployed and the monthly average percentage of the working age population claiming job seekers allowance (JSA) and universal credit within the LIA and district align with the proportions for the East Midlands and England.

Table 13.7: Unemployment indicators

	Local impact area	Newark-on-Trent and Sherwood	East Midlands	England
% working age population unemployed	19%	20%	19%	18%
Monthly average % working age population claiming JSA and universal credit	n/a	4.0%	4.6%	5.5%

Source: ONS Annual Population Survey Jan 2021-Dec 2021, ONS Claimant Count Jan 2021-Dec 2021 and ONS 2020 mid-year population estimates

Health indicators

13.5.17 Table 13.8 presents key health indicators within the LIA, Newark-on-Trent and Sherwood, East Midlands and England.

13.5.18 The indicators for the LIA (where available) and Newark-on-Trent and Sherwood broadly align with the equivalent data presented for the East Midlands and England. However, the under 75 mortality rate from cardiovascular disease and the mortality rate from Chronic Obstructive Pulmonary Disease (COPD) are considerably lower than the regional and national rates. Moreover, the percentage of physically active

adults is considerably higher for Newark-on-Trent and Sherwood (72.5%) than the region (64.5%) and national (65.9%) proportions.

Table 13.8: Health indicators

	Local impact area	Newark-on-Trent and Sherwood	East Midlands	England
Long term health problem or disability	19%	20%	19%	18%
Life expectancy at birth for females (2018-2020)	n/a	82.7	82.7	83.1
Life expectancy at birth for males (2018-2020)	n/a	79.8	79.2	79.4
Under 75 mortality rate from all cardiovascular disease	n/a	58.1	72.1	70.4
Under 75 mortality rate from all respiratory disease	n/a	32.8	34.3	33.6
Mortality rate from Chronic Obstructive Pulmonary Disease (COPD)	n/a	45.1	53.6	52.8
Percentage of physically active adults	n/a	72.5%	64.5%	65.9%

Sources: ONS life expectancy estimates, all ages, UK, 2018-2020/Public Health England Profile 2017-2019, 2011 Census, ONS – long-term health problem or disability.

Health determinants

13.5.19 Health determinants include the range of personal, social, economic, and environmental factors that influence human health status²²⁰. The DMRB LA 112 specifies the indicative types of human health determinants, which include:

- The location and type of community, recreational and education facilities and severance/separation of communities from such facilities.
- The location of green and open space and severance/separation from such facilities.
- The location of healthcare facilities and severance/separation from such facilities.

²²⁰ UK Government (2017) Chapter 6: social determinants of health. Available at: <https://www.gov.uk/Government/publications/health-profile-for-england/chapter-6-social-determinants-of-health>

- Outline spatial characteristics of the transport network and usage in the area²²¹.
- Air quality management areas and ambient air quality.
- Noise sensitive areas.
- Sources and pathways of potential pollution.
- Landscape amenity.
- Safety information associated with the existing road²²².
- Information from stakeholder consultation²²³.

Community, recreational and education facilities

13.5.20 The community, recreational and educational facilities within the LIA are listed in section 13.2.1.2 above.

Green/open space

13.5.21 There are several green and open spaces within the LIA (Figure 13.5 contained in Volume 2). These are:

- Sconce and Devon Park, Boundary Road, located approximately 500 metres to the south west of the proposed scheme.
- Riverside Park, Great North Road, approximately 480 metres to the south west of the proposed scheme.
- Mather Road Play Area, Mather Road, approximately 200 metres to the south of the proposed scheme.
- Fleming Drive Play Area, Fleming Drive, approximately 280 metres to the south east of the proposed scheme.
- Cedar Avenue Park, Cedar Avenue, approximately 310 metres to the south of the proposed scheme.

Healthcare facilities

13.5.22 There are several healthcare facilities and hospitals within the LIA, amongst which are:

- The Red Rose Care Community Nursing Home, Brockton Avenue, approximately 170 metres east of the proposed scheme
- The Farndon Unit, Farndon Road, located approximately 130 metres to the south west of the proposed scheme
- Raphael Healthcare, Farndon Road, located approximately 130 metres to the south west of the proposed scheme
- Winthorpe Hall Care Home, Gainsborough Road, located approximately 500m to the north east of the proposed scheme.

Transport network

13.5.23 The A46 connects the West Midlands with Lincolnshire, passing close to Bath, Leicester, and Newark-on-Trent. The A46 is approximately 350 kilometres long and provides connectivity within the LIA and WIA

²²¹ Usage details are not available at this early stage.

²²² Safety information is not available at this early stage.

²²³ Consultation information is not available at this early stage.

between Newark-on-Trent-on-Trent, Farndon, and Winthorpe. Within the LIA, the A46 is crossed by Great North Road, the A1, and the A1133.

- 13.5.24 The A46 is located near to the two main railway stations in the local area, Newark-on-Trent Castle station and Newark-on-Trent Northgate station. Newark-on-Trent Castle Station is operated by East Midlands Railway providing regular services across the East Midlands and two trains per day to London. Newark-on-Trent Northgate Station is served by intercity trains to London, Newcastle and Edinburgh as well as Lincoln.
- 13.5.25 The bus network operating within the LIA operates from Newark-on-Trent Bus Station and provides connectivity between Lincoln, Nottingham, and Grantham. The services include²²⁴:
- Bus 47: Lincoln
 - Bus 90/A: Nottingham
 - Bus 28: Mansfield
 - Bus 24: Grantham

Air quality management

- 13.5.26 There are no Air Quality Management Areas currently designated within the Newark and Sherwood District Council area.

Noise

- 13.5.27 As outlined in Chapter 12: Noise and Vibration, several Noise Important Areas are located in the vicinity of the scheme, seven of which are within the LIA (see Figure 12.1 contained in Volume 2):
- 7834 (Langford, A46).
 - 7838 (Newark-on-Trent-on-Trent, A1).
 - 7840 (Newark-on-Trent-on-Trent, A46).
 - 7839 (Newark-on-Trent-on-Trent, A46).
 - 8220 (Newark-on-Trent-on-Trent, A46/A1).
 - 7846 (Farndon, A46).
 - 7847 (Farndon, A46).
- 13.5.28 The closest noise sensitive receptors adjoining the A46 (listed in Chapter 12: Noise and Vibration) are exposed to background noise - largely consisting of road traffic noise and noise from the railways, dependent on the time of day.

²²⁴ Nottinghamshire Country Council (2022). *Newark Bus Station*. Accessed at: <https://www.nottinghamshire.gov.uk/transport/public-transport/bus-stations/newark-bus-station>

Land quality

13.5.29 The baseline conditions are summarized in Chapter 10: Geology and Soils. The scheme is situated within an existing highway network comprising carriageway, roundabouts and junctions, with surrounding agricultural, residential, commercial and industrial land.

Landscape amenity

13.5.30 Works proposed fall within National Character Area (NCA) 48 Trent and Belvoir Vales, which is detailed further in Chapter 8: Landscape and Visual Effects.

13.6 Value (sensitivity of resources and receptors)

13.6.1 As the baseline data is still to be collated, the value (sensitivity) placed on receptors cannot be determined and will be developed further as part of the ongoing environmental assessment to be presented in the ES.

Land use and accessibility

13.6.2 Relevant land use and accessibility receptors are outlined in Table 13.9.

Table 13.9: Land use and accessibility receptors

Resource/receptor	Description
Dwellings	Houses and other buildings in residential use such as care homes, hotels, etc.
Community facilities	Libraries, public halls, sports centres, theatres, concert halls, places of worship, allotments, health facilities (hospitals, GPs, etc.), etc.
Commercial premises	Shops, offices, etc.
Educational establishments	schools, nurseries, university campus, etc.
Open spaces	Parks, playgrounds, etc.
Recreational facilities	Amenity areas, footpaths, sport grounds, etc.

Human health

13.6.3 Relevant health receptor groups, including specific vulnerable groups, are outlined in Table 13.10 below. For each health impact, the assessment considers the potential effects on population groups. The first is the general population and the second is vulnerable groups within the general population. Vulnerable groups have been identified by reviewing local planning policy relevant to this assessment. This approach ensures that the health assessment takes account of the

ways in which the Proposed Development may affect health inequalities. Health, by its nature is very specific to individuals. However, the focus of the assessment will be on receptors as population groups.

Table 13.10: Health receptor groups

Receptor	Receptors included within the group
General Population	Residents
	Construction workers
	Owners, operators and users of community facilities (including healthcare services and schools)
	Visitors to, or workers in or passing, the communities, open spaces and sport facilities around the proposed Scheme.
Vulnerable group population	Young age – children (up to 15 years) and young people (16-25 years)
	Old age – older people, over the age of 65
	Low income – people who are unemployed/on low incomes
	Poor health – people (and their carers) with existing poor health (physical and mental health), including where this is due to disabilities
	Social disadvantage – people who may experience social isolation, discrimination or social disadvantage (including people from Black and Minority Ethnic Groups (BAME) and people who identify as being part of faith and belief groups).

13.7 Potential impacts

13.7.1 A summary of the potential impacts (both positive and negative) associated with the construction and operation of the proposed scheme is outlined below.

Construction

Land use and accessibility

- 13.7.2 The construction of the scheme may require both permanent and temporary land take from the grounds of residential property and housing, development land and businesses within the scheme footprint.
- 13.7.3 The construction of the scheme may require both permanent and temporary use of agricultural land along the route within the scheme footprint, potentially impacting on the functioning and viability of agricultural holdings and enterprises.
- 13.7.4 Temporary changes to access and increases in traffic from construction activities could impact access to residential property and

housing; community land and assets; development land and businesses; and access of WCH within the study area. Temporary changes to access may also impact the ability of residents to access existing or prospective employment.

- 13.7.5 Temporary diversions or closures of WCH routes (including PRow, footways, road crossings and long distance routes) are likely to be needed within the study area. There is also the potential for permanent closures or diversions to be required for WCH routes. This could result in changes to accessibility and increases to journey lengths for WCHs potentially introducing severance for communities across the study area.
- 13.7.6 The construction of the scheme may result in temporary environmental changes for communities in proximity to construction activities – resulting in an overall change in amenity for these communities. Changes in amenity result from a combination of significant residual (post-mitigation) effects reported in other assessment topics, specifically noise, vibration, air quality and visual effects. For an amenity effect to be identified, at least two residual effects must combine at the same location.

Human Health

- 13.7.7 Temporary creation of jobs necessary to deliver the scheme may have direct and indirect beneficial impacts on employment in the study area.
- 13.7.8 The construction of the scheme may require both permanent and temporary use of recreational areas and green/open spaces, potentially impacting on people's ability to take part in physical activity.
- 13.7.9 Temporary changes to the local environment (increase of noise, decrease of air quality, landscape, severance) may affect the health of communities.

Operation

Land use and accessibility

- 13.7.10 The operation of the scheme has the potential to improve access to and across the A46, as well as improving access to the wider road network. This will benefit both motorised and non-motorised users within the study area, by improving access to services, amenities, open spaces and economic opportunities outside of immediate communities. Moreover, the delivery of an improved road network will reduce severances between communities along the scheme.
- 13.7.11 The scheme has the potential to reduce severance resulting in a benefit for cyclists, walkers and other vulnerable road users wishing to cross the A46 within the study area.

- 13.7.12 The scheme has the potential to permanently alter the environment of local communities surrounding the operational scheme. This could adversely or beneficially alter the amenity of receptors.

Human health

- 13.7.13 The scheme has the potential to improve the provision of infrastructure that encourages active travel modes, supports a potential reduction in pollutants and offers access to employment with the potential for positive health impacts.
- 13.7.14 The operation of the scheme is anticipated to reduce congestion, reduce journey time and improve safety, improving the access to employment for people living within the LIA and supporting the future economic growth of the region.
- 13.7.15 During operation there is the potential for changes in traffic flows and road alignment which could result in changes in amenity and affect health outcomes for communities in the study area. Impacts can be beneficial or adverse.

13.8 Consultation

- 13.8.1 No consultation in relation to population and human health has been undertaken at this stage. Engagement with population and human health receptors may be undertaken as part of the ES to determine the value of receptors to the local community. This would include:
- Local Authority Health professionals: engagement will focus on identifying any information gaps on community and health resources and receptors, health issues and sensitivities of the local population, and their views on the potential effects on the population and population health; and
 - Owners and operators of any community resources where effects are predicted.
 - Newark and Sherwood District Council Environmental Health Officer(s), as detailed in Chapter 6 Air Quality and Chapter 12 Noise and Vibration.
 - Representatives of local recreational societies and groups
 - Others identified by the Overseeing Organisation

13.9 Assumptions and limitations

- 13.9.1 This assessment has been undertaken in line with the early stages of the project design.
- 13.9.2 This assessment has been completed without detailed construction information or the use of Ordnance Survey baseline data. This information will be provided within the ES to improve the accuracy of the assessment.

- 13.9.3 The assessment of the potential for significant effects has been carried out against a benchmark of current baseline conditions within the LIA and WIA. As with any dataset, these may be subject to change over time, which may influence the findings of the assessment and could lead to the assessment being subject to statistical time lag.
- 13.9.4 No topic-specific formal consultation or primary research has been undertaken in the production of this chapter.
- 13.9.5 It is currently assumed that the construction process would not render local properties unusable and there would be no displacement of local residents.
- 13.9.6 Questionnaires and interviews have not been undertaken with agricultural land holders at this stage of design so further information on type, husbandry, frequency of use, and existing severance/accessibility issues, for example, is not yet known. Therefore, the assessment presented within this chapter only identifies broad agricultural land within the area and land take, and has not considered impacts at the land holding scale.
- 13.9.7 WCH surveys have not been undertaken to date. If WCH amenities (for example PRoWs) are to be affected, then surveys will be completed in subsequent design stages to inform WCH provision for the scheme and the ES.
- 13.9.8 The traffic model is currently being updated, therefore, to date, information on traffic flows at any WCH crossings in the study area is not known. This information will be available to inform the ES.

13.10 Design, mitigation and enhancement measures

Design measures

- 13.10.1 The development of the scheme design shall be an iterative process undertaken as part of an integrated design team to adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA 104. The first principle being to avoid potential adverse effects if at all possible, before seeking to minimise or mitigate for any unavoidable impacts through a well-developed mitigation strategy. Embedded mitigation incorporated into the scheme design development to date is outlined in Chapter 2 (section 2.7) of this report.
- 13.10.2 There are a number of opportunities for further embedded mitigation that will be considered during the development of the ongoing scheme design. These include:
- Minimising the extent of direct, permanent land take affecting identified individual receptors

- Providing appropriate signage for temporary WCH diversions to direct users during construction and support access to community and recreational facilities using footpaths and cycleways
- Producing an NMU strategy which includes the provision and locations for diversions of existing NMU routes, new crossings, potential cycle routes and PRowS to be extinguished, as well as ensuring access for key NMU routes
- Utilising DMRB GG 142²²⁵ to enable opportunities for new or improved facilities and the integration with the local and national networks. This could include the creation and/or improvement of facilities for pedestrians, cyclists and equestrians that are separate from the highway.
- Mitigation to maintain access to all affected residential properties, businesses and areas of open space and recreation.
- Ongoing consultation to take into account the individual needs of landowners and inform mitigation design, where appropriate.

Mitigation – construction

13.10.3 Mitigation measures of relevance during construction include the following:

- Use of appropriate mitigation measures through the implementation of the Environmental Management Plan (EMP) to mitigate adverse effects associated with air quality, noise, traffic, and visual.
- Development of a Construction Communications plan to engage with local people and businesses about how construction may impact them, for example through road diversions.
- A Traffic Management Plan (TMP) would be implemented during the construction phase of the Scheme, to ensure that access is maintained and disruption is minimised as far as possible.
- Provision of appropriate signage for temporary WCH diversions, new or diverted WCH routes is recommended to be embedded into the scheme in operation.
- Liaise with private businesses to inform them on the extent of the construction works and changes that will be delivered in the local area. Potential mitigation could include building a better understanding of access requirements to maintain footfall for businesses.
- Liaise with bus companies in advance of works to enable them to plan service changes as necessary and advise passengers accordingly.

Mitigation – operation

13.10.4 Mitigation measures of relevance during operation include the following:

²²⁵ National Highways (2019) *DMRB GG 142 - Walking, cycling and horse-riding assessment and review*. Accessed at: [5f33456d-32f9-4822-abf6-e12510f5c8dc \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/5f33456d-32f9-4822-abf6-e12510f5c8dc)

- Provision of appropriate signage for new or permanently diverted WCH routes.
- Access to all affected residential properties, businesses and areas of open space and recreation will be maintained.

Enhancement measures

13.10.5 Consideration will be given throughout the design development to any potential for enhancement opportunities in relation to population and human health.

13.10.6 Based on current information, the following enhancement measures for the construction and operation of the scheme are as follows:

- Exploration of opportunities to rectify existing severance problems in the area and encourage greater use of WCH routes.
- Access in and around proposed junctions to accommodate walking, cycling and horse riding as required (excluding Winthorpe, existing provisions retained at Farndon).
- Where the proposed alignment severs an existing public right of way, connectivity will be maintained wherever possible. This will be achieved with the reconnection of severed PRoW with permanent diverted routes.

13.10.7 These enhancement measures will not be taken into account when determining whether effects are significant or not.

13.11 Assessment of effects

Construction impacts on land use and accessibility

Residential property and housing

Permanent land requirements

13.11.1 The requirement for land from residential properties along the scheme is likely. The preliminary assessment has identified two residential properties within the draft Order Limits which are likely to experience permanent land take, resulting in a loss of garden space. These include:

- Crees House, Crees Lane
- Ivy Cottage, Crees Lane

13.11.2 These are therefore likely to experience significant adverse effects (in terms of permanent land take). The permanent loss of land will occur during the construction period.

Temporary changes to access to residential properties

13.11.3 Changes to road layouts, temporary diversions and road closures are anticipated throughout the construction period. Changes to access, as well as increases in traffic from construction activities, may affect access to a number of residential properties located within the LIA,

particularly in terms of increased journey times and associated community severance.

13.11.4 Several residential properties within the LIA fall within the scheme's draft Order Limits and are, therefore, likely to experience some disruption. Residential streets within the draft Order Limits include those bordering:

- Farndon Roundabout: in particular, Crees Lane;
- Cattle Market Roundabout: including, Cullen Close, Kelham Road, Sandhills Park, Sandhills Close Sikorski Close, Foundry Close and Mather Road;
- Brownhills Roundabout: including Wheatsheaf Avenue, Barley Way and Harvest Drive; and
- Friendly Farmer roundabout.

13.11.5 As construction information is not yet fully developed, the assessment of construction activities on access to residential properties will be developed further as part of the ongoing ES.

Temporary changes to amenity

13.11.6 Construction of the proposed scheme will result in an increase in HGV and other construction traffic on local roads, the diversion of local traffic, the establishment of construction sites, the installation and use of construction equipment, as well as the presence of construction workers in the LIA. These factors all have the potential to adversely alter the amenity of the local community for residents – both directly and indirectly via environmental effects.

13.11.7 Residential properties located in close proximity to temporary works areas (identified on Figure 2.2 contained in Volume 2) are likely to experience changes in amenity during the construction period. These include:

- Residential properties on the northern and western edges of Newark-on-Trent between River Trent and the Farndon Roundabout.
- Properties along Great North Road, between the River Trent and Cattle Market Roundabout. This includes properties along Sandhills Park.
- Properties on Crees Lane.
- Residential properties at villages of Winthorpe, Kelham and Averham.

13.11.8 The assessment of construction activities on the amenity of residential properties will be developed further as part of the ongoing development of the scheme and reported in the ES.

Community land and assets

13.11.9 It is currently anticipated that no temporary or permanent construction works will require land from community land and assets.

Temporary changes to access affecting community land and assets

13.11.10 Temporary changes to access and increases in traffic from construction activities may affect access to a number of community land and assets within the LIA – particularly for those located within the scheme’s draft Order Limits (identified below). Effects may include an increase in journey times for those trying to access community land and assets, potentially increasing the rate of severance despite mitigation.

13.11.11 The preliminary assessment has identified several community receptors that may experience adverse effects (in terms of access) during the construction period:

- Newark Cricket Ground (located within the scheme’s draft Order Limits)
- Newark Indoor Bowls Centre (located within the scheme’s draft Order Limits)
- Newark Rugby Club
- Red Rose Care Community Nursing Home
- Riverside Park
- Mather Road Play Area
- Bishop Alexander Primary School
- Newark Golf Centre
- Newark Showground

13.11.12 However, as the full details of the construction requirements are not yet known, specific details on construction vehicle movements, the location of construction sites and the proportion of potentially significantly affected community receptors will be further developed as part of the ongoing ES.

Temporary changes to amenity of community land and assets

13.11.13 Construction of the proposed scheme will result in an increase in HGV and other construction traffic on some local roads, the diversion of some local traffic, the establishment of construction sites, the installation and use of construction equipment, as well as the presence of construction workers in the LIA. As detailed in Chapter 8 Landscape and Visual Effects of this PEI Report, the presence of construction plant, materials, machinery, construction compounds and the provision of construction lighting is likely to have a direct impact on landscape features and visual receptors within the study area. Air quality and noise impacts are detailed in Chapters 6 and 12 respectively.

- 13.11.14 There is the potential for changes to the environment (for example noise, air quality and visual effects) to combine at particular locations and alter the amenity of how people enjoy community land and assets. The combined effects of these potential changes upon individual receptors will be assessed as part of the assessment of cumulative effects to be presented within the ES.
- 13.11.15 Community assets in proximity to proposed temporary construction sites and therefore would likely to experience temporary changes in amenity include:
- Community resources located along Great North Road, between the River Trent and Cattle Market Roundabout. This includes assets along Sandhills Park.
 - Community resources along Trent Lane, such as 776 Gymnastics Academy Newark-on-Trent and Robin Hood Entertainment and Soft Play.
 - Community resources north of Newark-on-Trent, between the A46 and Wolsey Road, such as Church of Promise, Explorers Childcare and users of the allotments off Fleming Drive.
- 13.11.16 As construction information is not yet fully developed, the assessment of construction activities on the amenity of community land and assets will be developed further as part of the ES.

Development land and businesses

Permanent land requirements

- 13.11.17 The need for permanent land take from development land along the scheme is likely. It has been estimated that the scheme would require approximately 357 hectares of land within the draft Order Limits to be acquired permanently. The scheme would require the demolition of the redundant equipment/vehicle maintenance shed within the now disused Nottinghamshire County Council Highways depot to the west of the Great North Road at Cattle Market and the demolition of the disused Mint Leaf restaurant adjacent to the existing A46 to the east of the A1 which is currently closed for business. The draft Order Limits also currently skirts the edge of RAF Winthorpe and may require land take from this site.
- 13.11.18 Therefore, there are likely to be adverse effects (in terms of permanent land take). Specific details on land take, the number and locations of potentially significantly affected development land and businesses will be included as part of the ES.

Temporary land requirements

- 13.11.19 The need for temporary land take from development land along the scheme is likely. It has been estimated that the scheme would require approximately 600,000m² of land to be temporarily acquired during

construction. Therefore there is the potential for adverse effects. The preliminary assessment has identified two parcels of development land within the draft Order Limits and may be used for temporary works.

These include:

- Spatial Policy 7 Transport Scheme – Newark-on-Trent Flyover; and
- Employment allocation site (NUA/E/4) – Land at the former Nottinghamshire County Council Highways Depot, Great North Road, Newark-on-Trent.

13.11.20 These are therefore likely to experience adverse effects (in terms of temporary land take) during the construction period. However, in the absence of detailed construction requirements, specific details on land take, the number and locations of potentially significantly affected development land and businesses will be included as part of the ES.

Temporary changes to access affecting development land and businesses

13.11.21 Temporary changes to access and increases in traffic from construction activities, particularly due to works to the Winthorpe roundabout and the widening of the A46 to the west of Winthorpe, may affect access to a number of development land and businesses located around and within the town of Winthorpe. The works to the Brownhills roundabout will potentially impact people's ability to access the businesses located at Brownhills Junction.

13.11.22 Effects may include an increase in journey times for those trying to access development land and businesses, potentially increasing the rate of severance between users and service providers and therefore effect the viability of businesses, despite mitigation. However, in light of limited information regarding construction activities, specific details on the impact of construction activities on access to development land and businesses will be developed further as part of the ongoing ES.

Agricultural land holdings

Land requirements

13.11.23 The need for temporary and permanent land from agricultural land holdings within the LIA is likely, therefore there is the potential for adverse effects for these receptors. However, in the absence of the full details of the construction requirements, the specific details on land take and the number and locations of potentially affected agricultural land holdings will be further developed as part of the ongoing ES.

Walkers, cyclists and horse riders

Temporary land requirements

13.11.24 Construction of the proposed scheme may temporarily require land, disrupt or alter access to WCHs facilities. There is the potential for WCH facilities within the LIA, particularly Winthorpe Footpath 2, to

experience temporary and permanent diversions. This may result in journey length and time increases to routes used by local people including, vulnerable travellers, for accessing community facilities and travelling between communities.

- 13.11.25 However, as the full details of the construction requirements are not yet known and WCH facility user surveys are yet to be undertaken, specific details on land requirement, diversions and the proportion of potentially adversely affected WCH receptors will be developed further as part of the ongoing ES.

Temporary changes to amenity of community land and assets

- 13.11.26 Temporary changes in amenity as a result of construction activities could affect WCH facilities which lie in proximity to the proposed scheme. As construction information is not yet fully developed, the assessment of construction activities on the amenity of WCH facilities will be developed further as part of the ES.

Construction impacts on human health

Neighbourhood quality

Temporary changes to neighbourhood quality

- 13.11.27 There is evidence to suggest links between the quality of places and health and wellbeing, as health and wellbeing may be positively influenced by the perceived attractiveness of the environment. There is extensive evidence linking noise to changes in health and wellbeing, for example, exposure to noise can cause high blood pressure, heart disease, sleep disturbances, and stress.
- 13.11.28 Additional traffic and construction activities may be noticeable from some locations in proximity to the scheme and construction compounds. Some people in the LIA are likely to experience a change in the quality of their environment, stemming from changes in landscape and visual, air quality and noise, during the construction period.
- 13.11.29 As detailed in Chapter 8 Landscape and Visual Effects of this PEI Report, significant adverse effects upon landscape character are likely during both construction and operation, with the project having the potential to directly affect local character, including alterations to existing local pattern and land cover, as well as changes to the setting of an open, rural landscape that including local Conservation Areas. For example, the removal of vegetation during construction where required to facilitate the works, such as along the existing A46, has the potential to impact directly on key characteristics of the local landscape character within the study area. Such construction works have the potential to reduce the visual tranquility in the area,

particularly in close proximity to the scheme, which may in turn have an adverse effect on wellbeing.

13.11.30 As detailed in Chapter 6 Air Quality of this PEI Report, the construction phase is expected to last approximately 3 years and could affect local air quality through the generation and subsequent deposition of construction dust arising from construction activities and vehicle movements. However, with the implementation of appropriate mitigation measures for a high-risk site, air quality impacts from the construction phase of the scheme are not expected to be significant. It is also concluded there are no exceedances of the 1-hour NO₂ objective as a result of the scheme and therefore the effect on human health is not a significant effect for air quality.

13.11.31 As detailed in Chapter 12 Noise and Vibration of this PEI Report, for all receptors within the study area, an on-balance Not Significant Adverse effect for both noise and vibration is anticipated, provided temporary mitigation and best practice measures are in place and construction activities do not increase traffic flows in excess of 25%.

13.11.32 Neighbourhoods within the scheme's draft Order Limits and/or in proximity to proposed construction temporary works areas, and therefore may experience a temporary change in neighbourhood quality include:

- Neighbourhoods near Farndon roundabout
- Neighbourhoods near Cattle Market roundabout.
- Neighbourhoods near Brownhills roundabout
- Neighbourhoods near Friendly Farmer roundabout.
- Neighbourhoods bordering the East Coast Main Line, between the A46 and B6166
- The villages of Winthorpe, Kelham and Averham.

13.11.33 The assessment of construction activities on neighbourhood quality will be developed further as part of the ES.

[Access to local services](#)

Temporary changes in access to local services (such as health, social care and education facilities) due to changes in travel routes and delays

13.11.34 Evidence indicates that access to healthcare services can have a considerable impact on health and wellbeing, with both the use of and access to these services depending on proximity, transport facilities, and the supply of trained staff. Similarly, educational attainment is strongly linked with health outcomes, as better-educated individuals are less likely to suffer from long-term diseases or mental health conditions. Education provides knowledge and capabilities that contribute to mental, physical, and social wellbeing.

13.11.35 Changes to road lay outs, temporary diversions and road closures are likely, throughout the LIA, during the construction phase. There is therefore the potential for delays in access for users of local services.

13.11.36 As construction information is not yet fully developed, the assessment of construction activities on access to local health services will be developed further as part of the ES.

Social capital

Temporary impacts on social cohesion due to presence of construction workforce

13.11.37 The introduction of a temporary construction workforce into established communities has the potential to negatively alter people's perceptions of, and interactions with, their communities, modifying behaviour and the value they place on social capital.

13.11.38 A construction site will potentially be located in Newark-on-Trent-on-Trent, adjacent to the Cattle Market Roundabout. This has the potential to adversely affect social cohesion within the LIA, particularly for communities between Cattle Market Roundabout and Newark-on-Trent Castle train station. As construction information is not yet developed and community composition is not yet fully defined, the assessment of construction workforce on social cohesion will be assessed as part of the ongoing ES.

13.11.39 Potential increase in local employment due to need for a construction workforce and procurement of local goods and services

13.11.40 There is a strong correlation between employment status and health and wellbeing outcomes. Being employed increases a household's income, which can improve physical and psychological wellbeing, providing people with the financial means to access the goods and services which they need. There is also evidence to suggest that employment status may also be a consequence of physical and mental health, rather than the direct cause.

13.11.41 During construction of the proposed scheme, there is potential for a beneficial impact on the local economy through the provision of employment opportunities - via both new and existing construction contracts. This may offer an increase in employment opportunities, including employment directly associated with construction activity. Local businesses may indirectly benefit through expenditure from the construction workforce.

13.11.42 The size of the construction workforce and local procurement is currently unknown; however, it is likely that opportunities would be accessed by people/businesses across the WIA and region as a whole. As construction information is not yet developed, the impact of

the proposed scheme on employment will be assessed further as part of the ES.

Access to green space, recreation and physical activity

Temporary changes in access to areas of open space and recreation, including PRow and the ability for local communities to undertake physical activity and live active lifestyles

- 13.11.43 People who have greater exposure to green space tend to have healthier outcomes, including better mental health and wellbeing outcomes. There is evidence to suggest that urban parks and vegetation have beneficial effects on health, while active travel options such as walking and cycling tend to be facilitated through well designed and easily accessed green spaces. This, in turn, reduces transport-related air pollutants, improves local air quality and therefore results in positive outcomes for respiratory health.
- 13.11.44 Changes in traffic flow (including HGVs and diverted traffic) during the construction phase may impact users of PRow and open spaces within the LIA. PRow and green space within 500m of the proposed scheme include:
- Newark-on-Trent BW2;
 - Newark-on-Trent BW5;
 - Newark-on-Trent BW6;
 - Winthorpe FP2;
 - Sconce and Devon Park;
 - Boundary Road;
 - Riverside Park;
 - Mather Road Play Area;
 - Fleming Drive Play Area; and
 - Cedar Avenue Park.
- 13.11.45 As detailed in Chapter 8 Landscape and Visual Effects of this PEI Report, there would be the potential for short term impacts and resulting adverse visual effects for users of the PRow network, including Trent Valley Way Long Distance Footpath and National Cycle Route 64. This may temporarily deter active travel using this network, which may in turn have an adverse outcome for health outcomes linked to physical activity and recreation.
- 13.11.46 The assessment of construction activities on green space and recreation assets cannot be fully assessed at this stage. User surveys and consultation to value (sensitivity) of receptors will be undertaken as part of the ongoing ES.

Operation impacts on land use and accessibility

Residential property and housing

Permanent changes to access

13.11.47 The operation of the scheme has the potential to improve access and reduce severance to residential properties along the A46. The scheme has the potential to decrease congestion along the A46 and merging routes, consequently improving journey times for motorized users.

13.11.48 It is anticipated that the greatest improvement in access will potentially be for residential properties located in Winthorpe, as these will benefit from the operation of Winthorpe Junction and Brownhills Junction. However, due to the early stage of this assessment, significance of effect will be determined as part of the ongoing assessment.

Long-term changes to amenity

13.11.49 Changes in amenity result from a combination of significant residual (post-mitigation) effects reported in other assessment topics, specifically noise, vibration, air quality and visual effects. For an amenity effect to be identified, at least two residual effects must combine at the same location.

13.11.50 Based on the available environmental topic assessments so far, no significant operation effects on human health as a result of changes to amenity are expected for residential properties. As a result, at this stage in the development of the scheme and with the information available to date, it is not expected that there would be a significant effect as a result of long term changes to amenity. However, as the environmental assessment work is ongoing, the likely significance of effect will be revisited as part of that ongoing assessment, and the conclusions presented within the ES.

Community land and assets

Permanent changes to access

13.11.51 The operation of the scheme has the potential to improve access, and reduce severance to, community land and assets, along the A46. The scheme has the potential to decrease congestion along the A46 and merging routes, consequently improving journey times for motorized users.

13.11.52 It is anticipated that the greatest improvement in access will potentially be experienced by community land and assets located in Winthorpe as these will benefit from the operation of Winthorpe Junction and Brownhills Junction. However, due to the early stage of this assessment, significance of effect will be determined as part of the ongoing assessment.

Long-term changes to amenity

13.11.53 Changes in amenity result from a combination of significant residual (post-mitigation) effects reported in other assessment topics, specifically noise, vibration, air quality and visual effects. For an amenity effect to be identified, at least two residual effects must combine at the same location.

13.11.54 Based on the available environmental topic assessments, no significant operation effects on human health as a result of changes to amenity are expected for community land and assets. As a result, at this stage in the development of the scheme and with the information available to date, it is not expected that there would be a significant effect as a result of long term changes to amenity. However, as the environmental assessment work is ongoing, the likely significance of effect will be revisited as part of that ongoing assessment, and the conclusions presented within the ES.

Development land and businesses

Permanent changes to access

13.11.55 The operation of the scheme has the potential to improve access, and reduce severance to, development land and businesses, along the A46. The scheme has the potential to decrease congestion along the A46 and merging routes, consequently improving journey times for motorized users.

13.11.56 It is anticipated that the greatest improvement in access will potentially be experienced by businesses located in Winthorpe as these will benefit from the operation of Winthorpe Junction and Brownhills Junction. However, due to the early stage of this assessment, significance of effect will be determined as part of the ongoing assessment.

Long-term changes to amenity

13.11.57 Changes in amenity result from a combination of significant residual (post-mitigation) effects reported in other assessment topics, specifically noise, vibration, air quality and visual effects. For an amenity effect to be identified, at least two residual effects must combine at the same location.

13.11.58 Based on the available environmental topic assessments, no significant operation effects on human health as a result of changes to amenity are expected for development land and businesses. As a result, at this stage in the development of the scheme and with the information available to date, it is not expected that there would be a significant effect as a result of long term changes to amenity. However, as the environmental assessment work is ongoing, the likely

significance of effect will be revisited as part of that ongoing assessment, and the conclusions presented within the ES.

Agricultural land holdings

13.11.59 No significant operational impacts on agricultural land holdings are anticipated from a population and human health perspective.

Walkers, cyclists and horse riders

Permanent changes to access

13.11.60 The operation of the scheme has the potential to improve access along and across the A46 for WCHs. The delivery of new footways, shared access and pedestrian routes, wider roads, signalized routes, as well as new signing/road markings has the potential to improve traffic flows and improve safety for WCHs.

13.11.61 It is anticipated that the greatest improvement in access will potentially be experienced by WCHs in Winthorpe who will benefit from the provision of new footways / cycleways between Winthorpe Junction and the proposed Brownshill Junction. Due to the early stage of this assessment, significance of effect will be determined as part of the ongoing assessment.

Long-term changes to amenity

13.11.62 Changes in amenity result from a combination of significant residual (post-mitigation) effects reported in other assessment topics, specifically noise, vibration, air quality and visual effects. For an amenity effect to be identified, at least two residual effects must combine at the same location.

13.11.63 Based on the available environmental topic assessments, no significant effects on human health as a result of changes to amenity are expected for WCHs. As a result, at this stage in the development of the scheme and with the information available to date, it is not expected that there would be a significant effect as a result of long term changes to amenity. However, as the environmental assessment work is ongoing, the likely significance of effect will be revisited as part of that ongoing assessment, and the conclusions presented within the ES.

Operation impacts on human health

Neighbourhood quality

Long-term changes to neighbourhood quality

13.11.64 Changes in neighbourhood quality result from a combination of significant residual (post-mitigation) effects reported in other assessment topics, specifically noise, vibration, air quality and visual

effects. For an effect on neighbourhood quality to be identified, at least two residual effects must combine at the same location.

13.11.65 The operation of the scheme has the potential to alter neighbourhood quality, both positively or negatively, within the LIA. The completed scheme has the potential to alter the flow of traffic along the A46. This may have a positive or negative effect on noise and air quality (refer to Chapter 12 and 6 respectively), resulting in positive or adverse impacts on health and wellbeing for residents – particularly those in neighbourhoods within Winthorpe, Farndon and Newark-on-Trent.

13.11.66 As detailed in Chapter 8, (Landscape and Visual Effects) during operation, the widened A46 and associated highway features, including several at-height bridge structures and retaining walls, would increase the prominence of the A46 within the receiving landscape. In addition, there would be a loss of existing landscape features. There is the potential for such changes to the environment to combine at particular locations and alter the amenity of how people enjoy community land and assets. This may in turn adversely impact wellbeing within local communities – particularly neighbourhoods in proximity new grade-separated structures, including:

- the new grade-separated junction at Cattle Market junction;
- the new grade separated roundabout junction (Brownhills junction); and
- the new bridge structure across the existing A1, located to the north of the existing bridge.

13.11.67 As the operational effect of the scheme is yet to be fully developed, the assessment of the completed scheme on the neighbourhood quality will be developed further as part of the ongoing ES.

[Access to local services](#)

Permanent changes to access

13.11.68 The operation of the scheme has the potential to improve access to local services within the LIA. Improved junctions and new motorized and non-motorised user routes have the potential to change the volume and flow of traffic along the A46 and merging roads. The scheme has the potential to decrease congestion along the A46, between Winthorpe and Farndon, consequently improving journey times and reducing severance to local services for all users. This operation of the scheme may reduce feelings of isolation, encourage the use of non-motorised routes, resulting in positive impacts on physical and mental health.

13.11.69 As the operational effect of the scheme on traffic flows are yet to be fully developed, the assessment of the completed scheme on access to local services will be developed further as part of the ongoing ES.

Social Capital

Permanent changes to access

- 13.11.70 The operation of the scheme has the potential to improve access along and across the A46 for motorized and non-motorised users. The delivery of new highways, footways, shared access and pedestrian routes, wider roads, signalised routes, as well as new signing/road markings has the potential to improve traffic flows, allowing for quicker journey times for people accessing employment and education opportunities within the WIA.
- 13.11.71 It is anticipated that the greatest improvement in access will potentially be experienced by people accessing employment and education facilities in Winthorpe and Newark-on-Trent-on-Trent, as these will benefit from the operation of Winthorpe Junction and Brownhills Junction as well as new pedestrian facilities between the aforementioned junctions. However, due to the early stage of this assessment, significance of effect will be determined as part of the ongoing assessment.

Access to green space, recreation and physical activity

Permanent changes to access and use

- 13.11.72 The operation of the scheme has the potential to improve access along and across the A46 for motorised and non-motorised users. The delivery of new highways, footways, shared access and pedestrian routes, wider roads, signalised routes, as well as new signing/road markings has the potential to improve access to green / open spaces and recreation areas, improving opportunities to partake in recreation and physical activity for residents within the LIA.
- 13.11.73 It is anticipated that the greatest improvement in access will potentially be experienced by people accessing employment and education facilities in Winthorpe and Newark-on-Trent-on-Trent, as these will benefit from the operation of Winthorpe Junction and Brownhills Junction as well as new pedestrian facilities between the aforementioned junctions.

13.12 Monitoring requirements for significant adverse effects

- 13.12.1 Monitoring requirements will be explored as part of the on-going assessment and reported within the ES following the assessment of effects on population and human health and further discussions with landowners and the community.

13.13 Conclusions

- 13.13.1 This chapter provides a summary of the assessments that have been undertaken so far for population and human health effects of the scheme in accordance with DMRB LA 112, and supported by IEMA guidelines. The chapter sets out the criteria to determine the significance of population and human health effects of the scheme, and presents anticipated changes for community receptors in the short- and long-term.
- 13.13.2 The preliminary assessment shows several receptors will experience changes in access and amenity during the construction period as a result of proximity to construction activities. This includes potential temporary or permanent land requirements, as well as changes in amenity stemming from increases in traffic (from HGVs and diverted standard traffic), construction works and associated changes in determinants of health such as noise, air quality, visual landscape and the presence of construction workforce. A number of receptors, including residential properties, community assets, agricultural holdings, development land and businesses are within the draft Order Limits and will potentially experience significant adverse effects for a temporary period during construction.
- 13.13.3 During operation, both beneficial and adverse effects are anticipated, as a result of road improvements and the anticipated creation of new motorised and non-motorised routes. Whilst there is the potential for some adverse effects, changes in traffic flows once the scheme is operational are expected to result in an overall beneficial effect for population and human health receptors in terms of access, and a neutral effect in terms of amenity.
- 13.13.4 Findings in this report should be considered indicative on the basis that they represent an early stage of the assessment process with incomplete information. Further assessment will be reported within the ES.

14 Road Drainage and The Water Environment

14.1 Introduction

- 14.1.1 This chapter presents the on-going work for the assessment of the potential effects associated with the proposed scheme upon road drainage and the water environment.
- 14.1.2 The potential effects have been considered following the guidance contained in Section 14.3. Further detailed assessment is currently underway and will be reported within the Environmental Statement (ES) that will be submitted to support the Development Consent Order (DCO) application.

14.2 Legislation and policy context

- 14.2.1 The following legislation and policy are relevant to the proposed scheme.

Legislation

- 14.2.2 The overarching legislation in relation to road drainage and the water environment is provided by:

Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

- 14.2.3 These regulations aim to protect inland and coastal waters and prevent deterioration of aquatic ecosystems, including groundwaters. A key aim of the Water Framework Directive (WFD) is to achieve 'good' ecological status for all waterbodies by 2015, with a secondary aim to gradually reduce the release of pollutants which may pose significant risks to the aquatic ecosystems. The environmental objectives of the WFD are implemented through actions described in the River Basin Management Plans (RBMPs).
- 14.2.4 The WFD requires a single system of water resource management (through characterisation, protection and enhancement of water resources) to be considered within the context of a river basin district (RBD). Within England and Wales, 11 RBDs have been identified, including three cross-border RBDs, one of which crosses the borders of England and Scotland. The 2017 Regulations require 'the appropriate agency' (the Environment Agency in England) to prepare RBMPs for each RBD, for the approval of 'the appropriate authority' (the Secretary of State (SoS) in England).

Land Drainage Act 1991

- 14.2.5 The Land Drainage Act 1991 requires that a watercourse be maintained by its owner in such a condition that the free flow of water is not impeded. The riparian owner must accept the natural flow from upstream but need not carry out work to cater for increased flows resulting from some types of works carried out upstream, for example a new housing development.
- 14.2.6 If a riparian owner fails to carry out their responsibilities under the Land Drainage Act, or if anyone else causes a watercourse to become blocked or obstructed, the County and District Councils have powers of enforcement by serving a notice under the Act. If this is ignored, the Council concerned may carry out the necessary works itself and then recharge the person responsible for the full cost incurred.

Land Drainage Act 1994

- 14.2.7 This Act amends the Land Drainage Act 1991 in relation to the functions and duties of internal drainage boards and local authorities. It makes particular provision for duties with respect to Sites of Special Scientific Interest (SSSI).

Flood and Water Management Act 2010

- 14.2.8 The Flood and Water Management Act's aims are:
- Greater security for people and their property from the risk of flooding and coastal erosion by creating clearer structures and responsibilities for managing that risk, building on the Government's response to Sir Michael Pitt's report following the 2007 floods. It improves local leadership on flood risk, improves management of risk from surface run-off and enables better planning for and prediction and warning of floods. It also introduces modern risk-based approaches to reservoir safety as well as greater security of water supply in the event of water company failure, and improved protection of essential supplies during drought.
 - Better service for people through new ways of delivering major water and sewerage infrastructure projects and improving existing complaints and enforcement procedures.
 - Greater sustainability by helping people and their communities adapt to the increasing likelihood of severe weather events due to climate change, encouraging sustainable drainage systems in new developments, protecting communities and the environment better from the risk of flooding, protecting water resources and improving water quality.

The Water Resources Act 1991 (as amended)

- 14.2.9 An Act to consolidate enactments relating to the National Rivers Authority and the matters in relation to which it exercises functions, with amendments to give effect to recommendations of the Law Commission.

The Flood Risk Regulations 2009

- 14.2.10 These Regulations transposed the European Floods Directive into law for England and Wales and came into force on 10th December 2009. The Floods Directive sets out requirements to manage flood risk from all sources in order to reduce the consequence of flooding on human health, economic activity and the environment.

The Environment Act 2021

- 14.2.11 The Environment Act sets clear statutory targets for the recovery of the natural world in four priority areas: air quality, biodiversity, water and waste. Of particular relevance to water is the requirement for water companies to secure a progressive reduction in the adverse impacts of discharges from storm overflows and for the Government to publish a plan to reduce sewage discharges from storm overflows by September 2022, and report to Parliament on the progress towards implementing the plan.

National policy

National Policy Statement for National Networks (NPSNN): Paragraph 5.90 to 5.115, and Paragraph 5.219 to 5.231.

- 14.2.12 This policy outlines the policies the applicant, the Examining Authority and the Secretary of State should take into account when taking decisions.

Flood Risk

- 14.2.13 When determining an application for development consent in relation to flood risk, the policies relating to climate change adaption in paragraphs 4.36 to 4.47 of the NPSNN should be taken into account.
- 14.2.14 As per paragraphs 5.92, 5.93 and 5.96 of the NPSNN, applications for projects within Flood Zones 2 and 3, or within Flood Zone 1 for projects of 1 hectare or greater should be accompanied by a Flood Risk Assessment (FRA). This should identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account. Applicants for projects which may be affected by, or may add to, flood risk are advised to seek sufficiently early pre-application discussions with the Environment Agency and, where relevant, other flood risk management bodies such as lead local flood authorities, Internal

Drainage Boards, and reservoir owners and operators. Where flood risk is a factor in determining an application for development consent, the Secretary of State should be satisfied, where relevant;

- The application is supported by an appropriate FRA
- The Sequential Test has been applied as part of site selection and, if required, the Exception Test has also been applied.

14.2.15 If the Environment Agency has concerns and objects to the grant of development consent on grounds of flood risk, the Secretary of State can grant consent but would need to be satisfied before deciding whether or not to do so that all reasonable steps have been taken by the applicant and the Environment Agency to try and resolve the concerns.

Water Quality and resources

14.2.16 Infrastructure development can have adverse effects on the water environment. As per paragraph 5.220 of the NPSNN, the Government's planning policies make clear that the planning system should contribute to and enhance the natural and local environment by, amongst other things, preventing both new and existing development from contributing to, or being put at unacceptable risk from, or being adversely affected by, water pollution. The Government has issued guidance on water supply, wastewater and water quality considerations in the planning system. Where applicable, an application for a DCO has to contain a plan with accompanying information identifying water bodies in a River Basin Management Plan (RBMP).

[National Planning Policy Framework: Section 3, Section 14, Section 15, and Annex 3.](#)

14.2.17 When determining any planning application, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific FRA. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location
- The development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment
- It incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate
- Any residual risk can be safely managed

- Safe access and escape routes are included where appropriate, as part of an agreed emergency plan
- 14.2.18 Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:
- Take account of advice from the Lead Local Flood Authority
 - Have appropriate proposed minimum operational standards
 - Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development
 - Where possible, provide multifunctional benefits

25 Year Environment Plan

- 14.2.19 The Department for Environment, Food & Rural Affairs (Defra) 25 Year Environment Plan (2018)²²⁶ is a policy paper setting out what Government will do to improve the environment, including restoring and safeguarding wildlife habitats. This plan is being treated as the first Environmental Improvement Plan required under the Environment Act 2021. The plan sets out aims to achieve clean and plentiful water by improving at least three quarters of England's waters to be close to their natural state as soon as is practicable by:
- Reducing the damaging abstraction of water from rivers and groundwater, ensuring that by 2021 the proportion of water bodies with enough water to support environmental standards increases from 82% to 90% for surface water bodies and from 72% to 77% for groundwater bodies.
 - Reaching or exceeding objectives for rivers, lakes, coastal and ground waters that are specially protected, whether for biodiversity or drinking water as per River Basin Management Plans.
 - Supporting ambitions on leakage, minimising the amount of water lost through leakage year on year, with water companies expected to reduce leakage by at least an average of 15% by 2025.
 - Minimising by 2030 the harmful bacteria in our designated bathing waters and continuing to improve the cleanliness of our waters; we will make sure that potential bathers are warned of any short-term pollution risks.
- 14.2.20 The plan also aims to reduce the risk of harm to people, the environment and the economy from natural hazards including flooding by:
- Bringing the public, private and third sectors together to work with communities and individuals to reduce the risk of harm.
 - Making sure that decisions on land use, including development, reflect the level of current and future flood risk.

²²⁶ HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online] available at: 25 Year Environment Plan - GOV.UK (www.gov.uk) (last accessed October 2022).

- Boosting the long-term resilience of our homes, businesses and infrastructure.

Local policy

Newark-on-Trent & Sherwood Local Development Framework Core Strategy & Allocations

14.2.21 The relevant policies within the document are outlined below.

Core Policy 9 – Sustainable Design

14.2.22 The District Council will expect new development proposals to demonstrate a high standard of sustainable design, for water pro-actively managing surface water with Sustainable Drainage Systems and providing resilience against potential impacts of climate change and the varying needs of the community.

Core Policy 10 – Climate Change

14.2.23 The District Council is committed to tackling the causes and impacts of climate change and to delivering a reduction in the District's carbon footprint. The District Council will work with partners and developers to:

- Mitigate the impacts of climate change through ensuring that new development proposals minimise their potential adverse environmental impacts during their construction and eventual operation. New proposals for development should therefore:
 - Ensure that the impacts on natural resources are minimised and the use of renewable resources encouraged
 - Be efficient in the consumption of energy, water and other resources.
 - Steer new development away from those areas at highest risk of flooding, applying the sequential approach to its location detailed in Policy DM5 'Design'. Where appropriate the Authority will seek to secure strategic flood mitigation measures as part of new development.
 - Where appropriate having applied the Sequential Test move on to apply the Exceptions Test, in line with national guidance. In those circumstances where the wider Exceptions Test is not required proposals for new development in flood risk areas will still need to demonstrate that the safety of the development and future occupants from flood risk can be provided for, over the lifetime of the development.
 - Ensure that new development positively manages its surface water run-off through the design and layout of development to ensure that there is no unacceptable impact in run-off into surrounding areas or the existing drainage regime.

Core Policy 10A – Land Drainage Designations

14.2.24 In order to ensure the appropriate management of flood risk as part of new development, the District Council will work with partners to develop Local Drainage Designations in the following locations:

- Lowdham
- Southwell

14.2.25 These designations will set local drainage standards which specified forms of new development will be required to meet. This is to ensure that development positively manages its surface water run-off through the design and layout of new development, in order that there will be no unacceptable impact from run-off on surrounding areas or the existing drainage regime.

14.2.26 The geographic extent, forms of development which will be subject to the designation and the specific standards that proposals will need to meet will be defined through a Local Drainage Designations Supplementary Planning Document.

14.2.27 Where the evidence to support the development of additional Local Drainage Designations in other locations emerges then the District Council will work with partners, to secure their introduction and subsequent implementation, in line with the above.

National Highways policy

14.2.28 The National Highways Environment Strategy²²⁷ outlines the following objectives for National Highways in relation to road drainage and the water environment:

- To continue to mitigate existing discharges that pose a risk of pollution
- To identify opportunities for restoring waterbodies to a more natural condition and removing obstacles for fish and eel migration
- To update forward programme of water quality schemes in collaboration with the Environment Agency
- To commission further research to explore microplastic pollution in road run-off, and any associated impacts on the wider environment
- To achieve relevant National Highways' Key Performance Indicators (KPIs) relating to road drainage and the water environment:
 - KPI 4.7 'Water quality': This KPI outlines National Highways' aim to enhance medium, high and very high-risk outfalls as well as other enhancements such as river retraining/rewilding in order to reduce adverse effects on watercourses.

²²⁷ Highways England (2015) Environment Strategy Our approach [online]. Available at: https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/605063/Environment_Strategy_21_.pdf (Last accessed September 2022).

- KPI5: Flooding: The number of high or very high-risk flooding hotspots and priority culverts mitigated
 - Water Quality: The number of priority outfalls and soakaways mitigated
- 14.2.29 In addition, water quality and flooding is one of the environmental topic areas where the six strategic levers of the National Highways' Environment Strategy²²⁸ will be applied. The strategic levers will make a contribution towards the organisation's environment vision.

14.3 Assessment methodology

- 14.3.1 This preliminary assessment has been undertaken to better understand the potential for significant direct and indirect effects on the water environment.
- 14.3.2 In undertaking this preliminary assessment, guidance, standards and best practice have been followed with particular reference to:
- DMRB LA 113 - Road drainage and the water environment²²⁹.
 - The Planning Inspectorate's Advice Note Eighteen 'The Water Framework Directive'²³⁰.
 - The Environment Agency's groundwater protection guides covering requirements, permissions, risk assessments and controls²³¹, previously covered by the Environment Agency's groundwater protection: principles and practice²³².
- 14.3.3 Information from a previous WFD compliance assessment²³³ for the scheme has been used within this chapter to understand the WFD presence within the study area. The WFD compliance assessment will be refined based on the updated scheme design to assess if the WFD receptors could be affected by the scheme. The results will be presented as a technical appendix to the ES.
- 14.3.4 In relation to flood risk, a report titled "Flood Compensation Calculations – Fourth Iteration"²³⁴ was produced at the previous design

²²⁸ National Highways (2015) National Highways Environment Strategy [online] available at: https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/605063/Environment_Strategy_21.pdf (Last accessed September 2022).

²²⁹ Highways England (2020) DMRB LA 113 – Road drainage and the water environment Revision 1 [online] available at: [d6388f5f-2694-4986-ac46-b17b62c21727 \(standardsforhighways.co.uk\)](https://www.standardsforhighways.co.uk/d6388f5f-2694-4986-ac46-b17b62c21727) (Last accessed August 2022)

²³⁰ The Planning Inspectorate (2020) Advice Note Eighteen: The Water Framework Directive. [online] available at: [Advice Note Eighteen: The Water Framework Directive | National Infrastructure Planning \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/advice-note-eighteen-the-water-framework-directive/) (Last accessed August 2022)

²³¹ Environment Agency (2017) Groundwater protection guides covering requirements, permissions, risk assessments and controls [online] available at: [Groundwater protection - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/605063/Environment_Strategy_21.pdf) (Last accessed August 2022)

²³² Environment Agency (2013) Groundwater protection: principles and practice [online] available at: [\[Withdrawn\] Groundwater protection: principles and practice GP3 - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/605063/Environment_Strategy_21.pdf) (Last accessed August 2022)

²³³ Water Framework Directive Report, *Atkins*, March 2021. Document Reference: HE551478-ATK-EWE-XX-RP-LW-000003

²³⁴ Floodplain Compensation Calculations – Fourth Iteration, *Atkins*, December 2020. Document Reference: HE551478-ATK-EEV-XX_A46-RP-LW-000004

stage. The report outlined the estimated volume of floodplain that would be displaced by the proposed scheme. The report also looked at sizing a potential floodplain compensation site adjacent to the village of Kelham, approximately 2 kilometres north-west of the main scheme. The information within this report has been used to inform this chapter. Prior to the completion of the ES, further work will be carried out to assess potential floodplain compensation sites and identify appropriate flood risk mitigation measures.

14.3.5 As the majority of the scheme is within Flood Zones 2 and 3, an FRA will be undertaken prior to the completion of the ES to understand the potential risk of flooding. The results will be presented as a technical appendix to the ES.

14.3.6 The Highways England Water Risk Assessment Tool (HEWRAT) will also be completed to inform the ES and drainage design to ensure the design is compliant with water quality standards.

Assessment of sensitivity

14.3.7 Table 14.1 sets out the criteria that has been used to estimate the importance of the receptors as outlined in DMRB LA 113.

Table 14.1. Estimating the importance of water environment receptors

Importance	Typical criteria	Typical examples	
Very high	Nationally significant attribute of high importance	Surface water	<ul style="list-style-type: none"> • Watercourse having a WFD classification shown in a RBMP and $Q_{95} \geq 1.0 \text{ m}^3/\text{s}$. • Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water)/ Species protected by EC legislation LA 108.
		Groundwater	<ul style="list-style-type: none"> • Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation LA 108. • Groundwater locally supports Ground Water Dependent Terrestrial Ecosystems (GDWTE). • SPZ1.
		Flood Risk	<ul style="list-style-type: none"> • Essential infrastructure or highly vulnerable development.
High	Locally significant attribute of high importance	Surface water	<ul style="list-style-type: none"> • Watercourse having a WFD classification shown in a RBMP and $Q_{95} < 1.0 \text{ m}^3/\text{s}$. • Species protected under EC or UK legislation LA 108 [Ref 1.N].
		Groundwater	<ul style="list-style-type: none"> • Principal aquifer providing a locally important resource or supporting river ecosystem. • Groundwater locally supports GWDTE.

Importance	Typical criteria	Typical examples	
			<ul style="list-style-type: none"> • SPZ2.
Medium	Of moderate quality and rarity	Flood Risk	<ul style="list-style-type: none"> • More vulnerable development.
		Surface water	<ul style="list-style-type: none"> • Watercourses not having a WFD classification shown in a RBMP and $Q_{95} > 0.001\text{m}^3/\text{s}$.
		Groundwater	<ul style="list-style-type: none"> • Aquifer providing water for agricultural or industrial use with limited connection to surface water. • SPZ3.
		Flood Risk	<ul style="list-style-type: none"> • Less vulnerable development.
Low	Lower quality	Surface water	<ul style="list-style-type: none"> • Watercourses not having a WFD classification shown in a RBMP and $Q_{95} \leq 0.001\text{m}^3/\text{s}$.
		Groundwater	<ul style="list-style-type: none"> • Unproductive strata.
		Flood Risk	<ul style="list-style-type: none"> • Water compatible development.

Source: DMRB LA 113 – Road drainage and the water environment Revision 1. Table 3.70 & Ref 1.N

Assessment of magnitude

14.3.8 The magnitude of impact on the receptors from the scheme has been assessed in accordance with the criteria presented in Table 14.2 below.

Table 14.2. Estimating the magnitude of an impact on an attribute

Magnitude	Criteria	Typical examples	
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface water	<ul style="list-style-type: none"> • Failure of both acute-soluble and chronic sediment related pollutants in HEWRAT and compliance failure with EQS values. • Calculated risk of pollution from a spillage $\geq 2\%$ annually (spillage assessment). • Loss or extensive change to a fishery. • Loss of regionally important public water supply. • Loss or extensive change to a designated nature conservation site. • Reduction in water body WFD classification.
		Groundwater	<ul style="list-style-type: none"> • Loss of, or extensive change to an aquifer. • Loss of regionally important water supply. • Potential high risk of pollution to groundwater from routine run-off – risk score > 250 (Groundwater quality and run-off assessment). • Calculated risk of pollution from spillages $\geq 2\%$ annually (spillage assessment). • Loss of, or extensive change to the GWDTE or baseflow contribution to protected surface water bodies. • Reduction in water body WFD classification.

Magnitude	Criteria	Typical examples	
			<ul style="list-style-type: none"> • Loss or significant damage to major structures through subsidence or similar effects.
		Flood Risk	<ul style="list-style-type: none"> • Increase in peak flood level (> 100mm).
Moderate adverse	Results in some measurable change in attributes, quality or vulnerability	Surface water	<ul style="list-style-type: none"> • Failure of either acute-soluble and chronic sediment related pollutants in HEWRAT • Calculated risk of pollution from a spillage $\geq 1\%$ annually <2% annually (spillage assessment). • Partial loss in productivity of a fishery. • Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. • Contribution to reduction in water body WFD classification.
		Groundwater	<ul style="list-style-type: none"> • Partial loss or change to an aquifer. • Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies. • Potential medium risk of pollution from spillages $\geq 1\%$ annually <2% annually (spillage assessment). • Partial loss of the integrity of GWDTE.

Magnitude	Criteria	Typical examples	
			<ul style="list-style-type: none"> • Contribution to reduction in water body WFD classification. • Damage to major structure through subsidence or similar effects or loss of minor structures.
		Flood Risk	<ul style="list-style-type: none"> • Increase in peak flood level (> 50mm).
Minor adverse	Results in some measurable change in attributes, quality or vulnerability	Surface water	<ul style="list-style-type: none"> • Failure of either acute soluble or chronic sediment related pollutants in HEWRAT. • Calculated risk of pollution from spillages $\geq 0.5\%$ annually and $< 1\%$ annually. • Minor effects on water supplies.
		Groundwater	<ul style="list-style-type: none"> • Potential low risk of pollution to groundwater from routine run-off – risk score < 150. • Calculated risk of pollution from $\geq 0.5\%$ annually and $< 1\%$ annually. • Minor effects on an aquifer, GWDTEs, abstractions and structures.
		Flood Risk	<ul style="list-style-type: none"> • Increase in peak flood level (> 10mm).
Negligible	Results in some measurable change in attributes but of insufficient magnitude to affect the use or integrity	The proposed project is unlikely to affect the integrity of the water environment.	
		Surface water	<ul style="list-style-type: none"> • No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants).

Magnitude	Criteria	Typical examples	
			<ul style="list-style-type: none"> • Risk of pollution from spillages <0.5%.
		Groundwater	<ul style="list-style-type: none"> • No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages <0.5%.
		Flood Risk	<ul style="list-style-type: none"> • Negligible change to peak flood level ($\leq \pm 10$mm).
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Surface water	<ul style="list-style-type: none"> • HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. • Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually).
		Groundwater	<ul style="list-style-type: none"> • Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk is <1% annually). • Reduction of groundwater hazards to existing structures. • Reductions in waterlogging and groundwater flooding.
		Flood Risk	<ul style="list-style-type: none"> • Creation of flood storage and decrease in peak flood level (>10mm).
Moderate beneficial	Results in moderate improvement of attribute quality	Surface water	<ul style="list-style-type: none"> • HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition.

Magnitude	Criteria	Typical examples	
			<ul style="list-style-type: none"> • Calculated reduction in existing spillage by 50% or more (when existing spillage >1% annually). • Contribution to improvement in water body WFD classification.
		Groundwater	<ul style="list-style-type: none"> • Calculated reduction in existing spillage by 50% or more (when existing spillage >1% annually). • Contribution to improvement in water body WFD classification. • Improvement in water body catchment abstraction management strategy (or equivalent) classification. • Support to significant improvements in damaged GWDTE.
		Flood Risk	<ul style="list-style-type: none"> • Creation of floodplain storage and decrease in peak flood level (>50mm).
Major beneficial	Results in major improvement of attribute quality	Surface water	<ul style="list-style-type: none"> • Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. • Improvement in water body WFD classification.
		Groundwater	<ul style="list-style-type: none"> • Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. • Recharge of an aquifer.

Magnitude	Criteria	Typical examples	
			<ul style="list-style-type: none"> • Improvement in water body WFD classification.
		Flood Risk	<ul style="list-style-type: none"> • Creation of floodplain storage and decrease in peak flood level (>100mm).
No change		<ul style="list-style-type: none"> • No loss or alteration of characteristics, features or elements; no observable impact in either direction. 	

Source: DMRB LA 113 Road drainage and the water environment Revision 1. Table 3.71

Assessment of significance

14.3.9 Following on from identifying a receptor's sensitivity and magnitude of impact using Table 4.1 and Table 4.2, the likely significance category and overall significance of effects is assessed by using the matrix provided within Table 5.3 in Chapter 5.

14.3.10 The assessment of effects will be further refined within the ES and will be undertaken in accordance with DMRB LA 113 - Road drainage and the water environment and DMRB LA 104 – Environmental assessment and monitoring.

14.4 Study area

14.4.1 The study area for road drainage and the water environment covers a 1 kilometre radius around the scheme including the proposed floodplain compensation areas. This relates to both surface water and groundwater. This study area has been used as pollutants are expected to disperse and have been diluted beyond a 1 kilometre radius. Based on professional judgment the study area may be extended where there are sensitive features (protected areas) that may be affected by contaminants transported downstream of the works via surface water bodies or groundwater bodies. This approach ensures that any potential effects of the scheme are sufficiently identified. However, based on the current design and impacts identified at this stage of assessment, no receptors outside the 1 kilometre study area have been identified for this scheme. This assumption will be revisited as the design develops and any changes will be reported within the ES.

14.5 Existing baseline

14.5.1 Information to assist with defining the existing baseline conditions has been obtained from the following sources:

- Environment Agency's Catchment Data Explorer²³⁵.
- Environment Agency's Flood Map for Planning²³⁶.
- Humber RBMP²³⁷.
- Department for Environment Food Rural Affairs (Defra) 'Magic' (Multi-agency geographic information for the countryside) interactive map²³⁸.

²³⁵ Environment Agency (2021) Environment Agency Data Catchment Explorer [online] Available at: <https://environment.data.gov.uk/catchment-planning/> (Last accessed August 2022).

²³⁶ Environment Agency (2021) Environment Agency Flood Map for Planning [online] available at: <https://flood-map-for-planning.service.gov.uk/> (Last accessed August 2022).

²³⁷ Environment Agency (2016) Humber River Basin Management Plan [online] available at: [Humber river basin district river basin management plan - GOV.UK \(www.gov.uk\)](http://www.gov.uk) (Last accessed October 2022).

²³⁸ DEFRA Magic Map. Available at: <https://magic.defra.gov.uk/MagicMap.aspx> (Last accessed August 2022)

- Environment Agency's Public registers for environmental permits²³⁹.
- United Kingdom Soil Observatory (UKSO) information²⁴⁰.
- Newark and Sherwood District Council, Strategic Flood Risk Assessment (SFRA)²⁴¹,
- British Geological Survey Map²⁴².

14.5.2 The baseline identifies potential receptors of the scheme, considering the range and interactions of processes that will influence surface water, groundwater, flood risk and drainage, as well as ensuring WFD objectives are met. A sensitivity has been assigned to each identified water environment receptor based on DMRB LA 113.

Surface water

14.5.3 Figure 14.1 contained in Volume 2 shows the surface water baseline identified within the study area.

14.5.4 There are four Main Rivers located within the study area (River Trent, Middle Beck, River Devon, and Slough Dyke (The Fleet)). Currently, the A46 crosses the River Trent twice, and the Slough Dyke (the Fleet) once. There are also ordinary watercourses²⁴³ within the study area, including the Old Trent Dyke which the A46 crosses. The scheme is located within the Trent Valley Internal Drainage Board (IDB) area.

14.5.5 Table 14.3 lists the surface watercourse receptors identified within the study area, including distance to the scheme, which has been assigned based on whether or not the watercourse has a WFD classification and its Q95 flow, following DMRB LA 113 methodology. Where Q95 flow data is not readily available a conservative assumption has been made using professional judgement.

14.5.6 There are no WFD lake waterbodies within the study area, however, there are numerous non-WFD lakes/ponds. These are listed below:

- Farndon Ponds: located adjacent to Farndon Harbour approximately 0.9 kilometres west of the scheme.
- Three ponds adjacent to the proposed Kelham and Averham Floodplain Compensation Area (FCA).
- Ponds adjacent to Staythorpe Power Station: located approximately 0.7 kilometres east of the scheme, but separated from the scheme by the River Trent.

²³⁹ Environment Agency's published data. Available at: [Public registers \(data.gov.uk\)](https://public.registers.data.gov.uk) (Last accessed August 2022).

²⁴⁰ UKSO. Available at: [UK Soil Observatory \(bgs.ac.uk\)](https://bgs.ac.uk) (Last accessed August 2022).

²⁴¹ Newark and Sherwood District Council, Strategic Flood Risk Assessment [online]. Available at: [Strategic Flood Risk Assessment Level 2 Stage 2 | Newark & Sherwood District Council \(newark-sherwooddc.gov.uk\)](https://newark-sherwooddc.gov.uk) (last accessed August 2022)

²⁴² British Geological Survey Map [online]. Available at: [Geology of Britain viewer | British Geological Survey \(BGS\)](https://geology.bgs.ac.uk) (last accessed August 2022)

²⁴³ An ordinary watercourse is any channel that water flows through which is not part of the main river network, as defined by the Environment Agency. These watercourses are owned by the Local Lead Flood Authority.

- Three ponds approximately 0.9 kilometres north of the A46 and east of the A616 associated with Smeatons Lakes Camping site.
- Two bodies of water adjacent to Smeatons Lakes and the River Trent, the purposes of these are unclear. The closest of these waterbodies is approximately 0.5 kilometres north of the scheme (not separated by the River Trent).
- Four bodies of water to the north of the River Trent confluence, and south of the A1. These are separated from the scheme by the River Trent and it is unclear what the purpose of these waterbodies are. The closest of these waterbodies is approximately 0.3 kilometres west of the scheme.

14.5.7 At this stage, the ponds/lakes identified above are not believed to be groundwater dependent and, as such, should be considered to be surface water fed. The exact function of the waterbodies will be confirmed within the ES, where possible.

14.5.8 There are three marinas within the study area: Farndon Marina lies approximately 0.6 kilometres west of the scheme and upstream at the point where the A46 crosses the River Trent, Newark-on-Trent Marina is approximately 0.96 kilometres downstream of where the A46 crosses the River Trent, and Kings Waterside and Marina is adjacent to the A46 boundary (approximately 2.5 kilometres downstream of where the A46 crosses the River Trent near Farndon, and 0.8 kilometres upstream of where the A46 crosses the River Trent near Robert Dukes Avenue).

Table 14.3. Surface watercourses within the study area

Watercourse	Approximate distance from scheme²⁴⁴	Q₉₅ Levels (m³/s)²⁴⁵	Description
River Trent	0 kilometres - The A46 crosses this watercourse twice.	28.9	This waterbody splits into two, upstream of Newark-on-Trent-on-Trent and rejoins downstream of Newark-on-Trent-on-Trent.
Middle Beck	0.80 kilometres south-east (upstream) of the southern extent of the scheme.	Unknown	This waterbody joins the River Devon within the study area.
River Devon	0.1 kilometres, east (upstream) of the southern extent of the scheme.	0.132	This waterbody joins the River Trent within the study area.
Old Trent Dyke	0 kilometres - The A46 crosses this watercourse three times.	Unknown	This watercourse is a tributary of the River Trent.

²⁴⁴ The distance has been taken from the point of the watercourse closest to the scheme

²⁴⁵ Q₉₅ values obtained from UK Centre for Ecology & Hydrology, National River Flow Archive ([Search Data | National River Flow Archive \(ceh.ac.uk\)](https://www.ceh.ac.uk/nrfa)). Q₉₅ values taken from closest point on the watercourse. 'Unknown' Q₉₅ values are where the Q₉₅ values are not readily available for these watercourses.

Watercourse	Approximate distance from scheme²⁴⁴	Q₉₅ Levels (m³/s)²⁴⁵	Description
Unnamed watercourse (1)	0 kilometres – The A46 crosses this watercourse once.	Unknown	This watercourse is a tributary of the River Trent upstream of the B6326 bridge. This watercourse may be a feeder into the Old Trent Dyke. At this stage, it is not known what the relationship between these two watercourses is.
Misson Drain	0.4 kilometres north (downstream) of the Floodplain Compensation Area proposed in Kelham.	Unknown	This watercourse is a drain into the River Trent flowing through Kelham and connecting to Broadgate Lane feeder
Broadgate Lane Feeder	0 kilometres – adjacent to the Floodplain Compensation Area proposed in Kelham.	Unknown	This watercourse is a drain from fields north of Kelham, connecting to Mission Drain and the River Trent.
Unnamed watercourse (2)	0 kilometres – The A46 crosses this watercourse once.	Unknown	This watercourse drains into the River Trent downstream of where the A46 crosses.
Slough Dyke (The Fleet)	0 kilometres – The A46 crosses this watercourse immediately west of Brownshills roundabout.	Unknown	This watercourse flows through the north-east of Newark-on-Trent-on-Trent and Winthorpe before joining the River Trent downstream.

Flood Risk

- 14.5.9 Figure 14.2 in Volume 2 shows the Flood Zones identified within the study area.
- 14.5.10 The scheme is located across areas within Flood Zone 2 (land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding) and Flood Zone 3 (land having a 1 in 100 or greater annual probability of river flooding), with all aspects of the scheme north of Newark-on-Trent located within Flood Zone 1 (land having a less than 1 in 1,000 annual probability of river flooding). These Flood Zones are associated with the River Trent. The scheme is not located within an area at risk of tidal flooding.
- 14.5.11 There are areas of medium risk of surface water flooding (between 1 in 30 and 1 in 100 chance of flooding each year), as defined by surface water flood risk mapping, however the majority of the scheme is located within areas of very low risk of surface water flooding (between 1 in 100 and 1 in 1000 chance of flooding each year). There is a section in the northern extent of the scheme, adjacent to Alexander Avenue, where there is an area of medium risk associated with the ordinary watercourse being culverted under the A46.
- 14.5.12 The majority of the scheme is located within an area that is considered highly susceptible to groundwater flooding ($\geq 75\%$ chance of suffering from groundwater flooding).

Groundwater

- 14.5.13 Figure 14.3 in Volume 2 shows the groundwater constraints identified within the study area.
- 14.5.14 British Geological Survey (BGS) superficial geology mapping demonstrates Alluvium across the majority of the south-western half of the study area. The Balderton Sand and Gravel Member underlies the majority of the north-eastern section of the study area. Small areas of Holme Pierrepont Sand and Gravel Member are also present mainly located just west of the A1, north of Cattle Market and at the south-western extent of the study area. The combined superficial deposits throughout the study area are designated by the Environment Agency as a Secondary B aquifer, which typically comprise low permeability layers that store and yield limited amount of groundwater through fissures.
- 14.5.15 BGS bedrock designation indicate Mercia Mudstone underlying the scheme. The Edwalton Member is recorded underlying the southwest extent of the scheme whilst the Gunthorpe Member underlies the southeastern extent. The combined bedrock formations underlying the study area are designated by the Environment Agency as a

Secondary B aquifer, which typically comprise low permeability layers that store and yield limited amount of groundwater through fissures

- 14.5.16 The entirety of the scheme is located within the Lower Trent Erewash Secondary Combined (GB40402G990300) groundwater WFD waterbody.
- 14.5.17 There are no Source Protection Zones (SPZs), drinking water protected areas or drinking water safeguard zones within the study area. At this stage, it is not known whether there are private abstractions for drinking water or agriculture in the study area, this information will be requested and included in the ES.
- 14.5.18 There are three authorised landfill sites within the study area. Two of these landfills are located adjacent to the A46 as part of the British Sugar Company, and the third is located to the east of the A616, approximately 0.8 kilometres north of Cattle Market Junction. The risk of contaminated land and the risk to soils have been scoped-in (see Chapter 9 Geology and Soils). Therefore, mobilisation of sediment and contaminants will be considered further. For further information on the potential of contaminated land, see Chapter 9 Geology and Soils.

Designated sites

- 14.5.19 There are no Ramsar sites, Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Sites of Special Scientific Interest (SSSIs) located within the study area.
- 14.5.20 There are two Local Nature Reserves (LNRs) located within the study area
- Farndon Ponds LNR: located approximately 0.8 kilometres to the east of Farndon Junction. Whilst this site is hydraulically connected to the River Trent, it is upstream of the scheme.
 - Devon Park Pastures LNR: located approximately 500 metres east of Farndon Junction. This site is adjacent to the River Devon, however, upstream of the River Trent and the scheme.
- 14.5.21 Farndon Pond LNR is located upstream of the scheme, and Devon Park LNR is considered to be at a suitable distance downstream for any potential contaminants to disperse and have a credible pathway for surface water contaminants. A Ground Water Dependent Terrestrial Ecosystem (GWDTE) assessment was also undertaken during the earlier options appraisal stage of the scheme and did not identify any GWDTEs within the study area. Therefore, these LNRs are not considered to be GWDTEs. Given this information, LNRs have been scoped-out of the assessment and are not considered further.

14.6 Value (sensitivity of resources and receptors)

- 14.6.1 Table 14.4 assigns the receptors identified in Section 14.5 a sensitivity value based on the assessment outlined in Section 14.3.

Table 14.4. Receptor sensitivity

Name	Type of receptor	Sensitivity	Justification
River Trent	Main River	Very high	The watercourse has a WFD classification and Q_{95} level greater than $1\text{m}^3/\text{s}$ ²⁴⁶ . The scheme is essential infrastructure and is located within an area of Flood Zone 3 associated with the River Trent.
Middle Beck	Main River	High	The watercourse has a WFD classification. The Q_{95} level is unknown, however as it appears to be a narrow watercourse which joins the River Devon, it is assumed to have a Q_{95} level similar to the River Devon (less than $1\text{m}^3/\text{s}$.) There is no fluvial flood risk to the scheme associated with this watercourse. The scheme is not located within the floodplain of this watercourse.
River Devon	Main River	Very high	The watercourse has a WFD classification but the Q_{95} level is less than $1\text{m}^3/\text{s}$. The scheme is essential infrastructure, and the scheme is located within an area of Flood Zone 3 associated with the River Devon.
Old Trent Dyke	Ordinary Watercourse	Medium	The watercourse does not have a WFD classification. It is assumed the Q_{95} level is greater than $0.001\text{m}^3/\text{s}$.
Unnamed watercourse (1)	Ordinary Watercourse	Low	This watercourse does not have a WFD classification and appears to be heavily modified (culverted under development). It is assumed the Q_{95} level is less than $0.001\text{m}^3/\text{s}$.
Misson Drain	Ordinary Watercourse	Low	This watercourse does not have a WFD classification and appears to be a drainage channel (potentially for agricultural purposes). It is assumed the Q_{95} level is less than $0.001\text{m}^3/\text{s}$.

²⁴⁶ The flow in cubic metres per second which is equalled or exceeded for 95% of the flow record

Name	Type of receptor	Sensitivity	Justification
Broadgate Lane Feeder	Ordinary Watercourse	Low	This watercourse does not have a WFD classification and appears to be a drainage channel (potentially for agricultural purposes). It is assumed the Q_{95} level is less than $0.001 \text{ m}^3/\text{s}$.
Unnamed watercourse (2)	Ordinary Watercourse	Medium	The watercourse does not have a WFD classification. It is assumed the Q_{95} level is greater than $0.001 \text{ m}^3/\text{s}$.
Slough Dyke (The Fleet)	Main River	High	The watercourse has a WFD classification. The Q_{95} level is unknown, however it appears to be culverted under Newark-on-Trent. Assuming it would not have a flow rate higher than the River Devon, it is assumed to have a Q_{95} level less than $1 \text{ m}^3/\text{s}$.
All ponds	Ponds	Low	None of the ponds identified within the study area are mentioned within the RBMP or are WFD lake waterbodies.
Lower Trent Erewash Secondary Combined	Groundwater	Medium	This WFD groundwater body is considered to be a low productivity aquifer, and there are no SPZs.

14.7 Potential impacts

Construction

Surface water

- 14.7.1 There is the potential for surface water quality to be affected through contaminants arising from construction activities entering surface watercourses. These activities include excavation, deposition of soils, sediments, or other construction materials to accommodate new watercourse crossings; spillage of fuels or other contaminating liquids; and mobilisation of contamination following disturbance of contaminated ground or groundwater, or through uncontrolled surface runoff and discharge of silt-laden water during dewatering.
- 14.7.2 There is the potential for adverse impacts due to localised damage to channel and riparian features and disruption to the natural hydraulic and sediment transport processes, due to the modification and construction of culverts and bridges during construction for the scheme.

Flood Risk

- 14.7.3 There is the potential for an increase in flood risk within the scheme extent and the surrounding areas due to the potential for construction activities to alter the flow paths of surface water or increase the amount of surface water run-off in localised areas. An increase in flood risk within the scheme extent and the surrounding areas could also occur due to any changes in topography and/or earthworks, which could change the overland flows during storm events.

Groundwater

- 14.7.4 Ground and earthworks during construction may cause disruptions to the groundwater flow region. This may cause adverse impacts associated with interruptions of flow, leading to either a reduction or loss of water supply to abstractions.
- 14.7.5 There is potential for minor reduction in groundwater flows and levels due to dewatering in the superficial sediments or bedrocks during excavations.
- 14.7.6 There is the potential for adverse impacts from contamination of groundwater by the mobilisation of contaminants within the soils, through accidental spillages or direct contact with construction materials or piling operations which could create pathways to groundwater. In addition, there is the risk of contamination of aquifers through indirect groundwater receptors such as springs, streams and/or abstractions.

Regulatory compliance

- 14.7.7 The potential adverse impacts to channels and riparian features and disruption to the natural hydraulic and sediment transport processes, also have the potential to affect the WFD status of the surface waterbodies.
- 14.7.8 The cumulative impact of deep below ground works have the potential to affect the WFD status of the Lower Trent Erewash Secondary Combined groundwater body.

Operation

Surface water

- 14.7.9 Pollution of surface water from discharge of routine road run-off may lead to degradation of water quality. These contaminants within the runoff typically include vehicle emissions (including atmospheric deposition), vehicle part wear and vehicle leakages, catalytic converters, road surface erosion, and seasonal and regular maintenance practices. Possible contaminants include particulate solids, hydrocarbons (diesel, petroleum, lubricating oil leaks, and grease), heavy metals (especially copper and zinc, but also cadmium, iron, lead and chromium in lesser amounts), oxides of nitrogen, sulphates, rubber, asbestos, tyre wear deposits including lead, zinc and hydrocarbons, and de-icing during cold weather. All these contaminants have the potential to have an adverse effect on the water quality of the receiving watercourse and associated aquatic ecosystems.

Flood Risk

- 14.7.10 There is a potential for an increase in flood risk within the scheme extent and the surrounding areas due to:
- The presence of permanent infrastructure within the floodplain and the resultant decrease in areas to store water.
 - The increase in impermeable surfacing and changes in surface water run-off as a result of changes in topography or flow patterns.
 - The presence of permanent below-ground structures interrupting the groundwater flow regime.

Groundwater

- 14.7.11 Permanent below-ground infrastructure may cause a change in existing groundwater flow regime, resulting in an interruption to flow. This may lead to the loss of water supply to springs and streams.
- 14.7.12 New drainage systems have the potential to interrupt flow by reducing recharge to the underlying aquifer.

Regulatory compliance

14.7.13 Infrastructure within or adjacent to watercourses have the potential to cause direct adverse morphological impacts, which could result in a less dynamic flow, loss of riverbed continuity, increased sedimentation, habitat severance, potential barriers for fish migration, and loss of habitats for macrophytes through shading. These adverse impacts could affect the WFD status of the watercourse if unmitigated.

14.8 Consultation

14.8.1 An introductory meeting was held with the Environment Agency on 30 March 2022 to introduce the scheme and in particular water quality and flood management issues.

14.8.2 The first Flood and Drainage Steering Group meeting was held on 05 April 2022 with representatives from Nottinghamshire County Council and the Internal Drainage Board (Water Management Consortium). The meeting introduced the scheme and set out the aims for steering the drainage and flood management works. The second Flood and Drainage Steering Group was held on 11 May 2022 with representatives from the Internal Drainage Board (Water Management Consortium) and the Environment Agency. The meetings were used to collate further information on the following items: the River Trent Model, Basis of Design for Floodplain Level Compensation, Land Drainage, Records and models, Historic Flood Records, Run-off Control Conditions, and Flood Resilience – Joint Probability. A follow up meeting was held with the Environment Agency on 12 May 2022 to discuss the data received from the Environment Agency and procuring outstanding information from requests. The third Flood and Drainage Steering Group meeting was held on 07 July 2022 with representatives from Nottinghamshire County Council and the Internal Drainage Board (Water Management Consortium). The meetings were used to further discuss the flood management and drainage including: the operational working level for the Old Trent Dyke, the Old Trent Dyke drainage schematic, the existing structures where the scheme crosses Internal Drainage Board maintained watercourses, the land drainage and the drainage strategy.

14.8.3 Further meetings were held with the Environment Agency on 13 June 2022 to agree proposals for water quality monitoring for the scheme, both pre-construction (to inform the EIA) and during construction, and on the 22 July to provide a survey update, review the modelling approach, discuss floodplain compensation and agree future engagement.

14.8.4 Further consultation will be undertaken throughout the preparation of the ES.

14.9 Assumptions and limitations

14.9.1 The assumptions made to inform this chapter are as follows:

- This report has been prepared using publicly available information, and existing assessments undertaken as part of the previous stage of the scheme. It is assumed the information provided from these sources are correct and true to current baseline conditions for the scheme.
- Currently there are proposed floodplain compensation areas in the Kelham and Averham area, Brownhill's Junction area and an area south of the A46 close to the Old Trent Dyke that is being referred to as the Farndon Borrow Pits / Floodplain Compensation Area. These FCAs have been developed based on existing information about the scheme and as such are subject to refinement as the design progresses. To demonstrate that the floodplain compensation sites are effective, analytical flood modelling will be carried out at a later stage.
- Q95 values for watercourses within the study area have been taken from the closest point on the watercourse. 'Unknown' Q95 values are where the Q95 values are not readily available for these watercourses. Where Q95 flow data is not readily available a conservative assumption has been made using professional judgement.

14.9.2 The limitations to this chapter are as follows:

- No water or sediment sampling has been carried out to date. A water quality sampling strategy has been produced, however the exact locations of sampling is subject to change due to accessibility to the site and site conditions.

14.10 Design, mitigation and enhancement measures

Design

- 14.10.1 Design measures to reduce the impact of the scheme on the road drainage and water environment include: surface water management/drainage systems to control surface water run-off, and the use of Sustainable Drainage Systems (SuDs), in line with the SuDS hierarchy, and attenuation ponds.
- 14.10.2 A HEWRAT assessment will be completed to support the ES, and suitable measures (including a detailed drainage design) will be implemented. The drainage design will include pollution prevention measures to control and prevent polluted run-off, this will be informed by the HEWRAT assessments.
- 14.10.3 Monitoring of the watercourses at risk of pollution will be carried out prior to construction commencing to inform baseline conditions and the ES. At the time of writing, consultation with the Environment Agency is underway to determine sampling locations and requirements for pre-

construction monitoring. Types of assessment may include visual assessments for oil and silt, as well as laboratory and in-situ testing from sampling points located upstream and downstream of the scheme, in particular where the scheme crosses watercourses.

- 14.10.4 The scheme involves work within Flood Zone 2 and Flood Zone 3; design measures to mitigate for this include locating compounds outside of Flood Zones 2 and 3 and minimising floodplain working, where possible. A report titled “Flood Compensation Calculations – Fourth Iteration”²⁴⁷ was produced at the previous design stage. The report outlined the estimated volume of floodplain that would be displaced by the proposed scheme. The report also looked at sizing a potential floodplain compensation site adjacent to the village of Kelham. Prior to the completion of the ES, further work will be carried out to assess potential floodplain compensation area and identify appropriate flood risk mitigation measures. Hydraulic modelling will be undertaken to further understand the risk of the scheme to flooding.
- 14.10.5 The scheme involves works within/near to WFD waterbodies, therefore a WFD assessment will be undertaken and a WFD compliance report produced to inform the ES and assess the potential effects of the scheme on the status of these waterbodies.

Mitigation – construction

- 14.10.6 The First Iteration Environmental Management Plan will be submitted as part of the DCO application and will be further developed into the Second Iteration Environmental Management Plan prior to construction commencing. The Second Iteration Environmental Management Plan will be put in place to implement the required mitigation measures identified within the ES. This will manage the potential effects of the scheme on water resources and to ensure the scheme will comply with current policies/regulations that aim to protect water resources. Construction activities will be managed by best practices measures in accordance with Construction Industry Research and Information Association (CIRIA) Guidelines.
- 14.10.7 Guidance on best practice in relation to pollution prevention and water management is set out in the following:
- CIRIA’s ‘Environmental good practice on site’²⁴⁸
 - CIRIA’s ‘Control of water pollution from linear construction projects; Technical Guidance’²⁴⁹

²⁴⁷ Flood Compensation Calculations – Fourth Iteration, *Atkins*, December 2020. Document Reference: HE551478-ATK-EEV-XX_A46-RP-LW-000004

²⁴⁸ Audus, Charles and Evans (2010) *Environmental Good Practice on Site* (Third Edition) (C692)

²⁴⁹ Murnane, Heap and Swain (2006) *Control of water pollution from linear construction projects; Technical Guidance*.

- Environment Agency's 'Protect groundwater and prevent groundwater pollution'²⁵⁰
 - Environment Agency's Pollution Prevention Guidelines PPG5 'Works and maintenance in or near water', PPG6 'Working at Construction and Demolition Sites', PPG7 'The safe operation of refuelling facilities', and PPG13 'Vehicle washing and cleaning'²⁵¹
- 14.10.8 It is anticipated that surface water quality and groundwater level and/or quality monitoring will be undertaken during construction. Details of this monitoring will be included within the ES.
- 14.10.9 Discharges of trade effluent or unclean water to a body of surface water may require an environmental permit to be acquired from the Environment Agency.
- 14.10.10 Any piling works required for the scheme will be subject to appropriate risk assessments. Method statements detailing piling operations will cover the potential to cause pollution to the underlying aquifer and potential mobilisation of contaminated soil.
- 14.10.11 The construction works will minimise in-channel working and riparian vegetation removal, where necessary.
- 14.10.12 The scheme will require work to be carried out within Flood Zone 2 and Flood Zone 3. An FRA will be undertaken to understand the risk of flooding during construction and to ensure appropriate mitigation is implemented within the Second Iteration Environmental Management Plan.
- 14.10.13 The scheme potentially impacts a number of WFD waterbodies. A WFD compliance assessment will be undertaken to understand the extent to which the proposed scheme could impact on the current and future target WFD status of these waterbodies. Where potential adverse effects are identified, an assessment of these will inform what mitigation measures need to be incorporated into the design and construction methods of the proposed scheme to remove or minimise the effect.

Mitigation – operation

- 14.10.14 Alterations to the road network should provide adequate drainage to accommodate potential changes in surface run-off, including an allowance for climate change in accordance with the DMRB CG 501 -

²⁵⁰ Environment Agency (2017) Protect groundwater and prevent groundwater pollution [online] available at: <https://www.gov.uk/Government/publications/protect-groundwater-and-prevent-groundwater-pollution/protect-groundwater-and-prevent-groundwater-pollution> (last accessed August 2022)

²⁵¹ The Environment Agency PPGs were formally withdrawn on 17 December 2015, however, they nonetheless provide clear and useful best practice advice. The archived PPGs are available at: <https://webarchive.nationalarchives.gov.uk/ukqwa/20140328090931/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx> (Last accessed August 2022)

Design of highway drainage systems²⁵² standards, and through consultation with the Environment Agency and the Lead Local Flood Authority (Nottinghamshire County Council).

14.10.15 It is anticipated that surface water quality and groundwater level and/or quality monitoring will be undertaken post construction. Details of this monitoring will be included within the ES.

14.10.16 The scheme involves work within Flood Zone 2 and Flood Zone 3; therefore the scheme design will incorporate floodplain compensation areas and explore the potential of other mitigation measures to compensate for increases in surface water run-off due to increased impermeable surfacing. At this stage, the plans for the additional mitigation measures and the details on the design and extents of floodplain compensation areas are still to be determined. However, currently there are proposed FCA's in the Kelham-Averham area, Brownhill's Junction area and an area south of the A46 close to the Old Trent Dyke being referred to as the Farndon Borrow Pits / Floodplain Compensation Area.

Enhancement measures

14.10.17 Enhancement measures for road drainage and the water environment will be considered as part of the ongoing design development and will be reported in the ES. However, these enhancement measures will not be taken into account when determining whether effects are significant or not.

14.11 Assessment of effects

14.11.1 The assessment of likely significant effects considers impacts on surface water and groundwater receptors/features within the study area. This assessment only considers receptors that are directly hydrologically connected/linked to the scheme.

14.11.2 A summary of the assessment of likely significant effects during construction and operation is provided in Table 14.5.

Construction

14.11.3 Construction activities could mobilise sediment and contaminants (such as suspended soils, fuel, oil, concrete liquors, and hydrocarbons) through surface water run-off to the surrounding watercourses and ponds, in particular those which the scheme crosses. Construction activities also have the potential to disturb and release excess sediment and suspended solids which could

²⁵² National Highways (2020) DMRB CG 501 – Design of highway drainage systems. Available at: <https://www.standardsforhighways.co.uk/dmrB/search/ada3a978-b687-4115-9fcf-3648623aaff2> (last accessed August 2022).

contaminate surface water run-off. The mobilisation of these contaminants also has the potential to impact groundwater quality and cause aquifer contamination through construction activities (piling) creating pathways to the groundwater. In the absence of adequate mitigation, these activities could result in water quality deterioration.

- 14.11.4 Construction and modification of culverts and bridges as part of the scheme has the potential to cause localised damage to channel and riparian features, and cause disruption to the natural hydraulic and sediment transport. In the absence of adequate mitigation measures, this has the potential to result in an adverse effect on the objectives of the WFD catchment (including the River Trent, Old Trent Dyke and Unnamed watercourse (1)).
- 14.11.5 There is a potential for construction activities to alter flow paths of surface water through changes in topography, and/or earthworks, and diversion of run-off. In the absence of adequate mitigation, construction activities could result in an increase in flood risk in the surrounding watercourses and ponds.
- 14.11.6 In addition, ground and earthworks, including dewatering activities in the superficial sediments or bedrock during excavation activities may disrupt the groundwater flow and levels. If left unmitigated, these activities could result in either a reduction or a loss of water supply to abstractions.
- 14.11.7 The Environmental Management Plan will include mitigation measures outlined in Section 14.10. Mitigation measures will be refined and reported within the ES following further assessment.
- 14.11.8 Therefore, the impact magnitude and resultant significance on surface water receptors, assuming embedded mitigation, are considered to be:
- The importance of the watercourses and ponds vary from 'Very High' to 'Low' and the magnitude of impact of contaminated runoff and spillages would be 'Negligible'. Therefore, the significance of effect on all waterbodies (except Misson Drain and ponds²⁵³) would be 'Slight Adverse'. The effect on Misson Drain and ponds would be 'Neutral'.
 - The importance of the WFD watercourses (River Trent, Old Trent Dyke and Unnamed Watercourse (1)) vary from 'Very High' to 'Low' and the magnitude of impact of construction of culverts and bridges on the WFD objectives of the River Trent, Old Trent Dyke, and Unnamed watercourse (1) would be 'Negligible'. Therefore, the significance of effect on the WFD watercourses would be 'Slight Adverse'.

²⁵³ The value of importance of the receptors varies from 'Very High' to 'Low', therefore the significance of effect (with mitigation) varies depending on the importance. The assessment takes into account worst-case scenario where there is a choice in the significance matrix.

- The importance of the watercourses and ponds vary from 'Very High' to 'Low' and the magnitude of impact of altering surface water flow regime and an increase in flood risk would be 'Negligible' for all watercourses and ponds. Therefore, the significance of effect on all waterbodies (except Misson Drain and ponds²⁵⁴) would be 'Slight Adverse'. The effect on Misson Drain and ponds would be 'Neutral'.
- 14.11.1 The impact magnitude and resultant significance on groundwater receptors, assuming embedded mitigation, are considered to be:
- 14.11.2 The importance of groundwater (Lower Trent Erewash Secondary Combined) is 'Medium' and the magnitude of impact of ground and earthworks on the groundwater and potential for disruption to groundwater flow would be 'Negligible'. Therefore, the significance of effect on groundwater would be 'Slight Adverse'.
- The importance of groundwater (Lower Trent Erewash Secondary Combined) is 'Medium' and the magnitude of impact of mobilisation of contaminants and creation of groundwater pathways would be 'Minor Adverse'. Therefore, the significance of effect would be 'Slight Adverse'.

Operation

- 14.11.3 Contaminants within surface water runoff due to traffic typically include vehicle emissions, vehicle part wear and vehicle leakages, catalytic converters, road surface erosion, and seasonal and regular maintenance practices. Possible contaminants include particulate solids, hydrocarbons (diesel, petroleum, lubricating oil leakages, and grease), heavy metals, oxides of nitrogen, sulphates, rubber, asbestos, tyre wear deposits including lead, zinc and hydrocarbons, and de-icer during cold weather. If not mitigated for within the drainage design, surface water runoff could result in contaminated runoff and a deterioration in water quality.
- 14.11.4 The scheme will result in an increase in impermeable surfacing which would generate additional surface water runoff and possible redirection of surface water runoff, which if not attenuated, could increase flood risk to the surrounding area. The scheme design will incorporate attenuation ponds and explore the potential of other mitigation measures to compensate for the increase in surface water runoff. Soakaway testing will be carried out in the area to the north (Brownhill Roundabout to Winthorpe) of the scheme to understand the potential of groundwater infiltration, if considered viable, infiltration

²⁵⁴ The value of importance of the receptors varies from 'Very High' to 'Low', therefore the significance of effect (with mitigation) varies depending on the importance. The assessment takes into account worst-case scenario where there is a choice in the significance matrix.

basins/swales will be integrated within the design to mitigate for the increase in surface water run-off volume.

14.11.5 Piling and below ground structures may be required in some areas which has the potential to cause localised disruption to the groundwater flow regime with potential groundwater mounding upgradient of the structures. In addition, these structures have the potential to create preferential pathways for contaminants. Where possible, the presence of permanent structures will be minimised at design level. However, at aquifer scale, the impact on groundwater is anticipated to be negligible as the groundwater will flow around these structures.

14.11.6 Detailed design and embedded mitigation measures outlined in Section 14.10 will be incorporated. Therefore, the impact magnitude and resultant significance of effects on surface water receptors are:

- The importance of the watercourses and ponds vary from 'Very High' to 'Low' and the magnitude of impact of contaminated runoff due to traffic would be 'Negligible' for all watercourses and ponds. The effect on all waterbodies (except Misson Drain and ponds²⁵⁵) would be 'Slight Adverse'. Therefore, the significance of effect on Misson Drain and ponds would be 'Neutral'.
- The importance of the watercourses and ponds vary from 'Very High' to 'Low' and the magnitude of impact of increase in impermeable surfacing resulting in increase in flood risk would be 'Negligible' for all watercourses and ponds. Therefore, the significance of effect on all waterbodies (except Misson Drain and ponds²⁵⁶) would be Slight Adverse. The effect on Misson Drain and ponds would be Neutral.

14.11.7 Detailed design and embedded mitigation measures outlined in Section 14.10 will be incorporated. Therefore, the impact magnitude and resultant significance of effects on groundwater receptors are:

- The importance of groundwater (Lower Trent Erewash Secondary Combined) is 'Medium' and the magnitude of impact of creation of new pathways and permanent below ground structures would be 'Minor adverse'. Therefore, the significance of effect on the groundwater would be 'Slight Adverse'.

²⁵⁵ The value of importance of the receptors varies from 'Very High' to 'Low', therefore the significance of effect (with mitigation) varies depending on the importance. The assessment takes into account worst-case scenario where there is a choice in the significance matrix.

²⁵⁶ The value of importance of the receptors varies from 'Very High' to 'Low', therefore the significance of effect (with mitigation) varies depending on the importance. The assessment takes into account worst-case scenario where there is a choice in the significance matrix.

Table 14.5. Summary of assessment of effects

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
Construction					
River Trent	Very high	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse
		Localised damage to channel and riparian features	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. 	Negligible	Slight adverse
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse

²⁵⁷ Significance values which have a choice between two options within the significance matrix are shown by the presence of a '*' followed by a justification for this choice.

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
		Disruption to natural hydraulic and sediment transport	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. Monitoring strategy produced. 	Negligible	Slight adverse
		Increase in flood risk	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. 	Negligible	Slight adverse
Middle Beck	High	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. Construction related runoff would be controlled by measures listed in the Environmental Management Plan. Monitoring strategy produced. 	Negligible	Slight adverse
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. Construction related runoff would be controlled by measures listed in the Environmental Management Plan. Monitoring strategy produced. 	Negligible	Slight adverse
		Increase in flood risk	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. 	Negligible	Slight adverse

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
River Devon	Very high	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. Construction related runoff would be controlled by measures listed in the Environmental Management Plan. Monitoring strategy produced. 	Negligible	Slight adverse
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. Construction related runoff would be controlled by measures listed in the Environmental Management Plan. Monitoring strategy produced. 	Negligible	Slight adverse
		Increase in flood risk	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. 	Negligible	Slight adverse
Old Trent Dyke	Medium	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. Construction related runoff would be controlled by measures listed in the Environmental Management Plan. Monitoring strategy produced. 	Negligible	Slight adverse

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse
		Localised damage to channel and riparian features	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. 	Negligible	Slight adverse
		Disruption to natural hydraulic and sediment transport	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Monitoring strategy produced. 	Negligible	Slight adverse
		Increase in flood risk	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. 	Negligible	Slight adverse
Unnamed watercourse (1)	Low	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. Construction related runoff would be controlled by measures listed in the Environmental Management Plan. Monitoring strategy produced. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.
		Localised damage to channel and riparian features	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.
		Disruption to natural hydraulic and sediment transport	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. Monitoring strategy produced. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.
		Increase in flood risk	<ul style="list-style-type: none"> Compliance with CIRIA Guidance. 	Negligible	Slight adverse*. The watercourse is crossed by the

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
					scheme so a worst case has been assumed.
Misson Drain	Low	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. Monitoring strategy produced. 	Negligible	Neutral*. This watercourse is not expected to be directly impacted by the scheme.
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Neutral*. This watercourse is not expected to be directly impacted by the scheme.
		Increase in flood risk	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. 	Negligible	Neutral*. This watercourse is not expected to be directly impacted by the scheme.

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
Broadgate Lane Feeder	Low	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse*. This watercourse is adjacent to the proposed FCA works, so a worst case has been assumed.
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse*. This watercourse is adjacent to the proposed FCA works, so a worst case has been assumed.
		Increase in flood risk	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. 	Negligible	Slight adverse*. This watercourse is adjacent to the proposed FCA works, so a worst case has been assumed.

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
Unnamed watercourse (2)	Medium	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.
		Increase in flood risk	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
Slough Dyke (The Fleet)	High	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Slight adverse
		Increase in flood risk	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. 	Negligible	Slight adverse
All ponds	Low	Pollution from suspended sediment/contaminated runoff.	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Neutral

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
		Pollution from chemical spillages/leaks and water runoff	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. • Construction related runoff would be controlled by measures listed in the Environmental Management Plan. • Monitoring strategy produced. 	Negligible	Neutral
		Increase in flood risk	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance. 	Negligible	Neutral
Lower Trent Erewash Secondary Combined	Medium	Pollution from suspended sediment/ contaminated runoff	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance • Any piling works will be subject to appropriate risk assessments, with method statements covering the potential to cause pollution to the underlying aquifer. 	Minor adverse	Slight adverse
		Pollution from suspended sediment/ contaminated runoff	<ul style="list-style-type: none"> • Compliance with CIRIA Guidance • Any piling works will be subject to appropriate risk assessments, with method statements covering the potential to cause pollution to the underlying aquifer. 	Minor adverse	Slight adverse

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
		Dewatering affecting groundwater levels	<ul style="list-style-type: none"> No mitigation required for dewatering as groundwater impacts are expected to be temporary and local in scale. The aquifer is expected to recover quickly. 	Negligible	Slight adverse* a worst case has been assumed.
Operation					
River Trent	Very high	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> Pollution prevention measures incorporated within the drainage design. 	Negligible	Slight adverse
		Increase in flood risk	<ul style="list-style-type: none"> Floodplain compensation sites incorporated within design. 	Negligible	Slight adverse
Middle Beck	High	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> Pollution prevention measures incorporated within the drainage design. 	Negligible	Slight adverse
		Increase in flood risk	<ul style="list-style-type: none"> Floodplain compensation sites incorporated within design. 	Negligible	Slight adverse
River Devon	Very high	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> Pollution prevention measures incorporated within the drainage design. 	Negligible	Slight adverse

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
		Increase in flood risk	<ul style="list-style-type: none"> Floodplain compensation sites incorporated within design. 	Negligible	Slight adverse
Old Trent Dyke	Medium	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> Pollution prevention measures incorporated within the drainage design. 	Negligible	Slight adverse
		Increase in flood risk	<ul style="list-style-type: none"> Floodplain compensation sites incorporated within design. 	Negligible	Slight adverse
Unnamed watercourse (1)	Low	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> Pollution prevention measures incorporated within the drainage design. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.
		Increase in flood risk	<ul style="list-style-type: none"> Floodplain compensation sites incorporated within design. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
Misson Drain	Low	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> Pollution prevention measures incorporated within the drainage design. 	Negligible	Neutral*. This watercourse is not expected to be directly impacted by the scheme.
		Increase in flood risk	<ul style="list-style-type: none"> Floodplain compensation sites incorporated within design. 	Negligible	Neutral*. This watercourse is not expected to be directly impacted by the scheme.
Broadgate Lane Feeder	Low	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> Pollution prevention measures incorporated within the drainage design. 	Negligible	Slight adverse*. This watercourse is adjacent to the proposed FCA works, so a worst case has been assumed.
		Increase in flood risk	<ul style="list-style-type: none"> Floodplain compensation sites incorporated within design. 	Negligible	Slight adverse*. This watercourse is adjacent to the proposed FCA

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
					works, so a worst case has been assumed.
Unnamed watercourse (2)	Medium	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> Pollution prevention measures incorporated within the drainage design. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.
		Increase in flood risk	<ul style="list-style-type: none"> Floodplain compensation sites incorporated within design. 	Negligible	Slight adverse*. The watercourse is crossed by the scheme so a worst case has been assumed.
Slough Dyke (The Fleet)	High	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> Pollution prevention measures incorporated within the drainage design. 	Negligible	Slight adverse
		Increase in flood risk	<ul style="list-style-type: none"> Floodplain compensation sites incorporated within design. 	Negligible	Slight adverse

Receptor	Importance	Potential effect	Mitigation	Impact magnitude (with mitigation)	Significance of effect (with mitigation) ²⁵⁷
All ponds	Low	Contaminants within surface water runoff due to traffic	<ul style="list-style-type: none"> • Pollution prevention measures incorporated within the drainage design. 	Negligible	Neutral
		Increase in flood risk	<ul style="list-style-type: none"> • Floodplain compensation sites incorporated within design. 	Negligible	Neutral
Lower Trent Erewash Secondary Combined	Medium	Changes to groundwater level/flow	<ul style="list-style-type: none"> • Consideration of groundwater level/flow during detailed design. 	Negligible	Slight adverse
		Physical impact/creation of preferential pathway from piling/below ground structures	<ul style="list-style-type: none"> • Minimise piling where possible in detailed design. 	Negligible	Slight adverse

Monitoring requirements for significant adverse effects

- 14.11.8 At the time of writing, no significant adverse effects are anticipated on road drainage and the water environment, providing that the mitigation measures outlined within Section 14.10 are implemented in the design and during construction.
- 14.11.9 Surface water quality monitoring will be undertaken prior to, during and after construction to monitor selected watercourses. A surface water quality monitoring strategy will be produced, in consultation with the Environment Agency, prior to monitoring commencing.
- 14.11.10 Groundwater level and/or quality monitoring will be required prior, during and after construction to monitor the groundwater. A groundwater level and/or quality monitoring strategy will be produced, in consultation with the Environment Agency, prior to monitoring commencing.

14.12 Conclusions

- 14.12.1 This chapter provides a summary of the assessments that have been undertaken so far relating to the water environment of the scheme.
- 14.12.2 The assessment carried out within this chapter has been carried out at a qualitative level in terms of receptor value, predicted magnitude of impacts and significance of effect in accordance with DMRB LA 113. To prevent pollution within surface water discharge, prevent changes to flow regime from new structures, to attenuate surface water run-off, and to mitigate for any increase in flood risk, standard mitigation measures will be included in the EMP and embedded measures outlined in Section 14.10 will be incorporated within the design.
- 14.12.3 Due to the sensitive nature of a number of waterbodies within the study area and assuming a worst-case scenario at this stage, even with the outlined mitigation measures, the scheme has the potential to have a slight adverse effect on some receptors (as detailed within Table 14.6).
- 14.12.4 The ES will update this assessment, based on additional information from the FRA, WFD compliance assessment, site surveys, final design and other sources to be identified.

15 Climate

15.1 Introduction

- 15.1.1 This chapter presents the on-going work for the assessment of the potential effects associated with the proposed scheme upon climate change related environmental factors.
- 15.1.2 The potential effects have been considered following the requirements of the Infrastructure Planning (Environmental Impact Assessment) (EIA) Regulations 2017 and the National Policy Statement for National Networks¹⁵² (NPSNN) and will be considered in two sections:
- 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 Paragraph 5.17 of the NPSNN).
 - 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 Paragraph 4.40 of the NPSNN and the Infrastructure Planning (EIA) Regulations 2017).
- 15.1.3 The Preliminary Environmental Information (PEI) Report will detail the climatic assessments currently taken to date, both on the effects on climate and the resilience of the scheme to climate change. Furthermore, an update to this current assessment will be reported within the ES that will be submitted to support the Development Consent Order (DCO) application.

15.2 Legislation and policy context

- 15.2.1 The following legislation and policy are relevant to the proposed scheme.

Legislation

Climate Change Act 2008, (as amended)²⁵⁸

- 15.2.2 On 27th June 2019 the UK Government amended the Climate Change Act (2008) and set a legally binding target to achieve net zero GHG emissions from across the UK economy by 2050. In October 2021 the UK Government released their net-zero strategy, further outlining how this reduction is to be achieved.
- 15.2.3 The UK has in place carbon budgets for five-year periods up to 2037, see Table 15.1. The UK is currently in the third carbon budgetary

²⁵⁸ UK Parliament (2012), *Climate Change Act 2008* available at: [Climate Change Act 2008 \(legislation.gov.uk\)](https://www.legislation.gov.uk/ukpga/2008/27/section/1) ((Last accessed July 2022).

period (2018-2022), the budget for which is 2,544 MtCO_{2e} and cannot legally emit more GHGs than this within the budgetary period. The carbon budget for the 2023–2027 budgetary period is 1,950 MtCO_{2e}, and the budget for 2028-2032 is 1,725 MtCO_{2e}. The sixth carbon budget requires a 63% reduction in emissions from 2019 to 2035 (78% relative to 1990)²⁵⁹. Whilst budgets are not set beyond this, there is a legal requirement for the UK to reach 0 MtCO_{2e} by 2050²⁶⁰.

Table 15.1: UK carbon budgets²⁶¹

Carbon budgets	Carbon budget level (MtCO _{2e})	Reduction below 1990 levels
Third Carbon Budget (2018-2022)	2,544	36% by 2020
Fourth Carbon Budget (2023-2027)	1,950	51% by 2025
Fifth Carbon Budget (2028-2032)	1,725	57% by 2030
Sixth Carbon Budget (2033-2037)	965	78% by 2035

National policy

National Policy Statement for National Networks (NPSNN)

- 15.2.4 The NPSNN Paragraph 4.43 requires ‘The applicant should demonstrate that there are no critical features of the design of new national networks infrastructure which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK climate projections’.
- 15.2.5 Paragraph 5.17 of the NPSNN states that ‘it is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet the targets of its carbon reduction target plan.’ However, the paragraph goes on to say that applicants should provide evidence of the carbon impact of the project and an assessment against the Government’s carbon budgets.
- 15.2.6 Paragraph 5.18 of the NPSNN states that development consent might be refused if it would have a material impact on the Government reaching its reduction targets. The Government must ensure that any carbon increases from road development do not compromise their overall carbon reduction commitment.

²⁵⁹ UK Parliament (2021) *The Carbon Budget Order 2021* available at <https://www.legislation.gov.uk/uksi/2021/750/contents/made> (Last accessed July 2022)

²⁶⁰ UK Parliament (2012), *Climate Change Act 2008* available at: [Climate Change Act 2008 \(legislation.gov.uk\)](https://www.legislation.gov.uk/ukpga/2008/27/section/1) ((Last accessed July 2022).

²⁶¹ UK Parliament (2012), *Climate Change Act 2008* available at: [Climate Change Act 2008 \(legislation.gov.uk\)](https://www.legislation.gov.uk/ukpga/2008/27/section/1) ((Last accessed July 2022).

15.2.7 Paragraph 5.19 of the NPSNN outlines the need for appropriate mitigation measures to be implemented in both design and construction. The effectiveness of such mitigation will be considered by the Secretary of State in order to ensure the carbon footprint is not 'unnecessarily high', with the adequacy of the measures constituting a material factor in the decision-making process.

BSI (British Standards Institution) PAS 2080 – Carbon management in infrastructure in 2016²⁶²

15.2.8 This Publicly Available Specification (PAS) includes requirements for all value chain members to show the right leadership and to establish effective governance systems for reducing whole life carbon through the use of a carbon management process. The individual value chain requirements in the carbon management process are structured around the following components:

- Setting appropriate carbon reduction targets.
- Determining baselines against which to assess carbon reduction performance.
- Establishing metrics (e.g. Key Performance Indicators) for credible carbon emissions quantification and reporting.
- Selecting carbon emissions quantification methodologies (to include defining boundaries and cut off rules).
- Reporting at appropriate stages in the infrastructure work stages to enable visibility of performance.
- Continual improvement of carbon management and performance.

Department for Transport: Decarbonising Transport – setting the challenge (2020)²⁶³

15.2.9 The document presents transport modes and their current GHG emissions, the existing strategies and the policies already in place to deliver against current targets. It covers the projected trajectory of the forecast GHG emissions from transport to the fifth carbon budget (2028-2032) and beyond, based on the firm and funded commitments outlined. The document describes the challenge in meeting carbon budgets and net zero by 2050 and split the challenge into six strategic priorities. The document sets out the work approach through which interested parties and communities around the UK will collaborate to take urgent action on climate change, as well as delivering the substantial co-benefits of decarbonisation.

²⁶² BSI (2016). 'PAS 2080 – Carbon Management in Infrastructure' available at: <https://www.bsigroup.com/en-GB/our-services/product-certification/product-certification-schemes/pas-2080-carbon-management-in-infrastructure-verification/> (last accessed July 2022)

²⁶³ DfT (2020) Decarbonising Transport – setting the challenge https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/932122/decarbonising-transport-setting-the-challenge.pdf (Last accessed July 2022)

Department for Transport: Highways England: Licence – Secretary of State for Transport statutory directions and guidance to the strategic highways company (2015)²⁶⁴

15.2.10 Part 4, 4.2 commits National Highways (in section g) to minimise the environmental impacts of operating, maintaining and improving its network and seek to protect and enhance the quality of the surrounding environment; and (in section h) conform to the principles of sustainable development.

25 Year Environment Plan

15.2.11 The Department for Environment, Food & Rural Affairs (Defra) 25 Year Environment Plan (2018)²⁶⁵ is a policy paper setting out what Government will do to improve the environment, including restoring and safeguarding wildlife habitats. This plan is being treated as the first Environmental Improvement Plan required under the Environment Act 2021. The plan sets out aims to take all possible action to mitigate climate change, while adapting to reduce its impact, by:

- Continuing to cut GHG emissions including from land use, land use change, the agriculture and waste sectors and the use of fluorinated gases.
- Making sure that all policies, programmes and investment decisions take into account the possible extent of climate change this century.

Local Policy²⁶⁶

15.2.12 Three East Midlands councils (Leicester City Council, Leicestershire County Council and Nottingham City Council) have signed the UK100 Net Zero Pledge, with a statement to 'bring our council emissions to net zero by 2030 and we will work with our residents and businesses to bring our wider communities' emissions in line with net zero as soon as possible (and by 2045 at the latest)²⁶⁷.

²⁶⁴ DfT (2015) Highways England: Licence – Secretary of State for Transport statutory directions and guidance to the strategic highways company [Highways England: licence \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/421111/highways-england-licence-2015.pdf) (Last accessed August 2022)

²⁶⁵ HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online] available at: 25 Year Environment Plan - GOV.UK ([www.gov.uk](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/421111/25-year-environment-plan.pdf)) (last accessed October 2022)

²⁶⁶ Whilst the local Policy is included, for information, the project will legally report to the UK's official Carbon Budget and Net-zero Target Date as expressed in DMRB LLA114.

²⁶⁷ East Midlands Chamber (2020) Press Release available at <https://www.emc-dnl.co.uk/news/2020/12/10/uk100-net-zero-pledge-regional-leaders/#:~:text=The%20figureheads%20of%20three%20councils%20in%20the%20East,those%20of%20their%20residents%20and%20businesses%20by%202045.> (Last accessed July 2022)

Newark-on-Trent and Sherwood Local Development Framework Core Strategy Development Plan (amended 2019)²⁶⁸

15.2.13 The Development Plan outlines the approach to sustainable development, including the promotion of development that maximises resource efficiency. Core Policy 10 is a commitment to tackling the causes of climate change by delivering a reduction in the District's overall emissions. Relevant commitments are to: ensure that the impacts on natural resources are minimised and the use of renewable resources encouraged; and be efficient in the consumption of energy, water and other resources.

National Highways

National Highways Net Zero (2021)

15.2.14 In addition to the UK Government, National Highways have outlined their net zero strategy to achieve net zero²⁶⁹:

- Corporate emissions – net zero by 2030
- Maintenance and construction emissions – net zero by 2040
- Road user emissions – net zero by 2050

15.2.15 To enable net zero by 2040 for construction and maintenance the following interim targets are proposed: a trajectory of 0-10% reduction by 2025, 40-50% by 2030, 70-80% by 2035 and net zero by 2040 against a 2020 baseline. National Highways also target the use of only zero carbon plant on their sites by 2030. The scheme will directly affect the maintenance and construction emissions of National Highways.

National Highways: Preparing for climate change on the strategic road network - third adaptation report under the Climate Change Act (2022)²⁷⁰

15.2.16 The third report, published under the Climate Change Act's (2008) Adaptation Reporting Power (ARP):

- Re-evaluates significant climate risks threatening the safe operation of England's SRN using more up-to-date climate projections.
- Assesses progress against previously identified adaptation actions.
- Identifies areas for improvement and appropriate actions.

²⁶⁸ Newark and Sherwood District Council (2019) *Amended Core Strategy DPD* available at <https://www.newark-sherwooddc.gov.uk/amendedcorestrategy/> (Last accessed July 2022)

²⁶⁹ National Highways (2021) *Net zero highways: our 2030/2040/2050 plan* available at <https://nationalhighways.co.uk/media/eispciem/net-zero-highways-our-2030-2040-2050-plan.pdf> (Last accessed July 2022).

²⁷⁰ National Highways (2022) *Preparing for climate change on the strategic road network - third adaptation report under the Climate Change Act* available at <https://nationalhighways.co.uk/media/z1ndodqx/preparing-for-climate-change-on-the-strategic-road-network.pdf> (Last accessed July 2022).

15.2.17 Building on advice from the Climate Change Committee's CCRA3 report, the report aims to address the increased risk brought to the UK's Strategic Road Network with the overarching vision that in 2050 'The SRN is resilient to climate change and incidents, such as flooding, poor weather conditions, blockages on connecting transport networks'. The report carries out a risk assessment of likely highways impacts which include, but are not limited to:

- Overwhelming of drainage due to fluvial (river) and pluvial (surface) and groundwater flooding.
- Ground saturation affecting stability of geotechnical assets.
- Destabilisation of earthworks due to standing water.
- Waterlogging of pavement surface.

[National Highways: Strategic business plan 2020-2025 \(2020\)](#)²⁷¹

15.2.18 The Strategic business plan 2020-2025 sets out National Highways' response to Government's second Road Investment Strategy (RIS2)²⁴⁵. It presents the careful balancing between maintaining and operating the strategic road network (SRN) safely and providing new capacity where it is needed. It supports Government's ambition to achieve net zero UK carbon emissions by 2050. It notes that National Highways has a shared responsibility to tackle climate change and is dedicated to minimising the GHGs generated from the activities within National Highways' control including designing the schemes and services to be carbon and energy efficient, reducing carbon footprint through initiatives such as introducing energy-saving measures for maintenance depots and using low-energy lighting and control systems for motorways.

Topic-specific guidance

[Institute of Environmental Management & Assessment \(IEMA\) Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance 2nd Edition \(2022\)](#) ²⁷²

15.2.19 Whilst DMRB LA 114 remains the sole standard which the PEI report will speak to, the IEMA guidance will be used to assist, as it provides a complementary narrative to some elements of DMRB LA 114. IEMA states that this guidance is to assist GHG practitioners with addressing GHG emissions assessment, mitigation and reporting in statutory and non-statutory EIA. It is a revision of the 2017 IEMA guidance on

²⁷¹ National Highways (2020) *Strategic Business Plan* available at <https://nationalhighways.co.uk/strategic-business-plan/> (last accessed July 2022).

²⁷² IEMA (2022) *Assessing Greenhouse Gas Emissions and Evaluating their Significance 2nd Edition* available at <https://www.iema.net/resources/blog/2022/02/28/launch-of-the-updated-eia-guidance-on-assessing-ghg-emissions> (Last accessed July 2022)

Assessing Greenhouse Gas Emissions and Evaluating their Significance.

15.3 Assessment methodology

15.3.1 An initial construction and operational carbon assessment has been undertaken to provide oversight on the emissions associated with scheme construction (Section 15.5). Further information including the traffic model for the final design is currently under development (as described in Section 5.5). This data is expected to be available for the publication of the ES. As such an update to this assessment for effects on climate and climate resilience will be detailed in the ES.

15.3.2 This section details the methodology used in the current assessment and then outlines the additional assessment work that will be undertaken prior to the DCO submission and presented within the ES.

Effects on climate

Construction

15.3.3 This section details the methodology used for the construction carbon assessment as part of the PEI Report. At this stage, sufficient data is available to conduct a preliminary construction carbon assessment. Subsequently, this PEI report includes an assessment of effects based on data available for the preliminary scheme design developed for the preferred route announcement. It will be updated with data derived from the final scheme design which will be submitted at the DCO application stage, with the assessment presented within the ES. The Moata Carbon Portal was used to undertake the assessment. This is an in-house Mott MacDonald carbon tool which is globally compliant with PAS2080 certification and allows detailed embodied carbon accounting and planning at all stages of a project.

15.3.4 The emissions factors used were from UK Highways: Major Works V2, UK Civil Engineering V2 and National Highways Carbon Tool V2.4. These emission factors account for materials and plant (A1-3 & A5)²⁷³.

15.3.5 Transport emissions to site were calculated using assumptions. The distance travelled to site is assumed to be 50 kilometres based on local sourcing in the RICS guidance. Local travel applies for concrete, aggregate and earth which can be sourced locally, with other relevant distances selected for the other materials.

²⁷³Stages A0-5 represent the before use stage, B1-9 represent the use stage, and C-1-4 End of life stage for lifecycle carbon emission calculations, for the Publicly available standard (PAS) on carbon management in infrastructure.

PAS2080 lifecycle stages are available in detail in BSI (2016). 'PAS 2080 – Carbon Management in Infrastructure' available at: <https://www.bsigroup.com/en-GB/our-services/product-certification/product-certification-schemes/pas-2080-carbon-management-in-infrastructure-verification/> (last accessed August 2022)

- 15.3.6 Due to the current level of uncertainty in design and the complex nature and assumptions associated with carbon emission accounting, a contingency or 'risk' value has been added onto the calculations to ensure the scheme carbon is not underestimated. A 22.7% uplift has been applied, to align with risk contingencies in other project calculations. This uplift was applied to the sum of the material, plant and transport emissions.
- 15.3.7 For the ES, building on this initial assessment, the assessment of the construction effects on climate, will include GHGs emitted during construction using credible and recognised calculation methodologies and tools. It will provide a more detailed calculation than the PEI Report assessment using:
- The Mott MacDonald Moata Carbon Portal which is PAS 2080 certified which will be used to undertake the embodied carbon assessment, building on its use for the PEI Report assessment detailed above.
 - The Royal Institute of Chartered Surveyors (RICS)²⁷⁴ guidance and assumptions on the transport of materials to site which will be used where actual supplier information is not known.
 - Environmental Product Declarations (EPDs)²⁷⁵ detailing the emissions for certain design aspects where appropriate for bespoke items.
- 15.3.8 The assessment will fully align with the requirements outlined in Section 3 of DMRB LA 114, ensuring all substages of the construction stage are captured including:
- Product stage: including raw material supply, transport and manufacture.
 - Construction process stage: including transport to or from works site and construction or installation processes.
 - Land use change.
- 15.3.9 GHG emissions will be assessed using a calculation-based methodology as per the below equation:
- Activity data x GHG emissions factor = GHG emissions value
- 15.3.10 Activity data will be sourced from three primary sources when undertaking an assessment after the baseline has been set:
- Building information modelling (BIM) model, which will have first-hand data on the amounts of materials and other data pertaining to each of the assets.
 - Quantity Surveyor data used to produce bills of materials that will be available at certain points in the design process. This will be

²⁷⁴ RICS (2017). *Whole life carbon assessment for the built environment*, RICS professional statement.

²⁷⁵ An Environmental Product Declaration (EPD) 'quantifies environmental information on the lifecycle of a product to enable comparisons between products fulfilling the same function'.

used to make sure all activities have been captured in the same way for carbon as in cost.

- Supply chain data will be used to help define the specifications of certain materials and to define the travel and plant assumptions for the works.

15.3.11 In selecting activity data, the project will aim to use that data which is the most complete, up-to-date and referenceable. During the design process, it may be necessary to use interim data in order to support decision making. As far as possible this will follow the same criteria however there may be cases where assumptions are required.

15.3.12 Emission factor data will be selected based on its overall applicability to the project. A number of criteria will be applied:

- Age: the most recently published data will be preferred.
- Geography: data which applies to the location of actual suppliers and/or activities will be preferred.
- Technology: data which represent the actual product/activity in question will be preferred.
- Methodology: data which follow a published methodology or product category rules will be preferred.
- Competency: data which are produced from proficient entities will be preferred.

15.3.13 Ultimately, there may be trade-offs between these criteria. The choices made by the carbon consultant will be documented in accompanying reports and where necessary sensitivity analysis will be undertaken.

15.3.14 The construction carbon assessment will be presented against the following life cycle stages (modules) consistent with the principles set out in PAS 2080. The scope of assessment includes lifecycle stages material (A1-3) plant (A5), and transport (A4)²⁷⁶.

Operational

15.3.15 This PEI report includes an assessment of operational road user effects based on data available for the preliminary scheme design developed for the preferred route announcement including the traffic model available at for that design. It will be updated with data derived from the final scheme design which will be submitted at the DCO application stage, with the assessment presented within the ES.

15.3.16 The assessment included within this PEI includes the following:

- A road user assessment: the carbon dioxide equivalent (CO_{2e}) emissions will be calculated from the updated traffic model over a 60-year appraisal period presenting the net GHG emissions - the difference in GHG emissions between the do minimum and do

²⁷⁶ BSI (2016). 'PAS 2080 – Carbon Management in Infrastructure' available at: <https://www.bsigroup.com/en-GB/our-services/product-certification/product-certification-schemes/pas-2080-carbon-management-in-infrastructure-verification/> (last accessed July 2022).

something scenarios which will provide the traffic GHG impact figures for appraisal within the ES, using emission factor toolkit version 11 in line with DMRB LA 114.

- 15.3.17 As per DMRB LA 114, the operational emission assessment will be undertaken for each carbon budgetary period the scheme extends through.
- 15.3.18 For the assessment within the ES the assessment of operational effects on climate will include:
- A routine maintenance assessment: covering planned maintenance and repair.
 - An assessment of the GHG emissions associated with the electricity requirements for the operation of the scheme. This will utilise data determined through design and publicly available emission factors for grid electricity. Future grid decarbonisation trajectories will be used.
 - An assessment of the sequestration resulting from woodland planting based on the Woodland Carbon Code²⁷⁷ guidance and tools, based on available data.
- 15.3.19 The operational carbon assessment will be presented against the following life cycle stages (modules). The scope of assessment includes lifecycle stages use (B1), maintenance (B2), replacement (B4), operational energy use (B6), and users utilisation of infrastructure (B9) 276.

Significance of effect

- 15.3.20 The assessment of significance, in the ES will follow DMRB LA 114 Climate as this is currently the most relevant methodology for highways schemes on the strategic road network (SRN).
- 15.3.21 DMRB LA 114 states that 'projects shall only report significant effects where increases in GHG emissions will have a material impact on the ability of Government to meet its carbon reduction targets'. It also notes that the National Policy Statement for National Networks (NPSNN)²⁷⁸ reports that 'it is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets' and that in this context 'it is considered unlikely that projects will, in isolation, conclude significant effects on climate'.

²⁷⁷ Woodland Carbon Code (n.d) *Project Carbon Sequestration*, available at <https://woodlandcarboncode.org.uk/standard-and-guidance/3-carbon-sequestration/3-3-project-carbon-sequestration> (last accessed October 2022)

²⁷⁸ Department for Transport (2014). '*National Policy Statement for National Networks*'. available at: https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf (last accessed June 2022)

15.3.22 The assessment will include a comparison of estimated GHG emissions arising from the scheme with UK carbon budgets and the associated reduction targets in line with DMRB LA 114. The results of this comparison will be presented following the format of Table 3.18 in DMRB LA 114.

Resilience of the scheme to climate change

15.3.23 A qualitative methodology for assessing both the construction processes and the resilience of the scheme assets during operation to climate change, has been produced in line with DMRB LA 114. For this PEI Report, a desk-based study of UK climate projection data has been undertaken to identify the future climate projections, and their associated potential impacts to the scheme, during both construction and operation. These are detailed in section 13.5 and 13.7 respectfully.

15.3.24 A more detailed assessment which captures the resilience of the scheme to the impact of climate change in the future, including future extreme weather events such as hot days, cold days, heatwaves, and storms, as well as longer-term weather changes in temperature and precipitation, will be assessed in the ES. The assessment will be undertaken, at this later stage because the scheme design is yet to be finalised, and as such the full extent of the mitigation measures in place are not yet available.

15.3.25 The future assessment will identify hazards induced by climate change for the scheme design receptors because of the projected climate changes identified at a scheme level. The likelihood of these impacts occurring will be defined to determine their significance. Professional experience and judgement through collaboration between climate change specialists and the design team will be used to determine these factors. The criteria for determining the likelihood of impacts occurring and the measure of consequence is detailed below in Table 15.2 and 15.3.

Table 15.2: Criteria for determining likelihood of impacts occurring

Likelihood category	Description (probability and frequency of occurrence)
Very high	The event occurs multiple times during the lifetime of the project (60 years ²⁷⁹) e.g. approximately annually, typically 60 events.
High	The event occurs several times during the lifetime of the project (60 years) e.g. approximately once every five years, typically 12 events.
Medium	The event occurs limited times during the lifetime of the project (60 years) e.g. approximately once every 15 years, typically four events.
Low	The event occurs during the lifetime of the project (60 years) e.g. once in 60 years.
Very low	The event can occur once during the lifetime of the project (60 years).

Source: Table 3.39a DMRB LA 114.

Table 15.3: Criteria for determining measure of consequence

Consequence category	Description
Very large adverse	Operation - national level (or greater) disruption to strategic route(s) lasting more than one week.
Large adverse	Operation - national level disruption to strategic route(s) lasting more than one day but less than one week or regional level disruption to strategic route(s) lasting more than one week.
Moderate adverse	Operation - regional level disruption to strategic route(s) lasting more than one day but less than one week.
Minor adverse	Operation - regional level disruption to strategic route(s) lasting less than one day.
Negligible	Operation - disruption to an isolated section of a strategic route lasting less than one day.

Source: Table 3.39b DMRB LA 114.

Significance of effect

15.3.26 The criteria for determining the significance of effect for the resilience of the scheme is shown in Table 15.4. The likelihood and consequence of the impact is combined to determine the sensitivity of the receptor. The sensitivity is then combined with the magnitude of

²⁷⁹ As per DMRB LA114 3.31: The assessment of a project's vulnerability to climate change shall take the life span of the project to be 60 years.

effect to the allow determination of whether the effect is significant or not significant.

Table 15.4: Significance matrix

		Measure of likelihood				
		Very Low	Low	Medium	High	Very High
Measure of consequence	Very large	NS	S	S	S	S
	Large	NS	NS	S	S	S
	Moderate	NS	NS	S	S	S
	Minor	NS	NS	NS	NS	NS
	Negligible	NS	NS	NS	NS	NS

NOTE NS = Not significant; S = Significant. Source: Table 3.41 DMRB LA 114.

15.4 Study area

Effects on climate

- 15.4.1 For all assessments undertaken to date, and in the future, the study area captures the emission of GHGs²⁸⁰ resulting from the scheme in its construction and operation phases. The study area is not limited to the geographic extent of the scheme itself, as many emissions will result from upstream, downstream, and off-site activities such as materials production. DMRB LA 114 requires that the assessment and reporting shall identify the scale and nature of GHG emissions across the whole project life cycle, taking into account design and mitigation measures already incorporated into the project.
- 15.4.2 The effects on climate relate to the potential impacts of the scheme on the climate through an increase in GHG emissions. It captures all six GHGs defined by the Kyoto Protocol²⁸¹ but for the purpose of this report they will be considered analogous and will be referred to as 'GHG emissions', reported in terms of carbon dioxide equivalent (CO₂e).

Construction

- 15.4.3 For construction, the study area comprises GHG emissions associated with project construction related activities/materials and their associated transport including:

²⁸⁰ Greenhouse gases, or GHGs, are compound gases that trap heat or longwave radiation in the atmosphere. The principal GHGs, also known as heat trapping gases, are carbon dioxide, methane, nitrous oxide, and the fluorinated gases.

²⁸¹ United Nations Climate Change (2021). 'What is the Kyoto Protocol?' available at: https://unfccc.int/kyoto_protocol (last accessed June 2022).

- Raw material supply
- Manufacture
- Transport to and from site
- Construction/Installation process (for construction related processes the study area will consider emissions associated with the construction site area)

Operation

15.4.4 The operational road user assessment will consider carbon emissions associated with users of the road within a study area that is consistent with the affected road network (ARN) which is defined by the traffic modelling output for the scheme. The ARN considers roads which meet any of the following criteria:

- A change of more than 10% in AADT
- A change of more than 10% to the number of heavy-duty vehicles
- A change in daily average speed of more than 20 km/h

15.4.5 The operational maintenance study area will include:

- Maintenance activities
- Repair of existing assets
- Replacement of existing assets

Resilience of scheme to climate change

15.4.6 For all assessments undertaken to date, and in the future, the study area is based on the scheme boundary including any construction compounds and temporary land take. The draft Order Limits is available in Figure 2.2 contained in Volume 2.

15.5 Existing baseline

Effects on climate

15.5.1 The baseline for the effects on climate as detailed in DMRB LA 114 requires scheme specific information, including existing maintenance requirements and operational emissions from road users.

15.5.2 Scheme-specific baseline emissions equate to emissions in the Opening Year (2028) and Design Year (2043) assuming the scheme was not constructed - the Do-minimum (DM) scenario. There are no construction emissions associated with the DM scenario. The data used here is from the last operational assessment carried out, as shown in Table 15.5.

Table 15.5. Do-minimum emissions

Category	Opening Year (2028) emissions (tCO ₂ e)	Design Year (2043) emissions (tCO ₂ e)
Road User	2,854,461	3,140,949
Operation and maintenance	8,278	9,109
Total Operation	2,862,739	3,150,058

15.5.3 This PEI report includes an assessment of effects based on data available for the preliminary scheme design developed for the preferred route announcement. When the full assessment is undertaken on the final design which will be submitted at the DCO application stage, the construction assessment in section 15.11 of this PEI report will become the baseline against which changes in carbon emissions are assessed. The progress of carbon reduction against this baseline will then be considered. This will be reported in the ES.

Resilience of the scheme to climate change

Current climate

15.5.4 Mean annual temperatures over the region vary from around 8 °C to just over 10 °C. The highest values occur in the lower Severn valley, whilst the lowest occur at the higher altitudes such as the Peak District. This places the Midlands in the middle of the UK mean temperate range of 7-11°C²⁸². According to the Met Office, due to the Midland's distance from the regulating effects of the sea, the annual range is more pronounced than in most parts of the UK. Sharp winter frosts are common and there are occasional very hot summer days, particularly in the south and east of the region. These temperature extremes of both winter and summer are a key characteristic of the Midlands climate. As a result of this, the average number of days with air frost in the Midlands varies from about 40 a year in the lower Severn valley to over 60 a year in the Peak District and sheltered areas of the Welsh Marches. Ground frost occurs on average on about 100 to 125 days per year, with a similar distribution to air frost.

15.5.5 The wettest areas in the Midlands, with an average of over 800 mm per year, are along the Welsh border, in the Cotswolds and, especially, in the Peak District; the highest altitudes exceed 1000 mm. In contrast, the more sheltered areas of the South and East Midlands are the driest with less than 600 mm per year in parts of

²⁸² UK Met Office (2018) *Midlands: climate* available at <https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/midlands-climate---met-office.pdf> (last accessed July 2022)

Northamptonshire, the lower Trent valley and the Avon valley. This is 80% lower than the highest rainfall area in the UK, but still 300-500mm greater than the driest parts.

- 15.5.6 Periods of prolonged rainfall can lead to widespread flooding, especially in winter and early spring when soils are usually near saturation.

Future projections

Effects on climate

- 15.5.7 The projections from the Department for Business, Energy & Industrial Strategy (referred to as the BEIS projections) show a decline in total GHG emissions by 2040 (GHG emissions are projected to fall by 24% from 2019 levels). In 2018, 97% of transport's final energy consumption was from oil-based fossil fuels but by 2040 this is projected to fall to 89% due to an increase in electric vehicles and increasing use of biofuels²⁸³. In 2021, the UK Government pledged to end the sale of new petrol and diesel vehicles by 2030 and that all new cars and vans will be required to be fully zero emission at the tailpipe by 2035. Furthermore, the UK Government consulted to phase out all new, non-zero emission road vehicles and heavy goods vehicles by 2040 at the latest. Because of these changes, the BEIS projections are likely to be updated to meet these new policy goals. The BEIS projections show that the Third Carbon Budget is very likely to be achieved with headroom of approximately 26MtCO_{2e}. However, the projections show shortfalls for the Fourth Carbon Budget and Fifth Carbon Budget of 188MtCO_{2e} and 253MtCO_{2e} respectively. Meanwhile, the Committee on Climate Change (CCC), have stated that GHG emissions will need to fall more rapidly than these targets²⁸⁴.
- 15.5.8 The CCC have also determined a balanced net-zero pathway for construction and manufacturing that includes a reduction of 43% by 2030, 75% by 2035, and 90% by 2040 to achieve a 97% reduction by 2050²⁸⁵. The pathway considers a proportion of the reduction will come from improved resource efficiency in production and material substitution. Therefore, significant effort is required to ensure that all contributing emissions are reduced as far as possible through the design, construction, and operational elements of all projects.

²⁸³ Department for Business, Energy & Industrial Strategy (2020). Updated energy and emissions projections 2019 available at: https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/931323/updated-energy-and-emissions-projections-2019.pdf (last accessed July 2022).

²⁸⁴ Climate Change Committee (2020). *The Sixth Carbon Budget – The UK's path to Net-Zero*. available at: <https://www.theccc.org.uk/publication/sixth-carbon-budget/> (last accessed July 2022).

²⁸⁵ Climate Change Committee (2020). *Sector summary – Manufacturing and construction* available at: <https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Manufacturing-and-construction.pdf> (last accessed July 2022).

Resilience of the scheme to climate change

15.5.9 The Met Office provides information on observed and future climate change relative to the baseline period of 1961-1990, based on the latest scientific understanding United Kingdom Climate Projections 2018 (UKCP18). The project site sits within the Midlands region. Observed trends in the UK climate are as follows²⁸⁶:

- The UK's climate is changing. Recent decades have been warmer, wetter and sunnier than the 20th century.
- 2020 was third warmest, fifth wettest and eight sunniest on record for the UK. No other year has fallen in the top-10 for all three variables for the UK.
- The UK has warmed at a broadly consistent but slightly higher rate than the observed change in global mean temperature.

Future climate projections

15.5.10 The projected future climate which the scheme experiences, is likely to follow the UK wide trend of drier summers, wetter winters and an increase in average mean temperature, as estimated by the UK Met Office. It is also likely that changes to the climate will lead to a temporal and severity increase of weather events such as storms, heavy rainfall, droughts and heatwaves.

15.5.11 UKCP18 Representative Concentration Pathway (RCP) 8.5 for the East Midlands region estimates the changes shown in Table 15.6 below.

Table 15.6: UKCP18 RCP (8.5) Projections for the East Midlands in 2080-2099²⁸⁷

Variable	10th percentile change	50th percentile change	90th percentile change ²⁸⁸
Mean annual temperature (°C)	2.4	4.1	5.9
Mean winter temperature (°C)	1.5	3.5	5.7
Mean summer temperature (°C)	2.6	5.2	7.8
Mean winter precipitation (%)	-1	20	47
Mean summer precipitation (%)	-69	-35	-2

²⁸⁶ Kendon et al (2021) State of the UK Climate 2020 available at <https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.7285> (last accessed July 2022)

²⁸⁷ Met Office (2018) United Kingdom Climate Projections, available at <https://ukclimateprojections-ui.metoffice.gov.uk/ui/home> (last accessed July 2022)

²⁸⁸ Used in place of H++ Scenario. Where necessary for safety critical infrastructure the 90th percentile or H++ scenario of RCP 8.5 will be used for the assessment. This scenario represents the less likely but upper plausible limits of climate change.

15.6 Value (sensitivity of resources and receptors)

15.6.1 For climate, value is not an item which is explicitly considered in the assessment. The text below gives an indication as to the thought process around scheme receptors.

Effects on climate

Construction and Operation

15.6.2 Once emitted, GHGs enter the atmosphere and spread globally. As such, they do not have a local receptor, instead having a receptor of the earth's atmosphere. All GHG emissions contribute to climate change and the associated effects outlined in Section 15.7, as the climate is highly sensitive to change. Whilst emissions cannot be geographically defined once emitted, they can be attributed to a source. For the scheme the sources of emissions are outlined in Section 15.4.

15.6.3 Whilst the NPSNN²⁸⁹ reports that 'it is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets' and that in this context 'it is considered unlikely that projects will, in isolation, conclude significant effects on climate', it remains vital to reduce emissions where possible to reduce the impact on the global climatic system.

Resilience of the scheme to climate change

Construction

15.6.4 During construction, the receptors of climate change will be the scheme itself, as defined by the draft Order Limits. The potential impacts outlined in 15.7 are the likely effects which the scheme will be subject to. Care must be taken to ensure the contractor is aware of and resilient to the increase in risk posed by climate change.

Operation

15.6.5 Potential operational impacts on scheme assets and environmental receptors that are related to, or could be intensified by, climate change will be assessed considering the likelihood of impacts occurring and measure of consequence.

²⁸⁹ Department for Transport (2014). 'National Policy Statement for National Networks'. available at: https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf (last accessed June 2022)

15.7 Potential Impacts

Effects on Climate

15.7.1 This section highlights the potential impacts on climate that could occur as a result of the scheme, as identified in the assessments to date.

Construction

15.7.2 The main impact on climate during construction is the release of GHG which contribute towards altering the UK's climate.

15.7.3 The impact will be caused by GHG released by:

- Diesel and Hydrotreated Vegetable Oil (HVO) plant and machinery.
- Construction process stage: including transport to / from works site and construction/installation processes.
- Materials production.
- Land use change as a result of habitat loss to accommodate the scheme.
- Changes to traffic flows causing increased congestion during construction.

Operation

15.7.4 The main impact on climate during operation is the release of GHG which contribute towards altering the UK's climate.

15.7.5 The impact will be caused by GHG released by:

- Changes in vehicle distributions and speed limits
- Maintenance activities
- Repair activities (from accidents/fire and flood)
- Replacement of assets
- Refurbishment of assets

Resilience of the scheme to climate change

Construction

15.7.6 Whilst the scheme's construction (planned to commence 2025) is not expected to be so far in the future that the climate will adversely change further prior to construction, climate change is expected to impact construction. For example, if construction coincides with extreme weather event(s) such as drought or storms there may be construction impacts.

15.7.7 Climate events, and the anticipated impacts associated with each event on the scheme, during construction are presented in Table 15.7 below.

Table 15.7: Climate event and anticipated impacts during construction

Climate Event	Impact
Increased winter precipitation	<ul style="list-style-type: none"> • Damage to construction site and equipment through loss of stability in ground surface. • Risk of flooding
Changes in the future precipitation regime (varying from drought conditions to heavy rainfall)	<ul style="list-style-type: none"> • Increasing the risk to earthworks stability • Risk of flooding
Increase yearly average temperature	<ul style="list-style-type: none"> • Safer driving conditions in winter if less frost and ice
Increased summer temperature	<ul style="list-style-type: none"> • Damage to plant and machinery in adversely hot temperatures • Risk to workforce in extreme heat
Extreme weather events	<ul style="list-style-type: none"> • Damage to plant and machinery in adversely hot temperatures, flooding and high winds • Risk to workforce in extreme heat/flooding

Operation

15.7.8 The climate of the study area has already changed from its natural state as a result of climate change, and will change significantly over the lifetime of the project. Climate events and the anticipated impacts associated with each event during operation are presented in Table 15.8 below.

Table 15.8: Climate event and anticipated impacts during operation

Climate Event	Impact
Increased winter precipitation	<ul style="list-style-type: none"> • Increasing sub-surface moisture and inducing premature pavement failure. • Increasing standing water, the build-up of particulates on road surfaces, and flood risk. • Increase safety risk for active travel users e.g. cyclists. • Increase in occurrence of pot holes (by weakening the soil beneath the carriageway) increasing maintenance requirements and associated traffic disruption.
Changes in the future precipitation regime (varying from drought conditions to heavy rainfall)	<ul style="list-style-type: none"> • Causing pavements to heave. • Increasing the risk to earthworks stability.

Climate Event	Impact
Increase yearly average temperature	<ul style="list-style-type: none"> • Reduced freeze thaw erosion which could damage underground assets, reducing maintenance requirements and associated traffic disruption. • Safer driving conditions in winter if less frost and ice.
Increased summer temperature	<ul style="list-style-type: none"> • Greater risk of joint, bearing or surface failure • Accelerating the weathering of road markings • Increased temperatures which may be greater than the rated equipment tolerance and lead to equipment failure. • Increased likelihood of disease, and changing precipitation patterns including greater frequency of drought. • May cause soil instability (intensify and extend soil moisture deficits and impact groundwater levels and earth pressures) increasing maintenance requirements and associated traffic disruption. • Greater risk of soils drying out and increasing erosion. This causes sedimentation within the schemes drainage infrastructure that reduces its drainage capacity and so increases the risk of flooding which causes traffic disruption. Additional maintenance work to prevent flooding may also cause traffic disruption.
Extreme weather events	<ul style="list-style-type: none"> • Impact to signs from high winds. • Safety concerns associated with extreme weather which may result in reduced likelihood of maintenance. • Impacts on electrical equipment include more regular lightning strikes and extreme hot temperatures causing thermal over loading of circuits. Repair and maintenance cause traffic disruption.
Longer vegetation growing season	<ul style="list-style-type: none"> • Leading to increased need for maintenance (due to warmer winters and wetter summers).

15.8 Consultation

- 15.8.1 In relation to flood risk and drainage design, the design and flood risk assessment will be produced in accordance with the climate change requirements of the Environment Agency and the Lead Local Flood Authority (LLFA). The FRA will use the latest climate change allowances. Meetings are ongoing as part of the Flood and Drainage Steering Group (see Chapter 14 for more details).
- 15.8.2 Consultation will continue through the key stakeholder engagement exercises throughout the development of the scheme design and ES (refer to Chapter 4 for further details).

15.9 Assumptions and limitations

Effects on climate

- 15.9.1 For the construction carbon assessment undertaken as part of the PEI Report, the following assumptions were used:

Earthworks

- The preliminary assessment has assumed that 80% of cut is to be reused. However, due to poor material quality this assumption has been dismissed. Instead, it was agreed that none of the material will be able to be reused due to the quality of the soil that was observed in the ground condition report.
- Quantities include floodplain compensation areas and double handling

Structures

- The figures were extrapolated from two similar bridge structures on the M42 Junction 6 Improvement project²⁹⁰ as the bridge structures had a very similar composition. Carbon calculations were based on an approximate deck area for the A46 structures compared to those of the M42 bridges.
 - For other structures, such as culverts, carbon emissions were calculated by the amount of material used for the structures.
- 15.9.2 An uplift was added for the Landscape and Utilities sections as an approximation based on other projects. This was carried out due to limited information for the A46.
- 15.9.3 The full construction assessment, detailed in the ES will be based on the available information provided by the design team. However, assumptions will be necessary to ensure the aspects can be assessed. Assumptions may include selection of the closest match in the Mott MacDonald Moata Carbon Portal, and assumptions on

²⁹⁰ National Infrastructure Planning – M42 Junction 6 Improvement Scheme (National Highways) – available at: [M42 Junction 6 Improvement | National Infrastructure Planning \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/m42-junction-6-improvement/)

dimensions and material type. A list of the key assumptions will be detailed within the assessment results within the ES.

- 15.9.4 The operational road user assessment will be based upon outputs from the WebTAG assessment. The assumptions and limitations of this approach will be detailed within the relevant report. Until this publication it is assumed that longer routes will lead to greater vehicle kilometres travelled, and therefore a greater magnitude of emissions. Whilst this assumption is the likely outcome for vehicle kilometres it will remain a limitation of the assessment of the schemes climate impact until a full assessment is undertaken.
- 15.9.5 The assessment of land use change will be based upon the level of information available at the time on proposed planting and woodland removal. Where necessary assumptions on the details of the woodland will be made. In addition, the WCC tool will be utilised, and assumptions may be necessary for the yield class, age of trees, soil disturbance and other details.

Resilience of the scheme to climate change

- 15.9.6 Information on the climate baseline and future projections are based on freely available information from third parties, including the historical meteorological variables recorded by the Met Office and the UK Climate Projections (UKCP18) developed by the Met Office.
- 15.9.7 Climate projections are not predictions or forecasts but simulations of potential scenarios of future climate, under a range of hypothetical GHG emissions scenarios and assumptions. Therefore, the results from running the climate models cannot be treated as exact or factual, but projection options. They represent internally consistent representations of how the climate may evolve in response to a range of potential forcing scenarios, and their reliability varies between climate variables. Scenarios 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 are more certain than those for precipitation. Furthermore, the degree of uncertainty associated with all climate change projections increases for projections further into the future.
- 15.9.8 Accordingly, any further research, analysis or decision-making should take account of the nature of the data sources and climate projections, and should consider the range of literature, additional observational data, evidence, and research available, and any recent developments in these.

15.10 Design, mitigation and enhancement measures

Effects on climate

Design measures

- 15.10.1 The development of the scheme design shall be an iterative process undertaken as part of an integrated design team to adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA 104. The first principle being to avoid adverse effects if at all possible, before seeking to minimise or mitigate for any unavoidable impacts through a well-developed mitigation strategy.
- 15.10.2 The effective assessment and management of impacts on climate offers the opportunity to reduce the impact of projects on climate by minimising the magnitude of GHG emissions as far as possible. The project will work with the 80:20 rule in mind where targeted interventions into the largest 20% of causes, as identified by the assessment, can impact a large proportion (80%) of the scheme.
- 15.10.3 A Carbon Management Plan (CMP) has been produced for the scheme to act as a live document that will be updated as the scheme progresses through design. This ensures the consideration of carbon reduction through all phases of the scheme. It outlines the process to be followed to reduce carbon and the methodology for the carbon assessment, and will be updated with progress made through the design development. The CMP will be submitted as part of the DCO process, providing it is not superseded by new documentation.
- 15.10.4 The following high-level approach to mitigation (as defined within PAS 2080²⁹¹) will be applied and developed, with a particular focus on the hotspots identified through the carbon assessment:
- Build nothing: Evaluate the basic need for an asset and explore alternative approaches to achieve outcomes set by the asset owner/manager.
 - Build less: Evaluate the potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required.
 - Build clever: Consider the use of low carbon solutions (including technologies, materials, and products) to minimise resource consumption during the construction, operation, and user utilisation stages of the asset.
 - Build efficiently: Use techniques that reduce resource consumption during the construction and operational phases.

²⁹¹ BSI (2016). 'PAS 2080 – Carbon Management in Infrastructure' available at: <https://www.bsigroup.com/en-GB/our-services/product-certification/product-certification-schemes/pas-2080-carbon-management-in-infrastructure-verification/> (last accessed July 2022).

Mitigation measures - Construction

- 15.10.5 The procurement team have set requirements for subcontractors and suppliers to engage with them to include:
- Low/zero carbon solutions – these will be explored beyond business as usual to achieve carbon savings beyond a typical project.
 - Competency/training requirements – these will be adjusted to include training on sustainable construction practices.
 - Reporting expectations around emissions.
 - Collaboration potential between schemes and contractors for more effective use of arisings.
- 15.10.6 An updated construction CMP will be compiled in conjunction with the Second Iteration Environmental Management Plan (EMP), building on the First Iteration EMP, and will include the following topics:
- Procurement
 - Materials and resource management on site
 - Change process for low/zero carbon solutions
 - Low/zero carbon plant and management
 - Construction techniques and competency
 - Training matrix

Mitigation measures – Operation

- 15.10.7 The scheme will be designed to ensure the lifetime operation is as efficient as possible ensuring a whole-life low carbon scheme supporting the National Highways' ambitions.
- 15.10.8 Opportunities identified during the design and construction of the scheme during operation will be captured within the Opportunities Log and handed over for the operating agency to pursue during the scheme's operation and shared as part of best practice processes where relevant.

Enhancement measures

- 15.10.9 The scheme will result in a net-increase in emissions beyond a do-minimum scenario, and will not result in a net reduction in emissions from today's baseline therefore it is not possible to deliver enhancements. Notwithstanding this position, if this situation is to change and with the potential to utilise any new and emerging technologies, the potential for delivering enhancements will be considered as part of the ongoing EIA and design development, and will be reported in the ES, if feasible. However, these enhancement measures will not be taken into account when determining whether effects are significant or not.

Resilience of the scheme to climate change

Design measures

- 15.10.10 The design will consider the climatic changes where appropriate to ensure the scheme is resilient to future changes in climate and extreme weather events. The design guidance ensures the consideration of temperature ranges and precipitation levels.
- 15.10.11 Specific examples of design measures to date are captured in Section 2.7. These measures capture the predicted uplift in climate and include drainage features such as balancing ponds, drainage ditches and culverts, subject to further design consideration. The inclusion of such measures are intended to ensure excessive rainfall is mitigated and the impact on scheme operation is minimised.

Mitigation measures - construction

- 15.10.12 Building on the First Iteration EMP, to be issued as part of the DCO submission, a Second Iteration EMP will be prepared by the contractor and implemented during the construction period. The Second Iteration EMP will ensure that the construction of the scheme allows for adaptation to impacts of changes in climate, such as ensuring construction materials are covered when stored and pro-active planning to minimise adverse effects.

Mitigation measures – operation

- 15.10.13 The design measures available in Section 2 create a road surface and infrastructure which is resilient to the potential impacts identified in Section 15.7. Further mitigations, for example drought resistant plants will be explored in the ES.

Enhancement measures

- 15.10.14 Enhancement measures for resilience of the scheme to climate change will be considered as part of the ongoing EIA and design development, and will be reported in the ES. Measures which go beyond the anticipated change in climate and reduce the effects of projected weather change in the local area will be explored.

15.11 Assessment of effects

Effects on climate

- 15.11.1 For both construction and operational effects on climate, it is not known at this stage if the final scheme design will result in GHG emissions that that would be defined as significant, however it is considered likely to not be significant. That said, in line with the UK Government's Carbon Reduction Plan, the scheme will seek to reduce GHG emissions as far as practicable to contribute to the UK's net reduction in GHG emissions and maximise the potential for reducing GHG emissions.

Construction

15.11.2 For this PEI Report, a construction carbon assessment of the baseline design has been undertaken making use of the preliminary scheme design developed for the preferred route announcement and to supplement previous environmental assessment work. The estimated construction baseline emissions of the scheme are 254,536 tCO₂e split between material, plant and transport as shown in Table 15.9.

Table 15.9: Split of carbon emissions by scope type (including 23% uplift)

PAS2080 Lifecycle stage	Carbon emissions tCO ₂ e (inc. uplift)	Percentage of total
Material (A1-3)	152,051	60%
Transport (A4)	62,079	24%
Plant (A5)	40,406	16%
Total	254,536	

15.11.3 The carbon emissions were broken down into series numbers, corresponding to work packages and to make the quantities easier to track and manage. The breakdown of these figures can be seen in Table 15.10. This indicates the majority of the emissions are from earthworks, pavements and structures which should be the focus of the carbon reduction efforts. Whilst this data gives an indication, significance cannot be fully determined at this stage due to the lack of a full assessment in the absence of updated traffic data.

Table 15.10: tCO₂e by discipline

tCO ₂ e per discipline + uplift				
	Material	Plant	Transport	Total
Series 100 Preliminaries	30,611	493	3,307	34,411
Series 200 Site Clearance	-	3,320	13	3,333
Series 300 Fencing	313	-	4	318
Series 400 VRS	2,171	70	156	2,397
Series 500 Drainage	1,596	358	111	2,066
Series 600 Earthworks	44,508	28,395	47,050	119,954
Series 700-1000 Pavements	18,223	1,891	3,857	23,971
Series 1100 Kerbs and footways	1,250	37	225	1,512
Series 1200 Traffic Signs	174	61	2	237
Series 1300-1400 Lighting and electrical	285	67	32	385
Series 1500 Communications	-	6	0	6

tCO₂e per discipline + uplift				
Series 1600-2600 Structures	49,103	3,008	5,858	57,969
Series 3000 Landscape	222	779	6	1,008
Utilities	4,758	1,226	1,946	7,930
TOTAL	153,214	39,712	62,568	255,495

Operation

15.11.4 The final detailed assessment has yet been undertaken for the operational impact of the scheme. At present the assessment of the effects on climate for the scheme operation, based on the preliminary scheme design developed for the preferred route announcement and associated traffic model, are that in the 2028 Opening Year, operational emissions would contribute 10,411 tCO₂e (10,350 road user, 61 maintenance). A detailed assessment will be undertaken and presented within the ES, when updated traffic data is available.

Resilience of the Scheme to climate change

15.11.5 The projected future climate is likely to follow the UK wide trend of drier summers, wetter winters and an increase in average mean temperature. It is also likely that changes to the climate will lead to temporal and severity increase of weather events such as storms, heavy rainfall, droughts and heatwaves. The scheme will experience the effects of these changes in both its construction and operation.

15.11.6 A detailed assessment of the scheme's resilience to climate change is yet to be undertaken and will be captured in the ES. The assessment cannot be undertaken at this stage as the design is still being developed.

Construction

15.11.7 The assessment work undertaken at the options identification stage did not identify the potential for significant climate resilience construction impacts and no assessment was therefore completed. However, following further analysis of climate data and the identification of the potential impacts of the scheme during construction, the A46 Newark Bypass Environmental Scoping Report²⁹² scoped in the need for further assessment of the resilience of the scheme to climate change. At this stage, data is not available to undertake a full assessment as the design will be further developed following consultation, but the projected impacts of climate change on the scheme construction will be detailed in the ES. The impact in

²⁹² National Highways (August, 2022) A46 Newark Bypass Environmental Scoping Report [online] available at: [TR010065-000002-A46N - Scoping Report.pdf \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/tr010065-000002-A46N-Scoping-Report.pdf) (last accessed October 2022).

respect to flooding is captured in more detail in Chapter 14 of this PEI report.

Operation

15.11.8 The assessment work undertaken at the options identification stage identified that significant effects are unlikely to occur. However, following further analysis of climate data and the identification of the potential impacts of the scheme during operation, the A46 Newark Bypass EIA Scoping Report scoped in the need for further assessment of the resilience of the scheme to climate change. The scheme design will be further developed following consultation, and the projected impacts of climate change on the scheme operation will be detailed in the ES once the relevant data to conduct this assessment is available. The impact in respect to flooding is captured in more detail in Chapter 14.

Monitoring requirements for significant adverse effects

15.11.9 To allow the monitoring of GHG emissions, the full assessment in the ES will include a comparison of estimated GHG emissions arising from the scheme with UK carbon budgets, in line with DMRB LA 114. The results of this comparison will be presented following the format of Table 3.18 in DMRB LA 114.

15.11.10 Quarterly GHG emission returns required on projects during the construction and operation stages shall be reported in accordance with NH requirements.

15.11.11 Once the scheme is operational, asset data shall be managed, maintained and monitored to ensure the project design is operating as intended. Any further requirements for monitoring the effects on climate and resilience of the scheme to climate change will be detailed in the ES.

15.12 Conclusions

15.12.1 This chapter provides a summary of the assessments that have been undertaken so far for climate change related environmental factors, of the scheme in accordance with DMRB LA 114. At this stage a construction carbon assessment has been undertaken, alongside a desktop study of future climate projections. Future detailed assessments of both the effects on climate and the resilience of the scheme to climate change as per DMRB LA 114 will be detailed in the ES. At the current stage, the effects on climate are predicted not to be significant. In addition, effects on the resilience of the scheme to climate change are also predicted not to be significant.

16 Combined and cumulative effects

16.1 Introduction

16.1.1 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 (synergistic) from a single project (the interrelationship between different environmental factors).
- Cumulative effects (additive) from different projects (with the project being assessed).

16.1.2 This chapter draws upon guidance and standards provided within the Advice Note Seventeen: Cumulative Effects Assessment²⁹³, the DMRB LA 104 – Environmental assessment and monitoring²⁹⁴ and the NPSNN²⁹⁵.

16.1.3 The previous chapters presented within this report have identified that further assessment is required for a number of environmental factors, which would be presented within the ES. As DMRB LA 104 states that cumulative effects should be assessed when the conclusions of individual environmental factor assessments have been reached and reported, no assessment of cumulative effects has currently been made within this report. Instead, this chapter provides an overview of the baseline, potential impacts, and methodology of assessment for combined and cumulative effects, with further assessment to be included within the ES.

16.2 Legislation and policy

16.2.1 European Directive 3011/92/EU, as amended by European Directive 2014/52/EU, requires environmental impact assessments to identify, describe and assess significant environmental effects arising from the interaction between the following factors: population and human health; biodiversity; land; soil; water; air and climate; material assets; cultural heritage and the landscape.

²⁹³ The Planning Inspectorate (2019) Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects [online] available at: [Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects | National Infrastructure Planning \(planninginspectorate.gov.uk\)](https://www.planninginspectorate.gov.uk/advice-note-seventeen-cumulative-effects-assessment-relevant-to-nationally-significant-infrastructure-projects/) (Last accessed June 2022).

²⁹⁴ National Highways (2020) LA 104 – Environmental assessment and monitoring [online] available at: [0f6e0b6a-d08e-4673-8691-cab564d4a60a \(standardsforhighways.co.uk\)](https://standardsforhighways.co.uk/0f6e0b6a-d08e-4673-8691-cab564d4a60a/) (Last accessed June 2022).

²⁹⁵ Department for Transport (2014) National Policy Statement for National Networks [online] available at: https://www.gov.uk/Government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf (last accessed June 2022).

- 16.2.2 Schedule 4 of the Infrastructure Planning EIA Regulations 2017 requires an EIA to identify and assess the likely significant cumulative effects of a development, either cumulatively with other developments or the in-combination environmental effects on receptors. The requirement to assess the cumulative effects of development is also set out in Regulation 5(2)(e) of the 2017 Regulations. This regulation states that the EIA must identify, describe and assess in an appropriate manner the direct and indirect significant effects of the proposed development arising from the interaction between the following factors: population and human health; biodiversity; land, soil, water, air and climate; material assets, cultural heritage and the landscape.
- 16.2.3 The NPSNN states “In considering any proposed development, and in particular, when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State should take into account ...its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.”

16.3 Assessment methodology

- 16.3.1 The assessment for combined and cumulative effects within the ES will be undertaken for the scheme for both the construction and operation phases.

Combined effects methodology

- 16.3.2 The assessment methodology for combined effects will involve the identification of impact interactions associated with the scheme upon separate environmental receptors, to better understand the overall environmental effect of the scheme.
- 16.3.3 The significance of construction and operational phase environmental effects will be brought forward from the preceding chapters of the ES into matrices, providing an overview of the potential effects on individual receptors. The assessment will consider adverse effects, after design mitigation has been taken into account. The significance of combined effects upon each environmental receptor group will then be made based upon the balance of scores and using professional judgement.
- 16.3.4 The methodology for the assessment of combined effects will follow DMRB LA 104. For the purposes of the assessment, combined effects of Moderate Adverse or Moderate Beneficial and above will be considered significant.

Cumulative effects methodology

- 16.3.5 The assessment methodology for cumulative effects will involve the identification of incremental changes likely to be caused by potential 'other developments' together with the scheme.
- 16.3.6 The assessment of cumulative effects will follow PINS Advice Note Seventeen: Cumulative Effects Assessment with the four stages of assessment:
- Stage 1: Establish the NSIP's 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.
- 16.3.7 The ES will set out the methodology, recognising the requirements of the DMRB LA 104, NPSNN and advice on development of threshold criteria in Advice Note Seventeen: Cumulative Effects Assessment, giving particular regard to the size and spatial influence of developments on the proposed project.
- 16.3.8 In accordance DMRB LA 104, the assessment of cumulative effects will report on:
- Roads projects which have been confirmed for delivery over a similar timeframe.
 - Other development projects within 2 kilometres of the scheme with valid planning permissions or consent orders, and for which EIA is a requirement.
 - Proposals in adopted development plans within 2 kilometres of the scheme with a clear identified programme for delivery.
- 16.3.9 The search areas for other developments have been chosen to allow a proportionate assessment. The search areas will be reviewed as the traffic modelling is updated. At this stage no consultation has been undertaken to agree the list of other developments included in the assessment.
- 16.3.10 Rather than reporting every interaction, the methodology for the assessment of cumulative effects will concentrate on the significant effects, and will aim to differentiate between permanent, temporary, direct, indirect and secondary effects, positive or negative.
- 16.3.11 For the purposes of the cumulative effects assessment, in the event that the respective construction phases of other developments coincide with the scheme, it will be assumed that the cumulative effects from traffic could be mitigated to avoid significant effects, for example restrictions on routing and programming of construction traffic. Similarly, it is assumed that appropriate avoidance, mitigation

and compensation to offset potential disturbance and collision risk impacts to legally protected and priority species will be employed at the identified committed developments given the planning and legal obligations that must be met when such species are present.

- 16.3.12 The search areas for other developments have been chosen to allow a proportionate assessment at this option selection stage. The search areas will be reviewed at the next stage as and when the Traffic Model Uncertainty Log is developed. At this stage no consultation has been undertaken to agree the long or short list of developments included in the assessment.
- 16.3.13 Where significant cumulative effects, beyond those identified as residual effects from the scheme in isolation, have been identified, additional mitigation measures will be developed to avoid significant effects.
- 16.3.14 The significance of cumulative effects upon each environmental resource will then be made based on the balance of scores and using professional judgement. An on-balance approach will be taken when identifying the overall cumulative effect for the proposed scheme in conjunction with the other proposed major developments.

Significance Criteria

- 16.3.15 The assessment of significance of the combined and cumulative effects will be determined in accordance with requirements in DMRB LA 104. 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 valued resource suffering a major detrimental impact would be a very large adverse effect.
- 16.3.16 For the purposes of the cumulative effects assessment, the value of a resource and magnitude of impact will be determined according to the criteria set within the preceding chapters of the ES. The significance of effect will then be 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 16.1, which reflects this on balance approach. Overall significance will be determined with mitigation included, as shown in Table 5.3 contained in Chapter 5 of this report.
- 16.3.17 Significance descriptors have also been aligned with the considerations included within Advice Note Seventeen: Cumulative Effects. Accordingly, where impacts are likely to be temporary, the overall significance of effect is considered to be reduced compared to

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 1 hectare, resulting in 2ha cumulative woodland loss) or synergistic (two discharges combining to have an effect on a species not affected by discharges in isolation).

16.3.18 Where an effect is Moderate or above (Adverse or Beneficial), it is deemed to be significant (see Table 16.1).

Table 16.1: Combined and cumulative significance criteria

Significance	Definition
Very Large (Adverse or Beneficial)	Where the combined effects of the scheme or cumulative effects of the 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: <ul style="list-style-type: none"> • Permanent and widespread for receptors of very high value
Large (Adverse or Beneficial)	Where the combined effects of the scheme or cumulative effects of the 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: <ul style="list-style-type: none"> • Permanent and widespread for receptors of high value • Localised for a receptor of very high value or • Temporary for a receptor of very high value
Moderate (Adverse or Beneficial)	Where the combined effects of the scheme or cumulative effects of the 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: <ul style="list-style-type: none"> • Permanent and widespread for receptors of medium value • Localised for receptors of high value or • Temporary for a receptor of high value
Slight (Adverse or Beneficial)	Where the combined effects of the scheme or cumulative effects of the scheme in association with other existing or more than likely/ near certain future major developments upon an individual

Significance	Definition
	<p>or collection of environmental receptors would be noteworthy but not significant. Effects would be:</p> <ul style="list-style-type: none"> • Permanent and widespread for receptors of low value • Localised for receptors of medium value or • Temporary for a receptor of medium value
Neutral	Where the combined effects of the scheme or the cumulative effects of the scheme in association with other existing or more than likely/ near certain future major developments would not be discernible.

16.4 Study area

Combined effects

- 16.4.1 The study area for the assessment of combined effects of the scheme, for both construction and operation, is defined by the study areas identified within the relevant environment chapters of this report, ranging from 200 metres (for Air Quality) to 30 kilometres (for Biodiversity).
- 16.4.2 In terms of the combined effects of climate, a qualitative assessment of these effects will be included as part of the Climate chapter.

Cumulative effects

- 16.4.3 The potential for cumulative effects is where the Zone of Influence (ZOI) for the scheme overlaps with the ZOI for other development. This ZOI will vary from topic to topic. The study area for the identification of 'other development' for inclusion in the assessment of cumulative effects is based upon thresholds and spatial areas. These thresholds and spatial areas are based upon professional judgement and take into account the nature and location of the scheme and the ZOI for individual environmental topics, as outlined in Table 16.2 below.
- 16.4.4 These thresholds and spatial areas are based upon professional judgement and take into account the nature and location of the scheme and the ZOI for individual environmental topics, as outlined in Table 16.2 below.

Table 16.2: Environmental factor zone of influence

Environmental factor	Zone of Influence (ZOI)
Air Quality	<p>Construction: The ZOI will be 200 metres from construction activities for construction dust and emissions. A ZOI for construction traffic will be determined based on a review of other development proposals and their construction programmes.</p> <p>Operation: The affected road network plus adjoining roads within 200 metres will define the ZOI. As the operational phase traffic data includes traffic associated with other developments, the air quality impact assessment to be included in the ES will inherently be a cumulative impact assessment.</p> <p>See Chapter 6 Air Quality for further information.</p>
Cultural heritage	<p>Construction and Operation: A 1 kilometre buffer around the scheme extent for designated heritage assets and a 500 metre buffer around the scheme extent for non-designated heritage assets. A Zone of Theoretical Visibility (ZTV) will be produced to inform the cultural heritage assessment which may include sensitive assets beyond the 1km study area.</p> <p>See Chapter 7 Cultural heritage for further information.</p>
Landscape and visual ²⁹⁶	<p>Construction and Operation: 1 kilometre ZOI for landscape and visual impacts. However, the study area will be extended for any receptors sitting outside of the 1 kilometre which have the capacity to experience significant effects as a result of the scheme. These effects which may be influenced by the scheme include:</p> <ol style="list-style-type: none"> 1. Integrated receptors in the scheme's construction works and their visual footprint 2. The wider landscape setting and visual envelope 3. Areas visible by the scheme and the extent of representative viewpoints 4. Where applicable, the full extent of adjacent or affected landscape receptors of special value 5. The extent of adjacent or affected visual receptors and the visual amenity of the area <p>The final ZOI will be informed by a range of computer-generated Zones of Theoretical Visibility which will be prepared in</p>

²⁹⁶ The methodology adopted for the LVIA requires that any impacts associated with the presence of new infrastructure are taken into account during the operational stage assessment, and therefore differs from the approach used for other topic assessments. The cumulative effects assessment therefore considers a 'worst case' scenario in respect of landscape and visual impacts

Environmental factor	Zone of Influence (ZOI)
	<p>accordance with Guidelines for Landscape and Visual Impact Assessment, and verified by site visit.</p> <p>See Chapter 8 Landscape and visual effects for further information.</p>
Biodiversity	<p>Construction and Operation: A 2 kilometre ZOI for all internationally and nationally designated nature conservation sites²⁹⁷.</p> <p>See Chapter 9 Biodiversity for further information.</p>
Geology and Soils	<p>Construction and Operation: All locations where physical works and ground disturbance would take place, plus a 500 metre buffer.</p> <p>See Chapter 10 Geology and Soils for further information.</p>
Material assets and waste	<p>Construction: ZOI will be defined by the influence of the scheme, rather than through a set geographical location. Feasible sources of construction material will focus primarily on the Order Limits and the region within which waste management facilities are located and from where construction materials may be sourced. This area will initially focus on Nottinghamshire County Council and, where required, the East Midlands region.</p> <p>Operation: use of materials and waste management issues have been scoped out of the assessment.</p> <p>See Chapter 11 Material assets and waste for further information.</p>
Noise and Vibration	<p>Construction: The construction noise and vibration ZOI is defined by proximity of closest identified receptors to the A46 construction works, following which an appropriate buffer will be established around receptors. The specific location of construction work areas is still to be confirmed.</p> <p>Operation: The operational noise and vibration ZOI is defined by other cumulative developments which will be included in the traffic model that will accompany the application. As the operational phase traffic data includes traffic associated with other developments, the noise and vibration impact assessment to be included in the ES will inherently be a cumulative impact assessment.</p> <p>See Chapter 10 Noise and Vibration for further information.</p>

²⁹⁷ A 30 kilometre ZOI is used specifically for sites within the National Site Network designated for bat populations within the HRA. However, as there are no such sites within 30 kilometres of the scheme a 2 kilometre ZOI has been used.

Environmental factor	Zone of Influence (ZOI)
Population and human health	<p>Construction and Operation: When assessing impacts on land-use and accessibility, the study area will be based on the Order Limits including compounds and temporary land take, as well as a 500 metre area surrounding the Order Limits. Where effects are either identified outside of the 500m area or are unlikely to occur within the 500 metre area, the study area has been amended accordingly.</p> <p>The human health baseline study area has been determined by the local authorities and wards which are either directly or indirectly affected by the Scheme. The local authority of Newark and Sherwood District Council makes up the study area for the human health baseline assessment.</p> <p>See Chapter 13 Population and human health for further information.</p>
Road drainage and the water environment	<p>Construction and Operation: 1 kilometre ZOI for waterbodies. This is extended where there are sensitive features downstream of the works. For groundwater bodies, the ZOI is the potential zone of impact.</p> <p>See Chapter 14 Road drainage and the water environment for further information.</p>
Climate	<p>N/A - the climate assessment methodology (see Chapter 15), will test whether the proposed scheme hinders the UK's ability to meet its national climate change targets by 2050. The assessment can be regarded as a cumulative assessment as the national projected GHG emissions take into account trends such as future development, technology and population changes. The receptor for the climate change topic is the global atmosphere, and its relative carrying capacity for GHG emissions is large, therefore the scope for cumulative effects has the potential to be unlimited. Therefore, a separate cumulative effects assessment on GHG emissions will not be undertaken.</p> <p>See Chapter 15 Climate for further information.</p>

16.4.5 Consultation with local authorities will be undertaken as part of the ES to agree a list of proposed developments to be included within the cumulative effects assessment. To enable a reasonable and proportionate assessment, the following selection criteria will be used to identify and determine 'other development' which could result in potential cumulative effects with the scheme:

- Nationally Significant Infrastructure Project's (NSIP's) on the PINS' Programme of Projects.
- Road projects which have been confirmed over a similar timeframe.
- Other development projects under construction or with valid planning permissions, and for which formal EIA is a requirement or for which non-statutory EIA has been undertaken.
- Proposals in adopted Development Plans, with a clear identified programme for delivery.

16.4.6 The developments in the above categories will only be considered in the assessment if they are considered to be 'reasonably foreseeable' and 'committed', in line with the requirements in DMRB LA 104.

16.5 Existing baseline

16.5.1 The baseline for each environmental factor is described in detail for air quality, cultural heritage, landscape and visual, biodiversity, geology and soils, material assets and waste, noise and vibration, population and human health, road drainage and the water environment, and climate, all contained in the preceding chapters of this report (Chapters 6 to 15).

16.5.2 The assessment of cumulative effects arising from the scheme in combination with other schemes primarily constitutes a desk-top study of planning documents broadly covering the location of schemes considered relevant to the assessment. This broadly focuses on the collection of information relating to the background of relevant projects, their expected timelines and likely environmental impacts. The search of planning history and development plans was previously undertaken in December 2020 by visiting the information held on-line by NSDC and Nottinghamshire County Council. This information will be revisited to identify the proposed major developments within the study area and to inform the baseline for the cumulative effects assessment within the ES.

16.5.3 The scheme traffic modelling will also include assessment of other development to determine changes in operational traffic. These developments will also be used to inform the baseline for the cumulative effects assessment within the ES.

16.6 Potential impacts

Combined effects

Construction

16.6.1 During construction, there is the potential for combined effects to receptors as a result of the scheme due to the potential effects reported within the preceding chapters (Chapters 6 to 15). Receptors

may experience combined effects from altered highway arrangements, traffic flows, or as a result of construction activity, plant and machinery. Receptors could receive a combination of amenity effects such as visual impact, noise, vibration, and air quality which may be significant. Changes in journey time/distance and changes in amenity during construction may combine to give risk to significant severance effects. Combinations of effects may require additional mitigation.

Operation

16.6.2 During operation, there is the potential for combined effects to receptors as a result of the scheme due to the potential effects reported within the preceding chapters (Chapters 6 to 15). Combined effects may result from changes in landscape, noise, vibration, and air quality associated with new or altered highway infrastructure and/or traffic flows which may be significant. Combinations of effects may require additional mitigation.

Cumulative effects

Construction

16.6.3 During construction, there would be the potential for cumulative effects on all receptors, as a result of the scheme with any of the other developments, for which the construction stages overlap. Further investigation into other developments is required before potential cumulative effects during construction may reasonably be identified. The nature of effects will be dependent on the nature, scale, and location of other development. The types of cumulative effects that could occur may relate to amenity effects from other development in close proximity to the scheme, and traffic effects from other projects located further from the scheme.

Operation

16.6.4 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, further investigation into other developments is required before potential cumulative effects during operation may reasonably be identified. The nature of effects will be dependent on the nature, scale, and location of other development. The types of cumulative effects that could occur may relate to amenity effects from other development in close proximity to the scheme, and traffic effects from other projects located further from the scheme.

16.7 Consultation

- 16.7.1 Consultation with local authorities will be undertaken as part of the ES to agree a list of proposed developments to be included within the cumulative effects assessment.

16.8 Assumptions and limitations

- 16.8.1 At this stage of assessment, the proposed major other developments within the area have not been identified. Therefore, the environmental effects that would result from 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.

16.9 Design, mitigation and enhancement measures

Design measures

- 16.9.1 The development of the scheme design shall be an iterative process undertaken as part of an integrated design team to adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA 104. The first principle being to avoid potential adverse effects if at all possible, before seeking to minimise or mitigate for any unavoidable impacts through a well-developed mitigation strategy. Embedded mitigation incorporated into the scheme design development to date is outlined in Chapter 2 Section 2.6 of this report as well as in individual receptor chapters where relevant.

Construction

- 16.9.2 For both combined and cumulative effects during construction, best practice mitigation measures included in the Second Iteration Environmental Management Plan would ensure that effects are reduced as far as possible.

Operation

- 16.9.3 Combined effects would be reduced as far as possible through the implementation of best practice mitigation which would be identified following the assessment to be included within the ES.
- 16.9.4 In relation to cumulative effects, it is assumed that mitigation would be provided by the other developments to offset any significant environmental effects and monitoring of significant effects would also be in place for those other developments that have gone through the

statutory EIA process. This would reduce the likelihood of significant cumulative effects during operation.

Enhancement Measures

- 16.9.5 Enhancement measures will be considered as part of the ongoing design development, and will be reported in the topic specific chapters of the ES. However, these enhancement measures will not be taken into account when determining whether effects are significant or not.

16.10 Assessment of effects

Construction

- 16.10.1 With best practice mitigation measures in place, effects are not anticipated to be significant. However, an assessment of combined and cumulative effects during construction will be undertaken as part of the ES, following completion of environmental assessments contained within the ES (for combined effects), and further understanding of other developments within the vicinity (for cumulative effects).

Operation

- 16.10.2 With best practice mitigation measures in place, and any further mitigation developed by other developments to offset any significant environmental effects, effects are not anticipated to be significant. However, an assessment of combined and cumulative effects during operation will be undertaken as part of the ES, following completion of environmental assessments contained within the ES (for combined effects), and further understanding of the other developments within the vicinity (for cumulative effects).
- 16.10.3 The details of any monitoring required for anticipated significant adverse effects will be included as part of the ES.
- 16.10.4 Where significant cumulative effects, beyond those identified as residual effects from the scheme in isolation, have been identified, additional mitigation measures will be developed to avoid significant effects where possible.

16.11 Conclusions

- 16.11.1 The methodology for the assessment of combined and cumulative effects has been considered within this chapter. It is recommended that the assessment for combined and cumulative effects is undertaken as part of the ES following completion of environmental assessments contained within the ES (for combined effects), and further understanding of the other developments within the vicinity (for cumulative effects).

- 16.11.2 The approach to the assessment within the ES needs to align with the standards outlined in the DMRB LA 104 Environmental assessment and monitoring, and the Planning Inspectorate (PINS) Advice Note Seventeen: Cumulative Effects Assessment.

17 Summary

Table 17.1 presents the conclusions of each of the specialist topics included within this PEI Report.

Table 17.1: Summary table

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
Air Quality			
Local Air Quality - Human Health	Construction	The potential for local air quality could be affected through the generation and subsequent deposition of construction dust arising from construction activities and vehicle movements. With the implementation of appropriate mitigation measures effects are not expected to be significant.	Not significant
Local Air Quality - Human Health	Operation	The scheme is predicted to reduce traffic flows in the centre of Newark-on-Trent. Flows on the A46 are predicted to increase as a result of the increased lanes and junction improvements. These increased flows may result in small deteriorations in air quality along the existing A46 alignment. No exceedances of air quality objectives are predicted at human receptors, and therefore effects are not expected to be significant.	Not significant
Local Air Quality – Ecological Effects	Operation	The scheme is predicted to reduce traffic flows in the centre of Newark-on-Trent. Flows on the A46 are predicted to increase as a result of the increased lanes and junction improvements. These increased flows may result in increased nitrogen deposition at	Not significant

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
		ecological receptors. There is potential for significant effects at four LWSs. These sites were assessed by a biodiversity expert during the options appraisal stage with all effects deemed to be not significant.	
Cultural Heritage			
Heritage assets	Construction	Direct physical impacts on Grade II listed Causeway Arches due to the permanent construction of the scheme is likely to constitute an adverse significant effect. Construction of the scheme could also lead to direct physical impacts from the removal of buried archaeological remains. These include the prehistoric deposits at Farndon, the prehistoric settlement features at Kelham and the archaeological assets related to the Civil War. Additional impacts to unknown archaeological remains may also be identified due to fieldwork. The permanent construction and expansion of the existing road toward Scheduled Monuments such as the Civil War redoubts at Cattle Market roundabout will potentially degrade the setting of these monuments and may constitute an adverse significant effect.	Significant adverse
Historic landscape	Construction	The permanent construction of the scheme is unlikely to result in adverse significant effects on the historic landscape.	Not significant
Heritage assets	Operation	There will be no operational effects on buried archaeological remains. Further assessment is required to establish any	Further assessment required as part of the ES

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
		significant effects from noise and vibration from traffic on designated and non-designated built heritage or due to changes in the vertical road alignment which could impact the setting of these assets.	to determine significance of effect.
Historic landscape	Operation	Further assessment is required to establish any significant effects from noise and vibration from traffic or due to changes in the vertical road alignment which could impact the historic landscape.	Further assessment required as part of the ES to determine significance of effect.
Landscape and Visual Effects			
Landscape character	Construction	The presence of construction plant, materials, machinery, construction compounds and the provision of construction lighting is likely to have a direct and indirect impacts on landscape features within the study area. Similarly, the removal of vegetation where required to facilitate the works has the potential to impact directly on key characteristics of the local landscape character. Earthworks required for the construction of the floodplain compensation area would also lead to the introduction of detracting features in an otherwise rural landscape. The works also have the potential to bring adverse effects upon the setting of the townscape of Newark-on-Trent, given the intervisibility of neighbouring detracting construction elements in and around the A46. However, any landscape effects would be set in the context of the existing A46, wider road and rail network, and other detracting features	Significant Adverse

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
		associated with industry such as the Sugar Factory and local industrial and commercial developments.	
Visual amenity	Construction	Short distance views are likely to be afforded from a number of receptors in close proximity to the scheme construction works. In addition, the removal of any existing trees and screening vegetation may result in the opening up of views of the A46 as well as of construction activity, bringing further visual change to local receptors.	Significant Adverse
Landscape character	Operation	The widened A46 and associated highway features, including a number of at-height bridge structures and retaining walls, would increase the prominence of the A46 within the receiving landscape. The introduction of the floodplain compensation area at Kelham may also bring a change in local topography and land use, with opportunities for biodiversity enhancements to be explored. Effects upon landscape character during operation would also arise from loss of existing hedgerow field boundaries and linear belts of trees adjacent to the scheme. However, the essential mitigation strategy seeks to reinstate field boundaries and screening vegetation lost during construction wherever practicable.	Significant Adverse in early years, reducing over time
Visual amenity	Operation	Visual amenity would also be affected as a result of the increased visual prominence of the widened A46. This would arise from impacts associated with an additional lane of traffic movements and new or enlarged structures and junctions. Visual impacts	Significant Adverse in early years, reducing over time

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
		<p>would also arise due to views of signage, lighting at junctions and vehicle headlights during hours of darkness. Views to the new floodplain compensation area are also likely to be afforded from local receptors during operation. However, given the nature of the works in this area and planned landscape mitigation, it is not considered that long term adverse visual effects are likely in this location.</p>	
Biodiversity			
Designated sites	Construction	<p>Permanent habitat loss and fragmentation of LWSs could lead to significant effects.</p> <p>Construction activities could increase the risk of a pollution incident, such as contaminated land run-off or spills / leaks of oils and fuels, to downstream LWSs. Vegetation clearance along the carriageway embankments to facilitate the works would also result in reduced leaf litter and therefore lower nutrients entering the water in these LWSs. The works could also result in siltation and increase water turbidity. Increased levels of noise and light disturbance may also occur. With the implementation of appropriate mitigation measures effects are not expected to be significant.</p>	<p>Significant adverse (direct habitat loss)</p> <p>Not significant (all other effects)</p>
Priority habitats	Construction	<p>There is potential for direct damage and permanent loss of priority habitats such as lowland mixed deciduous woodland, lowland fen,</p>	<p>Significant (precautionary for lowland fen)</p>

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
		lowland meadows and coastal and floodplain grazing marsh. Additional indirect impacts may also impact habitats through disturbance, airborne pollution, run-off and compaction of root systems.	Not significant for effects on all other priority habitats
Veteran and notable trees	Construction	Loss of three veteran trees and up to 10 notable trees.	Significant
Protected and notable species	Construction	Fragmentation of foraging and commuting routes due to vegetation clearance, lighting and noise disturbance. The removal of vegetation would be likely to temporarily disrupt foraging and roosting areas, and has the potential to result in the destruction of nests and eggs. Potential for pollution incidents, infilling and earthworks to create changes in sediment dynamics to impact on aquatic species. With the implementation of appropriate mitigation measures effects are not expected to be significant.	Not significant
Designated sites	Operation	There is the potential for changes to hydrology and water quality at LWSs as a result of additional traffic during operation of the scheme. Increased emissions from traffic could also lead to increased levels of nitrogen deposition at the LWSs which could have a detrimental effect on habitats by changing the species composition. With the implementation of appropriate mitigation measures effects are not expected to be significant.	Not significant

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
Priority habitats	Operation	There is the potential for changes to hydrology and water quality at nearby grassland and woodland habitats as a result of additional traffic during operation of the scheme. Increased emissions from traffic could also lead to increased levels of nitrogen deposition affecting nearby habitats, including grassland and woodland, by changing the species composition of these habitats. With the implementation of appropriate mitigation measures effects are not expected to be significant.	Not significant
Protected and notable species	Operation	There is the potential for adverse effects on protected species through the incorporation of a new road at height, with the risk of killing and injuring species such as bats, otters and barn owls through collision with traffic along the flyover. There is also the potential for adverse effects on nocturnal species as a result of light disturbance. Increased traffic volume and speed during operation may have adverse effects on the behaviour of species sensitive to noise, particularly birds.	Not significant
Geology and soils			
Soils	Construction	There is potential for removal of ALC Grade 2, deemed 'best and most versatile' soils, associated with the food compensation area at Kelham. There is also the potential for removal of ALC Grade 3 (good to moderate) soils associated with the scheme. There is also	Significant Adverse (ALC Grade 2 soils) Not significant (all other soils)

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
		the potential for soil deterioration and compaction due to general construction, shallow excavation and earthworks.	
Contamination – human receptors	Construction	There is the potential for construction workers to come into contact with potentially contaminated soils /leachates/gases. With the implementation of appropriate mitigation measures effects are not expected to be significant.	Not significant
Contamination – surface water	Construction	There is the potential for surface water run-off to become entrained with sediment and pollute nearby watercourses. There is also the potential for discharge of potentially contaminated/sediment laden groundwater to watercourses following dewatering of excavations/foundation works. With the implementation of appropriate mitigation measures effects are not expected to be significant.	Not significant
Contamination – groundwater	Construction	There is the potential for the creation of contamination pathways/driving down of contaminants during GI/foundation works, presenting a risk to groundwater. With the implementation of appropriate mitigation measures effects are not expected to be significant.	Not significant
Materials			
Use of material resources	Construction	Due to the large quantities of material resources required for the scheme there is the potential for this to lead to a depletion of non-renewable resources. However, it is anticipated that any significant	Not significant

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
		effects due to the quantity of material resources required could be appropriately mitigated. Further assessment is required to confirm the significance of this effect.	
Waste generation	Construction	Disposal of waste to landfill that cannot be re-used or recycled, could impact on the remaining landfill capacity of the area. It is currently considered unlikely that the generation and management of waste would result in significant effects, conditional to appropriate waste management and the implementation of mitigation measures.	Not significant
Noise and vibration			
Noise and vibration	Construction	There is the potential for disturbance to receptors due to noise and vibration from construction activities. With the implementation of appropriate mitigation measures effects are not expected to be significant.	Not significant
Noise	Operation	There is the potential for changes to traffic flows to result in increased and decreased noise levels at sensitive receptors. Based on current modelling no significant effects are anticipated.	Not significant
Population and Human Health			
Land use and accessibility	Construction	A number of receptors, including residential properties, community assets, agricultural holdings, development land and businesses are	Significant adverse

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
		within or adjacent to the draft Order Limits and will potentially experience considerable adverse effects during construction.	
Human health	Construction	Changes in determinants of health such as noise, air quality, and visual landscape have the potential to be impacted by increased traffic and construction activities.	Not significant
Land use and accessibility	Operation	During operation, both positive and adverse effects are anticipated, as a result of road improvements and the creation of new motorised and non-motorised routes. Changes in traffic flows once the scheme is operational has the potential to have positive or adverse effects on population and human health receptors.	Not significant
Human health	Operation	During operation, both positive and adverse effects are anticipated, as a result of road improvements and the creation of new motorised and non-motorised routes. Changes in traffic flows once the scheme is operational has the potential to have positive or adverse effects on population and human health receptors.	Not significant
Road drainage and the water environment			
Surface water	Construction	Construction activities have the potential to result in pollution from suspended sediment/contaminated runoff, pollution from chemical spillages/leaks and water runoff, localised damage to channel and riparian features, disruption to natural hydraulic and sediment transport and increased flood risk. Standard mitigation measures	Not significant

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
		will be included in the EMP and embedded measures will be incorporated within the design to minimise effects.	
Groundwater	Construction	Construction activities have the potential to result in pollution from suspended sediment/contaminated runoff and dewatering affecting groundwater levels. Standard mitigation measures will be included in the EMP and embedded measures will be incorporated within the design to minimise effects.	Not significant
Surface water	Operation	Operation activities have the potential to lead to contaminants within runoff due to traffic entering surface water. Operation of the scheme could also lead to increases in flood risk. Standard mitigation measures will be included in the EMP and embedded measures will be incorporated within the design to minimise effects.	Not significant
Groundwater	Operation	Operation of the scheme has the potential to lead to changes to groundwater level/flow and physical impact/creation of preferential pathway from below ground structures. Standard mitigation measures will be included in the EMP and embedded measures will be incorporated within the design to minimise effects.	Not significant
Climate			
Effects on climate	Construction	The estimated construction emissions of the scheme are 254,536 tCO ₂ e split between material, plant and transport.	Further assessment required as part of the ES

Topic	Stage	Description of potential effects	Overall likely significance of residual effect post mitigation
			to determine significance of effect.
Resilience of the scheme to Climate Change	Construction	Whilst the scheme's construction is not expected to be so far in the future that the climate will adversely change further prior to construction, the construction site may be vulnerable to extremes of weather, leading to the risk of delay in activities. Climate change could result in a change in the risk of severe weather through the construction period.	Further assessment required as part of the ES to determine significance of effect.
Effects on climate	Operation	The scheme would produce emissions due to traffic and through maintenance.	Further assessment required as part of the ES to determine significance of effect.
Resilience of the scheme to Climate Change	Operation	The climate of the study area has already changed from its natural state, as a result of climate change, and will change significantly over the lifetime of the project. There is the potential for various effects to occur on the scheme.	Further assessment required as part of the ES to determine significance of effect.

18 Glossary and Abbreviations

Term	Accronym or abbreviation	Definition
A		
Above Ordnance Datum	AOD	Above the mean sea level at Newlyn in Cornwall calculated between 1915 and 1921, taken as a reference point for the height data on Ordnance Survey maps.
Acces		The means by which to approach or enter land, property and assets.
Additional mitigation		Mitigation measures which are over and above any embedded and standard mitigation measures, and which are required to further reduce the significance of an environmental effect
AddressBase data		An Ordnance Survey data product which enables property information to be linked to addresses on a map.
Affected road network	ARN	Parts of the road network which are identified as likely to be affected by changes in air quality as a result of a project. These comprise all roads that trigger the traffic screening criteria and adjoining roads within 200m.
Aggregate		Granular material (for example sand and gravel or crushed rock) that can be used for building and/or civil engineering purposes (for example for concrete production).
Agricultural Land Classification	ALC	The system devised and introduced by the Ministry of Agriculture, Fisheries and Food to classify agricultural land according to the

Term	Accronym or abbreviation	Definition
		extent to which its physical or chemical characteristics impose long-term limitations on agricultural use. Land is graded between 1 (excellent quality) to 5 (very poor quality), with grade 3 subdivided into agricultural subgrades 3a and 3b.
Agricultural land holding		Land and associated infrastructure for the purpose of agricultural production.
Air quality action plan		A plan that must be compiled by a local authority if they declare an air quality management area.
Air Quality Dispersion Modelling System	ADMS	An advanced dispersion model used to model the air quality impact of projects.
Air quality exceedance		Where pollutant concentrations exceed an air quality standard.
Air quality limit value		A maximum pollutant concentration to be achieved in the atmosphere, either without exception or with a permitted number of exceedances. Limit values are defined in United Kingdom legislation.
Air Quality Mangement Area	AQMA	An area declared by a local authority which has been determined will exceed the relevant air quality strategy objective.
Air quality objective		Objectives are policy targets generally expressed as a maximum ambient pollutant concentration to be achieved. The objectives are set out in the UK Government's Air

Term	Accronym or abbreviation	Definition
		Quality Strategy for the key air pollutants.
Air quality threshold		Generic term to represent the relevant pollutant averaging period and concentration value described by the air quality strategy objectives or UK limit values.
Alluvial deposits		Natural materials deposited within and adjacent to rivers.
Alternatives		Different modes, design options and variations considered during project development that have potential to fulfil the project objectives.
Ambient noise		Ambient noise is the total sound in a given situation at a given time usually composed of sound from many sources, near and far.
Ameity		The benefits of enjoyment and well-being which are gained from a resource in line with its intended function. Amenity may be affected by a combination of factors such as: sound, noise and vibration; dust/air quality; traffic/congestion; and visual impacts.
Ancient woodland		Any area that has been continually wooded since at least 1600 AD and have developed irreplaceable, complex ecosystems.
Annual Average Daily Traffic	AADT	The total volume of vehicle traffic on a road flowing past a certain point over a year, divided by 365 days.

Term	Accronym or abbreviation	Definition
Annual Average Weekday Traffic	AAWT	The average 24-hour traffic volume occurring on weekdays throughout a full year.
Anthropogenic		Relating to, or resulting from the influence of human beings on nature
Appropriate Assessment		The assessment of the impact on the integrity of the National Site Network of a project or plan, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives.
Aquifer		An underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand or silt).
Arisings		Construction, demolition, excavation and other arisings generated from within a project boundary, during both construction, and operation and maintenance phases.
A-Road		A type of road prefixed with the letter 'A'. These are the busiest and most direct main roads, apart from motorways, and can be of different standard.
Arborist		An arborist is a professional in the practice of arboriculture, which is the cultivation, management, and study of individual trees, shrubs, vines, and other perennial woody plants in dendrology and horticulture.
Assemblage		A group of species found in the same location.

Term	Accronym or abbreviation	Definition
At-grade		On the same level. For example, when a road is on the current ground level.
Attenuation pond		Part of a drainage system that is used for temporarily storing and attenuating flood waters (can also be referred to as an attenuation basin).
Avoidance		The first stage in the mitigation hierarchy in which measures are assessed in advance of minimisation of impacts, and which are certain.
A-weighting		In addition to its non-linear amplitude response, the human ear has a non-linear frequency response; it is less sensitive at low and high frequencies and most sensitive in the mid-range frequencies.
B		
Baseline conditions		The environment as it appears (or would appear) immediately prior to the implementation of the project together with any known or foreseeable future changes that will take place before completion of the project.
Base year (traffic data)		The outputs of the traffic model coinciding with the year the traffic data was collected.
Basic Noise Level	BNL	A measure of source noise.
Bedrock		Rock that underlies loose deposits such as soil or alluvium.
Below ground level	BGL	Term used to differentiate below ground from above ground.
Best and most versatile land	BMV	Land defined as grades 1, 2 and 3a of the Agricultural Land Classification. This land is considered the most flexible, productive and efficient and is most

Term	Accronym or abbreviation	Definition
		capable of delivering crops for food and non-food uses.
Biodiversity		The variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part of. This includes diversity within species, between species and of ecosystems.
Biodiveristy Net Gain	BNG	An approach that aims to leave biodiversity within the natural environment in a measurably better state than its condition prior to implementation of a project.
Biodiversity offsetting		A system used predominantly by planning authorities and developers to fully compensate for biodiversity impacts associated with economic development, through the planning process. In some circumstances, biodiversity offsets are designed to result in an overall biodiversity gain.
Borehole		A hole bored into the ground, usually as part of investigations, typically to test the depth and quality of soil, rock and groundwater. A borehole can also be used to dewater the ground.
Borrow Pit		An excavated area where material has been dug for use as fill at another location.
Bridelway		A highway over which the public have the following, but no other, rights of way, that is to say, a right of way on foot and a right of way on horseback or leading a horse
British Geological Survey	BGS	A body which aims to advance geoscientific knowledge of the United Kingdom landmass and its continental shelf by means of

Term	Accronym or abbreviation	Definition
		systematic surveying, monitoring and research
British Standard	BS	Standard produced by the British Standards Institution.
British Standards Institution		A group which produces British Standards across industry sectors and which is formally designated as the National Standards Body for the UK.
Buffer		Specified area or distance surrounding a site or feature of interest.
Built heritage		A structure or building of historic value. These structures are visible above ground level.
Bund		An embankment which acts as a visual or noise screen, or acts as a barrier to control the spillage of fluids.
Buried archaeology (or buried heritage)		An archaeological asset beneath ground level, which may include earthworks.
Businesses		Land and buildings for the purpose of commercial/industrial enterprise.
Bypass		The diversion of a major road to carry traffic around a built up area, constructed to improve the journey of through traffic and/or improve the environmental conditions along the original route.
Byway		A track, often rural, which is too small to be called a road but which may be open to use by all vehicular traffic or have restrictions on use by non-mechanically propelled vehicles.
C		

Term	Accronym or abbreviation	Definition
Calculation of Road Traffic Noise	CRTN	A technical memorandum that describes the procedures for calculating noise from road traffic.
Carbon budgets		UK greenhouse gas targets over defined periods of time
Carbon emissions		Shorthand for emissions of any of the seven greenhouse gases that contribute to climate change.
Carbon footprint		The total greenhouse gas emissions associated with a particular policy or development.
Catchment		A drainage/basin area within which precipitation drains into a river system and eventually into the sea.
Catchment abstraction management strategy		A process in which the Environment Agency assesses the availability of water resources for each river catchment, produces a strategy and feeds into investigations to identify failing water quality.
Celcius	°C	A scale of temperature
Chainage		The distance of any point along a road, measured along the road centreline from a chosen origin or start point.
Chartered Institute of Ecology and Environmental Management	CIEEM	The leading professional membership body representing and supporting ecologists and environmental managers in the UK, Ireland and abroad.
Clay		An inorganic component of soil derived from the weathering of rock and comprising particles less than 0.002mm in equivalent diameter.
Climate		Long-term weather conditions prevailing over a region.
Climate change		This refers to a change in the state of the climate, which can be identified by changes in average climate characteristics which

Term	Accronym or abbreviation	Definition
		persist for an extended period, typically decades or longer
Climate resilience		The ability to anticipate, prepare for, and respond to climatic events, trends or disturbances.
Closed-circuit Television	CCTV	A type of video surveillance.
Combined effect		A type of cumulative effect which occurs when different types of activity combine to have an effect on a specific receptor or resource.
Committed development		A development that has full or outline planning permission or is allocated in an adopted development plan.
Community		A group of people living in the same place or having a particular characteristic in common.
Community facilities		Facilities designed for the use and benefit to the local population, for example village greens, village halls, and healthcare and education facilities.
Compensation (environmental)		Offsetting measures applied where nothing can be done to reduce an environmental impact or effect.
Competent Expert(s)		The terms used in the EIA Regulations to describe a suitably qualified and experienced person (or persons) responsible for the preparation of the Environmental Statement, either whole or in part.
Congestion		A situation where the volume of traffic is too great for the road, causing vehicles to slow down or stop, often caused by bottlenecks, traffic incidents and junction design.
Connectivity		A measure of the availability of the habitats needed for a particular species to move through a given area.

Term	Accronym or abbreviation	Definition
Conservation (ecology)		A series of measures required to maintain or restore the natural habitats and the populations of species of wild fauna and flora at a favourable status.
Conservation area		An area designated under section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990 as being of special architectural or historic interest and with a character or appearance which is desirable to preserve or enhance.
Conservation status		The sum of the influences acting on a natural habitat and its typical species that can affect its long-term natural.
Construction and Demolition Waste	CDW	Consists of unwanted material produced directly or indirectly as a result of the construction phase.
Construction compound		Construction compounds generally act as the points of entry to the worksites from the public highway. They may also be used for major stockpiling of materials such as topsoil, be used to facilitate transfer of materials, and accommodate offices and welfare facilities.
Construction materials		Primary, recycled / secondary and renewable sources of materials required for constructing a project.
Construction noise assessment		An assessment which compares predicted noise levels from construction tasks to ambient noise levels at nearby noise sensitive receptors.
Construction plant		Portable construction machinery and equipment.
Construction Traffic Management Plan		A plan which identifies clear controls on routes, vehicle types, vehicle frequency, vehicle quality and hours of site operation.

Term	Accronym or abbreviation	Definition
Construction vibration assessment		An assessment of magnitude of predicted vibration from construction activities.
Consultation Report		A report which summarises all consultation responses received and explains how the applicant of a Nationally Significant Infrastructure Project has had regard to those responses.
Contractor		A general term used to describe an individual or company appointed by a developer to construct or manage a project at a certain price or rate.
Controlled waters		Rivers, streams, estuaries, lakes, canals, ditches, ponds and groundwater as far out as the UK territorial limit. The statutory definition is provided in section 104 (1) of the Water Resources Act 1991 and section 30A (d) of the Control of Pollution Act 1974.
Cropmark		Cropmarks are a means through which sub-surface archaeological, natural and recent features may be visible from the air or a vantage point on higher ground or a temporary platform.
Cultural heriage		Historic monuments, historic groups of buildings and/or historic sites.
Cultural heritage resource		A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest.
Culvert		A tunnel (pipe or box shaped) that carries a stream or open drain under a road or railway.
Cumulative effect (or impact)		A cumulative impact (or effect) may arise as the result of: a. the combined impact of:

Term	Accronym or abbreviation	Definition
		<p>A. number of different environmental topic-specific impacts from a single environmental impact assessment project on a single receptor/resource; and</p> <p>B. the combined impact of a number of different projects within the vicinity (in combination with the environmental impact assessment project) on a single receptor/resource.</p>
Cut-fill balance		Where the amount of material obtained from earthwork cuttings broadly matches the amount of fill material required to form embankments, thereby minimising the amount of material needed to be imported into, or exported from, a construction site.
Cutting (earthwork)		Excavation of earth material to lower the ground level on which a road would be positioned, in order to help to reduce noise and/or visual impact.
Cycleway		A road, route, or path intended for use by people on bicycles.
D		
Decibel	dB	The scale used to measure noise is the decibel scale which extends from 0 to 140 decibels, corresponding to the intensity of the sound pressure level.
Decision-maker		The Secretary of State for Transport (in England).
Decommission		The act of ceasing operation of an asset to a non-active status.
Definitive Map		A record of Public Rights of Way in England and Wales, maintained by local authorities.

Term	Accronym or abbreviation	Definition
Delay		For pedestrians, this is the increase in the 'personminutes' of the journey times of pedestrians and other non-motorised travellers. For traffic, this is the increase in journey times for drivers and passengers.
Department for Environment, Foods and Rural Affairs	Defra	The Government department responsible for policy and regulations on environmental, food and rural issues. The department's priorities are to grow the rural economy, improve the environment and safeguard animal and plant health.
Department for Transport	DfT	The national Government body responsible for transport in Britain, and therefore in overall control of the road network. It is mainly responsible for policy decisions, and its responsibilities are carried out by a range of agencies and local authorities.
Department for Transport's Transport Analysis Framework	TAG	A framework for options appraisal used by National Highways.
Deposition (dust)		The vertical passage of a substance (for example dust) to a surface or the ground.
Deposition (sediment)		The laying down of part, or all, of the sediment load of a stream on the bed, banks or floodplain which forms various sediment features such as bars, berms and floodplain deposits.
Designated habitats		Internationally, nationally and locally designated sites of ecological conservation importance on protected species and on habitats and other species identified as being of principal

Term	Accronym or abbreviation	Definition
		importance for the conservation of biodiversity.
Design Manual for Roads and Bridges	DMRB	The Design Manual for Roads and Bridges contains information about current standards relating to the design, assessment and operation of motorway and allpurpose trunk roads in the United Kingdom.
Design development		The process in which technical specialists (for example engineers and environmentalists) refine the design for the various elements of a development project.
Detailed assessment		Detailed field surveys and/or quantified modelling techniques to understand complex environmental effects.
Development Consent Order	DCO	The consent for a Nationally Significant Infrastructure Project required under the Planning Act 2008.
Development plan		Documentation which seeks to guide development and planning in a local authority area for a set period of time.
Development land		Land identified in national or local plans, policies or strategies for development (including intensification of existing uses) and land subject to planning permission.
Diffusion tube		Passive devices used in air quality monitoring to measure weekly or monthly average pollutant concentrations.
Directive		Legal obligations imposed on European member states by the European Union. Directives have now been transposed to UK legislation since leaving the European Union.

Term	Accronym or abbreviation	Definition
Discharge consent		A consent or permit to discharge effluent that could harm the environment.
Displacement		Loss of local economic activity as a direct consequence of a proposed development.
Disposal		Any operation which is not recovery, even where the operation has as a secondary consequence the reclamation of substances or energy.
Diverge		The point where two streams of traffic split and go in different directions.
Diversion route		A set of approved routes to follow in the case of closure of motorways and/or major A-roads.
Diverted route / walkers, cyclists and horseriders route		An approved route to follow in the case of closure of, or alteration to, a public right of way.
Do Minium	DM	The conditions that would persist in the absence of the implementation of a construction or improvement project but on the basis that maintenance on the road network is ongoing.
Do Somehting	DS	The conditions that would occur as a consequence the implementation of a construction or improvement project.
Drinking Water Safeguard Zone		Designated areas in which the use of certain substances must be carefully managed to prevent the pollution of raw water sources that are used to provide drinking water.
Dust		All airborne particulate matter.
E		
Early Assessment and Sifting Tool	EAST	A Department for Transport tool developed to quickly summarise and present evidence on options in

Term	Accronym or abbreviation	Definition
		a clear and consistent format, to provide decision-makers with comparative evidence on how they perform.
Earth bund		A bund constructed to provide noise or landscape mitigation.
Earthworkds		The removal or placement of soils and rocks such as in cuttings, embankments and environmental mitigation, including the in-situ improvement of soils/rocks to achieve the desired properties.
East Coast Main Line	ECML	A 393-mile long major railway between London and Edinburgh via Peterborough, Doncaster, York, Darlington, Durham and Newcastle.
Ecological feature		Habitats, species or ecosystems.
Ecological Impact Assessment	EclA	The process of identifying, quantifying and evaluating the potential impacts of defined actions on ecosystems or their components.
Ecological status		The state of a water body, derived from a number of factors, including: the abundance of aquatic flora and fauna, nutrient availability, salinity, temperature and chemical pollution levels.
Ecosystem		Biological community of interacting organisms (for example plants and animals) and their environment.
Effect		Term used to express the consequence of an impact (expressed as the 'significance of effect').
Electric vehicles		A vehicle which uses one or more electric motors for propulsion.
Elements		Parts of environmental factors. For example, listed buildings are part of cultural heritage.

Term	Accronym or abbreviation	Definition
Embankment		Artificially raised ground, commonly made of earth material, such as stone, on which the carriageway is laid.
Embedded mitigation		Design measures which are integrated into a project for the purpose of minimising environmental effects.
Emodied carbon		Carbon emissions associated with energy consumption and chemical processes during the extraction, transport and/or manufacture of construction materials or products.
Emission Factor	EFT	A tool used to assist local authorities in carrying out a review and assessment of local air quality as part of their duties under the Environmental Act 1995.
Enabling works		Enabling works are preparations to make a building site ready for construction. It covers activities from site preparation, creation of access routes, and the installation of facilities like security fencing, ramps, and placing of signs.
Enclosure		Enclosure (sometimes inclosure) was the legal process in England of consolidating (enclosing) small landholdings into larger farms.
Enhancement		A beneficial measure that is over and above what is required to mitigate the adverse effects of a project.
Envirocheck		A provider of environmental data, reports and risk solutions for use in site-based assessments.
Environment Agency	EA	Government agency established to protect and improve the environment and contribute to sustainable development in England. Responsibilities include: water quality and resources,

Term	Accronym or abbreviation	Definition
		flooding and coastal risk management and contaminated land.
Environment Noise Directive	END	The Assessment and Management of Noise Directive 2002/49/EC.
Environmental (or Ecological) Clerk of Works	ECoW	An individual that supports compliance with legislation and planning conditions or requirements, and also provides advice and guidance throughout construction.
Environmental assessment		A process by which information about environmental effects is collected, assessed and used to inform decision-making.
Environmental DNA	eDNA	DNA that is collected from a range of environmental samples including soil and water, rather than being directly sampled from a plant or animal.
Environmental factors		Population and human health; biodiversity; land, soil, water, air and climate; material assets, cultural heritage, and landscape; and the interaction between these factors.
Environmental Health Officer	EHO	A local authority officer with responsibilities for protecting public health through the administration and enforcement of environmental health legislation. Can also be referred to as an Environmental Protection Officer.
Environmental Impact Assessment	EIA	The statutory process through which the likely significant effects of a development project on the environment are identified and assessed.
Environmental Impact Assessment Directive	EIA Directive	Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014, amending Directive 2011/92/EU on the

Term	Accronym or abbreviation	Definition
		assessment of the effects of certain public and private projects on the environment.
Environmental Impact Assessment Regulations	EIA Regulations	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.
Environmental Management Plan	EMP	A site specific plan developed to ensure that a project is implemented in an environmentally sustainable manner where all contractors and subcontractors, including consultants, understand the environmental constraints within the site.
Environmental Masterplan		Plan which illustrates the mitigation measures integrated into the design of the Scheme.
Environmental Quality Standard	EQS	The maximum permissible concentration of a potentially hazardous chemical.
Environmental Statement	ES	A statutory document which reports the EIA process, produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations.
Erosion		The removal of sediment or bedrock from the bed or banks of a channel by flowing water occurring mostly during high flows and flood events. Forms various river features such as scour holes and steep outer banks.
Essential mitigation		Mitigation critical for the delivery of a project which can be acquired through statutory powers.
European Commission	EC	An executive branch of the European Union.
European Economic Area	EEA	The European Economic Area (EEA) was established via the EEA Agreement, an international agreement which allows for the

Term	Accronym or abbreviation	Definition
		extension of the EU's single market to nonEU member parties.
European Protected Species	EPS	Species of plants and animals (not birds) which are protected by European law, and now transposed to UK Law.
European Union	EU	An economic and political union of 28 countries which operates an internal (or single) market which allows the free movement of goods, capital, services and people between member states.
Evaluation		The determination of the significance of effects. Evaluation involves making judgements as to the value of the receptor/resource that is being affected and the consequences of the effect on the receptor/resource based on the magnitude of the impact.
Examining Authority	ExA	A panel of inspectors appointed by the Secretary of State who are responsible for examining Development Consent Order applications for Nationally Significant Infrastructure Projects.
Excavated material		Largely natural soil and rock material that is removed from the ground during construction.
Extreme weather		A weather event which is significantly different from the average or usual weather pattern.
F		
Façade noise level		Sound level that is determined 1 metre (m) in front of a window or door in a façade.
Fauna		The animals of a particular region, habitat, or geological period.
Features		Particularly prominent, eye-catching elements or characteristic

Term	Accronym or abbreviation	Definition
		components such as tree clumps, church towers, or wooded skylines.
Fill		Material used to artificially raise the existing ground levels.
Find spot		A term used to describe the location at which an archaeological find was discovered.
First Iteration Environmental Management Plan		The first iteration of the Environmental Management Plan produced during the design stage for the preferred option.
Flood risk		A combination of the probability (likelihood or chance) of a flood event happening, and the consequences (impact) if it occurred.
Flood Risk Assessment	FRA	The process of assessing potential flood risk to a site and identifying whether there are any flooding or surface water management issues that may warrant further consideration or may affect the feasibility of a project.
Flood Zone 1		Land outside the floodplain where there is little or no risk of flooding.
Flood Zone 2		The area of the floodplain where there is a low to medium flood risk.
Flood Zone 3		The area of the floodplain where there is a high risk of flooding.
Floodplain		Land adjacent to a watercourse over which water flows or would flow in times of flood, but for defences in place.
Fluvial		A term that relates to rivers and streams and the processes that occur within them.
Formation (geological)		A group of related rock strata with some common properties.

Term	Accronym or abbreviation	Definition
Fragmentation (ecological)		The breaking up of a habitat, ecosystem or land use types into smaller parcels.
Free-field sound level		The sound level which is measured or calculated, in the open, without any reflections from nearby surfaces except the ground.
Future baseline		The likely evolution of the current state of the environment without implementation of the project.
Future year		A year between the opening year and the fifteenth year of operation of a project.
G		
Geology		The physical structure, substance and history of the earth (rocks and minerals).
Geomorphology		The structure, origin, and development of the topographical features of the earth's surface.
Geophysical survey		A process involving ground-based physical sensing techniques to determine the presence or absence of anomalies likely to be caused by archaeological features, structures or deposits.
Grade separated		A type of junction where the major route (or routes) through the junction do not stop and do not cross any other road on the level. Movements to other roads are made using sliproads and bridges.
Great Crested Newt	GCN	A newt in the family Salamandridae, found across Europe and parts of Asia, which are protected under the Conservation of Habitats and Species Regulations 2017.
Green Belt		A designation for land around certain cities and large built-up areas, which aims to keep this land

Term	Accronym or abbreviation	Definition
		permanently open or largely undeveloped.
Greenhouse gases	GHG	Atmospheric gases that absorb and emit infrared radiation emitted by the Earth's surface, the atmosphere and clouds.
Ground investigation	GI	An intrusive investigation undertaken to collect information relating to the ground conditions, normally for geotechnical or land contamination purposes.
Groundwater		Water found underground in porous geological strata and soils.
Groundwater body		A distinct volume of groundwater within an aquifer or aquifers
Groundwater Dependent Terrestrial Ecosystems	GWDTE	Wetlands which depend on groundwater flows or chemistries.
Groundwater source protection zone		Areas defined by the Environment Agency which show the risk from contamination/pollution to groundwater that is extracted for drinking water.
H		
Habitat		The place or type of site where an organism or population naturally occurs. Often used in the wider sense referring to major assemblages of plants and animals found together.
Habitat of principal importance	HPI	Habitats in England identified as requiring action in the UK Biodiversity Action Plan and which are regarded as having biodiversity conservation priorities.
Habitats Regulations Assessment	HRA	An assessment of projects (or plans) potentially affecting European Sites in the UK, required under the Habitats Directive and Regulations. Also known as an

Term	Accronym or abbreviation	Definition
		assessment of implications on European Sites.
Habitat Suitability Index	HSI	A numerical index that represents the capacity of a given habitat to support a selected species.
Haul road		A temporary road provided within a contractor's site area to allow for the movement of construction material, construction machinery and/or construction labour around the site.
Hazardous waste		Any waste that displays one or more of the hazardous properties listed in Annex III of the Waste Directive.
Health determinants		Personal, social, economic and environmental factors which determine the health status of individuals and communities.
Heavy Duty Vehicle	HDV	See Heavy Goods Vehicle.
Heavy Goods Vehicle	HGV	A commercial carrier vehicle with a gross vehicle weight of more than 3.5 tonnes.
Hectare	ha	A metric unit of measurement, equal to 2.471 acres or 10,000 square metres.
Heritage asset		A building, monument, site, place, area or landscape of historic value.
Highways England Water Risk Assessment Tool	HEWRAT	A tool which determines whether the catchments in which they operate are particularly exposed to water risk, as well as to better understand the nature of risk in specific catchments.
Highways England		The Government agency responsible for the operation, maintenance and improvement of England's trunk roads and motorways. Now known as National Highways.

Term	Accronym or abbreviation	Definition
Historic		Associated with past human activity.
Historic England		<p>Executive non-departmental public body created under section 32 of the National Heritage Act 1983 to:</p> <ul style="list-style-type: none"> a. secure the preservation of ancient monuments and historic buildings situated in England; b. promote the preservation and enhancement of the character and appearance of conservation areas situated in England; and <p>promote the public's enjoyment of, and advance their knowledge of, ancient monuments and historic buildings situated in England and their preservation.</p>
Historic England Good Practice Advice		Historic England guidance which assists in establishing the significance of heritage assets and their setting.
Historic Environmental Record	HER	A record of all known archaeological finds and features and historic buildings and historic /landscape features, relating to all periods from the earliest human activity to the present day; maintained by each County and Unitary Authority in the United Kingdom.
Hoarding		A temporary fence erected around a construction site in order to visually screen and/or contain activities.
Hot rolled asphalt		A common type of road surfacing comprising a dense mixture of mineral aggregate, sand and bitumen.

Term	Accronym or abbreviation	Definition
Human health		A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity
Health outcome		The health status of an individual, group or population, attributable to a planned intervention.
Health profile		Statistical picture of the baseline health conditions and trends within an area.
Hydrology		The scientific study of the movement, distribution, and quality of water on Earth and other planets, including the water cycle, water resources and environmental watershed sustainability.
Hydrogeology		The nature, distribution and movement of groundwater in soils and rocks, including in aquifers.
Impact		Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact).
Inert waste		<p>Waste:</p> <ol style="list-style-type: none"> a. that does not undergo any significant physical, chemical or biological transformations; b. that does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health; and <p>where its total leachability and pollutant content and the ecotoxicity of its leachate are insignificant and, in particular, do</p>

Term	Accronym or abbreviation	Definition
		not endanger the quality of any surface water or groundwater.
Institute of Air Quality Management	IAQM	The professional body for air quality practitioners.
Institute of Environmental Management and Assessment	IEMA	A professional body for practitioners working in the fields of environmental management and assessment.
Integrity (ecological)		The coherence of a site's ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it [is or] was classified.
Internal Drainage Board	IDB	A public body that manage water levels in an area, known as an internal drainage district, where there is a special need for drainage. IDBs undertake works to reduce flood risk to people and property, and manage water levels for agricultural and environmental needs within their district.
Inspectorate		See Planning Inspectorate.
Intervention		Types or groups of highways works, for example online options, designed to meet a series of project objectives.
Invasive species		Non-native UK plants that are invasive, for example Japanese Knotweed.
Island		A raised area designed to deflect or divide traffic, or to make it easier for pedestrians to cross the road.
J		
Journey length		The physical length of a journey.

Term	Accronym or abbreviation	Definition
Junction		A place where two roads meet, regardless of design or layout.
K		
Key characteristics (landscape)		The combination of elements that are particularly important to the current character of the landscape and help to give an area its particularly distinctive sense of place.
Kilometre	km	A unit of measurement.
L		
LA10		The A-weighted sound level, in dB, that is exceeded 10% of the measurement period.
LA10,18hr		The noise level, in dB, that is exceeded 10% of the time between 0600 and 2400.
LAeq		The equivalent continuous sound level (LAeq) is the level of a notional steady sound, which at a given position and over a defined period of time, would have the same A- weighted acoustic energy as the fluctuating noise.
LAmx		The maximum A-weighted level measured during a given time period.
Lnight		A facade noise index derived from the LA10,18hr using the TRL conversion method PR/SE/451/02.
Lnight,outside		For the purpose of night-time noise assessment, the Lnight,outside is the equivalent continuous sound level LAeq,8hr for the period 23:00 to 07:00 hours assessed outside a dwelling and is free-field.
Land use		What land is used for, based on broad categories of functional land cover, such as urban and industrial

Term	Accronym or abbreviation	Definition
		use and the different types of agriculture and forestry.
Landfill capacity		The known, forecast or estimated remaining landfill void space, either regionally or nationally.
Landform		The shape and form of the land surface which has resulted from combinations of geology, geomorphology, slope, elevation and physical processes.
Landscape		An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors
Landscape character		A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse.
Landscape character area	LCA	Areas of landscape that have a broadly consistent pattern of topography, land use and vegetation cover.
Landscape character assessment		Process of identifying and describing variation in character of the landscape - the unique combination of elements and features that make landscapes distinctive - to assist in managing change in the landscape.
Landscape character type		Distinct types of relatively homogeneous landscape, generic in nature but which share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetics attributes.
Landscape elements		Individual parts of the landscape include physical influences (geology, soils, landform, drainage,

Term	Accronym or abbreviation	Definition
		and water bodies); land cover (different types of vegetation, patterns, and types of tree cover); and human influences (land use and management, character of settlements of buildings, and pattern and type of fields and enclosure).
Landscape quality (or condition)		Measure of the physical state of the landscape based on judgements, which can include typical character represented in individual areas, integrity of the landscape, and condition of individual elements.
Landscape receptor		Defined aspect of the landscape resource that potentially could be affected by the project.
Landscape resource		Natural and physical attribute, for example soils and vegetation.
Landscape sensitivity		Applied to specific landscape receptors, combining judgements of the susceptibility of the receptor to the specific type of change proposed and the value related to the receptor.
Land take		The extent of land required temporarily or permanently to construct and operate a project.
Lane		A section of carriageway marked out for the use of traffic, and typically intended for use in one direction.
Lead Local Flood Authority	LLFA	Authority responsible for developing, maintaining and applying a strategy for local flood risk management in their areas and for maintaining a register of flood risk assets.
LiDAR		An airborne mapping technique which accurately measures the height of the terrain and surface objects on the ground, through the

Term	Accronym or abbreviation	Definition
		use of a scanning laser that measures the distance between the aircraft and the ground.
Light goods vehicle	LGV	A motor vehicle used to carry goods with a total mass of up to 3.5 tonnes.
Limits of deviation	LoD	The maximum lateral and vertical extents within which a highway project can be built.
Link		A section of road between two junctions.
Listed building		A building of special architectural or historic interest. Listed buildings are graded I, II* or II, with Grade I being the highest. Listing includes the interior as well as the exterior of the building.
Lithology		The study of the general physical characteristics of rocks.
Local Air Quality Management	LAQM	A key part in the UK Government's and the Devolved Administrations' strategies to achieve the air quality objectives.
Local authority (also local planning authority)		The body officially responsible for all the public services and facilities in a particular area, and which is empowered by law to exercise planning functions.
Local Biodiversity Action Plan	LBAP	A plan that identifies threatened species and habitats and seeks to protect and restore biological systems.
Local Geological Site	LGS	Non-statutory geological sites considered worthy of protection for their earth science or landscape importance. Formerly known as Regionally Important Geological Sites.
Local Nature Reserve	LNR	A statutory designation made under Section 21 of the National Parks

Term	Accronym or abbreviation	Definition
		and Access to the Countryside Act 1949 by principal local authorities.
Local Wildlife Site	LWS	Non-statutory sites of nature conservation value that have been designated 'locally'. These sites are referred to differently between counties with common terms including site of importance for nature conservation, county wildlife site, site of biological importance, site of local importance and sites of metropolitan importance.
M		
Macrophyte		A plant (especially a marine plant) large enough to be visible to the naked eye.
Made ground		Land where natural and undisturbed soils have largely been replaced by man-made or artificial materials. It may be composed of a variety of materials including imported natural soils and rocks with or without residues of industrial processes (such as ash) or demolition material (such as crushed brick or concrete).
Magnitude		The size of something.
Main River		A river maintained directly by the Environment Agency. They are generally larger arterial watercourses.
Maintenance		Activities which do not change the nature of the asset.
Marine Conservation Zone	MCZ	Marine Conservation Zones are areas that protect a range of nationally important, rare or threatened habitats and species.
Marine Protection Area	MPA	Marine Protected Areas involve the protective management of natural areas according to pre-

Term	Accronym or abbreviation	Definition
		defined management objectives. They can be conserved for a number of reasons including economic resources, biodiversity conservation, and species protection.
MasterMap		A source of highly-detailed geographic data of Great Britain, provided by Ordnance Survey.
Materials Management Plan	MMP	A mechanism by which those who are developing a site can comply with Environment Agency regulations for excavated ground materials.
Merge		The point where two different traffic flows come together and continue as one.
Met Office		The United Kingdom's national weather service.
Methane		The main constituent of natural gas, and the second most important greenhouse gas.
Metre	M	A unit of measurement.
Micron	µm	One millionth of a metre.
Mineral safeguarding areas		Areas defined by mineral planning authorities with known mineral resources that are of identified economic or conservation value.
Mineral site		Operational sites or sites identified within strategic planning documents for the extraction of minerals.
Mitigation		Measures intended to avoid, reduce and, where possible, remedy significant adverse environmental effects.
Modelling		The process of estimating changes within an area of interest under a specific set of conditions.
Monitoring		An assessment of the performance of the project, including mitigation

Term	Accronym or abbreviation	Definition
		measures. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted.
Motorway		A special type of road reserved for motorised traffic only, the numbers of which are prefixed with the letter 'M'.
Movement (traffic)		A movement is one of the turns or changes in direction that a junction allows.
Multi-Agency Geographic Information Service	MAGIC	A website which provides geographic information about the natural environment.
N		
National Character Area		Areas of England defined by their unique combination of landscape, biodiversity, geodiversity, history and cultural an economic activity.
National Cycle Network	NCN	A national cycling route network of the United Kingdom, which was established to encourage cycling throughout Britain, as well as for the purposes of bicycle touring.
National Heritage List for England	NHLE	A database of designated heritage assets.
National Nature Reserve		National Nature Reserves were established to protect some of our most important habitats, species and geology, and to provide 'outdoor laboratories' for research.
National Park		A large area of land which is protected by the Government because of its natural beauty, plants or animals, and which the public can usually visit.
National Planning Policy Framework	NPPF	A planning framework which sets out the Government's planning

Term	Accronym or abbreviation	Definition
		policies for England and how these are expected to be applied.
National Policy Statement for England	NPSE	Statements prepared and designated by the Secretary of State under the Planning Act 2008, which establish national policy for Nationally Significant Infrastructure Projects, including energy, transport and water, waste water and waste and against which applications for Development Consent Orders are assessed.
National Policy Statement for National Networks	NPSNN	A statement setting out the need for, and the Government's policies to deliver, the development of Nationally Significant Infrastructure Projects on the national road and rail networks in England.
National Vegetation Classification	NVC	A comprehensive classification and description of the plant communities of Britain, administered by the Joint Nature Conservation Committee.
Nationally Significant Infrastructure Project	NSIP	A type of project listed in the Planning Act 2008, which must be consented by a Development Consent Order.
Natura 2000		A network of core breeding and resting sites for rare and threatened species, and some rare natural habitat types which are protected in their own right.
Natural England		Executive non-departmental public body constituted under the Natural Environment and Rural Communities Act 2006 (section 2(1)) to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development.

Term	Accronym or abbreviation	Definition
Net GHG emissions		The difference in greenhouse gas emissions between the do-minimum and do-something scenarios taking into consideration carbon reduction measures (i.e. mitigation measures).
Newark and Sherwood District Council		The local authority within whose jurisdiction the Scheme would be implemented.
Nitrate vulnerable zone	NVZ	Areas covering 62% of England designated as a result of the EU's Nitrates Directive in order to reduce the level of nitrates in surface and groundwater. Farmers with land in nitrate vulnerable zones have to follow mandatory rules to tackle nitrate loss from agriculture.
Nitrogen dioxide	NO ₂	A gas produced when fuels are burned and is often present in motor vehicle and boiler exhaust fumes. It is an irritant to the respiratory system.
Nitrogen oxides	NO _x	A group of chemical compounds consisting only of nitrogen and oxygen which may be interconverted in the atmosphere. The principal oxides of nitrogen are nitric oxide and nitrogen dioxide.
No Observed Adverse Effect Level	NOAEL	The no-observed-adverse-effect level denotes the level of exposure of an organism, found by experiment or observation, at which there is no biologically or statistically significant increase in the frequency or severity of any adverse effects (for example alteration of morphology, functional capacity, growth, development or life span) in the exposed population when compared to its appropriate control.
Noise		Unwanted sound.

Term	Accronym or abbreviation	Definition
Noise barrier		Fence placed between a road and a noise sensitive receptor to reduce noise levels. Includes all elements of the fence (posts and fixings, as well as panels).
Noise Important Area	NIA	Areas identified with respect to noise from major roads and from roads within agglomerations where 'the 1% of the population that are affected by the highest noise levels from major roads' are located according to the results of the strategic noise mapping.
Noise Insulation Regulations	NIR	Noise Insulation Regulations 1975 made under Part II of the Land Compensation Act 1973.
Noise mapping		The production of computer software generated maps showing how the predicted levels of outdoor noise vary with location.
Noise monitoring		The measurement of noise levels.
Noise Sensitive Receptor		Receptors which are potentially sensitive to noise. These comprise mainly residential buildings, but also include educational buildings, hospitals and places of worship.
Non-hazardous waste		Waste that is neither classified as inert nor hazardous.
Non-statutory public consultation		Engagement with members of the public, local groups or stakeholders which is not determined or governed by statutory requirements.
Non-Technical Summary		Information for the non-specialist reader to enable them to understand the main predicted environmental effects of the proposal without reference to the main Environmental Statement.

Term	Accronym or abbreviation	Definition
Nottinghamshire County Council		The county authority within whose jurisdiction the scheme would be implemented.
O		
Offline		Highway development on land under non-highway use, for example a new dual carriageway constructed on agricultural land.
Online		Highway development proposed along, or on the line of, an existing road, for example road widening.
Operational		The functioning of a project on completion of construction.
Operational GHG emissions		Greenhouse gas emissions associated with the operation and maintenance of the asset, and users of the asset.
Order Limits		The extent of the area within which the Scheme may be carried out.
Ordinary Watercourse		Ordinary watercourses include every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a main river.
Ordnance Survey		The national mapping agency for the UK.
Outfalls		The place where a river, drain or sewer empties into the sea, a river, or a lake.
Overbridge		A bridge crossing over a transport corridor (for example a highway).
Overseeing Organisation		The following organisations or their successors: <ul style="list-style-type: none"> a. Highways England (in England). b. Transport Scotland (in Scotland). c. The Welsh Government (in

Term	Accronym or abbreviation	Definition
		Wales). Department for Infrastructure (in Northern Ireland).
P		
Particulate matter	PM10 or PM2.5	Discrete particles in ambient air, with diameters ranging between nanometres (billionths of a metre) to micrometres (millionths of a metre).
Pathways		The routes by which pollutants are transmitted through air, water, soils, plants and organisms to their receptors.
Peak flood level		The highest stage (largest discharge) reached during a particular flood at a given point on a river.
Phase 1 habitat survey		A habitat classification and field survey technique to record semi-natural vegetation and other wildlife habitats.
Planning Act 2008	PA 2008	An Act of Parliament in the UK intended to speed up the process of approving major new infrastructure projects.
Planning Inspectorate		An executive agency with responsibilities for planning appeals, national infrastructure planning applications, local plan examinations and other planning-related casework in England and Wales.
Planning Practice Guidance	PPG	A series of guidance documents which support the content of the National Planning Policy Framework.
Plans and programmes		Documents which are: e. subject to preparation and/or adoption by an authority at national, regional or local level or which are prepared by an

Term	Accronym or abbreviation	Definition
		authority for adoption, through a legislative procedure by Parliament or Government; and required by legislative, regulatory or administrative provisions.
Pollutant concentrations		Concentrations of pollutants normally reported as micrograms per cubic metre of air ($\mu\text{g}/\text{m}^3$).
Pollution Climate Mapping	PCM	A collection of models designed to fulfil part of the UK's EU Directive (2008/50/EC) requirements to report on the concentrations of particular pollutants in the atmosphere.
Pollution prevention guidance		A series of guidance notes produced by the Environment Agency to advise industry and the public on legal responsibilities and good environmental practice.
Population		All individuals located in a particular location (this can be local, regional or at a national scale).
Preferred option		The chosen design option that most successfully achieves the project objectives and becomes subject to further design and assessment.
Preferred Route Announcement	PRA	An announcement made by Highways England following the selection of a preferred option or solution for a given road project.
Preliminary Environmental Information	PEI	The information referred to in Part 1 of Schedule 4 of the EIA Regulations that has been reasonably compiled by the applicant and is reasonably required to assess the environmental effects of a project.
Preliminary Environmental Information Report	PEI Report	A report that compiles and presents the Preliminary Environmental Information gathered for a project.

Term	Accronym or abbreviation	Definition
Priority habitats (and species)		<p>Species and habitats defined as:</p> <ol style="list-style-type: none"> a. listed as a national priority for conservation (such as those listed as habitats and species of principal importance for the conservation of biodiversity); b. listed as a local priority for conservation, for example in the relevant local Biodiversity Action Plan; c. Red Listed using International Union for the Conservation of Nature criteria or, where a more recent assessment of the taxonomic group has not yet been undertaken, listed in a Red Data Book; d. listed as Near Threatened or Amber Listed; e. listed as a Nationally Rare or Nationally Scarce species or listed as a Nationally Notable species where a more recent assessment of the taxonomic group has not yet been undertaken; and/or endemic to a country or geographic location.
Principal Aquifer		Aquifers previously designated as major aquifer
Private property		Land, buildings and infrastructure for the purpose of residential use.
Project		Construction works, installations, schemes, or interventions (in the natural surroundings and landscape) including those involving the extraction of mineral resources.

Term	Accronym or abbreviation	Definition
Project Control Framework	PCF	A joint Department for Transport and National Highways approach to developing, delivering and managing major road projects.
Protected species		Species of wild plants, birds and animals which are afforded protection through legislative provisions.
Public right of way	PRoW	A highway where the public has the right to pass. It can be a footpath (used for walking), a bridleway (used for walking, riding a horse and cycling), or a byway that is open to all traffic (including motor vehicles).
R		
Ramsar		Wetlands of international importance designated under the Ramsar Convention.
Reach		A stretch of a river used in the assessment of river water quality.
Reasonable alternatives		Different project design, technology, location, size and scale solutions considered by the developer.
Receptor		A defined individual environmental feature usually associated with population, fauna and flora that has potential to be affected by a project.
Recovery (waste)		Any operation, the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.
Recycling		Any recovery operation by which waste materials are reprocessed into products, materials or

Term	Accronym or abbreviation	Definition
		substances whether for the original or other purposes.
Remediation (contaminated land)		The process of removing a pollution linkage (i.e. by removing one or more of the elements in a source-pathway-receptor linkage) in contaminated land in order to render an acceptable risk. Usually this involves a degree of removal of contaminants and/ or blockage of pathways.
Representative Concentration Pathway	RCP	A greenhouse gas concentration (not emissions) trajectory adopted by the IPCC for its fifth Assessment Report in 2014
Resilience		The capacity of a project (or lack thereof) to withstand the adverse effects of climate change.
Resource		A defined but generally collective environmental feature usually associated with soil, water, air, climatic factors, landscape, material assets, including the architectural and archaeological heritage that has potential to be affected by a project.
Restoration (ecological)		The re-establishment of a damaged or degraded system or habitat to a level similar to its original condition.
Re-use		Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.
Riparian		Relating to or situated on the banks of a river.
Risk assessment		An assessment of the probability of a hazard occurring that could result in an impact.
River Basin Management Plan	RBMP	A regional plan that sets out how organisations, stakeholders and communities will work together to improve the water environment and

Term	Accronym or abbreviation	Definition
		fulfil the requirements of the Water Framework Directive.
River Habitat Survey	RHS	A system for assessing the character and habitat quality of rivers based on their physical structure.
Road Investment Strategy 2	RIS2	A document which sets a long-term strategic vision for the network. With that vision in mind, it then: specifies the performance standards Highways England must meet; lists planned enhancement schemes we expect to be built; and states the funding that we will make available during the second Road Period (RP2), covering the financial years 2020/21 to 2024/25.
Roundabout		A circular, one-way junction at which other roads meet and terminate.
Runoff		The flow of water over the ground surface.
Routine runoff		The normal runoff from roads including any contaminants washed off the surface in rainfall events which can result in either acute or chronic impacts.
S		
Sand		Soil particles from 0.06mm-2.0mm in equivalent diameter. Fine sand particles are from 0.06mm-0.2mm; medium sand from 0.2mm-0.6mm; and coarse sand from 0.6mm-2.0mm.
Scheduled Monument	SM	Nationally significant heritage assets protected by the Ancient Monuments and Archaeological Areas Act 1979.
Scoping		The process of identifying the issues to be addressed by the Environmental Impact Assessment process. It is a method of ensuring

Term	Accronym or abbreviation	Definition
		that an assessment focuses on the important issues and avoids those that are considered to be not significant.
Scoping Opinion		The written opinion of the relevant authority, following a request from the applicant as to the information to be provided in an Environmental Statement.
Scoping Report		A report which records the outcomes of the scoping process and is typically submitted as part of a formal request for a Scoping Opinion.
Screening		The formal process undertaken to determine whether it is necessary to carry out a statutory Environmental Impact Assessment and publish an Environmental Statement in accordance with the EIA Regulations.
Second Iteration Environmental Management Plan		The second iteration of the Environmental Management Plan, which is refined for the construction stage of the consented project and prepared in advance of construction.
Secretary of State for Transport		The cabinet minister who (among other things) acts as decision-maker on all national infrastructure applications for development consent.
Sediment		Organic and inorganic material that has precipitated from water to accumulate on the floor of a water body, watercourse or trap.
Sense of place		The essential character and spirit of an area.
Sensitive receptor		Can include residential properties, gardens, schools, hospitals, care homes, public open spaces, and public access.

Term	Accronym or abbreviation	Definition
Sensitivity		Term applied to specific receptors, combining judgements of the susceptibility of the receptor to specific type of change proposed and the value related to that receptor.
Sett (badger)		Any structure or place which displays signs indicating current use by a badger.
Setting (cultural heritage)		The surroundings in which a heritage asset is experienced.
Setting (landscape)		Contribution of the surroundings to the appearance of an area or feature and the interrelationship of the area or feature to the wider context and sense of place.
Severance (land)		The splitting of a land holding into more than one part, for example through the introduction of a new section of road.
Severance (walkers, cyclists and horse riders)		The extent to which members of communities are able (or not able) to move around their community and access services/facilities.
Sewage Treatment Works	STW	Sewage treatment is the process of removing contaminants from municipal wastewater, containing mainly household sewage plus some industrial wastewater.
Short-term (noise)		Noise change based on parallel assessment year (for example do-minimum opening year against do-something opening year scenario).
Significance (of effect)		A measure of the importance or gravity of the environmental effect, defined by generic significance criteria or criteria specific to an environmental topic.
Significant Observed Adverse Effect Level	SOAEL	The level above which significant adverse effects on health and quality of life occur.

Term	Accronym or abbreviation	Definition
Silt		Soil particles from 0.002mm to less than 0.06mm in equivalent diameter.
Siltation		The process of blocking something with sand or soil.
Simple Assessment		The collection and assessment of data and information that is readily available to reach an understanding of the likely environmental effects of a project. This informs the final design or need for further detailed assessment.
Site investigation		An exploratory site investigation, including field reconnaissance, field and laboratory work, designed to prove the basis of the conceptual site model, as established within the preliminary risk assessment / desk study.
Site of Importance for Nature Conservation	SINC	Sites designated by local authorities for the purpose of conserving wildlife.
Site of Special Scientific Interest	SSSI	Area of land notified by Natural England under section 28 of the Wildlife and Countryside Act 1981 as being of special interest due to its flora, fauna or geological or physiological features.
Site Waste Management Plan	SWMP	A plan that is used to outline how a construction project would avoid, minimise or mitigate effects on waste production and handling on the environment and surrounding area.
Site-won		Material derived from a construction site rather than being imported.
Slip road		A connector road within a junction between a mainline carriageway and the local highway network, or vice versa, which meets the local highway network at-grade.

Term	Accronym or abbreviation	Definition
Soil		An assemblage of mineral particles and/or organic matter which includes variable amounts of water and air (and sometimes other gases).
Soil resource		The textures, structures and volume of different qualities of topsoil and subsoil that have a potential for beneficial reuse.
Sound pressure level		The parameter by which sound levels are measured in air. It is measured in decibels. The threshold of hearing has been set at 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB at a distance of 1 metre and a change of 3dB in a time varying sound signal is commonly regarded as being just detectable. A change of 10dB is subjectively twice, or half, as loud.
Source Protection Zone	SPZ	Zones defined by the Environment Agency to protect groundwater sources such as wells, boreholes and springs from potential contamination.
Span		The horizontal distance between two supports of a structure (for example piers of a bridge or viaduct).
Special Area of Conservation	SAC	Sites designated under EU legislation for the protection of habitats and species considered to be of European interest.
Species of Principal Importance	SPI	Habitats and species of principal importance in England. Section 41 of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England.

Term	Accronym or abbreviation	Definition
Speed band		A range of categories for which outputs from the traffic model are grouped into to describe their emissions.
Speed pivoting		An adjustment made, where required, to modelled traffic speeds on individual road links to better reflect observed speeds.
Stable Non-Reactive Hazardous Waste	SNRHW	A type of waste that can potentially include a range of monolithic solid waste (these being wastes in large blocky form) or granular solid wastes produced by treatment plants.
Stakeholder		An organisation or individual with a particular interest in a project.
Standard mitigation		Measures comprising standard techniques and activities which are implemented during the construction of a project to protect the environment and/or mitigate adverse effects, for example the covering of exposed materials to reduce dust emissions.
Statement of Community Consultation	SoCC	A document detailing how an applicant of a Nationally Significant Infrastructure Project intends to undertake consultation on its proposals.
Statutory consultation		Engagement with stakeholders determined or governed by statutory requirements.
Statutory consultee		Organisations and bodies, defined by statute, which must be consulted on relevant planning matters.
Statutory undertaker		Companies and agencies with legal rights to carry out certain types of development and/or highways works.

Term	Accronym or abbreviation	Definition
Strategic housing site		Large scale sites/land allocated in local planning policy for the provision of residential land use.
Strategic employment site		Large scale sites/land allocated in local planning policy for the provision of employment land use.
Strategic road network		The network of motorways and trunk roads in England.
Sterilise		Substantially constrain / prevent existing and potential future use and extraction of materials.
Study area		The spatial area within which environmental effects are assessed (i.e. extending a distance from the project footprint in which significant environmental effects are anticipated to occur).
Subsoil		Weathered soil layer extending between the natural topsoil and the unweathered basal layer (geological parent material) below, or similar material on which topsoil can be spread. Subsoil has lower organic matter and plant nutrient content than topsoil. In most cases topsoil requires a subsoil to perform one or a number of natural soil functions.
Superficial deposit		A geological deposit that was laid down during the Quaternary period. Such deposits were largely formed by river, marine or glacial processes but can also include wind-blown deposits known as loess.
Surface water (or surface water body)		Waters including rivers, lakes, loughs, reservoirs, canals, streams, ditches, coastal waters and estuaries.
Susceptibility (landscape)		Ability of a defined landscape or visual receptor to accommodate the

Term	Accronym or abbreviation	Definition
		specific proposed change without negative consequences.
Sustainable development		Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Sustainable drainage system	SuDS	Techniques for managing water runoff to reduce the quantity, and increase the quality, of surface water that drains from a development.
Sustrans		A UK charity which aims to make it easier for people to walk and cycle, and which promotes the National Cycle Network.
Swale		A low or hollow place, especially a marshy depression between ridges.
T		
Temporal scope		The duration of time over which environmental impacts and effects could occur as a result of a project.
The Scheme		The A446 Newark Bypass.
Thin surface course system		A generic term used to describe a type of road surfacing which has a high stone content, laid at a thickness of less than 50mm. It is applied to reduce the noise resulting from the interaction of vehicle tyres with the road. Also known as low-noise surfacing.
Third Iteration Environmental Management Plan		The third iteration of the Environmental Management Plan is refined at the end of the construction stage to support future management and operation of the consented project.
Till		Unsorted glacial sediment deposited directly by a glacier.

Term	Accronym or abbreviation	Definition
Tonnes of carbon dioxide equivalent	tCO ₂ e	A measure that allows the different greenhouse gases to be compared on a like-for-like basis relative to one unit of CO ₂ .
Topsoil		Natural topsoil or manufactured topsoil, usually covering the top 25cm in which plants can grow healthily.
Townscape		The landscape within the built-up area, including the buildings, urban open spaces, including green spaces and the relationship between buildings and between buildings and open spaces.
Transect Survey		A path along which one counts and records occurrences of the species of study (for example plants).
Translocation		The transporting and release of species or habitats from one location to another. For example, if an area of land is required permanently for a new development, species can be moved from that site to a suitable alternative location.
Transport Analysis Guidance	TAG	Guidance produced by the Department for Transport for undertaking transportation studies, appraisals and modelling. Also referred to as WebTAG.
Transport Research Laboratory	TRL	An independent company which offers consultancy and research advice on transportation to the public and private sector.
Tree Preservation Order	TPO	An order made by a local planning authority, under the Town and Country Planning Act 1990, in respect of trees or woodlands. The principal effect of a tree preservation order is to prohibit the cutting down, uprooting, topping, lopping, willful damage or willful

Term	Accronym or abbreviation	Definition
		destruction of trees without the local planning authority's consent.
Trial trenching (cultural heritage)		A method of on-site archaeological investigation where trenches are dug at intervals across a site to identify any archaeological remains.
Trunk road		A road operated and maintained in England by Highways England.
U		
UK Biodiversity Action Plan	UKBAP	The UK Government's response to the Convention on Biological Diversity.
UK Climate Projections	UKCP	The name given to the UK Climate Projections.
Unacceptable Adverse Effect Level	UAEL	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, for example regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, including auditory and non-auditory.
Underpass (or underbridge)		A bridge crossing under a transport corridor (for example a highway).
Unexploded ordnance	UXO	Explosives that did not explode when deployed and thus still pose a risk of detonation.
Unproductive strata		Layers of rock or superficial deposits with low permeability or porosity that have a negligible significance for water supply.
Upgrade		Refers to the physical improvement of a road, through widening of the carriageway or rebuilding a junction.
Utilities		The term utilities refers to the set of services provided by these

Term	Accronym or abbreviation	Definition
		organisations consumed by the public: Coal, electricity, natural gas, water, sewage, telephone, and transportation. Broadband internet services (both fixed- line and mobile) are increasingly being included within the definition.
V		
Value (landscape)		Relative value or importance of a landscape's quality, special qualities including perceptual aspects such as scenic beauty, tranquility, or wildness, cultural associations or other conservation issues.
Vehicle movement		A journey made by a vehicle. This can either be a one way or two way trip.
Veteran tree		Veteran trees are trees which have features of ancientness but at a younger age. These features include missing branches, hollow trunks and habitat features more commonly associated with ancient trees.
Vibration		A to-and-fro motion which oscillates about a fixed equilibrium position.
Viewpoint		A place from which something can be viewed.
Visual amenity		Overall enjoyment of a particular area, surroundings, or views in terms of people's activities - living, recreating, travelling through, visiting, or working.
Visual envelope		An area from which a project can be visible
Visual receptor		Individuals and/or defined groups of people who potentially could be affected by a project.
Visual sensitivity		Visual experience, be it sensitivity to light or visual clutter.

Term	Accronym or abbreviation	Definition
Vulnerability (climate)		The degree to which a system/asset is exposed and resilient to adverse effects of climate change.
W		
Walkers, cyclists and horse riders	WCH	A collective term used to describe pedestrians, cyclists and equestrians.
Waste		Any substance or object which the holder disposes or intends / is required to dispose.
Water Framework Directive	WFD	A European Union Directive which commits member states to achieve good status of all waterbodies (both surface and groundwater), and also requires that no such waterbodies experience deterioration in status. Good status is a function of good ecological and good chemical status, defined by a number of elements.
Water Framework Directive Assessment		Assessment to identify how the project has the potential to affect each of the water body's quality/quantity elements and whether it could lead to non-compliance with the Water Framework Directive.
-	WebTAG	See Transport Analysis Guidance.
World Health Organisation	WHO	An agency of the United Nations whose role is to direct and coordinate international health within the United Nations system and to lead partners in global health responses.
World Heritage Site		World Heritage is the designation for places on Earth that are of outstanding universal value to humanity and as such, have been inscribed on the World Heritage List to be protected for future

Term	Accronym or abbreviation	Definition
		generations to appreciate and enjoy.
Worst-case assumption (or scenario)		An assumption adopted within an Environmental Impact Assessment which identifies a scenario or parameter that would likely result in the maximum environmental effect (termed the worst-case). This is typically applied where uncertainty exists over the detail of a particular project component or approach to project delivery, for which a basis of assessment is needed.
Written Schemes of Investigation	WSI	Documents which set out the approach to undertaking archaeological monitoring of ground investigation works.
Z		
Zone of Influence	Zol	The geographic area (or timescale) over which existing environmental conditions are likely to be influenced by change.
Zone of visual influence		The area within which a project can have an influence or effect on visual amenity.
Zone of theoretical visibility	ZTV	Map produced (usually digitally) to specific criteria to illustrate the area(s) from which a project can theoretically be visual.

Appendix A: List of visual receptors

Visual receptors currently proposed for inclusion within the assessment include:

1. Residential receptors on Marsh Lane and Crees Lane.
2. Residential receptors on Fosse Road, Brockton Avenue and Linton Close including Red Rose Care Community.
3. Workers and visitors to Lord Ted – Pub and Carvery and other surrounding place of employment.
4. Works and visitors to Farndon Fields and surrounding industrial units.
5. Residential receptors on Peebles Road, and Riverside Road.
6. Users of PRow and residential receptors on The Ivies, The Oseries, The Weavers, The Maltsters and Lamb Close.
7. Users of PRow Newark-on-Trent BW1 and BW2.
8. Users of PRow Newark-on-Trent BW5.
9. Users of Newark-on-Trent Marina Ltd.
10. Residential receptors, road users and pedestrians on Mill Gate Street.
11. Users of Riverside Car Park and surround recreational facilities.
12. Visitors to Newark-on-Trent Castle and Gardens.
13. Residential receptors and road users on Great North Rd and Bar Gate.
14. Users of Newark-on-Trent Ransome and Marles Cricket Club.
15. Users of Newark-on-Trent Rugby Club.
16. Users of PRow Newark-on-Trent FP14.
17. Residential receptors on Sandhills Park, Sandhills Close, Kelham Road and Cullen Close.
18. Residential receptors on Great North Road and works and visitors to the British Sugar Factory.
19. Visitors to Smeatons Lakes Touring, Caravan and Fishing Park.
20. Users of King Waterside and Marina.
21. Business and road users of North Gate Street.
22. Users of PRow Newark-on-Trent BW6 and residential receptors.
23. Residential receptors along Wolsey Road and Fleming Drive.
24. Users of PRow Newark-on-Trent FP48.
25. Residential receptors on Robert Dukeson Avenue, John Pope Way, Halliwell Close, Stephen Road and Alexander Avenue including Bishop Alexander Primary School.
26. Residential receptors on Wheatsheaf Avenue, Barley Way, Winthorpe Road, Pine Close, Primrose Avenue and Harvest Drive including users of Premier Inn Newark-on-Trent, Roman Way Beefeater and MacDonalds.
27. Users of the recreational route – Trent Valley Way, long distance path.
28. Workers and visitors to Bridge Houser Boarding Kennels.

29. Workers on the Long Hollow Way industrial site.
30. Residential receptors on The Spinney and adjacent All Saints Church Winthorpe.
31. Users of PRow Winthorpe FP2 and FP3.
32. Residential receptors on Hargon Lane.
33. Residential receptors on Hargon Lane, Pocklington Crescent and Branston Close.
34. Users of Holm FP1 and surrounding residential properties.
35. Winthorpe Primary School and surrounding properties on Gainsborough Road.
36. Residents and visitors of Langford Hall (A46 entrance).
37. Residents and visitors of Langford Hall (A1133 entrance).
38. Visitors to Newark-on-Trent Showground (Drove Lane entrance).
39. Visitors to Newark-on-Trent Air Museum.
40. Users of Newark-on-Trent Indoor Bowls Centre and Golf Centre.
41. Visitors to Newark-on-Trent Showground.
42. Residents and Visitors to Hawthorn.
43. Users of Kelham PRow FP4.
44. Residential receptors and visitors to Latham Farms.
45. Residential receptors and visitors to South Muskham Main Street.
46. Users of Trent Valley Way between Kelham and A617 at Newark-on-Trent.
47. Users of Trent Valley Way and residential receptors at Averham.
48. Residential receptors at Kelham.
49. Users of Kelham Church and surrounding grounds of Kelham Hall.
50. Users of PRow BW1/BW2 at Upper Water Mouth.
51. Road users of A46.
52. Road users of B6166 at Farndon.
53. Road users of B6326.
54. Road users of B6166 at Brownhill.
55. Road users of A1.
56. Road users of A17.
57. Road users of A1133.

Appendix B: Habitats

Several areas not yet accessed will require extended phase 1 habitat surveys. The findings of which will determine whether further botanical surveys are required. If so, these will be presented within the Environmental Statement (ES).

Priority habitats

Wood pasture

Wood pasture habitat was identified at two sites within the study area at Winthorpe House (central OS national grid reference SK 81595 56469) and Langford Hall (central OS national grid reference SK 82476 57126). The wood pasture at both sites is comprised of scattered mature coniferous pine *Pinus* spp., as well as deciduous ash *Fraxinus excelsior*, oak *Quercus* spp. and beech *Fagus sylvatica*. The trees are currently actively managed as pollards. The pasture is comprised of species-poor semi-improved grassland and is sward dominant.

Traditional orchard

There is an area of traditional orchard habitat (central OS national grid reference SK 78237 52338) typified by the presence of several mature apple *Malus domestica* and pear *Pyrus communis* trees. This is located adjacent to a residential property and the produce is not grown commercially.

Eutrophic standing water

There is an area of eutrophic standing water which is located within British Sugar land (central OS national grid reference SK 79696 54878). This large water body is likely to be nutrient enriched by nearby industrial processes.

Lowland meadows

Although this could not be positively identified during the survey due to the time of year, the options appraisal recorded Lowland Meadows habitat (classified as unimproved neutral grassland under JNCC phase 1 habitat coding) directly west of the A616 Great North Road (central OS national grid reference SK 79289 54757). The species identified during surveys undertaken in 2019 included common knapweed *Centaurea nigra*, common bird's-foot-trefoil *Lotus corniculatus*, meadow vetchling *Lathyrus pratensis*, lady's bedstraw *Galium verum*, rough hawkbit *Leontodon hispidus* and great burnet *Sanguisorba officinalis*. Unimproved grassland was also recorded adjacent to the wetland mosaic habitat directly north-east of the A46.

Coastal and floodplain grazing marsh

This habitat was positively identified at British Sugar land (central OS national grid reference SK 79501 55069) and also west of the A46 (central OS national grid reference SK 78339 53812). Floodplain Grazing marsh is defined as periodically inundated pasture, or meadow with ditches which maintain the water levels, containing standing brackish or fresh water.

Other habitats

Arable

Arable habitat was ubiquitous throughout the study area and has been identified within Nottinghamshire's Habitat Action Plan²⁹⁸. Arable farmland provides vital habitat for many bird species, both for breeding and over-wintering. Arable fields also provide feeding and roosting opportunities for large numbers of birds such as geese, ducks, wading species and gulls that visit the county in winter.

Amenity grassland

This regularly managed habitat was located throughout the study area generally present in small patches (between 100 metres squared and 250 metres squared) adjacent to commercial, as well as industrial buildings and residential properties. The grassland sward composition was dominated by perennial rye-grass *Lolium perenne* with occasional cock's-foot *Dactylis glomerata* whilst the forbs were comprised of occasional common daisy *Bellis perennis* and ribwort plantain *Plantago lanceolata*.

Improved grassland

This species-poor habitat was present throughout the draft Order Limits and is identified by plant species that are known to be tolerant of nutrient rich soils and are often found in agriculturally managed field grazed by livestock. Species that were present within the sward included perennial rye-grass, cock's-foot and Yorkshire fog *Holcus lanatus*. Improved grassland habitat has been identified within Nottinghamshire's Habitat Action Plan²⁹⁸. These grasslands are not without biodiversity interest; they provide nesting opportunities for bird and animal species. Taller permanent improved grasslands can support large populations of small mammals which are vital food sources for birds of prey such as barn owl *Tyto alba*.

Species-poor semi-improved grassland

This habitat was also common throughout the 250 metre study area and was characterised by the presence of red fescue *Festuca rubra* within the composition of the sward. A full species list of the habitat was not possible, due to the sub-optimal time of the survey (January – February 2022).

²⁹⁸ Nottinghamshire Biodiversity Action Group. Local Biodiversity Action Plan [online] available at: [Local Biodiversity Action Plan – Nottinghamshire Biodiversity Action Group \(nottsbiac.org.uk\)](https://www.nottsbiac.org.uk/)

Semi-natural broad-leaved woodland

There are numerous pockets of semi-natural broad-leaved woodland within the study area. The canopy was generally comprised of semi-mature to mature oak and ash. There were also some woodland areas that had sycamore *Acer pseudoplatanus* and beech present within the canopy layer.

Holly *Ilex aquifolium* and hazel *Corylus avellana* was present within the sub-canopy layers in some parcels, though very local in abundance. Due to the sub-optimal time of the survey (January – February 2022), it was impossible to accurately survey the ground flora layer.

Scattered broad-leaved trees

There are numerous scattered broad-leaved trees within the study area. Species present included; ash, oak, sycamore, beech, silver birch *Betula pendula*, horse chestnut *Aesculus hippocastanum*, sweet chestnut *Castanea sativa*, willow *Salix* spp. and poplar *Populus* spp. Some of the trees are currently actively managed by pollarding.

Scattered coniferous trees

Several mature pine trees and Leyland cypress *Cupressocyparis x leylandii* trees were recorded within the study area. Namely at Newark-on-Trent Rugby Club, Newark-on-Trent Cricket Club and within wood pasture at Winthorpe House and Langford Hall.

Standing water (ditches/dykes)

There were a number of ditches and dykes within the study area adjacent to scattered broad-leaved trees, species-poor semi-improved grassland and arable. The Old Trent Dyke lies approximately 600 metres north of the River Trent and passes under the existing A46. Ditch habitats have been identified under Nottinghamshire's Habitat Action Plan ²⁹⁹.

Standing water (ponds)

There are several ponds located within the study area. Each were subjected to a HSI survey to assess for the suitability of great crested newt populations during the breeding season. Common bulrush *Typha latifolia* was often present within pond habitat.

Running water (river/streams)

²⁹⁹ Nottinghamshire Habitat Action Plan, available at: nottsbag.org.uk/lbap/lbap-introduction-and-sections-1-to-6 (last accessed October 2022)

Habitats of running water have been identified throughout the scheme, mainly the Rivers Trent and Devon. Rivers and stream habitats have been identified under Nottinghamshire's Habitat Action Plan.

Mixed plantation woodland

An area of mixed plantation woodland was recorded directly westerly adjacent to the A46 close to Winthorpe House. The woodland was comprised of pine species, ash, beech and oak species).

Broad-leaved plantation woodland

There is ubiquitous broad-leaved plantation woodland mainly located adjacent to the A46. It is likely that this planting has been implemented as screening.

Scrub

Scrub habitat is present throughout the study area, both in scattered and dense forms. The dominant species within this habitat was bramble *Rubus fruticosus* agg.

Tall ruderal

Tall ruderal habitat existed within several land parcels and was comprised of mainly willowherb species *Epilobium* spp., creeping thistle *Cirsium arvense*, common nettle *Urtica dioica* and broad-leaved dock *Rumex obtusifolius*.

Buildings

Numerous buildings were recorded. The buildings have been constructed for commercial, administrative, amenity, industrial or residential purposes.

Species-poor intact hedgerow

Species-poor intact hedgerows existed throughout the study area. The habitat was comprised mainly of hawthorn *Crataegus monogyna* and blackthorn *Prunus spinosa* with few other species present.

Species-poor intact hedgerow with trees

Several hedgerows had young and semi-mature trees present which were mainly comprised of ash and oak.

Species-poor defunct hedgerow

The habitat exists on field boundaries with hawthorn present as the dominant species.

Dry ditch

This habitat was uncommon throughout the study area, though two examples were located at central OS national grid references SK 78110 53244 and SK 78218 52530.

Appendix C: Protected and notable species

Bats

Tree and buildings with bat roosting potential were recorded during the extended phase 1 habitat survey within the draft Order Limits, temporary works areas and within a 250m buffer in January and March 2022.

A total of 19 structures were identified during the extended phase 1 habitat survey. Initial inspections of these 19 structures from ground level identified 13 structures have features of low to high potential to support roosting bats.

A total of 136 trees were identified during the extended phase 1 habitat survey. Initial inspections of these 136 trees from ground level identified 109 trees have features of low to high potential to support roosting bats. Only trees assessed as having moderate or high potential for roosting bats will undergo climb inspections where safe to do so. Tree climbing inspection surveys are proposed to be undertaken within the winter months of 2022 - 2023 (November 2022 – February 2023).

The zone of influence of the scheme in terms of impact on bat roosts is considered to be no more than 100 metres during operation or construction. Therefore, further bat surveys will not be undertaken on structures or trees located more than 100 metres from the scheme.

Suitable foraging and commuting habitat is present across the full stretch of the A46 throughout the survey area. In addition to the suitable habitats identified within the boundaries of the draft Order Limits, other suitable habitats within the wider survey area are also present and are well connected to the survey area. These include wider areas of woodland, open standing water, arable land, grassland and linear features such as hedgerows, watercourses and lines of trees.

Due to the presence of suitable foraging and commuting habitat within the survey area and the connectivity of the survey area to suitable habitat within the wider area, the survey as a whole is considered to have a moderate suitability to support foraging and commuting bat species, with reference to the Bat Conservation Trust (BCT) Guidelines³⁰⁰.

Additional surveys including further preliminary roost assessments in newly accessible areas, bat activity surveys by way of walked transects and static detector monitoring and further assessment of structures and trees deemed to have suitability for bats will be undertaken throughout the remainder of 2022 and during 2023 and will inform the Environmental Statement.

³⁰⁰ Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). Bat Conservation Trust, London. [online], available at: https://cdn.bats.org.uk/uploads/pdf/Resources/Bat_Survey_Guidelines_2016_NON_PRINTABLE.pdf?v=1542281971.

Birds

Scrub, woodland, wetland, arable habitat and grassland, found throughout the survey area offer suitable breeding habitat for bird species. The large water body/eutrophic standing water habitat at the British Sugar land provides optimal habitat for wintering bird species.

Scrub, woodland, wetland and farmland offer suitable habitat for breeding bird populations. Breeding bird surveys were undertaken through April to June 2022 inclusive, with the final surveys scheduled for July 2022.

Wintering bird surveys were undertaken utilising the 'look-see' method described by Bibby *et al* (1992; 2000)³⁰¹ in January and February 2022.

A total of 68 species were recorded during the over-wintering bird surveys undertaken.

Records of notable species include the following:

- Five Schedule 1 species
- Twelve Section 41 species
- Thirteen species on the Red List Birds of Conservation Concern
- Twenty-four species Amber List Birds of Conservation Concern

Thirty-seven of the species recorded on site are of conservation concern (Red or Amber List Birds of Conservation Concern) and are considered to be range restricted but are common and widespread in England and Wales as per Balmer *et al*³⁰².

Additional surveys will include wintering bird surveys in November and December 2022 and will inform the Environmental statement.

Reptiles

Grass snakes *Natrix natrix* require some cover and a degree of structural diversity³⁰³. Therefore, exposed drains that were previously assessed as having optimal grass snake habitat during options appraisal stages can be scoped out. Seasonal water filled hollows within the study area are also likely to be dry during the active summer months and can also be scoped out. Ponds and other watercourses that have a habitat structural diversity close by (scrub, tall vegetation, scattered trees,

³⁰¹ Bibby, C.J., Burgess, N.D., Hill, D.A., Mustoe, S. and Lambton, S. (1992, 2000) Bird Census Techniques. Academic Press, London, UK.

³⁰² Gillings, S., Balmer, D. E., Caffrey, B. J. & Swann, B., 2013. Survey methods and data sources. In: Balmer, D. E., Gillings, S., Caffrey, B. J., Swann, R. L., Downie, I. S. & Fuller, R. J. (eds), 2013. Bird Atlas 2007–11: The Breeding and Wintering Birds of Britain and Ireland. BTO Books, Thetford, UK. pp.34–45.

³⁰³ Edgar, P., Foster, J. and Baker, J. (2010). Reptile Habitat Management Handbook. Amphibian and Reptile Conservation, Bournemouth.

hedgerows and woodland), offer optimal habitat for grass snakes and other reptile species. There are several such habitats scattered throughout the draft Order Limits.

Great crested newts

Habitat suitability Index (HSI) surveys were undertaken within the draft Order Limits, temporary works areas and within a 250 metre buffer from January to June 2022 inclusive. A total of 22 waterbodies were identified within the survey area, five of which are within the scheme extent and two are within the temporary works areas. Two ponds were dry at the time of HSI surveys. Two waterbodies could not be accessed for further surveys following completion of the HSI surveys due to access constraints. A total of 14 waterbodies were subjected to eDNA surveys in April, May or June 2022 to confirm great crested newt (GCN) presence. At the time of writing this report, the results for one waterbody were waiting to be returned from the laboratory, a total of 12 waterbodies had negative results and one waterbody received an inconclusive result. All waterbodies with negative results are scoped out of further surveys for GCN. The one waterbody with an inconclusive eDNA result and those not accessible beyond HSI surveys, will require eDNA sampling and potentially population class surveys in spring 2023 to inform the Environmental Statement.

Badgers

Badger walkover surveys have been ongoing from January 2022 as additional land becomes accessible. Two badger setts were identified during the initial site walkover survey, one of which was identified during options appraisal stages of the scheme (documented in the 2019 Preliminary Ecological Appraisal (PEA)). Both of these setts were single-entrance outlier setts with no evidence of recent use by badger. One of these setts had evidence of use by rabbits, which may have occupied the disused sett.

Further badger surveys have been recommended in areas that were previously inaccessible to inform a full badger survey report and the Environmental Statement. Further badgers surveys are proposed to be conducted alongside the extended phase 1 surveys from April 2023.

Otters

No otter field signs were identified during the extended phase 1 habitat survey or water voles surveys to date. However, the banks of the River Trent and River Devon and immediate surroundings adjacent to the A46 comprise suitable habitat for otters to commute along the watercourse and construct holts. Further surveys to assess the suitability of habitat for otters and to search for otter field signs will be undertaken within the remainder of 2022 and 2023 (October 2022 – July 2023) to inform the Environmental Statement.

Water voles

Several watercourses within the study area were identified as having suitable habitat for water voles by assessing the following characteristics: bank profile, channel profile, water levels, availability of food sources, vegetation structure, level of shading, disturbance levels, bordering land use and connectivity to other habitats. A survey in 2019 identified suitable habitat at the River Trent where it crosses underneath the A46. However, these habitats can be scoped out as the River Trent at these locations is fast flowing and is not suitable for populations of water voles. No field signs of water voles were recorded during the extended phase 1 habitat survey.. Habitat assessment and the first of two field sign searches for water voles have been conducted where access allowed (May – September 2022). The second of these field sign searches , as well as the first of the field sign searches on land that was inaccessible in 2022, will be undertaken in spring 2023 (in the next survey period) to inform the Environmental Statement.

Other mammals

No sightings or field signs of hedgehog were recorded during the extended phase 1 habitat survey. Several sightings of brown hare have been recorded as incidental observations during various ecological surveys. Optimal brown hare habitat is a mosaic of arable fields, grasses and hedgerows, whilst hedgehogs favor mosaic of hedges, grassland and woodland habitat. This mosaic of habitat is ubiquitous throughout the draft Order Limits and surrounding areas.

White clawed crayfish

No habitat was found during the extended phase 1 habitat survey that was suitable for populations of white clawed crayfish. Freshwater streams less than 1m in depth within the survey area did not have gravel substrate, stones and rocks for shelter or small crevices for foraging.

Invertebrates

Nine LWS were identified as requiring further surveys following a desk study undertaken in March 2022 to identify habitat with potential to support protected or notable terrestrial invertebrate species. These surveys have been ongoing since April 2022 and will be reported in the Environmental Statement. Aquatic invertebrate surveys are also underway and will inform the Environmental Statement.