

A614/A6097 Corridor Improvements Environmental Impact Assessment Scoping Report





Via East Midlands Ltd



Project number: 60643622

June 2021

Quality information

Prepared by	Checked by	Verified by	Approved by
			
J Wright Senior Environmental Consultant	A Morrissy Associate Director, EIA	C Bush Associate Director, EIA	S B Banks Project Manager Associate Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	07 June 21	Issue to NCC	SB	Sheila Banks	AECOM Project Manager

Distribution List

# Hard Copies	PDF Required	Association / Company Name
N/A	✓	Nottinghamshire County Council

Prepared for:

Via East Midlands Ltd



Prepared by:

AECOM Infrastructure & Environment UK Limited,
Royal Court, Basil Close,
Chesterfield,
Derbyshire, S41 7SL,
United Kingdom.

T: +44 (0)1246 209221
aecom.com

© 2021 AECOM Infrastructure & Environment UK Limited. All Rights Reserved.

This document has been prepared by AECOM Infrastructure & Environment UK Limited ("AECOM") for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

TABLE OF CONTENTS

1.	Introduction.....	1
1.1	Background	1
1.2	The Requirement for EIA.....	1
1.3	Purpose of this Scoping Report	2
1.4	Structure of the Scoping Report.....	3
2.	The Project.....	5
2.1	Need for the Project.....	5
2.2	Project Objectives	6
2.3	Project Location.....	7
2.4	Project Description	9
2.5	Construction, Operation and Long-Term Management	11
3.	Assessment of Alternatives.....	13
3.1	Assessment Methodology.....	13
3.2	Reasonable Alternatives Studied	13
4.	Consultation.....	19
4.2	Previous Consultation.....	19
4.3	Future Planned Consultation	20
5.	Environmental Assessment Methodology	21
5.1	Surveys and Predictive Techniques and Methods.....	21
5.2	General Assessment Assumptions and Limitations.....	23
5.3	Significance Criteria.....	23
6.	Air Quality	25
6.1	Introduction	25
6.2	Study Area.....	25
6.3	Existing and Baseline Conditions.....	25
6.4	Potential Effects	28
6.5	Proposed Level and Scope of Assessment.....	28
6.6	Proposed Assessment Methodology Including Significance.....	29
6.7	Assumptions and Limitations	35
7.	Cultural Heritage.....	36
7.1	Introduction	36
7.2	Study Area.....	36
7.3	Existing and Baseline Conditions.....	36
7.4	Value of Environmental and Resource Receptors.....	39
7.5	Potential Effects	40
7.6	Proposed Level and Scope of Assessment.....	41
7.7	Proposed Assessment Methodology Including Significance.....	41
7.8	Assumptions and Limitations	43
8.	Landscape and Visual	44
8.1	Introduction	44
8.2	Study Area.....	44
8.3	Existing and Baseline Conditions.....	44
8.4	Value of Environmental and Resource Receptors.....	79
8.5	Potential Effects	90
8.6	Proposed Level and Scope of Assessment.....	92
8.7	Proposed Assessment Methodology Including Significance.....	93

8.8	Assumptions and Limitations	95
9.	Biodiversity	96
9.1	Introduction	96
9.2	Study Area.....	96
9.3	Existing and Baseline Conditions.....	97
9.4	Value of Environmental and Resource Receptors.....	124
9.5	Potential Effects	124
9.6	Proposed Level and Scope of Assessment.....	127
9.7	Proposed Assessment Methodology Including Significance.....	128
9.8	Assumptions and Limitations	133
10.	Geology and Soils	134
10.1	Introduction	134
10.2	Study Area.....	134
10.3	Existing and Baseline Conditions.....	134
10.4	Value of Environmental and Resources Receptors.....	162
10.5	Potential Effects	163
10.6	Proposed Level and Scope of Assessment.....	164
10.7	Proposed Assessment Methodology including Significance.....	165
10.8	Assumptions and Limitations	172
11.	Material Assets and Waste.....	174
11.1	Introduction	174
11.2	Study Area.....	174
11.3	Existing and Baseline Conditions.....	174
11.4	Potential Effects	176
11.5	Proposed Scope and Level of Assessment.....	177
11.6	Assumptions and Limitations	178
12.	Noise and Vibration	179
12.1	Introduction	179
12.2	Study Area.....	179
12.3	Existing and Baseline Conditions.....	180
12.4	Value of Environmental and Resource Receptors.....	182
12.5	Potential Effects	183
12.6	Proposed Level and Scope of Assessment.....	184
12.7	Proposed Assessment Methodology Including Significance.....	185
12.8	Assumptions and Limitations	189
13.	Population and health	190
13.1	Introduction	190
13.2	Study Area.....	190
13.3	Existing and Baseline Conditions.....	190
13.4	Potential Effects	193
13.5	Proposed Level and Scope of Assessment.....	195
14.	Road Drainage and the Water Environment.....	196
14.1	Introduction	196
14.2	Study Area.....	196
14.3	Existing and Baseline Conditions.....	196
14.4	Value of Environmental and Resource Receptors.....	217
14.5	Potential Effects	222
14.6	Proposed Level and Scope of Assessment.....	223

14.7	Proposed Assessment Methodology Including Significance.....	225
14.8	Assumptions and Limitations	233
15.	Climate	234
15.1	Introduction	234
15.2	Study Area.....	234
15.3	Existing and Baseline Conditions.....	234
15.4	Value of Environmental and Resource Receptors.....	237
15.5	Potential Effects	237
15.6	Proposed Level and Scope of Assessment.....	238
15.7	Proposed Assessment Methodology Including Significance.....	239
15.8	Assumptions and Limitations	243
16.	Cumulative Effects Assessment	244
16.2	Multiple Effects on Individual Receptors (In-combination Effects)	244
16.3	Cumulative Effects with Other Developments	244
16.4	Proposed Methodology Including Significance.....	245
17.	Summary	246
17.2	Proposed Structure of the ES	248
18.	References	250
Appendix A : Figures		255
Appendix B : Design Layout and EIA Scoping Boundary Plans.....		256
Appendix C : Landscape Character Types		257
C.1	Ollerton Roundabout	257
C.2	Mickledale Lane Junction Option 1	262
C.3	Mickledale Lane Junction Option 2	269
C.4	Lowdham Roundabout	277
C.5	Kirk Hill Junction.....	282

FIGURES

Figure 2-1: Project Location Plan
Figure 5-1 - 5-7: Environmental Constraints Plans
Figure 5-8a: Ollerton ppSPA
Figure 5-8b: Mickledale Lane ppSPA
Figure 8-1a: Ollerton Study Area
Figure 8-1b: Mickledale Option 1 Study Area
Figure 8-1c: Mickledale Option 2 Study Area
Figure 8-1d: Lowdham Study Area
Figure 8-1e: Kirk Hill Study Area
Figure 8-2a: Ollerton Aerial Photo
Figure 8-2b: Mickledale Option 1 Aerial Photo
Figure 8-2c: Mickledale Option 2 Aerial Photo
Figure 8-2d: Lowdham Aerial Photo
Figure 8-2e: Kirk Hill Aerial Photo
Figure 8-3a: Ollerton Topography
Figure 8-3b: Mickledale Option 1 Topography
Figure 8-3c: Mickledale Option 2 Topography
Figure 8-3d: Lowdham Topography
Figure 8-3e: Kirk Hill Topography
Figure 8-4a: 1 of 2 Ollerton Designations
Figure 8-4a: 2 of 2 Ollerton Designations
Figure 8-4b: 1 of 2 Mickledale Option 1 Designations
Figure 8-4b: 2 of 2 Mickledale Option 1 Designations
Figure 8-4c: 1 of 2 Mickledale Option 2 Designations
Figure 8-4c: 2 of 2 Mickledale Option 2 Designations
Figure 8-4d: 1 of 2 Lowdham Designations
Figure 8-4d: 2 of 2 Lowdham Designations
Figure 8-4e: 1 of 2 Kirk Hill Designations
Figure 8-4e: 2 of 2 Kirk Hill Designations
Figure 8-5a: Ollerton Landscape Character
Figure 8-5b: Mickledale 1 Landscape Character
Figure 8-5c: Mickledale 2 Landscape Character
Figure 8-5d: Lowdham Landscape Character
Figure 8-5e: Kirk Hill Landscape Character
Figure 8-6a: Ollerton ZTV
Figure 8-6b: Mickledale Option 1 ZTV
Figure 8-6c: Mickledale Option 2 ZTV
Figure 8-6d: Lowdham ZTV
Figure 8-6e: Kirk Hill ZTV
Figure 8-7a: Ollerton Viewpoints
Figure 8-7b: Mickledale 1 Viewpoints
Figure 8-7c: Mickledale 2 Viewpoints
Figure 8-7d: Lowdham Viewpoints
Figure 8-7e: Kirk Hill Viewpoints
Figure 10-1: Buffers Ollerton
Figure 10-2: Buffers Mickledale Option 1
Figure 10-3: Buffers Mickledale Option 2
Figure 10-4: Buffers White Post
Figure 10-5: Buffers Warren Hill
Figure 10-6: Buffers Lowdham
Figure 10-7: Buffers Kirk Hill
Figure 12-1: Noise Ollerton
Figure 12-2: Noise Mickledale Option 1

Figure 12-3: Noise Mickledale Option 2
Figure 12-4: Noise White Post
Figure 12-5: Noise Warren Hill
Figure 12-6: Noise Lowdham
Figure 12-7: Noise Kirk Hill

TABLES

Table 1-1: Scoping Information Required by the EIA Regulations.....	3
Table 2-1: Scheme Anticipated Construction Start Dates and Opening Years	12
Table 3-1: Non-Car Alternatives Considered	13
Table 3-2: Long List Intervention Packages.....	15
Table 3-3 Package 5: Package 4 with the inclusion of Intervention 12 Kirk Hill.....	15
Table 3-4: Package 6: Package 5 minus Intervention 5: Deerdale Lane.....	16
Table 3-5 Alternative Scheme Design Options	16
Table 5-1: Significance Matrix (reproduced from DMRB LA 104).....	24
Table 6-1: NO ₂ Monitoring in Newark and Sherwood District 2016 – 2019	26
Table 6-2. Summary of estimated background pollutant concentrations across the study area in the base year and Opening Year	27
Table 6-3 Receiving environment sensitivity to construction dust	30
Table 6-4: Definitions of the magnitude of change criteria	32
Table 6-5 Guideline band for the number of properties informing a judgement of significant air quality effects	33
Table 8-1 Landscape sensitivity (susceptibility and value) and typical descriptions (from DMRB LA 107 Table 3.22).....	79
Table 8-2 Visual sensitivity (susceptibility and value) and typical descriptions (from DMRB La 107 Table 3.41)	80
Table 8-3 Ollerton Roundabout Representative Viewpoints.....	82
Table 8-4 Mickledale Lane Junction Option 1 Representative Viewpoints	84
Table 8-5 Mickledale Lane Junction Option 2 Representative Viewpoints	86
Table 8-6 Lowdham Roundabout Representative Viewpoints.....	88
Table 8-7 Kirk Hill Junction Representative Viewpoints	90
Table 8-8 Magnitude of impact on landscape and typical descriptions.....	94
Table 8-9 Magnitude of impact on visual effect and typical descriptions	95
Table 9-1: Summary of Ecological Field Surveys Undertaken to Date	98
Table 9-2: Designated Statutory and Non-Statutory Sites located within the Ollerton Roundabout Study Area	101
Table 9-3: Summary of Baseline Details for Protected and Notable Species located within the Ollerton Roundabout Study Area.....	103
Table 9-4: Designated Statutory and Non-Statutory Sites located within the Mickledale Lane Junction (Options 1 and 2) Study Area.....	106
Table 9-5: Summary of Baseline Details for Protected and Notable Species within the Mickledale Lane Junction (Options 1 and 2) Study Area	108
Table 9-6: Designated Statutory and Non-Statutory Sites located within the White Post Roundabout Study Area	110
Table 9-7: Summary of Baseline Details for Protected and Notable Species within the White Post Roundabout Study Area	112
Table 9-8: Summary of Baseline Details for Protected and Notable Species	114
Table 9-9: Designated Statutory and Non-Statutory Sites located within the Lowdham Roundabout Study Area	116
Table 9-10: Summary of Baseline Details for Protected and Notable Species within the Lowdham Roundabout Study Area.....	118
Table 9-11: Designated Statutory and Non-Statutory Sites located within the Kirk Hill Junction Study Area	120
Table 9-12: Summary of Baseline Details for Protected and Notable Species	122
Table 9-13: Biodiversity Resource Importance	129
Table 9-14: Level of Impact and Typical Descriptions	132
Table 9-15: Significance Matrix	132
Table 10-1: Baseline Conditions for Ollerton Roundabout	135
Table 10-2: Baseline Conditions for Mickledale Lane Junction	141
Table 10-3: Baseline Conditions for White Post Roundabout.....	148

Table 10-4: Baseline Conditions for Warren Hill Junction	150
Table 10-5: Baseline Conditions for Lowdham Roundabout	152
Table 10-6: Baseline Conditions for Kirk Hill Junction.....	157
Table 10-7: Environmental value (sensitivity) and descriptions (based on DMRB LA 109 and LA 113).....	166
Table 10-8: Magnitude of impact (based on DMRB LA 109 and LA 113).....	169
Table 11-1: Recycled Aggregate Targets for England	175
Table 11-2: Nottinghamshire and East Midlands landfill capacity 2019	175
Table 11-3: Estimated Quantities of Material Use	176
Table 12-1: List of NSR from each Scheme (600m and 300m Buffers).....	183
Table 12-2: Construction noise SOAEL thresholds and LOAEL for all receptors.....	186
Table 12-3: Construction vibration criteria for human receptors (annoyance)	186
Table 12-4: Magnitude of the impacts from construction noise and vibration.	187
Table 12-5: Noise SOAEL and LOAEL for all receptors	188
Table 12-6: Magnitude of Change in traffic noise (short and long-term).....	188
Table 12-7: Initial assessment of operational noise significance	189
Table 14-1: Ponds within 1km of Ollerton Roundabout.....	198
Table 14-2: Ponds within 1km of Mickledale Lane Junction.....	202
Table 14-3: Ponds within 1km of White Post Roundabout	206
Table 14-4: Ponds within 1km of Warren Hill Junction	208
Table 14-5: Ponds within 1km of Lowdham Roundabout.....	211
Table 14-6 Ponds within 1km of Kirk Hill Junction	215
Table 14-7: Summary of Receptor Importance for Ollerton Roundabout	217
Table 14-8: Summary of Receptor Importance for Mickledale Lane Junction (Option 1 and 2)	218
Table 14-9: Summary of Receptor Importance for White Post Junction.....	219
Table 14-10: Summary of Receptor Importance for Warren Hill Junction.....	220
Table 14-11: Summary of Receptor Importance for Lowdham Roundabout.....	220
Table 14-12: Summary of Receptor Importance for Kirk Hill Junction	221
Table 14-13: Evaluating the Importance for Surface Water, Groundwater, Flood Risk, and Water Resources	228
Table 14-14: Evaluating Magnitude for Surface, Groundwater, Flood Risk, and Water Resources.....	230
Table 14-15: Significance of Effect Matrix.....	233
Table 15-1: Historic climate data - UK Met Office (2020).....	235
Table 15-2: Historic Climate Data - Met Office historic 10-year averages for the Midlands district	235
Table 15-3: Projected changes in temperature variables (°C), 50% probability (10% and 90% probability in parenthesis)	236
Table 15-4: Projected changes in precipitation (%), 50% probability (10% and 90% probability in parenthesis)	237
Table 15-5: Key anticipated GHG emissions sources.....	239
Table 15-6: Climatic parameters scoped for climate change resilience review	239
Table 15-7: UK carbon budgets.....	241
Table 15-8: Magnitude criteria for GHG impact assessment.....	241
Table 15-9: Significance of effects criteria for GHG impact assessment.....	242
Table 15-10: Likelihood categories	242
Table 15-11: Description of consequences	242
Table 15-12: Significance matrix (S = Significant, NS = Not Significant).....	243
Table 16-1: Determining the Significance of Cumulative Effects (in combination and cumulative)	245
Table 17-1: Summary of Assessment Scope for the ES	246
Table 17-2: Scope of the assessments for each Scheme to be included in the ES.....	247
Table 17-3: Proposed ES contents list/ structure	249

Abbreviations

AADT	Annual Average Daily Traffic
AOD	Above Ordnance Datum
ALC	Agricultural Land Classification
AQMA	Air Quality Management Area
AQO	Air quality objectives
ARN	Affected Road network
ASR	Annual Status Report
BGS	British Geological Society
BNG	Biodiversity net gain
BNL	Basic Noise Level
BS	British Standard
CEMP	Construction Environmental Management Plan
CO ₂	Carbon Dioxide
CL: AIRE	Contaminated land: Applications in Real Environments
CRTN	Calculation of Road Traffic Noise
cSAC	candidate Special Areas of Conservation
dB	Decibel
DEFRA	Department for the Environment Food and Rural Affairs
DfT	Department for Transport
DM	Do Minimum
DMOY	Do Minimum Opening Year
DSFY	Do Something Future Year
DSOY	Do Something Opening Year
DMRB	Design Manual for Roads and Bridges
DS	Do Something
EAST	Early Assessment and Sifting Tool
EEA	European Economic Area
END	Environmental Noise Directive
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ES	Environmental Statement
GCN	Great Crested Newt
GPA	Good Practice Advice
HER	Historical Environment Record
HEWRAT	Highways England Water Risk Assessment Tool
HDV	Heavy duty vehicle
HGV	Heavy Goods Vehicle
HRA	Habitat Regulations Assessment
HSI	Habitat Suitability Index
CIEEM	Chartered Institute of Ecological and Environmental Management
IEMA	Institute of Environmental Management and Assessment
JNCC	Joint Nature Conservation Committee
LAQM	Local Air Quality Management
LCA	Landscape Character Assessment

LCT	Landscape Character Type
LNR	Local Nature Reserve
LOAEL	Lowest Observable Adverse Effect Level
LTT	Long Term Trend
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
MAGIC	Multi-agency Geographic Information Centre
AOD	Above Ordnance Datum
MRN	Major Road Network
NHLE	National Heritage List for England
NCA	National Character Area
N/A*	Nottingham City Council
NCC	Nottinghamshire County Council
NIA	Noise Important Areas
NO2	Nitrogen Dioxide
NOX	Nitrogen Oxides
NPPF	National Planning Policy Framework
NSDC	Newark and Sherwood District Council
NVZ	Nitrate Vulnerable Zone
OEMP	Outline Environmental Management Plan
ONS	Office for National Statistics
PDBE	Polybrominated diphenyl ethers
PFOS	Perfluorooctane sulfonate
PM ₁₀	Particulate matter
pSAC	Possible Special Areas of Conservation
pSPA	Potential Special Protected Area
ppSPA	Possible potential Special Protected Area
PPV	Peak Particle Velocity
PRoW	Public Right of Way
PWS	Private Water Supply
RBC	Rushcliffe Borough Council
RIGS	Regionally Important Geological Sites
SAC	Special Area of Conservation
SNRHW	Stable non-reactive hazardous waste
SOAEL	Significant Observed Adverse Effect Level
SPA	Special Protection Area
SPZ	Source Protection Zone
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
UK	United Kingdom
WCH	Walkers, cyclists and horse riders
WFD	Water Framework Directive
ZTV	Zone of Theoretical Visibility
ZOI	Zone of Influence

*Note: Nottingham City Council is not abbreviated in order to avoid confusion with the abbreviation for Nottinghamshire County Council. The latter is more relevant to the Project and is, therefore, referred to the most and is, subsequently, abbreviated to NCC.

1. INTRODUCTION

1.1 Background

1.1.1 AECOM and Via East Midlands Ltd (Via) have prepared this Environmental Impact Assessment (EIA) Scoping Report (herein referred to as the 'Scoping Report') to outline the proposed approach to the EIA of the A614/A6097 Major Road Network Improvement Project (herein referred to as the 'Project'). The Project comprises improvements to six existing junctions along the A614/A6097 corridor (herein referred to as 'Schemes').

1.1.2 The A614/A6097 corridor is a 29 km, mainly single carriageway road that extends from the A46/A6097 junction (Bingham) to the A614/A617/A6075 Ollerton roundabout junction. The corridor was designated part of the Major Road Network (MRN) in October 2018. The MRN is defined as a middle tier of the busiest and most economically important local authority 'A' roads, sitting between the Strategic Road Network (SRN) and the rest of the Local Road Network.

1.1.3 Geographically, the route sits between the A1 to the east and M1 to the west, and forms a spine running through Nottinghamshire. The route regularly acts as a diversion or alternative route during major works or incidents on the SRN.

1.1.4 A number of junctions along the corridor are heavily congested whilst others pose difficulties and dangers for drivers trying to access the A614/A6097 from adjoining roads and settlements. The existing problems and traffic delays are set to worsen considerably with planned and forecast traffic growth. The Project is therefore proposed to address existing congestion issues and facilitate future traffic growth.

1.1.5 Nottinghamshire County Council (NCC) is promoting improvements at six junctions on the A614/A6097 corridor as a single package as listed below:

- **Ollerton Roundabout** – the roundabout intersection of the A614 (Old Rufford Road/Blyth Road, the A616 (Worksop Road/Ollerton Road), Newark Road and A6075 (Mansfield Road);
- **Mickledale Lane Junction** – the crossroads of A614 (Old Rufford Road), Mickledale Lane and Inkersall Lane;
- **White Post Roundabout** – the A614 (Old Rufford Road) and Mansfield Road roundabout;
- **Warren Hill Junction** – the A614 (Old Rufford Road) and A6097 (Ollerton Road) priority junction;
- **Lowdham Roundabout** – the roundabout intersection of the A6097 (Epperstone Bypass) and A612 Nottingham Road; and
- **Kirk Hill Junction** – the crossroads of the A6097 (Bridgford Street) and East Bridgford Road/Kirk Hill.

1.2 The Requirement for EIA

1.2.1 Early discussions were held with NCC planning department (NCC Planning) as the relevant planning authority early in design development. As noted in Chapter 4 of this report, a previous screening and scoping request was submitted to NCC

Planning based on earlier designs. Feedback was also obtained from a range of consultees which confirmed a likely need for EIA at Ollerton Roundabout due to the Scheme being located within a sensitive area (Birklands West and Ollerton Corner Site of Special Scientific Interest (SSSI)).

- 1.2.2 The Outline Business Case for the Project, submitted to the Department for Transport (DfT), required clear consideration for the impacts and benefits of each Scheme both individually and cumulatively.
- 1.2.3 NCC also sought legal advice on the likely planning route for the Project, given that some of the Schemes (Warren Hill Junction and White Post Roundabout) could be considered to align with permitted development requirements as the proposals are all within the current highway boundary.
- 1.2.4 Based on legal advice, feedback from DfT and early consultation responses on the need for EIA, NCC is planning to prepare an Environmental Statement (ES) for the Project. However, as some Schemes are not likely to result in significant environmental effects a proportionate approach to the assessment and reporting is proposed as documented in this Scoping Report.

1.3 Purpose of this Scoping Report

- 1.3.1 EIA scoping forms one of the early stages of the EIA process and refers to the activity of identifying the elements of the environment that should be considered within the EIA. Through consideration of environmental factors and potential receptors (both existing and introduced as a result of a new development), EIA scoping initiates the process of defining the potential for significant environmental effects. This in turn results in the identification of the environmental factors that require consideration and assessment as part of the EIA.
- 1.3.2 This Scoping Report constitutes a request for a scoping opinion to NCC under Regulation 15 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (hereafter referred to as 'the EIA Regulations'). In accordance with the EIA Regulations, a Scoping Opinion should be provided within five weeks unless otherwise agreed between the applicant and relevant planning authority.
- 1.3.3 The objectives of this Scoping Report are to:
 - Set out the proposed scope of the EIA (i.e. identify which environmental topics are to be 'scoped in' or 'out'), taking into account what is currently known about the site and the Project;
 - Set out what additional information needs to be collected (i.e. through desk-based studies or field survey work) to characterise the baseline environment of the Project site;
 - Define the assessment methods to be used to determine the likely significant environmental effects of the Project;
 - Identify potential environmental impacts and effects and opportunities for mitigation; and
 - Set out the proposed structure of the ES.
- 1.3.4 Regulation 15 (2) of the EIA regulations states that requests for scoping opinions shall be accompanied by specific information as noted in Table 1-1 below.

Table 1-1: Scoping Information Required by the EIA Regulations

Information Required by EIA Regulations	Location in this Report
A plan sufficient to identify the land	Appendix A contains plans for each Scheme and illustrates the indicative red line planning boundary used for scoping (the scoping boundary).
An explanation of the likely significant effects of the development on the environment	Chapters 6 to 15 are topic specific chapters which note the likely significant effects of the Project under the subheading 'potential effects'.
A brief description of the nature and purpose of the development, including its location and technical capacity	Chapter 2 describes the Project and individual Schemes.
Such other information or representations as the person making the request may wish to provide or make	A full breakdown of the structure of this Scoping Report is provided in Section 1.4.

1.4 Structure of the Scoping Report

1.4.1 The structure of this Scoping Report is as follows:

- **Chapter 1** – provides an introduction to the Project and the Scoping Report;
- **Chapter 2** – provides the following:
 - an outline of the need for the Project and the Project objectives;
 - details regarding the location of the Project and the individual Schemes; and
 - a description of the Project and the individual Schemes.
- **Chapter 3** – outlines the assessment of alternatives;
- **Chapter 4** - outlines the proposed consultation process;
- **Chapter 5** – introduces the EIA process;
- **Chapters 6 to 15** – set out the scope and specific methodologies proposed for each environmental assessment topic to be addressed during the EIA process and reported in the final ES. Each topic chapter provides the following information, where appropriate:
 - study area;
 - existing and baseline knowledge;
 - value of the environmental resources and receptors;
 - potential effects;
 - proposed level and scope of assessment; and
 - proposed methodology including significance.

- **Chapter 16** – describes the scope of the cumulative effects' assessment;
and
- **Chapter 17** – provides a summary of the conclusions drawn throughout the report and provides the proposed outline structure for the forthcoming ES.

2. THE PROJECT

2.1 Need for the Project

- 2.1.1 The A614/A6097 serves a dual-economic function by facilitating regular commuter trips and local movements, and also being an important corridor for the tourist economy.
- 2.1.2 The A614/A6097 route regularly experiences congestion and journey time delays in the peak periods, particularly at the Ollerton, Lowdham and Kirk Hill junctions due to insufficient capacity to cope with current traffic demands. There are regular delays to traffic joining the A614 at the Mickledale Lane junction as traffic waits for suitable gaps in the A614 traffic before joining.
- 2.1.3 The A614/A6097 route previously had a poor safety record and was subjected to a major safety improvement scheme in 2012 with the route subject to a 50mph speed limit and a series of time over distance (average speed) camera enforcement.
- 2.1.4 At the northern extent of the Project, the A614 serves a number of tourist attractions including: Rufford Abbey, Centre Parcs, Sherwood Pines Forest Park, Go Ape, Sherwood Forest Country Park, White Post Farm and Robin Hood's Wheelgate Family Theme Park. Within the NCC Visitor Economy Strategy 2019 – 2029 (NCC, 2019), the A614 is identified as being a Key Development Project to strengthen the sense of place for visitors along the A614 and to take advantage of investment along this growth corridor to:
- Use the latest technology to create a high quality, well-signed visitor route that welcomes people to the County and to Sherwood Forest; and
 - Create a visitor friendly bus route from Nottingham City to Sherwood Forest using existing services and Sherwood livery buses.
- 2.1.5 Traffic congestion is forecast to increase along the corridor without intervention. Increasing congestion will have a detrimental impact on journey time reliability for all users and local economic activity. The corridor already has a high proportion of heavy goods vehicle use therefore further delays will have a direct impact on the logistics supply chain for industries and businesses both on and close to this corridor.
- 2.1.6 Without highway improvements the ability of the local district councils to release housing and employment development will be restricted. There are already development limits on some planning permissions until such time as junction capacities have been improved to accommodate existing traffic levels and traffic anticipated to be generated by development.
- 2.1.7 At Thoresby Colliery near Ollerton, planning conditions limit development to 150 dwellings and 8,094 m² employment developments until capacity improvements to Ollerton Roundabout occur. The Project would allow a further 650 dwellings and 24,281 m² of employment development to progress.
- 2.1.8 At the Teal Close development site near Lowdham, planning conditions limit development to 150 dwellings until capacity improvements to Lowdham Roundabout occur. The Project would allow for a further 680 dwellings to progress.
- 2.1.9 It is also important to make sure that the corridor is as accessible and reliable as possible, in order to make further investment in the area an attractive prospect.

- 2.1.10 The route also frequently acts as a diversion or alternative route during major planned works or incidents on the SRN. As several junctions along A614/A6097 corridor are already operating close to, or above capacity, without intervention there would be a reduction in the effectiveness of the route for diversions from the SRN.
- 2.1.11 The six junctions included in the Project have been identified as requiring intervention for varying reasons as indicated in the ensuing paragraphs:
- **Ollerton Roundabout** is a six-arm standard roundabout with one arm approach being bus only. The roundabout currently experiences regular peak hour journey time delays and is considered to be a capacity restraint which has resulted in limits being placed on nearby planning applications (Thoresby Colliery);
 - **Mickledale Lane Junction** is a priority crossroads with right-turn harbourages provided into each of the minor arms. A key concern at this junction is the ability of minor-arm traffic to safely judge gaps when entering the A614 and to do so without undue delay;
 - **White Post Roundabout** is a four-arm standard roundabout which is approaching capacity in the peak periods. The junction requires carriageway upgrades to ensure the route is of a suitable standard to support the SRN and provide network resilience;
 - **Warren Hill Junction** is a priority controlled gyratory junction where traffic on the A6097 gives way to traffic travelling north/south on the A614. The junction layout is unusual in that traffic from the A6097 (routeing north) merging onto the A614 does so by entering the mainstream on the passenger side (rather than the normal driver's side). This unusual arrangement creates a perception that the junction is unsafe. The junction is predicted to be a capacity restraint in future years;
 - **Lowdham Roundabout** is a four-arm standard roundabout. The A6097 entering the junction from the north and south are both of dual-carriageway standards. The junction currently experiences significant journey delays (especially during the morning and evening peak periods) because of insufficient capacity to cater for current traffic demands and is considered to be a capacity restraint which has resulted in limits on nearby planning applications (Teal Park); and
 - **Kirk Hill Junction** is a signalised junction comprised of four arms: the A6097 Bridgford Street runs north-west-south-east, Kirk Hill joins the A6097 from the north and East Bridgford Road from the south. On the A6097 both junction approaches are characterised by two lanes, one of which is a dedicated right turn lane, with the other used for ahead and left movements. Both Kirk Hill and East Bridgford Road are single lane approaches. The junction currently experiences significant journey delays (especially during the morning and evening peaks) because of insufficient capacity to cater for current traffic demands. An Experimental Road Traffic Order (ETRO) at Trent Lane, East Bridgford, has increased through-traffic at this junction.

2.2 Project Objectives

- 2.2.1 The Project is an important part of NCC's strategy to support growth and development in this part of Nottinghamshire. It would enable the MRN, SRN and local roads to operate more efficiently by reducing congestion, improving the

reliability of journey times whilst also providing increased capacity at key junctions which would help facilitate economic growth in the area.

2.2.2 The objectives of the package of junction improvements are aligned closely with the objectives set out in the MRN programme to:

- **Reduce congestion** - a number of intersections along the A614/A6097 corridor currently suffer from significant levels of congestion, particularly at peak travel periods;
- **Support economic growth and housing delivery** - the Project would increase capacity along the corridor which in turn can accommodate new and additional trips arising from significant housing and employment developments that are to be constructed in future years;
- **Support the SRN** - the Project would add resilience to the route which will support the SRN during major works or incidents on the M1, A1, and A46;
- **Reducing journey time delays, particularly at peak periods** - improving journey time reliability will improve economic efficiency for businesses and make the corridor as attractive as possible to visitors to the many tourist attractions located along the corridor; and
- **Supporting all road users** - the Project would improve crossing facilities for pedestrians and cyclists.

2.3 Project Location

2.3.1 The Project location can be viewed on Figure 2-1 in Appendix A: Figures.

2.3.2 Geographically, the route sits between the A1 to the east and M1 to the west, forming a north-south route running from Nottingham in the south towards Worksop and Retford in the north.

2.3.3 The A6097 provides a spur from the A614 to the A46 (a highway linking Leicester with Newark and Lincoln). Within the scope of the Project, the A614 is a two-way single carriageway and the A6097 is a two-way single carriageway which has a short length of dual carriageway through Lowdham.

2.3.4 The six Schemes are situated within two local authority areas. The five most northern Schemes are located within Newark and Sherwood District Council (NSDC). The Kirk Hill Junction, the most southern Scheme, is within Rushcliffe Borough Council (RBC). A third local authority, Gedling Borough Council (GBC), is approximately 2 km to the west of the Schemes at Lowdham Roundabout and Kirk Hill Junction.

Ollerton Roundabout

2.3.5 Ollerton Roundabout is located in Ollerton, Newark, approximately 12 km north-east of Mansfield and 26 km north of Nottingham. Currently this is a six-arm standard roundabout, with the Newark Road approach arm being bus-only.

2.3.6 A McDonald's restaurant and a Costa Coffee shop have been built to the immediate south of the junction. A public house is situated to the west of the junction. Petrol filling stations are positioned on either side of Old Rufford Road leading into the junction from the south. Isolated housing is to the north-east of the junction.

2.3.7 Within 200 m of Ollerton Roundabout there are several ecologically sensitive sites including Birklands West and Ollerton Corner Site of Special Scientific Interest (SSSI), Birklands and Bilhaugh Local Wildlife Site (LWS) and Sherwood Heath Local Nature Reserve (LNR) and LWS. There are also habitats included within the Sherwood Area Possible Potential Special Protection Area (ppSPA) within 200 m. Some of these habitats are adjacent to the existing junction. More details can be found in Chapter 9 - Biodiversity.

2.3.8 There are footways along the roads leading into Ollerton Roundabout, with bridleway (BW) 26 and 24 leading north-west through Sherwood Heath LNR.

Mickledale Lane Junction

2.3.9 Mickledale Lane Junction is located approximately 500m west of the village of Bilsthorpe, approximately 9 km east of Mansfield and approximately 22 km to the north of Nottingham. The existing junction is currently a priority controlled four-arm crossroads junction with the side roads giving way to the A614 traffic flows.

2.3.10 Four houses occupy the south-east corner of the junction, and a transport café (Limes Café) is in the north-west quadrant. Other than these buildings, the junction is surrounded by agricultural land. Inkersall Lane is a narrow road leading westward from the junction to a small number of private properties and the former Rufford Colliery site. To the east, Mickledale Lane leads to the centre of Bilsthorpe village.

2.3.11 There are footpaths on both sides of the junction and a dropped crossing and refuge have been provided to assist crossing movements to the north of the junction. Inkersall Lane is a Public Right of Way (PRoW) Bridleway (Rufford BW5).

2.3.12 Route Number 645 of the National Cycle Network lies 210 m to the north of the junction and is a traffic free route. The route follows the disused mineral line and terminates just south of Kirklington.

White Post Roundabout

2.3.13 White Post Roundabout is located just west of the village of Farnsfield, approximately 9 km south-east of Mansfield and 16km north of Nottingham. The current layout is a four-arm standard roundabout with the A614 running north-south.

2.3.14 The Mansfield Road (West) leads to Rainworth and the town of Mansfield. The Mansfield Road (east) leads to the village of Farnsfield.

2.3.15 There are business and residential properties surrounding this junction on all sides. The Wheelgate Family Theme Park situated 200 m away from the junction to the west. There is a Day Nursery and White Post Farm located to the north-east of the junction.

2.3.16 Footpaths are available on each of the roads leading to the junction, and a pedestrian refuge (with dropped crossings) has been provided on the A614 north arm. There is a PRoW footpath to the south of the junction (Farnsfield FP19).

Warren Hill Junction

2.3.17 Warren Hill Junction is located just south of the village of Farnsfield, approximately 10km south-east of Mansfield and 14 km north of Nottingham.

2.3.18 This is a priority controlled gyratory junction where traffic on the A6097 gives way to traffic travelling north/south on the A614. The junction layout is unusual in that

traffic from the A6097 (routeing north) merges onto the A614 by entering the mainstream on the passenger side (rather than the normal driver's side).

- 2.3.19 A caravan sales site is located to the immediate north of the junction, though the rest of the junction is surrounded by agricultural land. No provision for walkers, cyclists or horse riders has been made at this junction.
- 2.3.20 There is a Public Right of Way (PROW) Byway Open to All Traffic (BOAT) (Rob Lane – Oxtou BOAT No11) just to the north of the junction.

Lowdham Roundabout

- 2.3.21 Lowdham Roundabout is located in Lowdham, approximately 2 km north of the village of Gunthorpe and 9km north-east of Nottingham. This is a four-arm standard roundabout. The A6097 entering the junction from the north and south are both of dual-carriageway standards.
- 2.3.22 Residential dwellings have been constructed to the east and south of the junction along the A612 and a cricket pitch is located to the north of the junction. To the west, the junction is bordered by agricultural land.
- 2.3.23 Footpaths have been provided around the junction and splitter islands are available to assist pedestrians crossing (albeit that they are also occupied by signage). There is a PROW footpath (Lowdham FP2) to the south of the junction.

Kirk Hill Junction

- 2.3.24 Kirk Hill Junction is located just south of East Bridgford, approximately 10km east of Nottingham.
- 2.3.25 This is a four-arm traffic signalled junction. The A6097 Bridgford Street runs north-west to south-east and Kirk Hill joins the A6097 from the north, providing access to East Bridgford village. East Bridgford Road provides access to Newton village to the south. Both A6097 approaches are characterised by two lanes, one of which is a dedicated right turn lane, with the other used for ahead and left movements. Both Kirk Hill and East Bridgford Road are single lane approaches.
- 2.3.26 The junction is in a rural location, predominantly bordered by agricultural land. Residential dwellings are located in an area of land between the A6097 and Kirk Hill.
- 2.3.27 A narrow footpath runs east-west along the northern side of the A6097. At the junction with Kirk Hill, the footpath diverts from the A6097 and continues along Kirk Hill into the village of East Bridgford. There is no crossing provision for walkers, cyclists, or horse riders at the junction currently.

2.4 Project Description

- 2.4.1 General arrangement plans can be viewed in Appendix B: Design Layout and EIA scoping boundary Plans.
- 2.4.2 For the purposes of this Scoping Report, a scoping boundary has been shown on the plans. Small changes may be made to this boundary prior to the submission of the ES and planning applications to form the final red line planning boundary, and to indicate temporary and permanent land take requirements.

Ollerton Roundabout

- 2.4.3 It is proposed to enlarge the existing Ollerton Roundabout. The junction currently has six approaches, and this would be reduced to five (removing the bus-only arm Newark Road, which would realign to join the A616 Ollerton Road arm).
- 2.4.4 The Inscribed Circle Diameter (ICD) of the roundabout would be increased from 37.5 m to 60 m. Approaches from all directions would be widened to provide two entry lanes onto the roundabout.
- 2.4.5 Toucan crossing points (a crossing with signal controls) for both pedestrians and cyclists would be provided on the A6075 Mansfield Road and the A614 Old Rufford Road.
- 2.4.6 Permanent land take beyond the highway boundary would be required. The area of land within the scoping boundary is approximately 3.1 ha.

Mickledale Lane Junction

- 2.4.7 There are currently two options proposed for this junction. Prior to submission of planning applications, a decision will be made as to which design will be taken forward. As noted in Chapter 4 of this report, there is some additional public consultation to be undertaken on these options prior to the decision being made.
- **Option 1** would introduce traffic signals to the existing junction, with two entry lanes for both A614 approaches. This would require permanent use of a strip of land outside the highway boundary to the west, both north and south of the existing junction. A new access road for the houses to the south-east of the junction from Mickledale Lane, would be provided to the rear of the houses, requiring some permanent land take from the adjacent field. The area of land within the scoping boundary is approximately 2.4 ha; and
 - **Option 2** would see the construction of a new three-arm roundabout on the A614 to the south of the existing junction. A new link road would connect the A614 and Mickledale Lane passing through a field to the south-east of the existing junction. The new link road would tie into Mickledale Lane via a second three-arm mini-roundabout. Mickledale Lane would be closed off to vehicles leaving the A614 and become a cul-de-sac accessed from the east, from the new link road. A new road access would be provided off the new link road into Strawson's Ltd premises to the east. This would require permanent use of part of the land to the east of the A614. The area of land within the scoping boundary is approximately 9.6 ha.

White Post Roundabout

- 2.4.8 The works proposed at White Post Roundabout are road safety and maintenance works. This would involve carriageway maintenance and repairs and the provision of high friction surfacing on carriageway entries and may include revisions to signage, drainage, carriageway lining and street lighting upgrades.
- 2.4.9 The area of land within the scoping boundary is approximately 1.6 ha. No land take beyond the highway boundary is required.

Warren Hill Junction

- 2.4.10 At this junction geometric improvements would be undertaken, the existing gyratory (where the A6097 gives way to traffic on the A614) would be simplified with the inclusion of an extended merge lane where the A614 Old Rufford Road

northbound merges with the A614 Ollerton Road as it loops around the southern side of the gyratory. This would require a small amount of carriageway reconstruction along with new white lining.

- 2.4.11 The area of land within the scoping boundary is approximately 2.4 ha. No land take beyond the highway boundary is required.

Lowdham Roundabout

- 2.4.12 It is proposed that an enlarged four-arm elliptical roundabout be constructed to replace the existing roundabout. This would have a two-lane circulatory carriageway and include a third left turn filter lane on the A612 Nottingham Road (eastbound) approach to the junction. A new access road would be provided from the A612 Nottingham Road to access the four properties on the south side of the road, closest to the roundabout.
- 2.4.13 Toucan crossing points for both pedestrians and cyclists would be provided on both carriageways of the A6097 Epperstone Bypass north-west of the roundabout.
- 2.4.14 This would require permanent land take associated with the westbound arm of the A612 and the new access road. The area of land within the scoping boundary is approximately 2.9 ha.

Kirk Hill Junction

- 2.4.15 Proposed improvements at this junction consist of:
- Localised widening of the A6097 junction approaches to provide separate right turn lanes into Kirk Hill and East Bridgford Road;
 - Widening works to provide two straight ahead lanes in both directions on the A6097;
 - Traffic signal improvements to the existing junction;
 - A reduction in the speed limit to 50 mph to make this consistent with the rest of the corridor;
 - A retaining structure adjacent to the northbound carriageway; and
 - Localised widening on Kirk Hill to facilitate easier negotiation of left turns into the side road.
- 2.4.16 This would require an area of permanent land use to the north-east of the Scheme. The area of land within the scoping boundary is approximately 3.6 ha.

2.5 Construction, Operation and Long-Term Management

Construction

- 2.5.1 Detailed construction information is not yet available, however anticipated Scheme construction start dates and opening years can be viewed in Table 2-1. Construction of the Project would be undertaken over an approximate three-year timeframe, with individual Scheme construction start dates being spread out over this period.
- 2.5.2 For the purposes of the assessment, an Opening Year of 2023 has been used to match the traffic modelling that has been completed to date. This uses an

assumption that all junctions are open in 2023. The Design Year (or Future Year) for assessment is 15 years post opening, 2038.

Table 2-1: Scheme Anticipated Construction Start Dates and Opening Years

Scheme Name	Construction Start Date	Opening Year
Ollerton Roundabout	Winter 2023	Autumn 2024
Mickledale Lane Junction	Summer 2025	Spring2026
White Post Junction	Spring 2025	Spring2025
Warren Hill Junction	Winter 2023	Winter 2023
Lowdham Roundabout	Autumn 2024	Spring 2025
Kirk Hill Junction	Summer 2023	Spring 2024

2.5.3 During construction there may be a requirement for some temporary road diversion, road closures and diversions of pedestrian footways across the junctions.

2.5.4 Night-time closures are likely to be required to complete the works. It is anticipated that traffic would be diverted to the A1 for the duration of the closure.

2.5.5 Construction compound locations are proposed to be included within the land show within the scoping boundary. There may also be a need to use the existing Bilsthorpe Maintenance Compound for storage during the construction of Ollerton Roundabout and Mickledale Lane Junction.

Operation and Long-Term Management

2.5.6 Operation and long-term management of the Project will remain the responsibility of NCC as the local highway authority. The maintenance of landscape planting would be the responsibility of NCC.

3. ASSESSMENT OF ALTERNATIVES

3.1 Assessment Methodology

3.1.1 The EIA process provides an opportunity to consider alternative development options with their respective environmental effects before a final decision is taken on the design. In accordance with the EIA Regulations and the DMRB LA 104 Environmental Assessment and Monitoring (Highways England, 2020a) the ES will describe those alternatives that were considered.

3.1.2 This chapter provides an overview of the development of the Project to date.

3.2 Reasonable Alternatives Studied

Non-Car Options

3.2.1 Early discussions explored potential public transport solutions to address the issues along the A614/A6097 as shown in **Error! Reference source not found..**

Table 3-1: Non-Car Alternatives Considered

Potential Measure	Assessment	Conclusion
Improvements to the existing bus network (increase frequency, express service, bus priority at junctions etc).	This is unlikely to have any impact on the road network in terms of modal shift. Limited numbers travelling from Ollerton to Nottingham and vice versa.	DISMISS.
Improvements to Rail System (Dukeries Line)	Not a viable short-term option, this is a long term opportunity.	DISMISS. However, has the potential to add resilience if and when constructed in the long term (2030).
Investment in cycling and walking infrastructure	Limited local impact anticipated. Scheme area too remote and rural to make any difference to modal shift.	DISMISS. However potential to improve facilities at individual junctions should be considered.

3.2.2 The A614 is served by the Sherwood Arrow service which has an hourly frequency from Ollerton to Nottingham. The route passes through Redhill, Farnsfield, Bilsthorpe, Rufford Country Park, Sherwood Forest and Ollerton. The route takes approximately 65 minutes to travel from Ollerton to Nottingham in the AM peak and 77 minutes in the PM peak. The journey times in the other direction (Nottingham to Ollerton) are 71 minutes in the AM peak and 67 minutes in the PM peak.

3.2.3 Increasing the frequency of the service by subsidising the route during the peak time periods was found unlikely to result in any noticeable shift in modal share because the journey length would still not compare favourably with car travel.

3.2.4 A more direct express service (say from Ollerton to Nottingham only) was also dismissed because the existing service is mainly used by passengers to get to the other villages along the corridor.

3.2.5 NCC does have a safeguarded bus-based park and ride (P&R) scheme at the A60/A614 Leapool roundabout. In the event of the park and ride scheme being

implemented, whilst it would undoubtedly be used by motorists travelling along the A614, the benefits will only be felt by those along the A60 corridor south of its proposed location and within Nottingham itself as it would reduce traffic flows on routes approaching the City Centre but will not make any difference to vehicular flows on the A614.

- 3.2.6 The overall conclusion at this stage was that the provision of standalone non-car options would be unlikely to deliver any meaningful benefit to the A614/A6097 corridor. However, improvements to walking and cycling facilities at individual junctions on the corridor were worth further consideration once a junction package had been identified.

Long List Highways Intervention Options

- 3.2.7 An early options development exercise was undertaken that produced a long list of twelve potential interventions:

- **Intervention 1** – Continuation of Dual Carriageway from A6097 Epperstone Bypass to Ollerton roundabout;
- **Intervention 2** - Ollerton roundabout capacity improvement;
- **Intervention 3** - Ollerton bypass;
- **Intervention 4** – Rose Cottage (Centre Parcs) Capacity Improvement;
- **Intervention 5** – Deerdale Lane, Bilsthorpe – Junction upgrade;
- **Intervention 6** – Mickledale Lane, Bilsthorpe – Junction upgrade;
- **Intervention 7** – White Post roundabout – Capacity Improvement;
- **Intervention 8** – Warren Hill – Junction upgrade;
- **Intervention 9** – Ton Lane/Epperstone Bypass – Capacity Improvement;
- **Intervention 10** – Lowdham roundabout – Capacity Improvement;
- **Intervention 11** – Gunthorpe Bridge – dual carriageway; and
- **Intervention 12** – Kirk Hill, East Bridgford – Capacity Improvement.

- 3.2.8 These intervention options were initially combined into a total of four packages as follows and shown in Table 3-2:

- **Package 1:** Dual carriageway from Epperstone Bypass to Ollerton and junction upgrades at all junctions (interventions 2 and 4 to 12);
- **Package 2:** Ollerton Bypass only;
- **Package 3:** Upgrade between Ollerton and Lowdham roundabouts only; and
- **Package 4:** Package 3 but without Rose Cottage and Ton Lane junctions.

Table 3-2: Long List Intervention Packages

	Interventions											
	1	2	3	4	5	6	7	8	9	10	11	12
Package 1	Green	Green	White	Green	Green	Green	Green	Green	Green	Green	Green	Green
Package 2	White	White	Green	White	White	White	White	White	White	White	White	White
Package 3	White	Green	White	Green	Green	Green	Green	Green	Green	Green	White	White
Package 4	White	Green	White	White	Green	Green	Green	Green	White	Green	White	White

Addition of Intervention 12: Kirk Hill Junction

- 3.2.9 The Kirk Hill junction (Intervention 12) was originally omitted from consideration because there were already proposed Section 278 works scheduled to improve the junction as part of the RAF Newton development site. The subsequent analysis at this junction indicated that the proposal put forward by the developer was not suitable and would not provide the level of capacity improvements required to meet the forecast traffic demand from the development site and growth. The existing problems at this junction and need for an improvement scheme were reinforced by comments made at the Lowdham public consultation events by regular users of the junction in August 2019.
- 3.2.10 It was decided that a more significant junction upgrade was required at Kirk Hill and that this would help deliver the Scheme objectives. An improvement to the Kirk Hill traffic signal-controlled junction was subsequently added to the package and this became package 5 (Table 3-3).

Table 3-3 Package 5: Package 4 with the inclusion of Intervention 12 Kirk Hill

	Interventions											
	1	2	3	4	5	6	7	8	9	10	11	12
Package 5	White	Green	White	White	Green	Green	Green	Green	White	Green	White	Green

Removal of Intervention 5: Deerdale Lane

- 3.2.11 After a further round of scheme design and costing it became evident, that following the return of significant utility diversion cost estimates for the A614 Deerdale Lane junction in October 2020, that the Deerdale Lane junction improvement scheme would be disproportionately expensive to construct and the large increase in costs would have had a severe detrimental impact on the Benefit Cost Ratio for the overall A614/A6097 Project. As a result, the proposed Deerdale Lane junction improvement scheme was dropped from the package of measures to improve the corridor, resulting in Package 6 (Table 3-4).

Table 3-4: Package 6: Package 5 minus Intervention 5: Deerdale Lane

	Interventions											
	1	2	3	4	5	6	7	8	9	10	11	12
Package 6												

Alternative Highways Solutions

3.2.12 Consideration was also given to low-cost demand management and traffic management solutions such as speed limit changes to the A614/A6097 corridor. There was potential scope to increase and decrease the speed limit along the route from 50mph.

- **Package 7** – Increase speed limit on A614/A6097 to 60mph; and
- **Package 8** – Reduce speed limit on A614/A6097 to 40mph.

Long List Sifting Conclusion

3.2.13 The combinations were entered into the DfT Early Assessment and Sifting Tool (EAST) to help inform the original business case that was submitted to the DfT in May 2019. EAST is a decision support tool provided by the DfT which can quickly summarise and present evidence on options in a clear and consistent format.

3.2.14 On completion of the EAST sifting, **Package 6** was selected as the preferred package as it was found to meet the Scheme objectives, fit with local and regional transport strategies, have relatively more acceptable and mitigatable impacts in comparison to other packages, was more acceptable to local stakeholders and provided good economic benefits.

Scheme Design Development

3.2.15 After the completion of the long list sifting, the options noted in Table 3-5 were carried forward for further consideration.

3.2.16 Since this initial options assessment process, a new option has been identified for Mickledale Lane Junction Option 2 which was not part of the early sifting but is noted in Table 3-5 below.

Table 3-5 Alternative Scheme Design Options

Scheme	Option Name	Design Description	Preferred Option
Ollerton Roundabout Junction	Option 1c	An enlarged conventional roundabout; it proposes five arms, with the bus-only link road realigned onto the A616 Ollerton Road arm.	Both Option 1c and 1d generate significant journey time benefits over the assessment period. However, Option 1d would have a larger overall footprint resulting in a greater negative impact on a number of environmental areas including ecology, landscape, air quality and noise. The
	Option 1d	Use of traffic signals on four of the arms, as well as three sets of traffic signals. The bus-only link road to be diverted onto the A616 Ollerton Road to allow the	

Scheme	Option Name	Design Description	Preferred Option
		junction to work as a five-arm signalised junction.	preferred option is Option 1c, to retain a standard roundabout layout.
Mickledale Lane Junction	Option 3a	Signalisation of the junction with two entry lanes southbound and only one entry lane northbound.	There is very little difference in land take between Options 3a and 3b but 3b would provide significantly more traffic capacity. Option 3c would require the largest amount of third-party land (including residential properties) which would not have been publicly acceptable and was dismissed on those grounds. A decision on Options 3b (referred to as Mickledale Lane Option 1 in this report) and Mickledale Lane Option 2 is still to be made.
	Option 3b	Expanded Option 3a by including two entry lanes for both A614 approaches.	
	Option 3c	Construction of a conventional four-arm roundabout.	
	Mickledale Lane Option 2	Construction of a new three-arm roundabout on the A614 to the south of the existing junction	
White Post Junction	Option 4a	Widening of entry lanes on the A614 approaches creating capacity improvements.	Following careful consideration of the options to improve the traffic carrying capacity of this junction it became clear that the availability of land to permit a meaningful improvement scheme was limited due to development on all four corners of this junction. It was therefore decided that, in order to ensure network resilience and to ensure that this junction continues to perform as effectively and as safely as possible, the junction would be improved in situ with Option 4d.
	Option 4b	Signalisation of all four arms of the junction.	
	Option 4c	Closing of the Mansfield Road arm (west) except for access so that the junction mainly functioned as a three-arm roundabout.	
	Option 4d	A road safety scheme involving anti-skid road surfacing and minor maintenance improvements.	
Warren Hill Junction	Option 5a	Construction of a three-arm signalised junction.	Option 5c was selected based on the need for less third-party land and lower cost whilst simplifying the unusual and confusing layout.
	Option 5b	Enlarged conventional roundabout	
	Option 5c	Geometric improvements to replace the existing priority controlled gyratory where traffic on the A6097 gives way to traffic on the A614.	

Scheme	Option Name	Design Description	Preferred Option
Lowdham Roundabout	Option 6a	Construction of an enlarged four-arm conventional roundabout with two lane proposed circulatory carriageway.	Option 6c was chosen as the elliptical roundabout option 6c delivers significant journey time benefits against a traffic signalled option and has less environmental impact than the alternative conventional roundabout layout.
	Option 6b	Signalisation of all four arms.	
	Option 6c	An elliptical roundabout with a third left turn filter lane incorporated on the A612 eastbound approach.	
Kirk Hill Junction	Option 7a	Localised widening of the A6097 junction, provision of two straight ahead lanes in both directions, traffic signal improvements, a retaining structure on the northbound carriageway, and localised widening on the Kirk Hill to facilitate easier negotiation of left turns into the side road.	Option 7a was chosen as this was considered to deliver the greatest benefit to reduce disruption to the flow of traffic on the A6097 and improve safety for left turning vehicles with the least environmental impact.
	Option 7b	Localised widening of the A6097 junction approaches, provision of two straight ahead lanes in both directions, traffic signal improvements, a retaining structure on the A6097 northbound carriageway and realignment of Kirk Hill to bring it in line with current design standards and to provide additional traffic capacity; and provision of a mini roundabout to facilitate access to the old Kirk Hill which would be stopped up (with a turning head).	

4. CONSULTATION

4.1.1 This section notes previous and planned consultation in relation to the Project. Further details where relevant to the EIA will be provided in the ES.

4.2 Previous Consultation

Previous Scoping Opinion for Ollerton Roundabout

4.2.1 In June 2019 a request for a scoping opinion for proposals at Ollerton Roundabout and a screening request for Mickledale Lane, Deerdale Lane, Warren Hill and Lowdham Roundabout were submitted to NCC Planning (as the relevant planning authority).

4.2.2 No formal scoping opinion was issued at the time however responses were made available from key consultees, which have been used to inform the scope of the assessment presented in this report.

4.2.3 Responses were received from the following Statutory Consultees:

- Environment Agency;
- Historic England (Ollerton Roundabout only);
- Nottinghamshire County Council Nature Conservation Team;
- Nottinghamshire County Council Highways Development Control;
- Nottinghamshire County Council as Lead Local Flood Authority;
- Natural England; and
- Newark and Sherwood District Council.

Natural England

4.2.4 Initial discussions were undertaken with Natural England in July 2019 regarding Ollerton Roundabout.

4.2.5 The Birklands and Bilhaugh Special Area of Conservation (SAC) was of concern to Natural England as the site contains habitats which are sensitive to changes in air quality, and currently exceeds the critical load for nitrogen deposition (Air Pollution information System (APIS), accessed May 2021)).

4.2.6 Mitigation through landscaping design to create a barrier of vegetation was discussed, along with mitigation for the direct loss of habitat from Birklands West and Ollerton Corner SSSI as a result of the Scheme.

4.2.7 Natural England requested that a biodiversity net gain (BNG) assessment was prepared to demonstrate that habitats will be left in a measurably improved state than they are currently. Off-site mitigation was agreed to be an appropriate approach to compensate for the loss of habitat from the SSSI due to the limited space within the highway verge.

Nottingham County Council – Archaeology

4.2.8 Discussions between Via and NCC archaeological representatives were undertaken in April 2021. As a result, it has been determined that an

archaeological watching brief is to be provided during construction (ground works phase) for the following Schemes:

- Ollerton Roundabout;
- Mickledale Lane Junction; and
- Kirk Hill Junction.

Public Consultation

- 4.2.9 There have been two major consultation events held so far. The first took place in the summer of 2019, with six consultation exhibition dates showcasing the early designs for Ollerton Roundabout, Mickledale Lane, White Post Roundabout, Warren Hill Junction and Lowdham Roundabout. Leaflets were distributed throughout each village near the A614/A6097 corridor to inform the public of the events.
- 4.2.10 The feedback from the first six events showed that the proposed improvements to Ollerton Roundabout and Mickledale Lane Junction were well received, however the proposals for Lowdham Roundabout were not. This led to reconsideration of the proposals at Lowdham Roundabout.
- 4.2.11 The second consultation event in November 2020 focused on the revised Lowdham Roundabout proposal and the introduction of Kirk Hill Junction to the Project. Unfortunately, COVID-19 meant face to face interaction with the public was not feasible, so a virtual consultation room was used in place of face to face events. The revised proposals were well received.

4.3 Future Planned Consultation

- 4.3.1 Further public consultation regarding the two Mickledale Lane options has commented in May 2021. As COVID-19 restrictions are still in place, this is also planned to be undertaken through a virtual consultation room in place of face to face events.
- 4.3.2 It is intended that further engagement will be undertaken with Natural England, in the preparation of the ES, specifically in relation to mitigation around Ollerton Roundabout. The purpose of this engagement is to introduce the Project and to understand any concerns around potential environmental effects. Any responses received will be used to inform the EIA.

5. ENVIRONMENTAL ASSESSMENT METHODOLOGY

5.1 Surveys and Predictive Techniques and Methods

5.1.1 This Scoping Report identifies the topics that will be covered in the environmental assessment and provides details on how the studies will be assessed and reported so that:

- Features of environmental importance that could be affected by the Scheme are identified and evaluated;
- Analysis of the impacts and potential effects during construction and operation of the Scheme are undertaken;
- Appropriate mitigation measures are identified;
- The significance of effects is assessed; and
- Cumulative effects are considered.

5.1.2 The environmental assessment process is designed to be capable of, and sensitive to, changes that occur as a result of changes to the design, including any mitigation measures that are incorporated during the process.

5.1.3 The preparation of this Scoping Report has followed the DMRB LA 103 Scoping Projects for Environmental Impact Assessment (Highways England, 2020b), and the DMRB LA 104. This has taken account of other topic-specific requirements set out in DMRB as referenced in each topic Chapters 6 – 15.

5.1.4 The assessment scope presented has been informed through:

- Online databases and records;
- Online mapping tools;
- Published reports; and
- Aerial photography.

5.1.5 The topics considered within this scoping assessment are as follows:

- Air Quality;
- Cultural Heritage;
- Landscape and Visual;
- Biodiversity;
- Geology and Soils;
- Material Assets and Waste;
- Noise and Vibration;
- Population and Health;

- Road Drainage and the Water Environment; and
 - Climate.
- 5.1.6 The potential for combined and cumulative effects will be considered as a separate assessment chapter as noted in Chapter 16 of this report.
- 5.1.7 The assessment of environmental effects will be undertaken in accordance with DMRB criteria as described in each of the topic Chapters 6 – 15.
- 5.1.8 Identified environmental constraints and receptors can be viewed Figures 5-1 to 12-7, located in Appendix A: Figures.
- 5.1.9 The EIA Regulations require that a description of the likely significant effects should also include consideration of the emissions of heat and radiation as a result of the project. During the construction phase, emissions of heat would be limited to heat generated on a temporary basis by construction equipment typically associated with the ground works and road construction projects. During the operation phase no heat emissions are anticipated. The Project is not anticipated to produce emissions of radiation during either the construction or operational phase. Therefore, the process of scoping concludes there is no potential for heat and/or radiation to occur given the nature and characteristics of the Project. The topics of heat and radiation have not been included further within this Scoping Report.
- 5.1.10 The EIA Regulations require the consideration of any likely significant effects on the environment of another European Economic Area (EEA) Member State. Consideration has been given to whether the Project alone or cumulatively with other development has the potential to result in transboundary impacts, taking account of factors including: the characteristics of the Project; its geographical location and relationship to other EEA States; the means by which potential effects could combine (or be carried); and the importance of the receiving environment; and the magnitude, extent, probability, duration, frequency and reversibility of potential impacts. It is considered that the Project:
- Would be implemented at a considerable distance from the nearest EEA States (Ireland and France);
 - Has the potential to combine with other development projects to give rise to greater environmental effects which would not extend beyond the adopted assessment study area(s) within England; and
 - Could give rise to increased greenhouse gas emissions as a result of vehicle exhaust emissions once operational, which have the potential to be carried beyond the locality of the Project, but which would not be of a sufficient order to significantly contribute to global climate change (and thereby affect other EEA States).
- 5.1.11 Accordingly, it is proposed to scope out transboundary impacts from the assessment.
- 5.1.12 The EIA Regulations also require the consideration of effects associated with the risk of major accidents and disasters. For the Project, the proposed options are similar to the existing road infrastructure in development terms, therefore it is considered that the associated risk of event will be equally similar and will not affect decision making. On this basis, consideration of major accidents and disasters is not considered further in this Scoping Report.

5.2 General Assessment Assumptions and Limitations

- 5.2.1 The scope of assessment described in this Scoping Report is based on information available at the time of preparing this report and on the Scheme designs as described in Chapter 2. The assessment will be undertaken using the third party and publicly available information described in Chapters 6 to 15.
- 5.2.2 This Scoping Report has been prepared using the design drawings included in Appendix B of this report. The scoping boundaries and land requirements are only indicative at this stage. The areas of land required for each of the Schemes, temporarily or permanently, will be refined at later stages in the design process as a preferred design emerges and further information is known, such as the location of construction compound(s).
- 5.2.3 Some site surveys have been undertaken to inform the Scoping Report, as noted in the Chapters 6 to 15. However, there remains further site visits, surveys and intrusive site investigations to be carried out as part of the preparation of the ES.
- 5.2.4 A detailed construction programme is not available at the time of writing. However, it is anticipated that construction of the Project would be undertaken between Winter 2023 and Spring 2026 (as outlined in Section 2.5).

5.3 Significance Criteria

- 5.3.1 Each technical topic has outlined the existing baseline conditions; identifying the receptors and resources likely to be affected by the Schemes. Where appropriate, each receptor has been assigned a value (or sensitivity) to potential impacts, as set out in the methodology presented within each topic chapter.
- 5.3.2 The magnitude of the impact, or scale of change, in comparison to baseline conditions as a result of construction or the operation of the Schemes is then determined, with consideration of any design and mitigation measures. Where it is not possible to quantify impacts, qualitative assessments will be carried out using reasoned argument and professional judgement. Where uncertainty exists, this will be noted in each chapter of the ES.
- 5.3.3 The effect of the Schemes is classified by combining the value or sensitivity of the receptor and the magnitude of impact. An example of how the significance of an effect may be classified is given in Table 5-1 which is reproduced from DMRB LA 104 Table 3.8.1.
- 5.3.4 Each topic may have its own method for classifying effects, based on the relevant standards, guidance or accepted criteria, where available. Topics which will use the below matrix include cultural heritage, geology and soils, road drainage and the water environment and the assessment of cumulative effects. Landscape and visual, air quality, noise and vibration, biodiversity, material assets and waste, people and human health, and climate use a topic-specific classification system based on relevant DMRB standards, informed by other relevant guidance as appropriate. This is set out within each of the topic Chapters 6 – 15.

Table 5-1: Significance Matrix (reproduced from DMRB LA 104)

		Magnitude of Impact (degree of change)				
		No change	Negligible	Minor	Moderate	Major
Environmental Value (sensitivity)	Very High	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

- 5.3.5 Where the effect significance is concluded to be Neutral or Slight; Slight or Moderate; Moderate or Large; or Large or Very Large, professional judgement will be used to derive a specific category of significance and the rationale provided in the ES.
- 5.3.6 Effects are generally considered significant if they are Moderate, Large and Very Large. Generally, Slight and Neutral effects are not considered to be significant

6. AIR QUALITY

6.1 Introduction

6.1.1 AECOM has prepared this chapter to outline the scope of assessment with regard to the Project.

6.1.2 This chapter sets out the approach and methodology that will be used in the assessment of effects on air quality during the construction and operation of the Schemes.

6.2 Study Area

6.2.1 The air quality study area for the operation of the Scheme will be determined in accordance with DMRB LA 105 Air Quality (Highways England, 2019a). An affected road network (ARN) will be defined on the basis of changes in traffic conditions (flow, speed, and fleet composition) and road alignment.

6.2.2 An affected road link is defined as a road that experiences one or more of the following changes with the Scheme in operation, as per the screening criteria set out in DMRB LA 105:

- Annual average daily traffic (AADT) $\geq 1,000$;
- Heavy duty vehicle (HDV) AADT ≥ 200 ;
- A change in speed band; and
- A change in carriageway alignment by ≥ 5 m.

6.2.3 The study area will consist of air quality sensitive receptors within 200 m of the ARN.

6.2.4 The air quality assessment will also consider construction air quality impacts with a study area of 200 m from the Scoping boundary.

6.2.5 Early traffic modelling has indicated that the study area is restricted to each junction and the roads leading into and out of the junctions.

6.3 Existing and Baseline Conditions

Air Quality Management Areas

6.3.1 Air Quality Management Areas (AQMAs) are declared by local authorities in areas where they consider that the national air quality objectives (AQO) for one or more pollutants, as set out in the Air Quality Standards Regulations 2010, are not likely to be achieved.

6.3.2 There are no AQMAs within the study area of any of the Schemes. The nearest AQMA is AQMA No.2 declared by NCC and associated with the centre of the City of Nottingham. AQMA No.2 is located approximately 8.5 km to the west of the A6097 outside of the anticipated study area.

Air Quality Monitoring

6.3.3 Baseline air quality monitoring data for the study area has been gathered from the following sources:

- RBC 2020 Annual Status Report (ASR); and
- NSDC 2020 ASR.

6.3.4 There is no nitrogen dioxide (NO₂) monitoring undertaken by RBC within the study area. Monitoring undertaken by NSDC has indicated that there are no exceedances of the AQO for NO₂ (of 40 µg/m³) within the study area.

6.3.5 NSDC undertakes monitoring at one location in the study area (referred to by NSDC as ‘the Big Fish Roundabout Ollerton’, which is now Costa Coffee), which is located at the Ollerton Roundabout Scheme. Annual mean NO₂ concentrations at this location have remained below the AQO since 2016. Details of this monitoring location are shown in Table 6-1.

Table 6-1: NO₂ Monitoring in Newark and Sherwood District 2016 – 2019

Site ID	X	Y	Location	NO ₂ Annual Mean Concentration (µg/m ³)			
				2016	2017	2018	2019
18N	465090	367595	A614, North of Big Fish Roundabout, Ollerton (Costa Coffee)	36.0	34.6	33.9	32.1

6.3.6 As this is the only monitoring location within any of the Scheme study areas, this monitoring location will be used across for all Schemes to verify the air quality model. The Scheme study areas are all similar enough to deem this an appropriate mitigation for the lack of monitoring data, and the approach has been agreed with both NSDC and RBC.

6.3.7 No monitoring of particulate matter (PM₁₀) is undertaken by NSDC or RBC within the study area.

Pollutant Background Maps

6.3.8 Information on background pollutant concentrations in the study area has been gathered from the Department for the Environment Food and Rural Affairs (DEFRA’s) 2018-based background concentration maps (DEFRA website, 2020a).

6.3.9 Annual mean background pollutant concentration estimates for 1km grid squares throughout the UK are available from Defra for the years 2018 – 2030 based on 2018 reference year projections. These have been sourced from Defra’s 2018-based background maps for the study area for NO₂ and PM₁₀.

6.3.10 Contributions from trunk A-roads and primary A-roads within the grid squares of the background maps have been removed from the mapped concentrations using the Sector Removal Tool v8.0 provided by Defra (DEFRA website, 2020b), as these sources will be explicitly modelled in the assessment.

6.3.11 The range of background concentrations for each 1 km x 1 km square intersecting the study area for the baseline year is presented in Table 6-2. Background concentrations are predicted to be below the AQOs in all areas. In years subsequent to 2018 background concentrations are predicted to decrease year-on-year. This trend is reflected in the projected background concentrations for the Opening Year of 2023, which are also presented in Table 6-2.

Table 6-2. Summary of estimated background pollutant concentrations across the study area in the base year and Opening Year

Statistic	Background Annual Mean NO ₂ (µg/m ³)		Background Annual Mean PM10 (µg/m ³)	
	2018	2023	2018	2023
Minimum	7.2	6.2	12.0	11.1
Average	9.1	7.6	15.5	14.6
Maximum	18.5	15.7	19.6	18.6

Compliance Information

6.3.12 Information on compliance with the Air Quality Directive (2008/50/EC) in the study area has been gathered from Defra’s 2018 Pollution Climate Mapping (PCM) Model (DEFRA, 2020a) for link by link information.

6.3.13 There are no PCM links within the study area.

Receptors

6.3.14 There are two types of air quality sensitive receptors that will be considered in the local air quality assessment as follows:

- Public Exposure Receptors - these are sensitive locations where relevant exposure for the air quality criteria being assessed could occur e.g. residential properties or schools. These locations are defined by Local Air Quality Management, Technical Guidance (DEFRA, 2016a); and
- Designated habitats such as Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC), Special Protection Areas (SPA) and sites listed under the Convention on Wetlands and Wildfowl (Ramsar), Local Nature Reserves (LNR), Local Wildlife Sites (LWS), Nature Improvement Areas, ancient woodland and veteran trees.

6.3.15 For the construction phase of the Scheme, sensitive receptors that may be affected include those outlined above and other receptors that may be sensitive to the deposition of dust (e.g. parks, car parks, museums). Construction dust specific receptors include such receptors located within 200 m of each Scoping boundary and those located adjacent to roads close to construction site access points.

6.3.16 Relating to road traffic emissions during construction and operation, there are public exposure receptors consisting of residential properties located within 200m of the Scheme which may be affected. In addition, it is possible that there will be further sensitive receptors within 200 m of the ARN. These will be identified once traffic data for assessment is available.

6.3.17 There are designated ecological sites within 200 m of the Schemes, including Birklands West and Ollerton Corner SSSI, Birklands and Bilhaugh LWS and Sherwood Heath LNR and LWS. There are also habitats included within the Sherwood Area Possible Potential Special Protection Area (ppSPA) within 200m. All designated ecological sites within 200 m of the ARN will be identified by project ecologists once traffic data is available and considered as part of the air quality assessment.

6.4 Potential Effects

Construction

- 6.4.1 Construction activities have the potential to give rise to adverse impacts from fugitive emissions of dust due to the realignment of roads, construction of new road links and road re-surfacing. These are likely to be temporary in nature and would be localised.
- 6.4.2 There may also be increases in particulate matter (PM₁₀) and NO₂ concentrations in certain locations due to emissions from construction traffic and plant (non-road mobile machinery) and from traffic management measures during the construction phase.

Operation

- 6.4.3 There is potential for air quality to be affected (positively or negatively) at sensitive receptors located close to the ARN due to changes in traffic conditions (flows, speeds and composition) as a result of the Schemes.
- 6.4.4 Changes in the layout of the Schemes may change the distance between sensitive receptors and road traffic, which also has the potential to affect air quality along with changes to the traffic flows and speeds through the junction.
- 6.4.5 The speed band, and in some instances the road alignment change criteria are expected to be triggered on roads within and surrounding the Schemes, and therefore in line with the criteria explained in Section 6.2, an air quality assessment is required.

6.5 Proposed Level and Scope of Assessment

Construction

- 6.5.1 A construction phase dust assessment will be undertaken. The key pollutants considered for the construction phase dust assessment are particulate matter with an aerodynamic diameter of less than 10 µm (PM₁₀) and dust (i.e. larger particles) with the potential to settle around construction sites and cause soiling/deposition effects on surfaces.
- 6.5.2 It is proposed that the following Schemes are scoped out of the construction dust assessment as these Schemes only involve minor improvements consistent with typical highway maintenance operations within the existing highway limits:
- White Post Roundabout; and
 - Warren Hill Junction.
- 6.5.3 Consideration of the potential effects from construction traffic is proposed to be scoped out of the assessment. As set out in DMRB LA 105, the impact of construction activities on vehicle movements shall be assessed where construction activities are programmed to last for more than two years. As noted in Table 2-1 within Chapter 2, the programme for each Scheme covers a period less than two years, while the full Project programme expected to cover a period of approximately three years. However, as the Schemes are distanced from each other by at least 2 km, consideration of the potential air quality effects associated with construction vehicle emissions is proposed to be scoped out for all Schemes.

Compliance Assessment

- 6.5.4 There are no road links which are part of Defra's 2018 PCM model (DEFRA, 2020c) within the expected ARN and so the Scheme will have no effect on the UK's compliance with the Air Quality Directive (2008/50/EC). This will be reconfirmed within the ES once the final ARN is identified.

6.6 Proposed Assessment Methodology Including Significance

General Assessment Methodology

- 6.6.1 The methodology for the air quality assessment will follow the guidance set out within the DMRB LA 105. The assessment includes the following elements:
- construction dust assessment to identify areas that could be affected by construction-phase activities;
 - local air quality assessment for the operation of the Scheme for public exposure and designated ecological sites; and
 - compliance risk assessment for NO₂.
- 6.6.2 The overall aim of the assessment for the elements listed above is to identify potential likely significant air quality effects and the effect of the Scheme on the UK's ability to comply with the Air Quality Directive (2008/50/EC).
- 6.6.3 Key methodology documents of relevance to the air quality assessment are:
- DMRB LA 105; and
 - Air Quality Management Technical Guidance (TG16) (LAQM.TG(16)) (Defra, 2019b).

Construction

- 6.6.4 The construction phase assessment requires the air quality assessor to determine the construction dust risk potential of the Scheme to the receiving environment, which informs the appropriate level of mitigation.
- 6.6.5 The construction dust risk potential is determined based on the following criteria:
- Large: large smart motorway projects, bypass and major motorway junction improvements; and
 - Small: junction congestion relief project i.e. small junction improvements, signalling changes, short smart motorway projects.
- 6.6.6 Sensitive receptor locations will be identified within 0-50 m, 50-100 m and 100–200 m from construction activity. The receiving environment sensitivity to construction dust is then determined according to Table 6-3.

Table 6-3 Receiving environment sensitivity to construction dust

Construction Dust Risk Potential	Distance from Construction Activities		
	0 to 50m	50 to 100m	100 to 200m
Large	High	High	Low
Small	High	Low	Low

Operation

- 6.6.7 The operational assessment will predict annual mean NO₂ concentrations for the baseline year (2018) and the Opening Year (2023) with the Scheme (DS) and without the Scheme (DM).
- 6.6.8 A detailed air quality assessment constitutes the following elements:
- Traffic input in the form of period flows (morning peak (AM), inter-peak (IP), afternoon peak (PM), and overnight (OP));
 - The use of a detailed air quality dispersion model; and
 - Identification of sensitive receptors including those likely to exceed AQOs.
- 6.6.9 Traffic data will be available for road links for a base year, and for the Opening Year both with and without the Scheme in place. Data will also be available for each of the AM, IP, PM and OP time periods including:
- Number of vehicles per hour;
 - Percentage of HDVs; and
 - Speed bands as defined by DMRB LA 105.
- 6.6.10 Using the traffic data provided, air quality predictions will be made for the following scenarios:
- Baseline year 2018;
 - Projected baseline year 2023;
 - Do Minimum Opening Year 2023 without the Scheme (DM); and
 - Do Something Opening Year 2023 with the Scheme (DS).
- 6.6.11 The assessment will use the latest version of the ADMS-Roads (v5) detailed dispersion model (Cambridge Environmental Research Consultant Ltd., 2020) to calculate the air quality predictions. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies.
- 6.6.12 ADMS-Roads calculates concentrations of pollutants emitted from roads using the following parameters:
- Spatial information of the modelled roads (location, geometry and road widths);

- Emission factors which account for vehicle numbers, composition, and speed;
- Meteorological information from a suitable nearby meteorological station; and
- Terrain information.

6.6.13 The outputs of ADMS-Roads are road-contributions to annual mean NOX concentrations (in $\mu\text{g}/\text{m}^3$) and annual mean road-contributions of PM₁₀ (in $\mu\text{g}/\text{m}^3$) concentrations at selected sensitive receptor locations.

Model Performance

6.6.14 When using modelling techniques to predict concentrations, it is necessary to make a comparison between the modelling results and available roadside monitoring data, to ensure that the model is reproducing actual observations. Where systematic bias is evident in the base year verification, the modelled results are factored to better match the monitoring data and reduce the overall uncertainty in the model predictions.

6.6.15 The Defra (2019b) LAQM.TG(16) guidance (Section 'Model Validation, Verification, Adjustment and Uncertainty', Paragraphs 7.509-7.546, will be followed. Annual mean NO₂ concentrations will be predicted at one monitoring site across the Project study area in the base year of 2018 and compared against the monitored concentration for that year. Adjustment factors will be derived to bring modelled concentrations into line with monitored concentrations, where necessary.

6.6.16 As NSDC's Big Fish Roundabout Ollerton location (the Big Fish restaurant is now a Costa Coffee café) is the only monitoring location within any of the Scheme study areas across the Project and will be used to verify the model for each Scheme. This approach is considered worse case as the monitoring site is located adjacent to the Ollerton Roundabout and in general, adjustment factors are higher at busier junctions than on quieter/free flowing sections of roads. This approach has been discussed with NSDC/RBC who have confirmed it is appropriate.

6.6.17 In the absence of appropriate PM₁₀ monitoring within the study area, the adjustment factors calculated for NO₂ will be applied to modelled PM₁₀ outputs, as recommended in LAQM.TG(16) (Defra, 2019b).

Public Exposure Receptors

6.6.18 Sensitive receptors are those where the AQOs apply, for example residential properties, schools, and hospitals. Sensitive receptors will be chosen to represent locations where pollutant concentrations are expected to be highest (those closest to the road, and those close to junctions) and where changes due to the Scheme are expected to be greatest. Model predictions are made at 1.5 m height to be representative of human exposure.

6.6.19 Receptor point locations will be identified using Ordnance Survey Mastermap (Ordnance Survey, 2020), Ordnance Survey Addressbase Plus (Ordnance Survey, 2020), and Google Earth (Google, 2020) mapping and imagery.

6.6.20 Predictions of total pollutant concentrations at receptors will be calculated by combining the verified modelled road pollutant contributions with background concentrations. Background concentrations are those from many sources not explicitly modelled which individually may not be significant, but collectively, over a large area, need to be considered.

- 6.6.21 The following post-processing methods will be applied to the dispersion model outputs:
- Adjustment factors derived via model verification (as noted above) will be applied to bring modelled concentrations into line with monitored concentrations;
 - Road contribution NO_x concentrations as outputted by ADMS-Roads will be converted to NO₂ concentrations using Defra's NO_x to NO₂ Calculator v8.1 (DEFRA, 2020d) for comparison against the AQO for NO₂; and
 - Highways England LTT_{E6} projection factors will be applied to the modelled DM and DS NO₂ concentrations to account for the observed gap between projected vehicle emission reductions and the estimated annual rate of improvement in annual mean NO₂.
- 6.6.22 The modelled annual average pollutant concentrations will be compared against the relevant AQOs and predicted exceedances identified. As set out in DMRB LA 105, annual mean PM₁₀ concentrations will be presented for the base year to demonstrate that pollutant concentrations are well below the objective value and therefore there is no risk of exceedance of these thresholds due to the Project.
- 6.6.23 Research projects completed on behalf of Defra and the Devolved Administrations (Laxen and Marner, 2003; AEAT, 2008) concluded that the hourly average NO₂ AQO is unlikely to be exceeded if annual average concentrations are predicted to be less than 60µg/m³. Therefore, this assessment will evaluate the likelihood of exceeding the hourly average NO₂ objective by comparing predicted annual average NO₂ concentrations at all receptors to an annual average equivalent threshold of 60µg/m³ NO₂. Where predicted concentrations are below this value, it can be concluded that the hourly average NO₂ objective is likely to be achieved.

Significance of Effects

- 6.6.24 Where a receptor is predicted to experience concentrations of NO₂ below the AQOs in both the DM and the DS scenario, it will not inform the judgement of significance.
- 6.6.25 Where annual mean concentrations of NO₂ at receptors are predicted to exceed the AQOs in the DM and/or DS, magnitude of change descriptors will be applied in line with DMRB LA 105 guidance as shown in Table 6-4.

Table 6-4: Definitions of the Magnitude of Change Criteria

Magnitude of change criteria	Concentration range applicable to:
Imperceptible	The change in concentration of NO ₂ between DM and DS is less than or equal to 0.4 µg/m ³ (≤1% of the AQO).
Small	The change in concentration of NO ₂ between DM and DS is greater than 0.4 µg/m ³ but less than or equal to 2.0 µg/m ³ (1-5% of the AQO).
Medium	The change in concentration of NO ₂ between DM and DS is greater than 2.0 µg/m ³ but less than or equal to 4.0 µg/m ³ (5-10% of the AQO).

Large The change in concentration of NO₂ between DM and DS is greater than 4.0 µg/m³ (>10% of the AQO).

6.6.26 The number of receptors assigned to ‘small’, ‘medium’ and ‘large’ change descriptors, for both worsening and improvement, will be tabulated as shown in Table 6-5.

6.6.27 Table 6-5 defines guideline bands that indicate a significant effect. Where the total number of receptors are greater than the upper guideline band in any of the magnitude categories the project shall trigger a significant air quality effect. Where the total number of receptors are smaller than the lower guideline band in any of the magnitude categories the project is unlikely to trigger a significant air quality effect.

Table 6-5 Guideline Band for the Number of Properties Informing a Judgement of Significant Air Quality Effects

Magnitude of change in annual mean NO ₂ (µg/m ³)	Total number of receptors with:	
	Worsening of an air quality objective already above the objective or the creation of a new exceedance	Improvement of an air quality objective already above the objective or the removal of an existing exceedance
Large (>4)	1 to 10	1 to 10
Medium (>2)	10 to 30	10 to 30
Small (>0.4)	30 to 60	30 to 60

6.6.28 Where the total number of receptors falls within the guideline bands in any of the magnitude categories the following criteria will be considered to inform the judgement of significance:

- the absolute concentration at each receptor i.e. is the modelled concentration 40 µg/m³ or 60 µg/m³;
- how many receptors are there in each of the magnitude of change criteria i.e. does the project create more worsening than improvements; and
- the magnitude of change in concentration at each receptor e.g. a modelled change in concentration of 1.8 µg/m³ would carry more weight than a change of 0.6 µg/m³ despite both falling within the 'small' magnitude of change category.

Designated Ecological Sites

6.6.29 As well as impacts on human health, some air pollutants also have an effect on vegetation. Concentrations of pollutants in air and deposition of particles can damage vegetation directly or affect plant health and productivity. Deposition of pollutants to the ground and vegetation can alter the characteristics of the soil, affecting the pH and nitrogen availability that can then affect plant health, productivity, and species composition. Increased greenhouse gas emissions on a global scale can affect the global climate, such that the ability of existing species to tolerate local conditions can change.

6.6.30 Internationally, nationally and locally designated sites of ecological conservation importance on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity (known as

designated sites) are also considered in the operational phase assessment. Designated sites include 'Ramsar' sites, Special Protection Areas (SPA), Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSSI), Local Nature Reserves (LNR), Local Wildlife Sites (LWS), Nature Improvement Areas (NIA), Ancient Woodland (AW) and veteran trees. The following sites are expected to be within the air quality study area:

- Birklands West and Ollerton Corner SSSI;
- Birklands and Bilhaugh LWS; and
- Sherwood Heath Local Nature Reserve (LNR) and LWS.

- 6.6.31 The final list of designated sites sensitive to nitrogen deposition to be included in the assessment will be confirmed with the project ecologists.
- 6.6.32 The pollutant of most concern for sensitive vegetation near roads is NO_x with a set level of 30 µg/m³ (annual mean) forming the critical load for designated ecological sites. Furthermore, critical loads for the deposition of nitrogen (N) representing the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem have been established for certain habitats and are expressed in deposition units of kg N/ha/year.
- 6.6.33 At each designated site, annual mean NO_x concentrations will be predicted along a transect, at 10 m intervals up to 200 m from the ARN. For each point along the transect, the road NO_x concentrations will be predicted for the base year, DM and DS in the Opening Year (following the methodology described above). The road NO_x concentration is converted to road NO₂ concentrations and then converted to dry nutrient nitrogen (N) deposition rate (kg N/ha/yr) using conversion rates outlined in the DMRB LA 105. The road N deposition rate is added to background N deposition rates derived from the Air Pollution Information System (APIS) (UK Centre for Ecology and Hydrology, accessed 2020) to determine total N deposition rates. These rates will then be compared to the critical loads for each designated site.
- 6.6.34 The process for assessing the significance of air quality effects at designated ecological sites from DMRB LA 105 will be followed. This states that if the total nitrogen deposition rate is under the critical load for the designated site in both DM and DS scenarios, or the change in total nitrogen deposition rate is less than 1% of the critical load, the effect is not significant. If these criteria are not met, further ecological assessment is required to determine whether the air quality effect is significant.

Compliance Risk Assessment

- 6.6.35 An assessment will be carried out in accordance with DMRB LA 105 guidance to evaluate the effect of the Scheme on the UK's ability to comply with the Air Quality Directive (2008/50/EC).

Overall significance determination

- 6.6.36 The overall significance of the Project with respect to air quality is determined for the construction phase and the operation phase.
- 6.6.37 In each case, the assessment of significance is informed by:
- The effects on human health (as determined by the significance of the local air quality assessment for public exposure receptors);

- The effects on designated habitats (as determined by the significance of the local air quality assessment for designated ecological sites); and
- The outcomes of the compliance risk assessment.

6.7 Assumptions and Limitations

6.7.1 A proportionate number of sensitive receptors will be assessed in areas expected to have the highest NO₂ and PM₁₀ concentrations and largest changes as a result of the Scheme.

Operation

6.7.2 To determine the appropriate level of assessment, both the project risk potential and sensitivity of receiving environment have been considered. Schemes which involve changes in road layout and speed banding where there are sensitive receptors in close proximity, are scoped into a detailed air quality assessment. The following Schemes are scoped into the operational assessment:

- Ollerton Roundabout;
- Mickledale Lane Junction Options 1 and 2;
- Lowdham Roundabout; and
- Kirk Hill Junction.

6.7.3 It is proposed that the following Schemes are scoped out of the operational assessment, as these Schemes only involve minor improvements consistent with typical highway maintenance operations within the existing highway limits:

- White Post Roundabout; and
- Warren Hill Junction.

7. CULTURAL HERITAGE

7.1 Introduction

- 7.1.1 AECOM has prepared this chapter to outline the scope of assessment with regard to the Project.
- 7.1.2 This chapter sets out the approach and methodology that will be used in the assessment of cultural heritage effects during the construction and operation of the Schemes.

7.2 Study Area

- 7.2.1 A study area of 500m around each Scheme has been adopted for consideration of designated and non-designated heritage assets. This has been informed by the DMRB LA 106 Cultural Heritage Assessment (Highways England, 2020c) which states that the study area defined for a Scheme should include the footprint of the Scheme and any land required where physical impacts to the heritage assets may occur, together with a defined study area that includes the settings of heritage assets where they lie either within the footprint of the Scheme, or within a zone of visual or aural influence.

7.3 Existing and Baseline Conditions

- 7.3.1 A desk-based review has been undertaken using publicly available information which includes:
- National Heritage List for England (NHLE) - the official online database for all nationally designated assets, including listed buildings, scheduled monuments, Registered Parks and Gardens, and Registered Battlefields (Historic England website, accessed December 2020);
 - Multi-Agency Geographic Information for the Countryside (MAGIC) mapping website (Defra, accessed December 2020); and
 - Nottinghamshire online Historic Environment Record (HER) at Heritage Gateway (website accessed December 2020).

Ollerton Roundabout

- 7.3.2 There are 11 listed buildings located within 500 m of the Scheme. These are all located to the east and south-east in Ollerton and comprise one Grade II* listed building and 10 Grade II listed buildings, these are detailed below along with their NHLE number.
- 7.3.3 The Grade II* listed building is Ollerton Hall (1045598), a c.1700 country house. The remaining Grade II listed buildings consist of:
- Boundary wall at Ollerton Hall (1157063);
 - Forest House Hotel (1045599);
 - Ollerton War Memorial (1462834);
 - Hop Pole Hotel and adjoining stable block and outbuilding (1157065);
 - K6 Telephone Kiosk opposite Hop Pole Hotel (1241206);

- Ollerton Watermill and adjoining Mill House (1157098);
- Curiosity Cottage and adjoining shop (1370161);
- Old Post Office (13202573);
- Church of St Giles (1045600); and
- White Hart Inn (1370162).

7.3.4 The Ollerton Conservation Area is also located directly to the east of the Scheme, the boundary of which runs to the Newark Road arm of the Ollerton Roundabout. The Conservation Area covers the western part of Ollerton, in which all of the listed buildings within the study area are contained.

7.3.5 There are several non-designated assets within 500 m of the Scheme, all located in Ollerton to the east of the roundabout. The closest non-designated asset to the Scheme is a bridge carrying Newark Road over the River Maun. The current bridge is a modern concrete bridge with stone parapets, although a predecessor to this bridge was recorded on Chapman's map of Nottinghamshire in 1774. The other assets mostly consist of non-designated, late 18th and 19th century buildings located within Ollerton Conservation Area.

Mickledale Lane Junction

7.3.6 There are no designated assets recorded within the study area of this Scheme (Option 1 and 2). The nearest listed building is 56, Kirklington Road (1045618), a Grade II listed 18th century house located in Bilsthorpe, approximately 1.6 km south-east of Option 1, and approximately 1.4 km east of Option 2.

7.3.7 There are three non-designated assets recorded within 500m of both options of the Scheme. Two of these are extant post-medieval buildings and comprise Featherstone House Farm, located approximately 250 m east of Option 1 and 110 m east of Option 2 and Labour in Vain Cottage, located approximately 390m east of option 1, 250 m east of option 2.

7.3.8 The remaining asset is a find of a Neolithic polished flint axe head. This was found approximately 230 m east of Option 1 and 100m east of Option 2.

7.3.9 There is also an additional asset located within the study area of Option 2. This is a bridge at Rufford, a post-medieval bridge recorded on the Chapman map of Nottinghamshire, 1774, located approximately 80m south of this option. This is located over 500 m from Option 1.

White Post Roundabout

7.3.10 There are no designated assets recorded within the study area around the Scheme. The nearest listed buildings are located approximately 1.5km to the east in Farnsfield.

7.3.11 A Scheduled Monument is also located to the south-east of the study area, approximately 1.6km from the Scheme. This consists of the buried remains of Farnsfield Roman camp (1018121), revealed by cropmarks as a sub-rectangular planned camp enclosing an area of c.3.9 ha. Excavations revealed a gate to the north-east side of the site and an internal bank.

7.3.12 There are two non-designated assets recorded within the study area. A post-medieval farm building is located directly to the north-east of the Scheme. The

building has surviving remains of rubble walls raised in brick. The other asset consists of an irregular enclosure with an adjacent linear feature recorded as part of the National Mapping Programme. This feature is located approximately 340m north-west of the Scheme.

Warren Hill Junction

- 7.3.13 There are no designated assets recorded within the study area of this Scheme.
- 7.3.14 There is a Scheduled Monument located approximately 730 m east of the Scheme. A slight univallate Iron Age hillfort, 169 m west of Combs Farm (1003483) survives as earthworks of a bank and an outer ditch, which encloses an area of c.1.4 ha. Excavation at the site revealed buried remains of the bank as well as Roman finds of pottery, brick and tile.
- 7.3.15 There are two non-designated assets recorded within the study area. The first is Baulker Farm, a post-medieval farmstead located approximately 500m north-west of the Scheme. The second asset is the site of a former windmill recorded on historic mapping, located approximately 60 m west of the Scheme.

Lowdham Roundabout

- 7.3.16 There are five listed buildings located within 500 m of the Scheme, all of which are Grade II listed. Four of these are located to the north-west of the Scheme, which comprise:
- Lowdham War Memorial (1456226);
 - Merevale House (1194564);
 - 2, Southwell Road (1194512); and
 - Numbers 4, 6, 8 and 10 Southwell Road (1045497).
- 7.3.17 The fifth listed building, Lowdham Railway Station (1370192) is located to the south-east of the Scheme: Lowdham Conservation Area also lies approximately 460 m to the north-west of the Scheme.
- 7.3.18 There are numerous non-designated assets recorded within 500 m of the Scheme. These include various non-designated buildings within Lowdham as well as earthwork features to the north and south-west of the Scheme consisting of hollow ways and banks. There is also ridge and furrow recorded in the fields directly to the north-west of the Junction.

Kirk Hill Junction

- 7.3.19 There is a Scheduled Monument located approximately 500 m north-west of the Scheme. The remains of a motte and bailey castle adjacent to the River Trent (1008568) include an elliptical motte, measuring 30 m from east to west by 10m from north to south and c.5 m high. The motte is surrounded by a ditch measuring up to 2 m deep and between 10 m and 15 m wide, with a small bailey located to the south.
- 7.3.20 There is a further Scheduled Monument to the south-east of the study area; Margidunum Roman Station (1006395) is located approximately 1.4 km to the south-east of the Scheme. Margidunum was a Roman settlement located along Fosse Way, between the Roman towns of Leicester and Lincoln. Remains of at least 22 buildings have been recorded during excavations in the 1920s and 1960s and were dated between the first and fourth centuries AD.

7.3.21 There are eight listed buildings within 500m of the Scheme, all located within East Bridgford to the north. The listed buildings comprise the Grade I listed Church of St Peter (1272697) and seven Grade II listed buildings, which include:

- Group of three headstones, seven metres south of the chancel at the Church of St Peter (1272676);
- The Old Rectory (1243712);
- East Bridgford War Memorial Cross (1456217);
- 3, Kirk Hill (1243770);
- The Hill Country House (1045675);
- Garden House, stable and garden wall at The Hill (1272770); and
- Walnut Lodge and adjoining stables.

7.3.22 The Scheme and the listed buildings to the north also lie within the East Bridgford Conservation Area. The section of the Conservation Area which the Scheme falls into consists of an approach to the village, characterised by brick cottages and country houses, separated from the road leading into East Bridgford by long stretches of brick walls.

7.3.23 There are also various non-designated assets recorded within 500m of the Scheme. These include post-medieval park grounds at East Bridgford Hill to the north-west of the Scheme. Also close to the Scheme are the site of a pinfold, located between the A6097 and Kirk Hill, and a former quarry to the south of the A6097. Both of these assets were recorded on the 1914 Ordnance Survey map.

7.3.24 Previous excavations carried out in the study area have also identified archaeological features, including evidence of Roman made ground, and an early medieval hearth, ditches and post holes recorded at land at Pancake Hill to the east of the Scheme.

7.4 Value of Environmental and Resource Receptors

7.4.1 There are 25 cultural heritage assets of high value (i.e. of national importance) (as defined by DMRB LA 104 and LA 106) within the study areas comprising the motte and bailey castle Scheduled Monument (1008568) and the Grade I listed Church of St Peter (1272697) in the Kirk Hill Junction study area, the Grade II* listed Ollerton Hall (1045598) in the Ollerton Roundabout study area and the 22 Grade II listed buildings.

7.4.2 There are three cultural heritage assets of medium value (i.e. of regional importance) within the study areas. These comprise the three Conservation Areas. (Ollerton, Lowdham and East Bridgford).

7.4.3 There are numerous cultural heritage assets of low value (i.e. of local importance) within the study areas comprising the non-designated assets listed in Section 7.2.

7.4.4 Previously unrecorded archaeological remains within the study area have the potential to be of local or regional importance, depending on their preservation status and their contribution to research agenda.

7.5 Potential Effects

7.5.1 An impact is defined as a change resulting from the Project Schemes on the heritage value of an asset.

7.5.2 The Project has the potential to impact heritage assets as follows:

- Physical impacts upon archaeological features; and
- Changes to the setting of heritage assets that affect their value.

7.5.3 These impacts have the potential to result in effects to the cultural heritage resources.

Construction

7.5.4 Temporary construction impacts that would last for all or part of the construction phase are likely to include the following:

- The presence and movement of construction plant and equipment, which may result in changes to the setting of heritage assets;
- The siting of construction compounds and activities within working areas, including associated construction noise and lighting, which may result in changes to the setting of heritage assets; and
- The use of traffic management and increased volumes of traffic on the local road network, which may result in changes to the setting of heritage assets.

7.5.5 Permanent construction impacts that would last beyond the construction phase are likely to include the following:

- Physical impacts on known archaeological assets arising from construction activities such as earthworks excavation, the formation of construction compounds and the installation of drainage infrastructure;
- Physical impacts on historic landscapes associated with the loss of key landscape components as a consequence of construction, such as those resulting from site clearance activities; and
- Impacts on archaeological remains, historic buildings and the historic landscape associated with the introduction of the physical form and appearance of the Scheme during construction in their setting.

7.5.6 There would be no direct physical impacts on known heritage assets during the construction of any of the Schemes, although there is potential for previously unrecorded archaeological remains to be physically impacted in areas of land not previously developed.

7.5.7 There may be some temporary changes to the setting of the Scheduled Monument, listed buildings near to Kirk Hill Junction (remains of a motte and bailey castle adjacent to the River Trent (1008568)) and Conservation Areas due to increased noise and traffic in relation to the construction of the Schemes as well as permanent changes due to the physical form of the Schemes.

Operation

7.5.8 Operational impacts of the Schemes are likely to include the following:

- Changes to traffic movements (and associated vehicle lighting), which could affect the setting of heritage assets;
- Changes in road noise from vehicle movements, which may affect the setting of heritage assets; and
- The operation of road lighting at junctions and on junction approaches, which may affect the setting of heritage assets.

7.5.9 There are a number of listed buildings and non-designated buildings which may have their setting affected by the operation of the Schemes. These will be assessed as part of the ES chapter.

7.6 Proposed Level and Scope of Assessment

7.6.1 At this stage it is proposed that the White Post Roundabout and Warren Hill Junction are be scoped out of the assessment as the improvements would be located entirely within the existing road boundaries and would not have any impact on archaeology. These Schemes are also not assessed as having any likely significant effects to the setting of any heritage assets in the area, including listed buildings and scheduled monuments.

7.6.2 It is proposed that the Ollerton, Mickledale Lane (Options 1 and 2), Lowdham and Kirk Hill Schemes are scoped into the assessment.

7.7 Proposed Assessment Methodology Including Significance

7.7.1 The assessment of impacts on cultural heritage and the design of appropriate mitigation and or enhancement will be carried out according to established prediction and assessment methodologies that are governed or guided by the following key documents:

- The Ancient Monuments and Archaeological Areas Act 1979;
- The Planning (Listed Buildings and Conservation Areas) Act 1990;
- National Policy Statement for National Networks (Department for Transport, 2014);
- National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019);
- Planning Practice Guidance;
- DMRB LA 106 Cultural Heritage Assessment;
- DMRB LA 104 Environmental Assessment and Monitoring;
- Historic England Good Practice Advice Note GPA3, The Setting of Heritage Assets (Historic England, 2017); and
- Chartered Institute for Archaeologists, Code of Conduct and Standards and Guidance for Historic Environment Desk-Based Assessment.

Baseline

7.7.2 To undertake the historic environment baseline research, data will be collected from the following sources:

- Nottinghamshire Historic Environment Record;
- Nottinghamshire Record Office;
- NSDC and RBC website for local lists and conservation areas;
- Historic England National Heritage List;
- Historic England Archives Service for aerial photographs;
- available ground investigation reports or borehole data; and
- an archaeological walkover survey of the route.

7.7.3 The information gathered will be used to identify the known archaeology, built heritage and historic landscapes within approximately 500m of the junctions. The results of the data collection will be used to produce a historic environment baseline and input into the impact assessment.

Impact Assessment

Design Manual for Roads and Bridges

7.7.4 Guidance contained within the DMRB LA 106 and DMRB LA 104 will be applied in the assessment to identify the value of archaeological remains, historic buildings and historic landscapes, and to identify and evaluate the impacts and effects that construction and operation of the Scheme would likely have on these assets.

Chartered Institute for Archaeologists Standards, Guidance and Code of Conduct

7.7.5 The assessment will be undertaken in accordance with the following best practice guidance published by the Chartered Institute for Archaeologists:

- Code of Conduct – sets out standards of ethical and responsible behaviour in the conduct of archaeological affairs to which members of the institute are expected to adhere; and
- Standards and Guidance for Historic Desk-Based Assessments.

Historic England Guidance

7.7.6 The following Historic England Good Practice Advice (GPA) notes will be used in the assessment to assist in establishing the significance of assets and their setting:

- GPA2: Managing Significance in Decision - Taking in the Historic Environment (Historic England, 2015) – emphasises the importance of having knowledge and understanding of the significance of heritage assets likely to be affected by the development, and where relevant the contribution of their settings to their significance;
- GPA3: The Setting of Heritage Assets (Historic England, 2017) – advises that elements of a setting can make positive or negative contributions to an asset's significance and the ways in which it is experienced. It acknowledges

that settings can overlap due to not having defined boundaries, and that settings can change as an asset and/or its surroundings evolve over time; and

- Historic England Advice Note 12 (Historic England, 2019) outlines a recommended approach to assessing the significance of heritage assets in line with the requirements of NPPF. It includes a suggested reporting structure for a 'Statement of Heritage Significance', as well as guidance on creating a statement that is proportionate to the asset's significance (heritage value) and the potential degree of impact of a proposed development.

7.7.7 Historic England Advice Note 12 (Historic England, 2019) also offers an interpretation of the various forms of heritage interest that an asset can possess, based on the terms provided in the NPPF Glossary (Ministry of Housing, Communities and Local Government, 2019, Annex 2: Glossary) as follows:

- i. Archaeological Interest – there will be archaeological interest in a heritage asset if it holds, or has the potential to hold, evidence of past human activity worth of expert investigation at some point;
- ii. Architectural and Artistic Interest – these are interests in the design or general aesthetics of a place. They can arise from conscious design or fortuitously from the way the heritage asset has evolved. More specifically, architectural interest is an interest in the art or science of the design, construction, craftsmanship and decoration of buildings and structures of all types. Artistic interest is an interest in other human creative skills, like sculpture; and
- iii. Historic Interest – an interest in past lives and events (including pre-historic). Heritage assets can illustrate or be associated with them. Heritage assets with historic interest not only provide a material record of our nation's history but can also provide meaning for communities derived from their collective experience of a place and can symbolise wider values such as faith and cultural identity.

7.8 Assumptions and Limitations

7.8.1 This scoping assessment has been produced using publicly electronically available data only, which lists known archaeological sites or significant historic landscape features. There is a possibility for the discovery of previously unrecorded archaeological remains within the Scheme boundaries.

7.8.2 The Schemes have not been subject to a cultural heritage site walkover at this preliminary stage. This will be undertaken during further stages of assessment and reported in the ES.

8. LANDSCAPE AND VISUAL

8.1 Introduction

- 8.1.1 Via has prepared this chapter to outline the scope of assessment with regard to the Project. This chapter sets out the approach and methodology that will be used in the assessment of landscape and visual effects during the construction and operation of the Schemes.
- 8.1.2 Landscape and visual effects are separate, although closely related and interlinked issues. As such, the assessment of the effects of the Project upon the landscape and visual amenity will be carried out under separate headings within the Landscape and Visual Impact Assessment (LVIA).
- 8.1.3 The assessment of landscape effects considers the potential effects of the Project on the landscape as an environmental resource. Landscape effects are caused by physical changes to the landscape, which may result in changes to the distinctive character of the landscape and how it is perceived.
- 8.1.4 The visual assessment is concerned with the potential effects that may occur resulting from the Project upon the population likely to be affected. It assesses the change in visual amenity experienced by people arising from the presence of the Project.
- 8.1.5 A desk-based assessment and a site walkover survey have informed this Chapter.
- 8.1.6 As the proposals for Warren Hill Junction and White Post Roundabout are small scale and akin to maintenance works, these Schemes have been scoped out of further assessment. No baseline section has been prepared for these two Schemes.

8.2 Study Area

- 8.2.1 For each Scheme, the study area for the LVIA has been determined based upon previous experience of similar developments and an understanding of the context of the site, including the surrounding landform and existing large-scale development. It is considered that if any significant landscape and visual effects would be experienced, they would arise at relatively close proximity to the Schemes, most likely within 2 km, because the Schemes will contain similar elements to the existing infrastructure such as lighting columns, highway signs, traffic signals, street furniture, carriageway surfacing, paved surfacing and soft landscape treatment as described in Chapter 2 of this report.
- 8.2.2 The study area has been informed by analysis of the Zone of Theoretical Visibility (ZTV) and future site work. The indicative scoping study area is shown on Figures 8-1a to 8-1e.

8.3 Existing and Baseline Conditions

- 8.3.1 The following information has been considered to describe the baseline conditions for each of the Schemes:
- Aerial imagery; Ordnance Survey 25k data;
 - Spectrum Spatial Analyst database (Pitney Bowes, 2018) for Public Rights of Way (PROWs), ecological designations, and heritage designations;

- NSDC Local Development Framework which includes the Policy Plan, the Amended Core Strategy Development Plan Document DPD (adopted March 2019), and the Allocations and Development Management DPD (adopted July 2013);
- RBC Local Development Framework which includes the Local Plan Part 1: Core Strategy (adopted 22 December 2014), and Local Plan Part 2: Local Planning Policies, Community Involvement, Local Development Scheme, and Local Monitoring Report (Adopted 8th October 2019);
- National Landscape Character Assessment Area 49 (Natural England, 2012);
- National Landscape Character Assessment Area 48 (Natural England, 2013);
- East Midlands Regional Landscape Character Assessment (Natural England, 2010);
- Newark and Sherwood District Council Landscape Character Assessment (NSDC, 2010);
- The Greater Nottingham Landscape Character Assessment (NCC, 2009); and
- Initial site walkover surveys undertaken on 13th January 2021 (Mickledale Option 1 and 2), 3rd February 2021 (Ollerton Roundabout) and 4th February 2021 (Lowdham Roundabout and Kirk Hill Junction).

8.3.2 Figures 8-4a to 8-4e show the relevant designations for each of the Schemes.

Ollerton Roundabout

Baseline Conditions of the Study Area

Land Use

- 8.3.3 The land use of the study area is predominately woodland, agricultural land and open areas within the valley of Rainworth Water and the River Maun, as well as highway infrastructure surrounding the junction of the A6075, A616 and A614.
- 8.3.4 The woodland is a semi natural broadleaved woodland which forms part of the Birklands and Bilhaugh SAC, SSSI and LWS and Birklands and West Ollerton corner SSSI to the north of Ollerton roundabout. There is also scrubby woodland within the more open heathland of Sherwood Heath LNR and LWS to the north-west of the roundabout. There are areas of more recently planted woodland within the restored areas of Ollerton and Thoresby Colliery to the east and west, respectively. The restored Ollerton colliery woodland is a LWS and Thoresby Colliery woodland and the adjacent Cockglode and Rotary Wood is an LNR. The woodland of the Rufford Estate lies to the south of the Scheme.
- 8.3.5 The agricultural areas are arable, grazing pasture and fields used for pig rearing. There are isolated farms spread throughout the area.
- 8.3.6 The towns of Ollerton and New Ollerton lie to the north-east and east of the existing roundabout. Evidence of former mining is provided by the partially restored Thoresby Colliery to the west of the site and the restored woodland of Ollerton Colliery to the east of the site.

8.3.7 There is isolated residential development to the north of the existing roundabout. There is also a hub of services to the south of the existing roundabout including fast food restaurants and petrol stations.

8.3.8 The land use of the study area is shown on Figure 8-2a.

Topography

8.3.9 The highest point in the study area is on the restored Thoresby Colliery spoil tip to the west of the site, just north of the A6075, at a height of 84 mAOD. There are also high points to the south-west of the site at 68 mAOD, in woodland to the north-west of the study area at 67 mAOD and woodland to the south-east at 66 mAOD around Wellow within the Rufford estate. The lowest point is in the valley of the River Maun at 36 mAOD to the north-east of the site. Topography can be viewed on Figure 8-3a.

Public Rights of Way

8.3.10 There are a number of PRowWs, both footpaths and bridleways, within the study area. These are shown on Figure 8-4a and are as follows:

- Edwinstowe BW 6 to the south-west, which connects the A6097 to Edwinstowe village;
- Edwinstowe FP 7 to the south-west, which connects the A614 to Edwinstowe village;
- Edwinstowe BW 24 to the north-west, which connects the B6034 and A6075;
- Ollerton and Boughton BW8 to the north-east which connects A616 with Whitewater Lane;
- Footpaths Ollerton and Boughton 2, 3, 4, 5, 6 and 25 all lie to the south-east of Ollerton;
- Footpath Ollerton and Boughton 10 is within Ollerton itself;
- Footpath Ollerton and Boughton 24 is within Boughton itself;
- Ollerton and Boughton BW1 to the south, which connects the Rufford lake area to the A614; and
- Footpaths Rufford 7, 8 and 9 lie to the south of the study area.

Landscape Designations

Statutory Landscape Designations

8.3.11 The study area is not covered by a statutory landscape designation. The nearest statutory landscape designation is the Peak District National Park, located approximately 32 km from the Scheme.

Non-Statutory Landscape Designations

8.3.12 The study area is within the jurisdiction of NSDC, and the planning policy for the area is shown on the Policies Map (adopted July 2013). This map forms part of the Local Development Framework which also includes the Amended Core Strategy Development Plan Document DPD (adopted March 2019), and the Allocations and Development Management DPD (adopted July 2013).

8.3.13 NSDC non-statutory landscape designations that apply to the area are as follows:

- Sherwood Forest Regional Park – (shAP1) - The Policy states that NSDC will work with its partners to maintain and enhance the ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.

Heritage Designations

8.3.14 Heritage designations within the study area are fully detailed in this report in Chapter 7 - Cultural Heritage, those relevant to this assessment are summarised below:

- Sherwood Forest heritage area – Core Policy 14;
- Ollerton Conservation Area – Core Policy 14 and DM9;
- Wellow Conservation Area - Core Policy 14 and DM9;
- Boughton Conservation Area – Core Policy 14 and DM9;
- Rufford Abbey – Registered Park and Garden (Grade II) – Core Policy 14 and DM9; and
- Thoresby Park – Registered Park and Garden (Grade I) – Core Policy and DM9.

8.3.15 There are numerous listed buildings and non-designated historic buildings within the Ollerton and Wellow Conservation Areas, and there are also non-designated historic buildings in the study area, several of which are isolated farms.

Ecological Designations

8.3.16 European, National and Local ecological designations within the study area are fully detailed in Chapter 9 – Biodiversity, those relevant to this assessment are summarised below:

- Birklands and Bilhaugh SAC - Core policy 12 and DM 7;
- Sherwood Forest NNR - Core policy 12 and DM 7;
- Birklands and Bilhaugh SSSI and Birklands west and Ollerton corner woodland SSSI – Core policy 12 and DM 7; and
- Sherwood Heath LNR - Core Policy 12 and DM 7.

Other Designations

Green Estates

8.3.17 These are areas managed by NCC and include Cockglode and Rotary Wood LNR adjacent to the former Thoresby Colliery, Ollerton west and Ollerton Colliery woodlands LWS and the existing Sherwood Forest Visitor Centre.

Cultural Associations

8.3.18 There are strong cultural associations within the study area due to the area including part of Sherwood Forest, which is associated with the legend of Robin Hood. Cultural associations will be considered within the ES.

Green Belt

- 8.3.19 The Scheme is not located in the Green Belt.

National Landscape Character

- 8.3.20 The study area is located within the Sherwood National Character Area (NCA) 49 which is described as follows (Natural England, 2012):

“The Sherwood NCA extends north from Nottingham principally coinciding with an outcrop of sandstone which forms part of gently rolling hills. Historically it was managed as woodland and remains a well wooded area. The oak and birch wood pasture in the heartland of Sherwood Forest and more recent pine plantations, contribute strongly to the sense of place. Large estate parklands, heathland, open arable lands and a strong mining heritage also characterise the area. The area contains the settlements of Mansfield, Worksop, Retford, and Ollerton around its peripheries and sits on an aquifer that provides water to the area.’

The woodlands of Sherwood support internationally important oak woodland and associated invertebrates. The area also supports nationally important assemblages of farmland birds. In addition, Sherwood’s strong cultural association with Robin Hood help attract around one million visitors/ year to the forest. Recent change has led to some increase in heathland through forestry clearance and conservation efforts, particularly on ex- industrial sites, and an increase in hedge size (largely through agri- environment incentives). However, high recreation use in protected areas, over abstraction from the aquifer, soil erosion (in arable areas), and restoring derelict landscapes continue to provide challenges and opportunities.”

Regional Landscape Character

- 8.3.21 The study area contains two areas in the East Midlands Regional Landscape Character Assessment, firstly subdivision 10b Sandstone forests and heaths, of Group 10 Woods and forests, which has the following key characteristic features:

- *“Undulating landform of low rounded hills on sandstone geology with numerous dry valleys;*
- *Mosaic of broadleaved, mixed and coniferous woodlands creating wooded skylines and enclosing extensive tracts of open arable farmland with large scale geometric fields and neatly trimmed and often treeless hedges;*
- *Free draining acid soils supporting many areas of unenclosed heathland vegetation often associated with woodland areas and also on marginal land and roadsides;*
- *Narrow river corridors with pasture, flood meadows and woodland, contrast with adjacent open arable farmland;*
- *Numerous large estates and associated parkland;*
- *Frequent evidence of remains of coal mining industry with mining settlements and associated spoil heaps, disused mines and old railway lines, and areas associated with reclaimed pit heaps; and*
- *Sandstone quarries for aggregates are locally conspicuous”.*

- 8.3.22 The study area also contains subdivision 5b wooded village farmlands of Group 5 Village farmlands, which has the following key characteristic features:

- *“Varied topography, ranging from gently undulating farmlands to rolling hills, becks and steep sided valleys, locally known as ‘Dumbles’;*
- *Scattered farm woodlands, ancient woodlands on prominent hills and tree lined valleys contribute to a well wooded character;*
- *Well maintained pattern of hedged fields enclosing pasture and arable fields, with evidence of decline close to urban areas;*
- *Sparsely settled, with traditional pattern of farms and small rural villages linked by quiet country lanes; and*
- *Strong sense of landscape history”.*

Local Landscape Character

8.3.23 At the county level, the study area is located at the junction of the Sherwood Landscape Character Type (LCT) and the Mid Nottinghamshire Farmlands LCT. This is shown on Figure 8-5a. Within the Sherwood LCT the study area is at the junction of four subdivisions of this landscape type. These are:

- Estate farmlands;
- Meadowlands with plantations;
- Wooded estatelands; and
- Meadowlands

8.3.24 Within the Mid Nottinghamshire Farmlands LCT the study area contains one subdivision of this landscape type, which is:

- Village Farmlands with ancient woodlands.

8.3.25 A full description is included in Appendix C.1.

8.3.26 The study area comprises a number of landscape Policy Zones within the Sherwood LCT and the Mid Nottinghamshire Farmlands LCT. These include:

- S PZ 09 Old Clipstone estate farmlands;
- S PZ 10 Rufford Abbey Estate farmlands;
- S PZ 14 Rainworth Water meadowlands with plantations;
- S PZ 15 River Maun meadowlands with plantations;
- S PZ 25 Birklands wooded estatelands;
- S PZ 26 Budby estate farmlands;
- S PZ 27 Ollerton estate farmlands;
- S PZ 56 Kirton Meadowlands;
- MN PZ 17 Wellow Park village farmlands with ancient woodlands; and
- MN PZ 22 Wellow village farmlands with ancient woodlands.

8.3.27 The Scheme is located in S PZ 15 River Maun meadowlands with plantations and S PZ 26 Budby Estate Farmlands.

8.3.28 Sherwood Policy Zone 15 River Maun meadowlands is assessed as having a good landscape condition and a moderate landscape sensitivity with an overall landscape action of conserve and reinforce, with the following objectives:

Landscape Features:

- Conserve and reinforce the pastoral character of the river valley;
- Promote measures for restoring arable land to pasture and flood meadow;
- Conserve and reinforce river channel diversity and marginal riverside vegetation; and
- Conserve and enhance the ecological diversity and character of riparian woodland.

Built Features:

- Conserve the sparsely settled character of the river corridor by avoiding development within the immediate flood plain of the River Maun;
- Reinforce the sense of place of the built environment by using materials and design that reflect the local character of the area; and
- Contain new small-scale development within historical field boundaries.

8.3.29 Sherwood Policy Zone 26 Budby Estate Farmlands is assessed as having a very good landscape condition, and a moderate landscape sensitivity with an overall landscape action of conserve, with the following objectives:

Landscape Features:

- Conserve the rural character of the landscape by concentrating new development around existing settlements of Budby and Perlethorpe;
- Conserve historic field pattern by containing new development within historic enclosed boundaries, restoring and reinforcing poor hedgerow boundaries and where necessary, create new hedgerows to replace post and wire fencing;
- Conserve permanent pasture and seek opportunities to restore arable land to pastoral; and
- Conserve ancient woodland, woodland and individual parkland trees, seek to reinforce as appropriate.

Built Features:

- Conserve and respect the historic character and setting of Thoresby Estate and surrounding parkland;
- Conserve the traditional architectural style of red brick construction; and
- Conserve and respect the character and setting of neighbouring Sherwood Forest Country Park.

Baseline Conditions of the Site

Land Use

- 8.3.30 The land uses of the site, as discussed above, include the following:
- Existing carriageway;
 - Existing footway;
 - Existing verges/roundabout with highway infrastructure such as signs and lighting;
 - Frontage of The Alders Public House with soft landscape treatment, and car parking;
 - Sherwood Heath Local Nature Reserve (LNR);
 - Birklands and Bilhaugh SAC, SSSI and LWS;
 - Arable agricultural land;
 - Frontage of restaurant - Costa Coffee drive through and carparking; and
 - Frontage of drive through fast food facility - McDonald's.

Boundaries

- 8.3.31 The Alders Public House and Sherwood Heath LNR form the north-west scoping boundary and the Birklands and Bilhaugh SSSI forms the northern boundary. Residential development and agricultural land form the north-eastern boundary. Two petrol stations and fast-food outlets including McDonald's and the Costa Coffee Drive Through Restaurant (located within the Scoping boundary) form the south-eastern and south-western boundaries of the Scheme.

Topography

- 8.3.32 The land within the scoping boundary is at a height of approximately 45 mAOD and falls away to the south- east to the valley of the River Maun.

Closest Residential Buildings

- 8.3.33 The closest residential buildings are three properties at Forest Side to the north of the existing roundabout, with surrounding gardens, paddocks and outbuildings. The closest of these is approximately 1.5m from the scoping boundary. A further single residential building is located to the south-west of the Scheme just south-west of the Costa Coffee shop on the A6075. This is approximately 12m from the scoping boundary at its closest point.

Mickledale Lane Junction Option 1

Baseline Conditions of the Study Area

Land Use

- 8.3.34 The land use of the study area is predominately woodland and agricultural land, as well as highway infrastructure surrounding the junction between Mickledale Lane and the A614.
- 8.3.35 The woodland is predominantly the coniferous plantation woodland area of Clipstone Forest, but there are smaller broadleaved woodlands such as Cutt's Wood, Flowers Wood, Rook Wood and Lockwell Hill Wood. In addition, riparian

woodland is located within the valley of Rainworth Water such as Damside Covert. There is also a relatively recently created woodland within the restored Bilsthorpe Colliery.

- 8.3.36 The agricultural areas are arable, grazing pasture and fields used for pig rearing. There are isolated farms throughout the area.
- 8.3.37 The town of Bilsthorpe lies to the east and south-east of the Scheme. Evidence of the former mining industry is provided by the restored Bilsthorpe Colliery to the east of the site.
- 8.3.38 There is isolated residential development to the immediate south-east of the junction of Mickledale Lane with the existing A614. The Limes café is located to the west of the junction with a large car parking area to its frontage to accommodate Heavy Goods Vehicle parking, a residential single storey property and outbuildings.
- 8.3.39 The land use of the study area is shown on Figure 8-2b – Aerial Photograph of Study Area.

Topography

- 8.3.40 The highest points in the study area are at Damside Covert at a height of 96 mAOD, and at 95 mAOD on the slopes of Watch Hill to the south-west. There are also high points at Lockwell Hill to the south of the Scheme at 95 mAOD and at the restored Bilsthorpe Colliery to the east, also at 95 mAOD. The lowest points are in the valley of Rainworth Water at 68 mAOD to the south of the site where it passes under the A614 and at 67 mAOD to the north-east on Deerdale Lane. Please refer to Figure 8-3b – Topography of the Study Area.

Public Rights of Way

- 8.3.41 There are a number of PRowS, both footpaths and bridleways, within the study area. These are shown on Figure 8-4b – Designations of the study area. These are as follows:
- Rufford BW5 to the west, which connects Mansfield with the A614;
 - Rufford RB24 to the north-west, which connects Kings Clipstone with Clipstone Forest;
 - Rufford BW19 to the north-east which connects Bilsthorpe to Deerdale Lane to the north-east;
 - Eakring FP1 to the east, which connects Bilsthorpe to Eakring;
 - Bisthorpe BW7 - The Southwell Trail to the south-east, which connects Farnsfield to Bilsthorpe;
 - Bisthorpe FP4 to the south-east, which also connects Farnsfield to Bilsthorpe;
 - Bilsthorpe FP3 to the south-east, which connects Bilsthorpe to Bilsthorpe BOAT 2;
 - Bilsthorpe FP1 to the south-eastern edge of Bilsthorpe;
 - Bilsthorpe BOAT2 to the south, which connects the Southwell Trail to the A614; and

- Bilsthorpe Footpaths 8,9,10,11,12,14,15 which are all within Bilsthorpe itself.

Landscape Designations

Statutory Landscape Designations

- 8.3.42 The study area is not covered by a landscape designation, the nearest statutory landscape designation being the Peak District National Park, located approximately 32 km from the Scheme.

Non-Statutory Landscape Designations

- 8.3.43 The study area is within the jurisdiction of NSDC, and the planning policy for the area is shown on the Policies Map (adopted July 2013). This map forms part of the Local Development Framework which also includes the Amended Core Strategy Development Plan Document DPD (adopted March 2019), and the Allocations and Development Management DPD (adopted July 2013).

- 8.3.44 NSDC non-statutory landscape designations that apply to the area are as follows:-
- Sherwood Forest Regional Park – (shAP1) - The Policy states that NSDC will work with its partners to maintain and enhance the ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.

Ecological Designations

- 8.3.45 European, national and local ecological designations within the study area are fully detailed in this report in Chapter 9 – Biodiversity and are summarised below:
- Local Nature Reserve – Cutts Wood LNR - Core Policy 12 and DM 7;
 - Local Nature Reserve – Clipstone Forest Area LNR - Core Policy 12 and DM 7;
 - Local Nature Reserve – Alder Carr, Inkersall LNR - Core Policy 12 and DM 7;
 - Local Nature Reserve – Bilsthorpe Grassland LNR - Core Policy 12 and DM 7;
 - Local Nature Reserve – Bilsthorpe Colliery LNR - Core Policy 12 and DM 7; and
 - Local Nature Reserve – Farnsfield Disused Railway LNR - Core Policy 12 and DM 7.

Heritage Designations

- 8.3.46 Heritage designations within the study area are fully detailed in this report in Chapter 7 – Cultural Heritage of this report and are summarised below:
- Sherwood Forest heritage area – Core Policy 14;
 - Bilsthorpe Conservation Area – Core Policy 14 and DM9; and
 - Rufford Abbey Registered Park and Garden (Grade II) - Core Policy 14.

- 8.3.47 There are a number of listed buildings and non-designated historic buildings within the Bilsthorpe Conservation Area. There are also other non-designated historic buildings in the study area, several of which are isolated farms.

Other Designations

Green Estates

- 8.3.48 These are areas managed by NCC and include the former Bilsthorpe Colliery railway line which is now a Multi-User Route.

Cultural Associations

- 8.3.49 There are strong cultural associations within the study area due to its relationship to Sherwood Forest, which is associated with the legend of Robin Hood. Cultural associations will be considered within the ES.

Green Belt

- 8.3.50 The Scheme is not located in the Green Belt.

National Landscape Character

- 8.3.51 The study area is located within the Sherwood NCA 49 which is described as follows (Natural England, 2012):

“The Sherwood NCA extends north from Nottingham principally coinciding with an outcrop of sandstone which forms part of gently rolling hills. Historically it was managed as woodland and remains a well wooded area. The oak and birch wood pasture in the heartland of Sherwood Forest and more recent pine plantations, contribute strongly to the sense of place. Large estate parklands, heathland, open arable lands and a strong mining heritage also characterise the area. The area contains the settlements of Mansfield, Worksop, Retford, and Ollerton around its peripheries and sits on an aquifer that provides water to the area.

The woodlands of Sherwood support internationally important oak woodland and associated invertebrates. The area also supports nationally important assemblages of farmland birds. In addition, Sherwood’s strong cultural association with Robin Hood help attract around one million visitors/ year to the forest. Recent change has led to some increase in heathland through forestry clearance and conservation efforts, particularly on ex- industrial sites, and an increase in hedge size (largely through agri- environment incentives. However, high recreation use in protected areas, over abstraction from the aquifer, soil erosion (in arable areas), and restoring derelict landscapes continue to provide challenges and opportunities.”

Regional Landscape Character

- 8.3.52 The study area contains two areas in the East Midlands Regional Landscape Character Assessment. The first of these is subdivision 10b Sandstone forests and heaths, of Group 10 Woods and forests, which has the following key characteristic features:

- *“Undulating landform of low rounded hills on sandstone geology with numerous dry valleys;*
- *Mosaic of broadleaved, mixed and coniferous woodlands creating wooded skylines and enclosing extensive tracts of open arable farmland with large scale geometric fields and neatly trimmed and often treeless hedges;*

- *Free draining acid soils supporting many areas of unenclosed heathland vegetation often associated with woodland areas and also on marginal land and roadsides;*
- *Narrow river corridors with pasture, flood meadows and woodland, contrast with adjacent open arable farmland;*
- *Numerous large estates and associated parkland;*
- *Frequent evidence of remains of coal mining industry with mining settlements and associated spoil heaps, disused mines and old railway lines, and areas associated with reclaimed pit heaps; and*
- *Sandstone quarries for aggregates are locally conspicuous.”*

8.3.53 The study area also contains subdivision 5b Wooded Village Farmlands of Group 5 Village Farmlands, which has the following key characteristic features:

- *“Varied topography, ranging from gently undulating farmlands to rolling hills, becks and steep sided valleys, locally known as ‘Dumbles’;*
- *Scattered farm woodlands, ancient woodlands on prominent hills and tree lined valleys contribute to a well wooded character;*
- *Well maintained pattern of hedged fields enclosing pasture and arable fields, with evidence of decline close to urban areas;*
- *Sparsely settled, with traditional pattern of farms and small rural villages linked by quiet country lanes; and*
- *Strong sense of landscape history.”*

Local Landscape Character

8.3.54 The study area is located at the county level at the junction of the Sherwood Landscape Character Type (LCT) and the Mid Nottinghamshire Farmlands LCT. This is shown on Figure 8-5b – Landscape Character of the study area. Within the Sherwood LCT, the study area is at the junction of four subdivisions of this landscape type. These are as follows:

- Wooded estate lands;
- Village farmlands;
- Estate farmlands; and
- Meadowlands with plantations.

8.3.55 Within the Mid Nottinghamshire Farmlands LCT, the study area is at the junction of two subdivisions of this landscape type. These are as follows:

- Estate farmlands with plantations; and
- Village farmlands.

8.3.56 A full description is included in Appendix C.2.

8.3.57 The study area comprises a number of landscape Policy Zones within the Sherwood LCT and the Mid Nottinghamshire Farmlands LCT. These include:

- SPZ 06 Sherwood Pines wooded estate lands;
- SPZ 07 Oxton village farmlands;
- SPZ 09 Old Clipstone estate farmlands;
- SPZ 14 Rainworth Water meadowlands with plantations;
- MN PZ 24 Rufford Park estate farmlands with plantations; and
- MN PZ 27 Kirklington village farmlands.

8.3.58 The Scheme is located in Sherwood PZ 09 Old Clipstone Estate Farmlands which is assessed as having a moderate landscape condition, and a moderate landscape sensitivity with an overall landscape action of conserve and create, with the following objectives:

Landscape Features:

- Conserve the ecological diversity of small deciduous woodlands throughout the area;
- Conserve and create field boundary and road hedgerows where these have become degraded or lost;
- Create opportunities for restoring areas of heath land where appropriate; and
- Create small deciduous woodlands where appropriate.

Built Features:

- Conserve the integrity and rural character of the landscape by concentrating new developments around the existing urban fringe of Edwinstowe and Lidgett;
- Create small scale woodland/tree planting to soften new development, preferably in advance of development;
- Conserve the existing field pattern by locating new small scale development within the existing field boundaries;
- Promote measures for reinforcing the traditional character of farm buildings using vernacular building styles; and
- Promote sensitive design and siting of agricultural buildings.

Baseline Conditions of the Site

Land Use

8.3.59 The land uses of the above area include the following:

- Carriageway;
- Footways;
- Verges with highway infrastructure, such as signs and lighting;

- Frontage of The Limes café (including informal car park) and residential property within;
- Four residential properties and surrounding gardens and hedgerows: and
- Agricultural land.

Boundaries

- 8.3.60 The entrance to Rufford Bridleway 5 (Inkersall Lane), agricultural land, existing highway verges and the frontage of the Limes café form the western boundary of the site. The existing highway verges and agricultural landform the eastern boundaries of the site. The existing carriageway and Mickledale Lane form the northern and southern boundaries of the site.

Topography

- 8.3.61 The Scheme is at a height of approximately 71 mAOD at the junction between Mickeldale Lane and the A614, the topography falls away to 68 mAOD to the east and to the south.

Closest residential buildings

- 8.3.62 The closest residential buildings are four properties to the south-east of the existing junction, with surrounding gardens and outbuildings, and the bungalow located north of The Lime's Café.

Mickledale Lane Junction Option 2

Baseline Conditions of the Study Area

Land Use

- 8.3.63 The land use of the study area is predominately woodland and agricultural land, as well as highway infrastructure surrounding the junction between Mickledale Lane and the A614.
- 8.3.64 The woodland is predominantly the coniferous plantation woodland area of Clipstone Forest, but there are smaller broadleaved woodlands such as Eakring Brail Wood, Cutt's Wood, Flowers Wood, Rook Wood and Lockwell Hill Wood. In addition, riparian woodland is located within the valley of Rainworth Water such as Damside Covert. There is also a relatively recently created woodland within the restored Bilsthorpe Colliery.
- 8.3.65 The agricultural areas are arable, grazing pasture and fields used for pig rearing. There are isolated farms throughout the area.
- 8.3.66 The town of Bilsthorpe lies to the east and south-east of the Scheme. Evidence of the former mining industry is provided by the restored Bilsthorpe Colliery to the east of the site.
- 8.3.67 There is isolated residential development to the immediate south-east of the junction of Mickledale Lane with the existing A614. The Limes café is located to the west of the junction with a large car parking area to its frontage to accommodate Heavy Goods Vehicle parking, a residential single storey property and outbuildings.
- 8.3.68 The land use of the study area is shown on Figure 8-2c – Aerial photograph of study area.

Topography

- 8.3.69 The highest points in the study area are at Damside Covert at a height of 96 mAOD, and at 95 mAOD on the slopes of Watch Hill to the south-west. There are also high points at Lockwell Hill to the south of the Scheme at 95m AOD. and at the restored Bilsthorpe Colliery to the east, also at 95 mAOD. The lowest points are in the valley of Rainworth Water at 68 mAOD to the south of the site where it passes under the A614, and at 67 mAOD to the north-east on Deerdale Lane. Please refer to Figure 8-3c – Topography of the study area.

Public Rights of Way

- 8.3.70 There are a number of PRowS, both footpaths and Bridleways within the study area. These are shown on Figure 8-4c – Designations of the study area. These are as follows:

- Rufford BW5 to the west, which connects Mansfield with the A614;
- Rufford RB24 to the north-west, which connects Kings Clipstone with Clipstone Forest;
- Rufford BW19 to the north-east which connects Bilsthorpe to Deerdale Lane to the north-east;
- Eakring FP1 to the east, which connects Bilsthorpe to Eakring;
- Bisthorpe BW7 - The Southwell Trail to the south-east, which connects Farnsfield to Bilsthorpe;
- Bisthorpe FP4 to the south-east, which also connects Farnsfield to Bilsthorpe;
- Bilsthorpe FP3 to the south-east, which connects Bilsthorpe to Bilsthorpe BOAT 2;
- Bilsthorpe FP1 to the south-eastern edge of Bilsthorpe;
- Bilsthorpe BOAT2 to the south, which connects the Southwell Trail to the A614; and
- Bilsthorpe Footpaths 8,9,10,11,12,14,15 which are all within Bilsthorpe itself.

Landscape Designations

Statutory Landscape Designations

- 8.3.71 The study area is not covered by a landscape designation, the nearest statutory landscape designation is the Peak District National Park, located approximately 32 km from the Scheme.

Non-Statutory Landscape Designations

- 8.3.72 The study area is within the jurisdiction of NSDC, and the planning policy for the area is shown on the Policies Map (adopted July 2013). This map forms part of the Local Development Framework which also includes the Amended Core Strategy Development Plan Document DPD (adopted March 2019), and the Allocations and Development Management DPD (adopted July 2013).
- 8.3.73 NSDC non-statutory landscape designations that apply to the area are as follows:

- Sherwood Forest Regional Park – (shAP1) - The Policy states that NSDC will work with its partners to maintain and enhance the ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.

Ecological Designations

8.3.74 European, National and Local ecological designations within the study area are fully detailed in the Ecology and Nature Conservation scoping Chapter 9 but are summarised below:

- Local Nature Reserve – Cutts Wood LNR - Core Policy 12 and DM 7;
- Local Nature Reserve – Clipstone Forest Area LNR - Core Policy 12 and DM 7;
- Local Nature Reserve – Alder Carr, Inkersall LNR - Core Policy 12 and DM 7;
- Local Nature Reserve – Bilsthorpe Grassland LNR - Core Policy 12 and DM 7;
- Local Nature Reserve – Bilsthorpe Colliery LNR - Core Policy 12 and DM 7;
- Local Nature Reserve – Eakring Brail Wood- Core Policy 12 and DM 7; and
- Local Nature Reserve – Farnsfield Disused Railway LNR - Core Policy 12 and DM 7.

Heritage Designations

8.3.75 Heritage designations within the study area are fully detailed in the Chapter 7 - Cultural Heritage of this report, but are summarised below:

- Sherwood Forest heritage area – Core Policy 14;
- Bilsthorpe Conservation Area – Core Policy 14 and DM9;
- Rufford Abbey Registered Park and Garden (Grade II) - Core Policy 14; and
- Hexgreave Park – non designated park and garden - Core Policy 14.

8.3.76 There are a number of listed buildings and non-designated historic buildings within the Bilsthorpe Conservation Area, and there are also non designated historic buildings in the study area, several of which are isolated farms.

Other Designations

Green Estates

8.3.77 These are areas managed by NCC and include the former Bilsthorpe Colliery railway line now a Multi-User Route.

Cultural Associations

8.3.78 There are strong Cultural Associations within the study area due to its relationship to Sherwood Forest, which is associated with the legend of Robin Hood. Cultural associations will be considered within the ES.

Green Belt

8.3.79 The Scheme is not located in the Green Belt.

National Landscape Character

8.3.80 The study area is located within the Sherwood NCA 49 which is described as follows (Natural England, 2012):

“The Sherwood NCA extends north from Nottingham principally coinciding with an outcrop of sandstone which forms part of gently rolling hills. Historically it was managed as woodland and remains a well wooded area. The oak and birch wood pasture in the heartland of Sherwood Forest and more recent pine plantations, contribute strongly to the sense of place. Large estate parklands, heathland, open arable lands and a strong mining heritage also characterise the area. The area contains the settlements of Mansfield, Worksop, Retford, and Ollerton around its peripheries and sits on an aquifer that provides water to the area.”

The woodlands of Sherwood support internationally important oak woodland and associated invertebrates. The area also supports nationally important assemblages of farmland birds. In addition, Sherwood’s strong cultural association with Robin Hood help attract around one million visitors/ year to the forest. Recent change has led to some increase in heathland through forestry clearance and conservation efforts, particularly on ex- industrial sites, and an increase in hedge size (largely through agri- environment incentives). However, high recreation use in protected areas, over abstraction from the aquifer, soil erosion (in arable areas), and restoring derelict landscapes continue to provide challenges and opportunities.”

Regional Landscape Character

8.3.81 The study area contains two areas in the East Midlands Regional Landscape Character Assessment, firstly subdivision 10b Sandstone forests and heaths, of Group 10 Woods and forests, which has the following key characteristic features:

- *“Undulating landform of low rounded hills on sandstone geology with numerous dry valleys;*
- *Mosaic of broadleaved, mixed and coniferous woodlands creating wooded skylines and enclosing extensive tracts of open arable farmland with large scale geometric fields and neatly trimmed and often treeless hedges;*
- *Free draining acid soils supporting many areas of unenclosed heathland vegetation often associated with woodland areas and also on marginal land and roadsides;*
- *Narrow river corridors with pasture, flood meadows and woodland, contrast with adjacent open arable farmland;*
- *Numerous large estates and associated parkland;*
- *Frequent evidence of remains of coal mining industry with mining settlements and associated spoil heaps, disused mines and old railway lines, and areas associated with reclaimed pit heaps; and*
- *Sandstone quarries for aggregates are locally conspicuous”.*

- 8.3.82 The study area also contains subdivision 5b Wooded Village Farmlands of Group 5 Village Farmlands, which has the following key characteristic features:
- *“Varied topography, ranging from gently undulating farmlands to rolling hills, becks and steep sided valleys, locally known as ‘Dumbles’;*
 - *Scattered farm woodlands, ancient woodlands on prominent hills and tree lined valleys contribute to a well wooded character;*
 - *Well maintained pattern of hedged fields enclosing pasture and arable fields, with evidence of decline close to urban areas;*
 - *Sparsely settled, with traditional pattern of farms and small rural villages linked by quiet country lanes; and*
 - *Strong sense of landscape history”.*

Local Landscape Character

- 8.3.83 The study area is located at the county level at the junction of the Sherwood Landscape Character Type (LCT) and the Mid Nottinghamshire Farmlands LCT. This is shown on Figure 8-5c – Landscape Character of the study area.
- 8.3.84 Within the Sherwood LCT, the study area is at the junction of four subdivisions of this landscape type, these are as follows:
- Wooded estatelands;
 - Village farmlands;
 - Estate farmlands; and
 - Meadowlands with plantations.
- 8.3.85 Within the Mid Nottinghamshire Farmlands LCT the study area is at the junction of three subdivisions of this landscape type, these are as follows:
- Estate farmlands with plantations;
 - Village farmlands; and
 - Village farmlands with ancient woodlands.
- 8.3.86 These are described in Appendix C.3.
- 8.3.87 The study area comprises a number of landscape Policy Zones within the Sherwood LCT and the Mid Nottinghamshire Farmlands LCT, these include:
- S PZ 06 Sherwood Pines wooded estatelands;
 - S PZ 07 Oxtun village farmlands;
 - S PZ 09 Old Clipstone estate farmlands;
 - S PZ 14 Rainworth Water meadowlands with plantations;
 - S PZ Blidworth and Rainworth wooded estatelands;
 - MN PZ 24 Rufford Park estate farmlands with plantations;

- MN PZ 26 Eakring Brail Wood village farmlands with ancient woodlands;
and
- MN PZ 27 Kirklington village farmlands.

8.3.88 The Scheme is located in Sherwood PZ 09 Old Clipstone Estate Farmlands which is assessed as having a moderate landscape condition, and a moderate landscape sensitivity with an overall landscape action of conserve and create, with the following objectives.

Landscape Features:

- Conserve the ecological diversity of small deciduous woodlands throughout the area;
- Conserve and create field boundary and road hedgerows where these have become degraded or lost;
- Create opportunities for restoring areas of heath land where appropriate;
and
- Create small deciduous woodlands where appropriate.

Built Features:

- Conserve the integrity and rural character of the landscape by concentrating new developments around the existing urban fringe of Edwinstowe and Lidgett;
- Create small scale woodland/tree planting to soften new development, preferably in advance of development;
- Conserve the existing field pattern by locating new small scale development within the existing field boundaries;
- Promote measures for reinforcing the traditional character of farm buildings using vernacular building styles and
- Promote sensitive design and siting of agricultural buildings.

Baseline Conditions of the Site

Land Use

8.3.89 The land uses of the above area include the following:-

- Carriageway;
- Footways;
- Verges with highway infrastructure, such as signs and lighting;
- Frontage of Featherstone House Farm;
- The Lime's Café (including residential bungalow) and four residential properties, and surrounding gardens and hedgerows; and
- Agricultural land.

Boundaries

- 8.3.90 The entrance to Rufford Bridleway 5 (Inkersall Lane), agricultural land and existing highway verges form the western boundary of the site. The existing highway verges, agricultural land and the frontage of Featherstone House Farm to the east of the site. The existing carriageway and Mickledale Lane form the northern edge of the site and the existing carriageway forms the southern boundary of the site.

Topography

- 8.3.91 The Scheme is at a height of approximately 71 mAOD at the junction between Mickledale Lane and the A614, the topography falls away to 68 mAOD to the east and to the south.

Closest Residential Buildings

- 8.3.92 The closest residential buildings are four properties to the south-east of the existing junction, with surrounding gardens and outbuildings.

Lowdham Roundabout

Baseline Conditions of the Study Area

Land Use

- 8.3.93 The land use of the study area is predominantly residential and agricultural and includes the valleys of the Cocker Beck and Dover Beck water courses, as well as highway infrastructure surrounding the junction of the A612 and A6097. There are restored sand and gravel workings in the Trent Valley at Gunthorpe, Shelford and Hoveringham.
- 8.3.94 There are only small, isolated areas of woodland within the area, with riparian woodland in association with the water courses. There is woodland associated with restored sand and gravel workings to the south and north-east of the study area.
- 8.3.95 The agricultural areas are a mix of arable, and grazing pasture, with isolated farms spread throughout the area.
- 8.3.96 The village of Lowdham lies to the north, north-west, north-east, east and south-east of the existing roundabout and is generally bounded by the A6097 and the A612. However, the older part of the village is to the west side of the A6097 and to the north-west of the existing roundabout. The village of Bulcote is located on the south-western edge of the study area, and the village of Gunthorpe to the southern edge. The village of Caythorpe is located to the south-east of the study area and the village of Gonalston to the north-east.
- 8.3.97 The land use of the study area is shown on Figure 8-2d – Aerial Photograph of Study area.

Topography

- 8.3.98 The highest point in the study area is at a height of 74 mAOD around Lowdham Grange to the north-west, and on the south-west/north-east escarpment forming the northern edge of the Trent Valley at 65 mAOD. The A6097 follows a valley which cuts through this escarpment. The land falls away sharply to the south of this escarpment to a height of 18 m on the A6097 to the south of the existing roundabout. Please refer to Figure 8-3d – Topography of the study area.

Public Rights of Way

8.3.99 There are a large number of PRoWs both footpaths and Bridleways within the study area. These are shown on Figure 8-4d – Designations of the study area. These are as follows:

North – north-western quadrant – between A6097 north route and A612 east route from roundabout:

- Epperstone BW7 to the north, which connects Gonalston to the high point of the escarpment at Hagg Farm;
- Epperstone FP8 to the north, which connects Lowdham BW 11 to Gonalston Lane;
- In Gonalston - FP3 to the north-east, which connects Gonalston village to Gonalston Lane;
- In Gonalston - FP 5/5a to the north-east, which connects Gonalston village to A612;
- Lowdham BW 10/Epperstone BW 7a to the north, which connects Gonalston Lane to A6097;
- Lowdham BW 11 to the north, which connects A6097 to Epperstone FP 8;
- Lowdham FP 8 to the north, which connects the centre of Lowdham with the valley of Dover Beck;
- In Lowdham - FP3 to the north, which connects A6097 with A612 across the recreation ground;
- In Lowdham - FP4 to the north-west, which connects A6097 to the recreation ground;
- Lowdham FP 9/Gonalston FP6 to the north, which connects the centre of Lowdham with the valley of Dover Beck; and
- Lowdham FP 26 to the north, connects A6097 with centre of Lowdham.

East – south-eastern quadrant – between A612 east route and A6097 south route from roundabout:

- Caythorpe BW2/Hoveringham BW 13 to the east, which connects Caythorpe Lane to Gonalston Lane;
- Gonalston FP4 to the north-east, which connects A6097 with Gonalston Lane;
- Gonalston FP 8/Hoveringham FP 8 to the north-east, which connects A612 to Gonalston Lane;
- Gonalston FP9/ Caythorpe FP 3 to the north-east, which follows the valley of the Dover Beck;
- Gunthorpe FP1 to the south-east, connects Gunthorpe to Hoveringham;
- Hoveringham BW4 to the east, which connects Hoveringham to Thurgaton;

- Hoveringham FP10 to the east, which connects Caythorpe Road to Gibsmere; and
- Lowdham BW6 to the east, which connects A612 to Caythorpe Road.

South-western quadrant – between A6097 south route and A612 west route from roundabout:

- Bulcote BW1/ Burton Joyce 4 - to the south, which connects Bulcote village with Burton Meadows.

North-western quadrant – between A612 west route and A6097 north route from roundabout:

- Bulcote BW 3/Burton Joyce BW 1 to the south-west, which connects A162 to Burton Joyce;
- Lowdham BW 11 to the north-west, which connects A6097 to Old Epperstone Road;
- Lowdham BW 15 to the north-west, connects Lambley Road to Lambley Lane;
- Lowdham FP1 to the north-west, which connects A612 to the escarpment;
- Lowdham FP 2 to the north-west, which connects A612 with Lowdham Conservation Area;
- Lowdham FP 12 to the north-west, which connects Old Epperstone Road to Lowdham Conservation Area;
- Lowdham FP 14 to the north-west, which connects the Lowdham Conservation Area to the valley of Cocker Beck;
- Lowdham FP 17 to the north-west connects Ton Lane to Lowdham FP 18;
- Lowdham FP 18 to the north-west connects Ton Lane to Lowdham FP 20;
- Lowdham FP 19 the north-west, connects to Lowdham FP 20;
- Lowdham FP 20 to the north-west, which connects A6097 to Lowdham Conservation Area; and
- In Lowdham Conservation Area FP 13, 14, 16, 17, 21, 22, 24 and 27.

Landscape Designations

Statutory Landscape Designations

- 8.3.100 The study area is not covered by a landscape designation. The nearest statutory landscape designation is the Peak District National Park, located approximately 40 km from the Scheme.

Non-Statutory Landscape Designations

- 8.3.101 The study area is within the jurisdiction of NS, and the planning policy for the area is shown on the Policies Map (adopted July 2013). This map forms part of the Local Development Framework which also includes the Amended Core Strategy

Development Plan Document DPD (adopted March 2019), and the Allocations and Development Management DPD (adopted July 2013).

8.3.102 NSDC non-statutory landscape designations that apply to the area are as follows:

- Sherwood Forest Regional Park – (shAP1) - The Policy states that NSDC will work with its partners to maintain and enhance the ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.

Ecological Designations

8.3.103 European, National and Local ecological designations within the study area are fully detailed in Chapter 9 - Ecology and Nature Conservation of this report but are summarised below:

- Local Nature Reserve – Gonalston Road grasslands, Epperstone - Core Policy 12 and DM 7;
- Local Nature Reserve – Ivy Cottage Pastures - Core Policy 12 and DM 7;
- Local Nature Reserve – Lowdham Pastures - Core Policy 12 and DM 7;
- Local Nature Reserve – Gonalston Marsh - Core Policy 12 and DM 7;
- Local Nature Reserve – Gonalston Lane Pit - Core Policy 12 and DM 7;
- Local Nature Reserve – Dover beck, Caythorpe - Core Policy 12 and DM 7; and
- Local Nature Reserve – Gunthorpe Lakes - Core Policy 12 and DM 7.

Heritage Designations

8.3.104 Heritage designations within the study area are fully detailed in this report in Chapter 7 – Cultural Heritage but are summarised below:

- Lowdham Conservation Area – Core Policy 14 and DM9; and
- Bulcote Conservation Area - Core Policy 14 and DM9.

8.3.105 There are a number of listed buildings and non-designated historic buildings within the Lowdham and Bulcote Conservation Areas, and there are also non-designated historic buildings in the study area, several of which are isolated farms.

Other Designations

Cultural Associations

8.3.106 There are strong cultural associations within the study area due to the overall settlement pattern being little changed since medieval times. The gravel terraces along the River Trent have been the focus of human activity for thousands of years. Cultural associations will be considered within the ES.

Green Belt

8.3.107 The Scheme is located in the Green Belt (Policy SP4A/4B). Green Belts are not a landscape designation but perspective on the openness of the Green Belt can be influenced by visual effects. As such, the visual effects upon the openness of the

Green Belt will be considered in the LVIA, in order to inform wider planning decisions.

National Landscape Character

8.3.108 The study area is located within the Trent and Belvoir Vales NCA 48 which is described as follows (Natural England, 2013):

“The Trent and Belvoir Vales National Character Area (NCA) is characterised by undulating, strongly 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. Newark-on-Trent (generally referred to as Newark) lies at the centre with Grantham, Nottingham, Lincoln and Gainsborough on the peripheries. The southern and eastern edges of the Vales are defined by the adjoining escarpments of the Lincolnshire Edge and the Leicestershire and Nottinghamshire Wolds NCA. To the west, the escarpment of a broad ridge of rolling landscape defines the boundary with the neighbouring Sherwood and Humberhead Levels NCAs. 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 flood plain 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.’

‘Cultural heritage is evident in the Trent and Belvoir Vales NCA with the overall settlement pattern little changed since medieval times. The gravel terraces along the Trent have been the focus of human activity for many thousands of years. The enclosure and reorganisation of the landscape in the 18th and 19th centuries can be seen in the regularly shaped hawthorn hedged fields and the distinctive red brick and pantile building style of the villages and farmsteads. Traditionally a mixed farming area, its intrinsic landscape character has been weakened by modern agricultural practices and development. Much pasture has been converted to arable use, hedgerows have been removed to create larger fields and the historic environment has been put at risk. Rural tranquillity is still a feature over much of the areas however, significant residential and landscape development pressures exist from the main settlements and major roads that traverse the area. Managing the ongoing extraction of the extensive sand and gravel and other mineral resources present challenges as well as opportunities. Habitats created after the extraction of sand and gravel provide regionally important sites for wildlife as well as major recreational assets to the area.’

Regional Landscape Character

8.3.109 The study area contains two areas in the East Midlands Regional Landscape Character Assessment, firstly subdivision 3a Floodplain Valleys, of Group 3, River Valley Floodplains which has the following key characteristic features:

- *“Deep alluvium and gravel deposits mask underlying bedrock geology to create wide, flat alluvial floodplains surrounded by rising landform of adjacent Landscape Character Types;*
- *River channels, often along managed courses, bordered by riparian habitat;*
- *Predominance of pastoral land use, with cereal growing increasing in some areas. ‘Warping’ areas subject to more intensive cereal growing;*

- *Limited woodland cover; however, steep riverside bluffs and areas close to settlement or on former gravel extraction sites notable for a higher level of woodland cover;*
- *Regular pattern of medium to large fields defined by hedgerows or post and wire fencing, breaking down and becoming open in some areas;*
- *Hedgerow and riverside trees important component of landscape. Alder, Willow and Poplar are typical riverside trees;*
- *Limited settlement and development in rural areas;*
- *Sewage Treatment Works and power stations common close to larger settlements that fringe the floodplains;*
- *Roads and communication routes often define the outer edges of the floodplain; and*
- *Restoration of sand and gravel extraction sites to open water creates new character across many areas.”*

8.3.110 The study area also contains subdivision 5b Wooded Village Farmlands of Group 5 Village Farmlands, which has the following key characteristic features:

- *“Varied topography, ranging from gently undulating farmlands to rolling hills, becks and steep sided valleys, locally known as ‘Dumbles’;*
- *Scattered farm woodlands, ancient woodlands on prominent hills and tree lined valleys contribute to a well wooded character;*
- *Well maintained pattern of hedged fields enclosing pasture and arable fields, with evidence of decline close to urban areas;*
- *Sparsely settled, with traditional pattern of farms and small rural villages linked by quiet country lanes; and*
- *Strong sense of landscape history.”*

Local Landscape Character

8.3.111 The study area is located at the county level at the junction of the Mid Nottinghamshire Farmlands Landscape Character Type (LCT) and Trent Washlands LCT. This is shown on Figure 8-5d – Landscape Character of the study area. Within the Mid Nottinghamshire Farmlands LCT the study area is at the junction of two subdivisions of this landscape type, these are as follows:

- Village farmlands with ancient woodlands; and
- Village farmlands.

8.3.112 Within the Trent Washlands LCT the study area is at the junction of two subdivisions of this landscape type, these are as follows:

- Village farmlands; and
- River meadowlands.

8.3.113 A full description is included in Appendix C.4.

8.3.114 The study area includes a number of Policy Zones, those relevant to the Scheme include:

- MN PZ 39 Thurgaton village farmlands with ancient woodlands;
- MN PZ 40 Epperstone village farmlands with ancient woodlands;
- MN PZ42 Lowdham Grange village farmlands;
- TW PZ 06 Bulcote village farmlands;
- TW PZ 08 Gunthorpe and Hoveringham village farmlands;
- TW PZ 26 Gunthorpe village farmlands;
- TW PZ 27 Caythorpe and Gonalston village farmlands;
- TW PZ 51 Stoke Lock river meadowlands; and
- TW PZ 52 Thurgaton river meadowlands.

8.3.115 The Scheme is located in Mid Nottinghamshire Farmlands Policy Zone 40 Epperstone village farmlands with ancient woodlands and Trent Washlands PZ 06 Bulcote village farmlands.

8.3.116 MN PZ 40 is assessed by NSDC as having a good landscape condition and a moderate landscape sensitivity with an overall landscape action of conserve and reinforce, with the following objectives:

Landscape Features:

- Conserve and reinforce hedgerows where these are fragmented and in poor condition, particularly internal hedgerows;
- Seek opportunities to restore the historic field pattern/boundaries where these have been lost and introduce more hedgerow trees;
- Reinforce with new planting to replace post and wire fencing; and
- Conserve and reinforce the ecological diversity of all designated SINC's where appropriate.

Built Features:

- Conserve and reinforce the rural character of the Policy Zone by concentrating new development around existing settlements of Southwell and Halloughton; and
- Conserve the local built vernacular and reinforce this in new development.

8.3.117 TW PZ 06 Bulcote Village Farmlands is assessed as having a moderate landscape condition and a moderate landscape sensitivity with an overall landscape action of conserve and create with the following objectives:

Landscape features:

- Conserve existing meadowland hedgerows and seek opportunities to restore the historic field pattern with new hedgerow planting;

- Seek opportunities to restore arable land to permanent pasture; and
- Strengthen the continuity and ecological diversity of stream corridors.

Built features:

- Conserve the historic character and setting of village settlement of Bulcote – new development should respect the scale, design and materials used traditionally;
- Conserve historic field pattern by containing new development within historic boundaries;
- Create small scale woodlands and carry out appropriate tree planting to reduce the visual impact of large scale agricultural sheds and commercial development along the A612;
- Promote sensitive design and siting of new agricultural buildings; and
- Promote measures for reinforcing the traditional character of farm buildings using vernacular styles.

Baseline conditions of the site

Land Use

8.3.118 The land uses of the above area include the following:

- Existing carriageway;
- Existing footway;
- Existing roundabout with highway infrastructure such as signs and lighting;
- Existing verges with trees and hedgerows; and
- Agricultural land.

Boundaries

8.3.119 The west and north-west boundary of the Scheme is formed by agricultural land and the existing carriageway, and the northern boundary of the Scheme is formed by an open recreational area with mature trees to its southern boundary. The east boundary of the Scheme is formed by houses at the south-eastern edge of Lowdham, and the existing carriageway. The south boundary of the Scheme is formed by agricultural land and houses, (numbers 15, 17, 19 and 21), adjacent to the existing roundabout. The south-western boundary of the Scheme is formed by the existing carriageway of the A612.

Topography

8.3.120 The Scheme is at a height of approximately 21 mAOD and falls away gently north-west - south-east into the Trent Valley.

Closest Residential Buildings

8.3.121 The closest residential buildings, (numbers 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 and 21) are to the south side of the A612/Nottingham Road adjacent to the roundabout split by the A6097 bypass road.

- 8.3.122 There are also detached houses on the north side of the A612/Nottingham Road (numbers 2, 4, 6, 8 and 10), a short distance south-west of the roundabout.
- 8.3.123 Properties on Victoria Avenue and parts of Station Rd, Lowdham are also relatively close to the existing roundabout site.

Kirk Hill Junction

Baseline Conditions of the Study Area

Land Use

- 8.3.124 The land use of the study area is predominately agricultural, with small woodlands, as well as highway infrastructure surrounding the junction of the A6097, with Kirk Hill and East Bridgford Road; and surrounding the A46 and its junction with the A6097.
- 8.3.125 The woodlands are small plantation woodlands such as Long Plantation, Shelford, Moor Close Plantation, Waterfurrow Plantation and Ash Holt, Newton. There are small broadleaved woodlands and orchards within the villages of East Bridgford and Gunthorpe. There is also riparian woodland and carr woodland associated with the River Trent corridor such as the Trent Hills woodland, woodland surrounding reclaimed sand and gravel pits at Gunthorpe, and the recently planted verges of the A46.
- 8.3.126 The agricultural areas are arable, and pasture. There are isolated farms spread throughout the area.
- 8.3.127 The villages of East Bridgford and Newton lie completely within the study area, and the village of Gunthorpe is partially within the study area. The residential areas of East Bridgford lie immediately to the north-east of the Scheme.
- 8.3.128 The River Trent flows through the study area from west to east.
- 8.3.129 The land use of the study area is shown on Figure 8-2e – Aerial Photograph of Study Area.

Topography

- 8.3.130 The highest points in the study area are at the top of the escarpment to the south-east of the Trent Valley, at a height of 70 mAOD at Mill Farm to the north-east of the site and the village of East Bridgford. There is also a high point on the ridge at 50 mAOD between the villages of Shelford and Newton. The lowest point is in the Trent Valley near Glebe Farm at 15 mAOD to the north of the site. Please refer to Figure 8-3e – Topography of the study area.

Public Rights of Way

- 8.3.131 There are many PRowWs, both footpaths and bridleways within the study area. These are shown on Figure 8-4e– Designations of the study area. These are as follows:

North of the River Trent:

- Gunthorpe BW 2 – to the north, which passes along the River Trent's northern embankment;
- Gunthorpe FP 1 – to the north, which connects Gunthorpe and Caythorpe; and

- Gunthorpe FP 3 and 4 – to the north, which connect Gunthorpe and the River Trent.

South-west of A6097:

- Shelford FP 3 – to the south-west, which connects Shelford to Shelford Road;
- Shelford FP 4 - to the south-west, which connects Shelford to Shelford Road;
- Shelford FP 9 - to the south-west, the Trent Valley Way – which connects the A6097 to Shelford Road;
- Newton BW 4 – to the south, which connects East Bridgford Road to Bingham;
- Newton FP 1 – to the south, which connects Newton to East Bridgford
- Newton FP 2 – to the south-west, which connects the Trent Valley Way to East Bridgford Road;
- Newton FP 3 – to the south, which connects Newton to East Bridgford; and
- Newton FP 5 – to the south, which connects Saxondale to Newton.

South-east of A46:

- Bingham BW 2 – to the south-west, which connects Bingham to A46 (former route);
- Bingham FP 3 – to the south-west, which connects Bingham to A46 (former route);
- Bingham FP 5 – to the south-west, which connects Bingham to A46 (former route); and
- Car Colston FP 17 - to the south-west, which connects Chapel Lane to B692.

North-west of East Bridgford:

- East Bridgford BW 15 – to the north-east, which passes along Old Hill Lane;
- East Bridgford BW 16 – to the north-east, which passes along Old Hill Lane;
- East Bridgford BW 28 – north-west – south-east, which connects the River Trent and A46 (new route);
- East Bridgford BW 35 – to the north, which passes along the River Trent;
- East Bridgford FP 11 - to the north-east, which connects FP 12 to BW 15;
- East Bridgford FP 12 – to the north, which connects East Bridgford to the River Trent;
- East Bridgford FP 13 and 14 – to the north, which passes along the River Trent;

- East Bridgford FP 17 – to the north-east, which connects BW 15 to Kneeton;
- East Bridgford FP 29 – to the north-west, which connects BW 28 to the River Trent;
- East Bridgford FP 30 – to the north-east, connects East Bridgford to the River Trent; and
- East Bridgford FP 31 - to the north, which passes along Trent Lane from East Bridgford to the River Trent.

Within East Bridgford village:

- East Bridgford BW 8;
- East Bridgford BW 36; and
- East Bridgford FP 2, 4, 5, 6, 7, 9, 10, 19, 20, 23, 24, 37 and 38.

South-east of East Bridgford:

- East Bridgford RB 18 – to the north-east, which connects Kneeton Road to Car Colston;
- East Bridgford RB 22 – to the north-east, which connects East Bridgford to A46;
- East Bridgford RB 33 – to the east, which connects East Bridgford to A46
- East Bridgford RB 34 – to the south-east, which connects East Bridgford to A6097;
- East Bridgford RB 43 – to the east, parallel with A46;
- East Bridgford RB 44 – to the east, which connects East Bridgford to A46;
- East Bridgford BW 42 – to the south-east, parallel with A46;
- East Bridgford FP 19 – to the north-east, which connects East Bridgford to RB 18;
- East Bridgford FP 21 – to the north-east, which connects East Bridgford to A46;
- East Bridgford FP 25 – to the south-east, which connects East Bridgford to A46; and
- East Bridgford FP 45 – to the south-east, which connects East Bridgford to A46.

Landscape Designations

Statutory Landscape Designations

- 8.3.132 The study area is not covered by a landscape designation. The nearest statutory landscape designation is the Peak District National Park, located approximately 43 km from the Scheme.

Non-Statutory Landscape Designations

- 8.3.133 The study area is within the jurisdiction of both RBC and NSDC, with the dividing line between the two areas being the River Trent.
- 8.3.134 The planning policy for the RBC part of the study area is shown on the Policies Map (adopted 22 December 2014). This map forms part of the RBC Local Development Framework which includes the Local Plan Part 1: Core Strategy (adopted 22 December 2014), and Local Plan Part 2: Local Planning Policies, Community Involvement, Local Development Scheme, and Local Monitoring Report (Adopted 8th October 2019).
- 8.3.135 The planning policy for the Newark and Sherwood Part of the study area is shown on the Policies Map (adopted July 2013). This map forms part of the Local Development Framework which also includes the Amended Core Strategy Development Plan Document DPD (adopted March 2019), and the Allocations and Development Management DPD (adopted July 2013).
- 8.3.136 Non-statutory landscape designations that apply to the study area are as follows:
- Sherwood Forest Regional Park – (shAP1) - The Policy states that NSDC will work with its partners to maintain and enhance the ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.

Ecological Designations

- 8.3.137 European, national and local ecological designations within the study area are fully detailed in this report in Chapter 9 - Biodiversity and are summarised below:
- Local Nature Reserve – Gunthorpe Lakes – NSDC Core Policy 12 and DM 7;
 - Local Nature Reserve – Shelford Carr - RBC LP1 Policy 17;
 - Local Nature Reserve – Gunthorpe Riverside Gravel Pit – RBC LP1 Policy 17; and
 - Local Nature Reserve – River Trent – Gunthorpe to Fiskerton – RBC LP1 Policy 17.

Heritage Designations

- 8.3.138 Heritage designations within the study area are fully detailed in this report in Chapter 7 – Cultural Heritage but are summarised below:
- East Bridgford Conservation Area – RBC LP1 Policy 11.
- 8.3.139 There are numerous listed buildings and non-designated historic buildings within the East Bridgford Conservation Area, and there are also non-designated historic buildings in the study area, several of which are isolated farms. These designations are relevant in that they contribute to the landscape value of the study area, and the visual impact of the proposals on the setting of such heritage features needs to be taken into account in the EA.

Other Designations

Cultural Associations

- 8.3.140 There are strong cultural associations within the study area due to the overall settlement pattern being little changed since medieval times. The gravel terraces along the River Trent have been the focus of human activity for thousands of years. Cultural associations will be considered within the ES.

Green Belt

- 8.3.141 The Scheme is located in the Green Belt (RBC LP1 Policy 4; LP2 Policy 21 and NSDC Policy SP4A/4B). Green Belts are not a landscape designation, but perspective on the openness of the Green Belt can be influenced by visual effects. As such, the visual effects upon the openness of the green belt will be considered in the LVIA, in order to inform wider planning decisions.

National Landscape Character

- 8.3.142 The study area is located within the Trent and Belvoir vales NCA 48 which is described as follows (Natural England, 2013):

“The Trent and Belvoir Vales National Character Area (NCA) is characterised by undulating, strongly 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. Newark-on-Trent (generally referred to as Newark) lies at the centre with Grantham, Nottingham, Lincoln and Gainsborough on the peripheries. The southern and eastern edges of the Vales are defined by the adjoining escarpments of the Lincolnshire Edge and the Leicestershire and Nottinghamshire Wolds NCA. To the west, the escarpment of a broad ridge of rolling landscape defines the boundary with the neighbouring Sherwood and Humberhead Levels NCAs. 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 flood plain 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.’

‘Cultural heritage is evident in the Trent and Belvoir Vales NCA with the overall settlement pattern little changed since medieval times. The gravel terraces along the Trent have been the focus of human activity for many thousands of years. The enclosure and reorganisation of the landscape in the 18th and 19th centuries can be seen in the regularly shaped hawthorn hedged fields and the distinctive red brick and pantile building style of the villages and farmsteads. Traditionally a mixed farming area, its intrinsic landscape character has been weakened by modern agricultural practices and development. Much pasture has been converted to arable use, hedgerows have been removed to create larger fields and the historic environment has been put at risk. Rural tranquillity is still a feature over much of the areas however, significant residential and landscape development pressures exist from the main settlements and major roads that traverse the area. Managing the ongoing extraction of the extensive sand and gravel and other mineral resources present challenges as well as opportunities. Habitats created after the extraction of sand and gravel provide regionally important sites for wildlife as well as major recreational assets to the area.’

Regional Landscape Character

8.3.143 The study area contains two areas in the East Midlands Regional Landscape Character Assessment, firstly subdivision 3a Floodplain Valleys, of Group 3, River Valley Floodplains which has the following key characteristic features:

- *“Deep alluvium and gravel deposits mask underlying bedrock geology to create wide, flat alluvial floodplains surrounded by rising landform of adjacent Landscape Character Types;*
- *River channels, often along managed courses, bordered by riparian habitat;*
- *Predominance of pastoral land use, with cereal growing increasing in some areas. ‘Warping’ areas subject to more intensive cereal growing;*
- *Limited woodland cover; however, steep riverside bluffs and areas close to settlement or on former gravel extraction sites notable for a higher level of woodland cover;*
- *Regular pattern of medium to large fields defined by hedgerows or post and wire fencing, breaking down and becoming open in some areas;*
- *Hedgerow and riverside trees important component of landscape. Alder, Willow and Poplar are typical riverside trees;*
- *Limited settlement and development in rural areas;*
- *Sewage Treatment Works and power stations common close to larger settlements that fringe the floodplains;*
- *Roads and communication routes often define the outer edges of the floodplain; and*
- *Restoration of sand and gravel extraction sites to open water creates new character across many areas.”*

8.3.144 The study area also contains subdivision 4a Unwooded vales of Group 4 Lowland Vales, which has the following key characteristic features:

- *“Extensive, low lying rural landscape underlain by Triassic and Jurassic mudstones and clays and widespread superficial deposits;*
- *Expansive long distance and panoramic views from higher ground at the margin of the vales gives a sense of visual containment;*
- *Low hills and ridges gain visual prominence in an otherwise gently undulating landscape;*
- *Complex drainage patterns of watercourses that flow within shallow undulations often flanked by pasture and riparian habitats;*
- *Limited woodland cover; shelter belts and hedgerow trees gain greater visual significance and habitat value as a result;*
- *Productive arable and pastoral farmland, with evidence of increasing reversion to arable cropping in recent times;*

- *Regular pattern of medium sized fields enclosed by low and generally well maintained hedgerows and ditches in low lying areas; large modern fieldscapes evident in areas of arable reversion; and*
- *Sparsely settled with small villages and dispersed farms linked by quiet rural lanes.”*

Local Landscape Character

- 8.3.145 At the County Level, the study area is located on the boundary between the Trent Washlands Landscape Character Type (LCT) and the South Nottinghamshire Farmlands LCT. Within the Trent Washlands LCT, these LCTs are as follows:
- Village Farmlands; and
 - River Meadowlands.
- 8.3.146 Within the South Nottinghamshire Farmlands LCT, these LCTs are as follows:
- Village Farmlands.
- 8.3.147 A full description is included in Appendix C.5.
- 8.3.148 The study area comprises a number of Landscape Policy Zones within the Trent Washlands LCT and South Nottinghamshire Farmlands LCT, the relevant Policy Zones include:
- SN PZ 05 East Bridgford escarpment farmlands;
 - SN PZ 06 Village farmlands;
 - TW PZ 07 Shelford village farmlands;
 - TW PZ 08 Gunthorpe and Hoveringham village farmlands;
 - TW PZ 26 Gunthorpe village farmlands; and
 - TW PZ 51 Stoke Lock river meadowlands.
- 8.3.149 The Scheme is located in South Nottinghamshire Policy Zone 05 East Bridgford escarpment farmlands.
- 8.3.150 South Nottinghamshire Farmlands Policy Zone 05 is assessed as having a moderate landscape condition, and a moderate landscape strength with an overall landscape action of enhance with the following objectives:

Landscape Features:

- Conserve the older field patterns within the DPZ around East Bridgford and Kneeton ensuring that fields are not expanded for more intensive farming
- Enhance field boundaries through augmentation of hedgerows to reinforce field pattern;
- Enhance the distribution of hedgerow trees by encouraging planting of trees within hedgerows. Species used should be mostly ash with some oak. These should be carefully located to ensure that an open character is retained;

- Conserve the small pockets of permanent pasture around village fringes;
- Enhance woodland cover within the DPZ ensuring where implemented it is small in size and reflects surrounding field patterns and the character of small infrequent prominent woodlands; and
- Conserve and enhance opportunities for distinctive views across the Trent Washlands from adjacent roads on higher ground through careful management of hedgerows and woodlands to retain views.

Built Features:

- Enhance village fringes through planting small copses to break up the uniform nature of the urban edge particularly along the fringes of larger commuter settlements such as Radcliffe on Trent and Newton;
- Conserve the older cores of villages with red brick and pantile roofed vernacular buildings;
- Conserve the narrow character of roads through East Bridgford and the distinctive walled approach along Kirk Hill;
- Conserve the variety of built form and orientation of buildings along roads within villages;
- Conserve the small scale character of Kneeton and retain the connection to farming through retaining the presence of working farms;
- Any developments along village fringes should encourage the use of red brick and pantile roofs and make a positive contribution to local character and distinctiveness within each individual village; and
- Development along village fringes should aim to provide a dispersed character rather than a sharp continuous built line and incorporate smaller fields or open spaces, to provide a dispersed appearance to village fringes.

Other Development/ Structures in the Landscape:

- Retain and enhance hedgerow boundaries and hedgerow tree boundaries along roads through the area;
- Conserve the small rural character of roads through the area; and
- Enhance the landscape through planting of small copses and hedgerows and hedgerow trees along the A46 to reduce its prominence.

Baseline conditions of the site

Land Use

8.3.151 The land uses of the above area include the following:

- Existing carriageway;
- Existing footway;
- Existing verges with highway infrastructure such as signs and lighting;
- Existing verges trees and hedgerows; and

- Agricultural land to the west of the junction.

Boundaries

8.3.152 The existing verge, hedgerows and trees form the northern boundary of the Scheme, with Kirk Hill joining the A6097 from the north. The existing verge, hedgerows and trees also form part of the southern boundary of the Scheme, with East Bridgford Road joining the A6097 from the south. The Scheme also extends into an area of agricultural land to the south. The existing carriageway forms the north-western and south-eastern boundaries of the Scheme.

Topography

8.3.153 The Scheme is at a height of approximately 47 mAOD and falls away to the north-west into the Trent valley and to the south-east towards the A46.

Closest Residential Buildings

8.3.154 The closest residential buildings are immediately adjacent to the Scheme between Kirk Hill and the A6097. There are also residential buildings at Hill Farm, between the edge of the village of East Bridgford and the A6097, and houses to the south of Main Street, East Bridgford to the north east of the Scheme.

8.4 Value of Environmental and Resource Receptors

8.4.1 This section provides the standard criteria to be used to define the sensitivity (value) of the receiving landscape and visual receptors. The sensitivity will be defined for the ES, based on the understanding of the baseline in Section 8.3 and further site survey work.

Landscape Sensitivity

8.4.2 Landscape sensitivity will be determined in accordance with DMRB guidance LA 107 Landscape and visual effects, revision 2 (Highways England, February 2020).

8.4.3 Relevant tables from the above guidance clarifying the terms used to describe landscape sensitivity and the corresponding typical landscape descriptions are set out in Table 8-1.

Table 8-1 Landscape Sensitivity (Susceptibility and Value) and Typical Descriptions (from DMRB LA 107 Table 3.22)

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 (i.e. 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 (i.e. designated areas, areas of strong sense of place - registered parks and gardens, country parks).
Medium	Landscapes of local or regional recognition of importance able to accommodate some change (i.e. features worthy of

Landscape sensitivity (susceptibility and value) of receptor/resource **Typical description**

	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 (i.e. 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.

Visual Sensitivity

- 8.4.4 Visual sensitivity will be determined in accordance with DMRB guidance LA 107.
- 8.4.5 Relevant tables from the above guidance clarifying the terms used to describe visual sensitivity and the corresponding typical receptor descriptions are set out in Table 8-2.

Table 8-2 Visual Sensitivity (Susceptibility and Value) and Typical Descriptions (from DMRB LA 107 Table 3.41)

Sensitivity (susceptibility and value)	Typical descriptions
Very high	<ol style="list-style-type: none"> 1) Static views from and of major tourist attractions; 2) Views from and of very important national/international landscapes, cultural/historical sites (e.g. National Parks, UNESCO World Heritage sites); 3) Receptors engaged in specific activities for enjoyment of dark skies.
High	<ol style="list-style-type: none"> 1) Views by users of nationally important PRow / recreational trails (e.g. national trails, long distance footpaths); 2) Views by users of public open spaces for enjoyment of the countryside (e.g. country parks); 3) Static views from dense residential areas, longer transient views from designated public open space, recreational areas; 4) Views from and of rare designated landscapes of national importance.
Moderate	<ol style="list-style-type: none"> 1) Static views from less populated residential areas, schools and other institutional buildings and their outdoor areas; 2) Views by outdoor workers; 3) 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; 4) Views from and of landscapes of regional importance.

Sensitivity (susceptibility and value)

Typical descriptions

Low	<ol style="list-style-type: none"> 1) Views by users of main roads or passengers in public transport on main arterial routes; 2) Views by indoor workers; 3) Views by users of recreational/formal sports facilities where the landscape is secondary to enjoyment of the sport; 4) Views by users of local public open spaces of limited importance with limited variety or distinctiveness.
Negligible	<ol style="list-style-type: none"> 1) Quick transient views such as from fast moving vehicles; 1) Views from industrial area, land awaiting re-development; 2) Views from landscapes of no importance with no variety or distinctiveness.

Ollerton Roundabout

Landscape Designations

- 8.4.6 Although the study area is not covered by statutory landscape designation, it still has value that is formed through a number of factors including landscape quality, scenic quality, rarity, representativeness, conservation interests, recreation value, perceptual aspects and associations.
- 8.4.7 The study area is within Sherwood Forest Regional Park – (shAP1). The Policy states that NSDC will work with its partners to maintain and enhance the ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.
- 8.4.8 Within the study area there are also several European, nationally and locally designated ecological sites and green estates, as well as several conservation areas, registered parks and gardens and the Sherwood Forest heritage area.
- 8.4.9 There are a number of listed buildings and non-designated historic buildings within the Ollerton and Wellow Conservation Areas and there are also other non-designated historic buildings in the study area, several of which are isolated farms.
- 8.4.10 These designations are relevant in that they contribute to the landscape value of the study area and inform the assessment of the visual impact of the proposals on the setting of such heritage features which should be taken into account in the EIA.

Landscape Character

- 8.4.11 At a county level the Scheme is located within the Sherwood Character Type (LCT) within the NSDC Landscape Character Assessment, which includes a number of SPZs, those relevant to the Scheme include:
- Sherwood Policy Zone 15 River Maun meadowlands which is assessed by NSDC as having a good landscape condition, and a moderate landscape sensitivity with an overall landscape action of conserve and reinforce.
 - Sherwood Policy Zone 26 Budby Estate Farmlands which is assessed by NSDC as having a very good landscape condition, and a moderate landscape sensitivity with an overall landscape action of conserve.

8.4.12 Further evaluation of the value of the character within the study area will be undertaken and reported in the ES.

Visual Receptors

8.4.13 Zone of Theoretical Visibility (ZTV) mapping will be used to identify the extent of the visibility of the Scheme. A preliminary ZTV drawing is included as Figure 8-6a. This is based on Environment Agency (EA) A 2m Digital Terrain Model (DTM) LIDAR data.

8.4.14 Receptors in the vicinity of the site that are likely to experience potential effects of the development include:

- Local residents;
- Visitors to fast food outlets and petrol stations;
- Users of PRow; and
- Road users.

8.4.15 The assessment will include a series of photographs from viewpoints representative of this range of receptors. Photomontages and/or other illustrative material may be prepared from specific key locations such as close to residential receptors which are the most sensitive to visual effects.

8.4.16 Provisional representative viewpoint locations are set out in Table 8-3, with locations illustrated in Figure 8-7a. These locations have been determined using the preliminary ZTV, aerial imagery and OS mapping. Final viewpoint locations will be determined following site investigation but may be fine-tuned or added to during consultation with NCC and NSDC planners.

Table 8-3 Ollerton Roundabout Representative Viewpoints

Viewpoint	Location	Receptor Type
1. Sherwood Heath LNR	At the commencement of PRow Ollerton and Boughton BW 26 on Sherwood Heath LNR	Representative of views for recreational receptors using the PRow
2.A614 traveling south	A614 north of the Scheme, adjacent to Forest Side cottages	Representative of views from the residential properties, and vehicular receptors travelling south
3.A616 traveling south-west	A616 east of Scheme	Representative of the edge of the Conservation Area and vehicular receptors travelling west
4. Entrance to Maida Lane	A616 east of Scheme, near entrance to Maida Lane	Representative of the edge of the Conservation Area, residential receptors and vehicular receptors travelling west

5. River Maun Bridge, Ollerton	Newark Road, Ollerton	Representative of the Conservation Area, and vehicular receptors travelling north-west
6. A614 traveling north	A614 south of the Scheme, adjacent to Shell petrol station	Representative of views of visitors to fast food outlets/petrol station, the edge of the Conservation Area and vehicular receptors travelling north
7. A6075 traveling east	A6075 west of Scheme, adjacent to The Coombs residential property	Representative of views from the residential property and vehicular receptors travelling east
8. Ollerton and Boughton Bridleway 8	Where the PRoW crosses the River Maun Valley	Representative of views for recreational receptors using the PRoW
9. Edwinstowe Footpath 7	Located at a high point south of the sewage works with long views towards the Scheme	Representative of views for recreational receptors using the PRoW

Mickledale Lane Junction Option 1

Landscape Designations

- 8.4.17 Although the study area is not covered by statutory landscape designation, it still has value that is formed through a number of factors including landscape quality, scenic quality, rarity, representativeness, conservation interests, recreation value, perceptual aspects and associations.
- 8.4.18 The study area is within Sherwood Forest Regional Park – (shAP1). The Policy states that NSDC will work with its partners to maintain and enhance the ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.
- 8.4.19 Within the study area there are also several locally designated ecological sites and green estates, as well as a conservation area, registered park and garden, the Sherwood Forest heritage area and the former Bilsthorpe Colliery railway line Multi-User Route.
- 8.4.20 These designations are relevant in that they contribute to the landscape value of the study area and the inform the assessment of the visual impact of the proposals on the setting of such heritage features which should be taken into account in the EIA.

Landscape Character

- 8.4.21 At a county level the Scheme is located within the Sherwood Character Type (LCT) within the NSDC Landscape Character Assessment, which include a number of SPZs, those relevant to the Scheme include:
- SPZ 09 Old Clipstone estate farmlands.
- 8.4.22 The Scheme is located in Sherwood PZ 09 Old Clipstone estate farmlands which is assessed by NSDC as having a moderate landscape condition, and a moderate landscape sensitivity with an overall landscape action of conserve and create.

8.4.23 Further evaluation of the value of the character within the study area will be undertaken and reported in the ES.

Visual Receptors

8.4.24 Zone of Theoretical Visibility (ZTV) mapping will be used to identify the extent of the visibility of the Scheme. A preliminary ZTV drawing is included as Figure 8-6b. This is based on EA 2m Digital Terrain Model (DTM) LIDAR data.

8.4.25 Receptors in the vicinity of the site that are likely to experience potential effects from the development include:

- Local residents;
- Visitors to the Limes café;
- Users of Public Rights of Way; and
- Road users.

8.4.26 The assessment will include a series of photographs from viewpoints representative of this range of receptors. Photomontages and/or other illustrative material may be prepared from specific key locations such as close to residential receptors which are the most sensitive to visual effects.

8.4.27 Provisional representative viewpoint locations are set out in Table 8-4 below, with locations illustrated in Figure 8-7b. These locations have been determined using the preliminary ZTV, aerial imagery, and OS mapping. Final viewpoint locations will be determined following further site investigation and consultation with NCC and NSDC.

Table 8-4 Mickledale Lane Junction Option 1 Representative Viewpoints

Viewpoint	Location	Receptor Type
1. Inkersall Lane – Rufford BW 5	PRoW Rufford BW 5, west of junction with A614	Representative of views of recreational receptors approaching the A614
2. The Limes café frontage	Car park of the Limes Cafe	Representative of views from the residential property, visitors to café, and vehicular receptors.
3. A614 travelling south	From Bilsthorpe Multi-User Route on the former mineral railway line	Representative of views of vehicular receptors and, recreational users of the Multi-User Route.
4. Residential edge of Bilsthorpe	From PRoW Rufford Bridleway 19	Representative of views of residential receptors on the edge of Bilsthorpe, and, recreational users of the PRoW
5. Mickledale Lane	Footway of Mickledale Lane, to the east of junction with A614.	Representative of views from one residential property and vehicular receptors

Viewpoint	Location	Receptor Type
6. A614 travelling north	Footway of A614 to south of junction with Mickledale Lane	Representative of views of vehicular receptors on A614

Mickledale Lane Junction Option 2

Landscape Designations

- 8.4.28 Although the study area is not covered by statutory landscape designation, it still has value that is formed through a number of factors including landscape quality, scenic quality, rarity, representativeness, conservation interests, recreation value, perceptual aspects and associations.
- 8.4.29 The study area is within Sherwood Forest Regional Park – (shAP1). The Policy states that NSDC will work with its partners to maintain and enhance the ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.
- 8.4.30 Within the study area there are also several locally designated ecological sites and green estates within the study area; as well as a conservation area, registered and non-registered parks and garden, the Sherwood Forest heritage area and the former Bilsthorpe Colliery railway line Multi-User Route.
- 8.4.31 These designations are relevant in that they contribute to the landscape value of the study area, and the inform the assessment of the visual impact of the proposals on the setting of such heritage features which should be taken into account in the EIA.

Landscape Character

- 8.4.32 At a county level the Scheme is located within the Sherwood Character Type (LCT) within the NSDC Landscape Character Assessment, which include a number of SPZs, those relevant to the Scheme include:
- SPZ 09 Old Clipstone estate farmlands.
- 8.4.33 The scheme is located in Sherwood PZ 09 Old Clipstone estate farmlands which is assessed is assessed by NSDC as having a moderate landscape condition, and a moderate landscape sensitivity with an overall landscape action of conserve and create.
- 8.4.34 Further evaluation of the value of the character within the study area will be undertaken and reported in the ES.

Visual Receptors

- 8.4.35 Zone of Theoretical Visibility (ZTV) mapping will be used to identify the extent of the visibility of the Scheme. A preliminary ZTV drawing is included as Figure 8-6c. This is based on EA 2m Digital Terrain Model (DTM) LIDAR data.
- 8.4.36 Receptors in the vicinity of the site that are likely to experience potential effects of the development include:
- Local residents;
 - Visitors to The Limes café;
 - Visitors and occupants of Featherstone House Farm;

- Users of Public Rights of Way; and
- Road users.

8.4.37 The assessment will include a series of photographs from viewpoints representative of this range of receptors. Photomontages and/or other illustrative material may be prepared from specific key locations such as close to residential receptors which are the most sensitive to visual effects.

8.4.38 Provisional representative viewpoint locations are set out in Table 8-5 below, with locations illustrated in Figure 8-7c. These locations have been determined using the preliminary ZTV, aerial imagery, and OS mapping. Final viewpoint locations will be determined following further site investigation and consultation with NCC and NSDC.

Table 8-5 Mickledale Lane Junction Option 2 Representative Viewpoints

Viewpoint	Location	Receptor Type
1. Inkersall Lane – Rufford BW 5	PRoW Rufford BW 5, west of junction with A614	Representative of views of recreational receptors approaching the A614
2. The Limes café frontage	Car park of the Limes Cafe	Representative of views from the residential property, visitors to café, and vehicular receptors
3. A614 travelling south	From Bilsthorpe Multi-User Route on the former mineral railway line	Representative of views of vehicular receptors, and recreational users of the Multi-User Route.
4. Residential edge of Bilsthorpe	From PRoW Rufford Bridleway 19	Representative of views of residential receptors on the edge of Bilsthorpe, and recreational users of the PRoW
5. Mickledale Lane	Footway of Mickledale Lane, to the east of junction with A614.	Representative of views from one residential property and vehicular receptors

Lowdham Roundabout

Landscape Designations

8.4.39 Although the study area is not covered by statutory landscape designation, it still has value that is formed through a number of factors including landscape quality, scenic quality, rarity, representativeness, conservation interests, recreation value, perceptual aspects and associations.

8.4.40 The study area is within Sherwood Forest Regional Park – (shAP1). The Policy states that NSDC will work with its partners to maintain and enhance the

ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.

- 8.4.41 Within the study area there are also several locally designated ecological sites and green estates.
- 8.4.42 There are a number of listed buildings and non-designated historic buildings within the Lowdham and Bulcote Conservation Areas. There are also other non-designated historic buildings in the study area, several of which are isolated farms.
- 8.4.43 These designations are relevant in that they contribute to the landscape value of the study area and inform the assessment of the visual impact of the proposals on the setting of such heritage features which should be taken into account in the EIA.
- 8.4.44 The Scheme is located in the Green Belt (Policy SP4A/4B). Green Belts are not a landscape designation, but perspective on the openness of the Green Belt can be influenced by visual effects. As such, the visual effects upon the openness of the Green Belt will be considered in the LVIA, in order to inform wider planning decisions.

Landscape Character

- 8.4.45 At a county level the Scheme is located at the boundary between two Landscape Character Types (LCT) within the NSDC Landscape Character Assessment, which includes a number of PZs, those relevant to the Scheme include:
- MN PZ 40 Epperstone village farmlands with ancient woodlands; and
 - TW PZ 06 Bulcote village farmlands.
- 8.4.46 The Scheme is located in Mid Nottinghamshire Farmlands Policy Zone 40 Epperstone village farmlands with ancient woodlands and Trent Washlands PZ 06 Bulcote village farmlands.
- 8.4.47 MN PZ 40 is assessed by NSDC as having a good landscape condition, and a moderate landscape sensitivity with an overall landscape action of Conserve and reinforce.
- 8.4.48 Bulcote Village Farmlands is assessed by NSDC as having a moderate landscape condition, and a moderate landscape sensitivity with an overall landscape action of conserve and create.
- 8.4.49 Further evaluation of the value of the character within the study area will be undertaken and reported in the ES.

Visual Receptors

- 8.4.50 Zone of Theoretical Visibility (ZTV) mapping will be used to identify the extent of the visibility of the Scheme. A preliminary ZTV drawing is included as Figure 8-6d. This is based on EA 2m Digital Terrain Model (DTM) LIDAR data.
- 8.4.51 Receptors in the vicinity of the site that are likely to experience views of the development include:
- Local residents;
 - Recreational users of Public Rights of Way; and
 - Road users.

- 8.4.52 The assessment will include a series of photographs from viewpoints representative of this range of receptors. Photomontages and/or other illustrative material may be prepared from specific key locations such as close to residential receptors which are the most sensitive to visual effects.
- 8.4.53 Provisional representative viewpoint locations are set out in Table 8-6, with locations illustrated in Figure 8-7d. These locations have been determined using the preliminary ZTV, aerial imagery, and OS mapping. Final viewpoint locations will be determined following further site investigation and consultation with NSDC and NCC.

Table 8-6 Lowdham Roundabout Representative Viewpoints

Viewpoint	Location	Receptor Type
1. Lowdham Conservation Area	PRoW Lowdham FP 20 at the southern edge of the Lowdham Conservation Area, at the field corner	Representative of views for recreational receptors using the PRoW, and the residents at the southern edge of the Conservation Area
2. PRoW Lowdham Footpath 8	PRoW Lowdham Footpath 8 on the slopes of Barker Hill	Representative of views for recreational receptors using the PRoW.
3. Lowdham Recreation Area	PRoW Lowdham FP 3 across the recreational area	Representative of views for recreational receptors using the PRoW, and the recreational area, and residents on the south-western edge of Lowdham
4. Station Road, Lowdham	To the south-east of junction with the A612	Representative of views of residents to the south-east of the Scheme, and vehicular receptors
5. A6097 traveling north-west	At the south-west end of Victoria Avenue, Lowdham	Representative of views of residents to the south-west of the Scheme, and vehicular receptors
6. A612 Burton Road traveling north east	North-west footway to A612	Representative of views of residents to the south-east of the Scheme, and vehicular receptors

Kirk Hill Junction

Landscape Designations

- 8.4.54 Although the study area is not covered by any statutory landscape designation, it still has value that is formed through a number of factors including landscape quality, scenic quality, rarity, representativeness, conservation interests, recreation value, perceptual aspects and associations.

- 8.4.55 The study area is within Sherwood Forest Regional Park – (shAP1). The Policy states that NSDC will work with its partners to maintain and enhance the ecological, heritage and landscape value of the Sherwood Area whilst promoting sustainable and appropriate leisure, tourism and economic regeneration.
- 8.4.56 Within the study area there are also several locally designated ecological sites and green estates.
- 8.4.57 There are a number of listed buildings and non-designated historic buildings within the East Bridgford Conservation Area. There are also other non-designated historic buildings in the study area, several of which are isolated farms.
- 8.4.58 These designations are relevant in that they contribute to the landscape value of the study area and inform the assessment of the visual impact of the proposals on the setting of such heritage features which should be taken into account in the EIA.
- 8.4.59 The Scheme is located in the Green Belt (NSDC Policy SP4A/4B and RBC LP1 Policy 4; LP2 Policy 21). Green Belts are not a landscape designation, but perspective on the openness of the Green Belt can be influenced by visual effects. As such, the visual effects upon the openness of the green belt will be considered in the LVIA, in order to inform wider planning decisions.

Landscape Character

- 8.4.60 At a county level the Scheme is located within the South Nottinghamshire Farmlands Character Type (LCT) within the Greater Nottingham Landscape Character Assessment, which includes a number of Policy Zones, those relevant to the Scheme include:
- SN PZ 05 East Bridgford escarpment farmlands.
- 8.4.61 South Nottinghamshire Farmlands Policy Zone 05 East Bridgford escarpment farmlands is assessed by RBC as having a moderate landscape condition, and a moderate landscape strength with an overall landscape action of enhance.
- 8.4.62 Further evaluation of the value of the character within the study area will be undertaken and reported in the ES.

Visual Receptors

- 8.4.63 Zone of Theoretical Visibility (ZTV) mapping will be used to identify the extent of the visibility of the Scheme. A preliminary ZTV drawing is included as Figure 8-6e. This is based on EA 2m Digital Terrain Model (DTM) LIDAR data.
- 8.4.64 Receptors in the vicinity of the site that are likely to experience views of the development include:
- Local residents;
 - Users of Public Rights of Way; and
 - Road users.
- 8.4.65 The assessment will include a series of photographs from viewpoints representative of this range of receptors. Photomontages and/or other illustrative material may be prepared from specific key locations such as close to residential receptors which are the most sensitive to visual effects.

8.4.66 Provisional representative viewpoint locations are set out in Table 8-7, with locations illustrated in Figure 8-7e. These locations have been determined using the preliminary ZTV, aerial imagery, and OS mapping. Final viewpoint locations will be determined following further site investigation and consultation with NSDC, RBC and NCC.

Table 8-7 Kirk Hill Junction Representative Viewpoints

Viewpoint	Location	Receptor Type
1. PRow East Bridgford FP 27	PRow East Bridgford FP 27 at Kirk Hill to the east of the Scheme	Representative of views of residential receptors at the south-western edge of East Bridgford, the edge of the Conservation Area, and recreational receptors using the PRow
2. PRow East Bridgford FP 26	PRow East Bridgford FP 26, to the north east of the Scheme	Representative of residential receptors at the south-western edge of East Bridgford, the edge of the Conservation Area, and recreational receptors using the PRow
3. PRow East Bridgford RB34	PRow East Bridgford RB34, to the east of the Scheme	Representative of views for recreational receptors using the PRow
4. PRow Newton FP 2	PRow Newton FP 2, to the east of the Scheme	Representative of views for recreational receptors using the PRow, and vehicular users of East Bridgford Road
5. PRow Shelford FP 9	PRow Shelford FP 9, to the west of the Scheme	Representative of views for recreational receptors using the PRow which at this point forms the Trent Valley Way

8.5 Potential Effects

General Potential Effects

8.5.1 Potentially significant effects could arise from the five Schemes considered (Ollerton Roundabout, Mickledale Lane Junction Option 1 and Option 2, Lowdham Roundabout and Kirk Hill Roundabout) as a result of the following:

Construction:

- Removal of the existing vegetation, and the addition of proposed soft landscape treatment.
- The introduction of new temporary compound buildings and highways infrastructure at the site.

- The influence of the above upon the character of the surrounding landscape.
- Views of this infrastructure from the surrounding area.

Year 1 (Opening Year, Year 15 (Design Year) Winter and Year 15 (Design Year) Summer:

- The introduction of new highways infrastructure at the site.
- Views of this infrastructure from the surrounding area whilst the proposed landscape treatment matures.
- The influence of the above upon the character of the surrounding landscape.

8.5.2 Specific issues relating to each of the Schemes is discussed in the following sections.

8.5.3 As part of each Scheme, a landscape design proposal will be developed. This will include (where practicable and subject to other constraints) opportunities for habitat creation. Other environmental mitigation measures may also be incorporated into the landscape scheme such as, noise attenuation and Sustainable Urban Drainage Systems where these are appropriate.

8.5.4 The details of the nature and extent of landscaping proposed will be determined by the final layout and footprint of the infrastructure and the nature and degree of potential adverse effects. The Scheme would be designed to a level of detail to allow determination of the planning application and to provide the necessary information required by statutory consultees such as Natural England.

Ollerton Roundabout

8.5.5 The key issues identified at the baseline stage are:

- Landscape impact of the Scheme on European, National and local ecological designated sites, and on Sherwood Policy Zone 15 River Maun and 26 Budby Estate Farmlands;
- Visual impact of the Scheme on close residential receptors at Forest Side to the north of Ollerton Roundabout; and the single residence to the south-west of the Scheme. Residential receptors are considered particularly susceptible to visual impacts;
- Visual impact of the Scheme on the Ollerton Conservation Area, the residential edge of Ollerton, and PRoW in the study area; and
- Visual impact upon users of the facilities immediately adjacent to the roundabout: public house, fast food outlets and petrol stations.

Mickledale Lane Junction Option 1

8.5.6 The key issues identified at the baseline stage are:

- Landscape Impact on Sherwood Policy Zone 09 Old Clipstone estate farmlands and surrounding Policy Zones;
- Visual impact of the Scheme on close residential receptors to the south-east of the junction; and

- Visual impact of the Scheme on the Bilsthorpe Conservation Area, the residential edge of Bilsthorpe, and Public Rights of Way in the study area.

Mickledale Lane Junction Option 2

8.5.7 The key issues identified at the baseline stage are:

- Landscape Impact of the Scheme on Sherwood Policy Zone 09 Old Clipstone estate farmlands and surrounding Policy Zones;
- Visual impact of the Scheme on close residential receptors to the south-east of the junction; the frontage of the Limes café; and
- Visual impact of the Scheme on the Bilsthorpe Conservation Area, the residential edge of Bilsthorpe, and Public Rights of Way in the study area.

Lowdham Roundabout

8.5.8 The key issues identified at the baseline stage are:

- Landscape impact of the Scheme on Mid Nottinghamshire Farmlands Policy Zone 40 Epperstone village farmlands with ancient woodlands and Trent Washlands PZ 06 Bulcote village farmlands;
- Visual impact of the Scheme on close residential receptors at the junction of the A612 with the A6097; and
- Visual impact of the Scheme on the Lowdham Conservation Area, the residential edge of Lowdham, and Public Rights of Way in the study area.

Kirk Hill Junction

8.5.9 The key issues identified at the baseline stage are:

- Landscape impact of the Scheme on existing vegetation including mature trees and hedgerows, and South Nottinghamshire Policy Zone 05 East Bridgford escarpment farmlands; and
- Visual impact of the Scheme on the East Bridgford Conservation Area, the residential edge of East Bridgford, and Public Rights of Way in the study area.

8.6 Proposed Level and Scope of Assessment

8.6.1 There is potential for significant effects on designated landscapes (including some containing ecological designations and conservation areas); landscape character; and significant visual effects on residential receptors and users of PRow, as a result of the development proposed in relation to the Ollerton, Mickledale (Option 1 and Option 2), Lowdham, and Kirk Hill Schemes. Therefore, it is proposed that these Schemes are assessed within the ES.

8.6.2 It is unlikely that the White Post and Warren Hill Schemes will result in significant landscape and visual impacts, as the development proposed in relation to these schemes is such that it is unlikely to introduce different features which would result in new significant landscape or visual effects. Therefore, these Schemes will not be assessed within the ES.

8.6.3 In addition, due to the existing lighting arrangements at junctions and the relatively minor proposed changes to lighting levels at all junctions, it is unlikely that there would be any significant night-time effects. Therefore, consideration of impacts on the night sky have been scoped out of the assessment for all of the Schemes that will be assessed within the ES.

8.6.4 It is unlikely there would be significant effects on the statutory landscape designation of the Peak District National Park and consideration of impacts on this designation is scoped out of the LVIA.

8.7 Proposed Assessment Methodology Including Significance

8.7.1 The LVIA will be carried out in accordance with a project specific methodology prepared in accordance with best practice guidance provided within DMRB LA 107. The LVIA will assess the following criteria in accordance with the above methodology – landscape susceptibility, landscape value, landscape sensitivity, magnitude of effect of landscape change and significance of landscape effect. It will also assess visual susceptibility, visual value, sensitivity of receptors, magnitude of effect of visual change and significance of visual effect.

8.7.2 The LVIA for each Scheme will provide:

- A clear understanding of the Scheme and its setting in respect of landscape character and visual amenity, and the sensitivity of the landscape as noted in Section 8.4;
- An understanding of the Scheme in terms of its relationship with the landscape character and visual amenity;
- Identification of the likely significant effects of the Scheme upon the landscape amenity and visual receptor;
- Identification of potential effects on visual receptors;
- Identification of any cumulative effects arising from other reasonably foreseeable future developments;
- A description of proposed mitigation measures; and
- The identification of likely significant residual effects (i.e. with mitigation) of the Scheme considered against the baseline situation.

8.7.3 The LVIA process will follow a standard approach, namely:

- The establishment of the baseline conditions, i.e. the existing character and sensitivity of the landscape, and the type and sensitivity of visual receptors;
- The prediction of the magnitude of change that the Scheme will bring, upon the landscape and upon visual receptors;
- An assessment of likely significance of effects that would occur, by considering the predicted magnitude of change, together with the sensitivity of the landscape or visual receptor; and
- An assessment of likely significant residual effects that would occur once mitigation has matured.

- 8.7.4 The conclusions of the LVIA will be determined by the use of professional judgement, set within a structured assessment framework and supported by reasoned justification.
- 8.7.5 Viewpoint photography and any photomontages will be produced with reference to the Landscape Institute practice note:
- Landscape Institute Technical Guidance Note 06/19 Visual representation of development proposals – 17 September 2019.
- 8.7.6 Photomontages may be produced for some of the Schemes, from specific key locations such as close to residential receptors which are the most sensitive to visual effects, the location and number of these will be discussed with the NCC’s landscape officer during the production of the ES.
- 8.7.7 As night sky impacts have been scoped out of the assessment no night-time visualisations will be produced.
- 8.7.8 The significance of any identified effects during both the construction and operational phase of the Scheme will ultimately be determined with regard to the magnitude of impact and the sensitivity of the receptor.

Landscape Impacts

- 8.7.9 The magnitude and nature of impacts on the Landscape will be determined in accordance DMRB guidance LA 107.
- 8.7.10 Relevant criteria from the above guidance clarify the terms which will be used to describe the magnitude of change (the impact) and the corresponding typical descriptions as set out in Table 8-8.

Table 8-8 Magnitude of Impact on Landscape and Typical Descriptions

Magnitude of impact (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 (i.e. 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 landscape character or distinctive features or elements; and/or addition of new uncharacteristic, noticeable features or elements (i.e. 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 landscape character of one (maybe more) key features and elements; and/or addition of new 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.

Visual Impacts

- 8.7.11 The magnitude of visual impacts on the landscape will be determined in accordance DMRB LA 107.
- 8.7.12 Relevant criteria from the above guidance clarify the terms which will be used to describe the magnitude of change (the impact) and the corresponding typical descriptions as set out in Table 8-9.

Table 8-9 Magnitude of Impact on Visual Receptors and Typical Descriptions

Magnitude of impact descriptions (Change)

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

Significance of Effects

- 8.7.13 The significance of the effect (described as adverse, neutral or beneficial) will be determined using the significance matrix taken from LA 104, which has been reproduced in Chapter 5. This is based on the environmental value (sensitivity) of the receptor versus the magnitude of change / impact.
- 8.7.14 Major and moderate effects are considered to be significant, while minor and negligible effects are considered to be manageable and not significant.
- 8.7.15 Where the matrix allows a range of effect, professional judgement will be used to determine the residual significance.

8.8 Assumptions and Limitations

- 8.8.1 No technical difficulties are anticipated in carrying out this LVIA. All representative viewpoints will be situated in publicly accessible locations such as on PRoW.

9. BIODIVERSITY

9.1 Introduction

9.1.1 Via has prepared this biodiversity chapter to outline the of scope of assessment for biodiversity with regard to the Project.

9.1.2 The purpose of this chapter is to identify the potential for likely significant ecological effects to the Project Schemes (as described in Chapter 2) and surrounding area. It also outlines the proposed approach to assessing these effects for the ES.

9.2 Study Area

9.2.1 To define the total extent of the study area for ecological assessment, the six individual Schemes (as outlined in Chapter 2: The Project) have been reviewed in order to identify the spatial scale at which ecological features could be affected. In accordance with the DMRB LA 108 Biodiversity (Highways England, 2020e) and the 'Guidelines for Ecological Impact Assessment in the UK and Ireland' issued by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018), the study area has been defined by determining a Zone of Influence (Zol) encompassing all likely biophysical changes that would occur as a result of the Schemes. This will include direct effects and indirect effects.

9.2.2 Differing Zol have been used to collate desk study data for designated sites and protected and/or notable habitat and species as follows:

- Statutory and non-statutory designated sites within 2 km of each Scheme;
- Ancient woodlands and notable habitats (outside of designated sites) within 1 km of each Scheme; and
- Protected and/or notable species recorded within 1km of each Scheme (unless stated otherwise).

9.2.3 Notable habitats and species are those considered as being of principal importance in England, as listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006.

9.2.4 In accordance with DMRB LA 115 Habitat Regulations Assessment (Highways England, 2020f), desk study information has being collated for sites designated at an International/European level, including Special Protection Areas (SPAs), potential SPAs (pSPAs); Special Areas of Conservation (SACs), candidate or possible (cSAC/pSAC) sites and Ramsar sites (wetlands of international importance) using the following criteria:

- The European Site or its functionally linked land are located within 2 km from the Scheme;
- The European Site is designated for bats and is located within 30 km of the Scheme;
- The Scheme crosses or lies adjacent to, upstream of, or downstream of, a watercourse which is designated part or wholly as a European Site;
- There is potential for hydrological or hydrogeological linkages to a European Site that may require further assessment in accordance with DMRB LA 113

Road Drainage and the Water Environment (Highways England, 2020i); and/or

- There is the possibility that the affected road network will require assessment for effects on a European Site in accordance with DMRB LA 105 Air Quality (Highways England, 2019).

9.3 Existing and Baseline Conditions

9.3.1 This Scoping Report draws on information collated from desk studies and field survey work undertaken to date, as outlined in Table 9-1.

9.3.2 Baker Consultants Ltd was commissioned by Via to undertake the following works in relation to the Project, excluding the Kirk Hill Junction Scheme:

- A desk-based study using online data (MAGIC) and data from the Nottinghamshire Biological and Geological Records Centre (NBGRC) to identify designated sites of nature conservation importance, areas of priority habitat and records of protected and/ or notable species;
- A Phase 1 Habitat Survey undertaken in 2019/2020 to record the nature and extent of vegetation and habitats within and adjacent to the Project Schemes; and
- Appraisals and targeted surveys for protected and/or notable flora and fauna (as detailed in Table 9-1).

9.3.3 Via has commenced the following works in relation to the Kirk Hill Junction Scheme to produce a Preliminary Ecological Appraisal:

- A desk-based study with local records centres and online databases to identify designated sites of nature conservation importance, areas of priority habitat and records of protected and/ or notable species;
- A Phase 1 Habitat Survey to record the nature and extent of vegetation and habitats within and adjacent to the Scheme; and
- Appraisals and targeted surveys for protected and/or notable flora and fauna (as detailed in Table 9-1).

9.3.4 The ecological assessment undertaken to date takes into account standard guidance from a variety of sources including the:

- Guidelines for Ecological Impact Assessment in The UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM 2018);
- Guidelines of Ecological Report Writing (CIEEM, 2015);
- Guidelines for Preliminary Ecological Appraisal (CIEEM, 2017);
- BS42020:2013 Biodiversity – Code of Practice for Planning and Development (British Standards Institute, 2013); and
- Protected species and development: advice for local planning authorities (GOV.UK, 2021).

Table 9-1: Summary of Ecological Field Surveys Undertaken to Date

Survey Target	Survey Type and Survey Area	Scheme Name	Date undertaken and consultancy	Description of Assessment Undertaken	Methodology
Habitats, botany and suitability for protected and notable species	Extended Phase 1 Habitat Survey, within up to 50 m from the Project Scheme boundaries	Ollerton Roundabout, Mickledale Lane Junction, White Post Roundabout, Warren Hill Junction, Lowdham Roundabout	20 th December 2019, Baker Consultants Ltd	Vegetation and habitats present were described and mapped during a walkover of the site. Habitats within the site and surrounding land were appraised for their suitability to support protected and notable species.	Joint Nature Conservation Committee (JNCC) (2010)
		Kirk Hill Junction	29 th September 2020, Via		
Habitats, botany and suitability for protected and notable species	Updated Extended Phase 1 Habitat Survey, within up to 50 m from the Project Scheme boundaries	Mickledale Lane and Lowdham Roundabout	3 rd December 2020, Baker Consultants Ltd	Vegetation and habitats present were described and mapped during a walkover of the site. Habitats within the site and surrounding land were appraised for their suitability to support protected and notable species.	JNCC (2010)
Badger	Badger Survey, within up to 30 m from the Scheme boundary	Warren Hill	4 th April 2019 – 17 th April 2019, Baker Consultants Ltd	Remote camera used to monitor the burrow for 14 days to establish the present or absence of badgers.	N/A
			22 nd March 2021, Via	Any signs of badger or badger setts present within, or up to 30 m from the scheme boundary were described and mapped to determine whether badgers were utilising the area.	The Mammal Society (1989)
		Ollerton Roundabout	22 nd March 2021, Via	Any signs of badger or badger setts present within, or up to 30 m from the scheme boundary were described	The Mammal Society (1989)

Survey Target	Survey Type and Survey Area	Scheme Name	Date undertaken and consultancy	Description of Assessment Undertaken	Methodology
				and mapped to determine whether badgers were utilising the area.	
Bats	Bat Roost/Habitat Survey, within the Scheme boundaries.	All Schemes, excluding Kirk Hill	During Extended Phase 1 Habitat Surveys, Baker Consultants Ltd	Habitats within the survey area were assessed for their potential to support roosting, commuting and foraging bats	Collins, J. (ed.) (2016)
		Kirk Hill	18 th March 2021		
Reptiles	Presence absence of reptiles, within and up to 50 m from the Scheme boundaries.	Mickledale Lane and Ollerton Roundabout	15 th April 2019 – 1 st May 2019 (7 survey visits undertaken), Baker Consultants Ltd	Target surveys aimed to establish the presence/ absence of reptiles using artificial refuges and also searching for basking animals within another suitable habitat.	Froglife (1999)
			April 2021 – ongoing (7 survey visits undertaken), Via		
Great Crested Newt (GCN) <i>Triturus cristatus</i>	HSI Assessment, on waterbodies within 500 m of the Scheme boundary.	Kirk Hill Junction	29 th October 2020, Via	Waterbodies within 500 m of the Kirk Hill Junction Scheme boundary were evaluated against the GCN Habitat Suitability Index to measure the suitability of a waterbody for supporting great crested newts.	Oldham <i>et al.</i> (2000)
	HSI Assessment, on water bodies within 500 m of the Scheme boundary	Mickledale Lane	19 th April 2021, Via	Waterbodies within 500 m of the Mickledale Lane Junction Scheme boundary were evaluated against the GCN Habitat Suitability Index to	NA

Survey Target	Survey Type and Survey Area	Scheme Name	Date undertaken and consultancy	Description of Assessment Undertaken	Methodology
	eDNA survey on suitable water bodies within 500 m of the Scheme boundary		19 th April 2021, Via	measure the suitability of a waterbody for supporting great crested newts. Suitable waterbodies within 500 m of the Mickledale Lane Junction Scheme boundary were subject to eDNA analysis to determine the presence, or likely absence of GCN DNA.	

Ollerton Roundabout

Designated Sites and Ancient Woodland

9.3.5 Designated sites identified within the study area are detailed in Table 9-2. Additional information is provided in the subsequent text. The location of designated sites can be viewed on Figure 5-1.

Table 9-2: Designated Statutory and Non-Statutory Sites located within the Ollerton Roundabout Study Area

Name	Status	Location/distance	Interest
Sherwood Forest Area	Possible Potential Special Protected Area (ppSPA) ¹	Within site boundary	Nightjar and woodlark
Birklands West and Ollerton Corner	Site of Special Scientific Interest (SSSI)	Within site boundary	Botanical, invertebrate, herpetofauna
Birklands and Bilhaugh	SAC	1.1 km to the north-west (a second area of this site is located 2.2 km to the west)	Ancient oak woodland
	SSSI	500 m to the north-west	
	Local Wildlife Site (LWS)	Within site boundary	
Ollerton Colliery	LWS	800 m to the south-east	Birds, botanical and invertebrate
Sherwood Heath	Local Nature Reserve (LNR)	Within site boundary	Botanical (heathland), invertebrate, herpetofauna
	LWS	Within site boundary	
Cockglode and Rotary Wood	LNR	600 m to the west	Woodland, colliery spoil tip
Broughton Railway Banks	LWS	1.8 km to the east	Notable sections of habitat along railway embankments
Willow Dam and Grassland	LWS	1.9 km to the east	A mosaic of scrub and damp, species-rich grassland with notable species around a fishing pond

9.3.6 A number of the designated sites listed in Table 9-2 overlap in their extents.

9.3.7 Sherwood Forest Area ppSPA: a part of the ppSPA is located within the Birklands West and Ollerton Corner SSSI which is located within the Scheme boundary. The ppSPA is may be considered for designation due to populations of nightjar

¹ ppSPA - a site that may be added to the list of candidate sites, with regards to designation as an SPA.

Caprimulgus europaeus and woodlark *Lullula arborea* presence. Suitable nesting and foraging habitat is present for both species within the Scheme boundary.

- 9.3.8 Birklands West and Ollerton Corner SSSI: a part of the SSSI is located within the Scheme boundary. The SSSI is described by Natural England (Natural England, n.d.) as 'a remnant of the historic Sherwood Forest which supports an outstanding invertebrate fauna associated with old trees characteristic of open oak-birch woodland in Nottinghamshire together with notable tracts of lowland acid grassland and heath'. Between the A616 and A614 highways, the SSSI is characterised by oak-birch woodland that is in close proximity to the road, 'scrubby', relatively immature and open. Sherwood Heath is located between the A616 and A6075 highways. The heath is a typical example of a Sherwood Forest heathland with a mosaic of habitat types.
- 9.3.9 Birklands and Bilhaugh SAC: The SAC is part of the larger Birklands and Bilhaugh SSSI. Birklands and Bilhaugh SAC is the most northerly site selected for old acidophilous oak woods and is notable for its rich invertebrate fauna, particularly spiders, and for a diverse fungal assemblage, including *Grifoa sulphurea* and *Fistulina hepatica* (JNCC, n.d.). Although there is continuous woodland habitat between the development site and the boundary of the SAC (at its nearest point), the woodland is not the characteristic old acidophilous oak wood (there are no veteran trees), for which the SAC is designated. Although there is oak-birch woodland in the vicinity of the roundabout, the woodland immediately adjacent is 'scrubby' and relatively immature, suggesting past disturbance. As such the characteristic invertebrate and fungal assemblages of the SAC are very likely to be geographically separated from the development site.
- 9.3.10 Sherwood Heath LWS and LNR: The boundaries of the LWS and LNR concur with the boundaries of the Ollerton Corner component of the Birklands West and Ollerton Corner SSSI which lies partially within the site boundary. The site is designated as an LWS because of its heathland and faunal interest. Its close proximity to Ollerton has contributed to its designation as an LNR.
- 9.3.11 Birklands & Bilhaugh LWS: the considerations regarding nightjar and woodlark habitat described for the Birkland West and Ollerton Corner SSSI also apply to the LWS.
- 9.3.12 Cockglode and Rotary Wood LNR, Ollerton Colliery LWS Broughton Railway Banks LWS and Willow Dam and Grassland LWS are geographically separated from the site and an adverse impact is not anticipated from the proposed development.
- 9.3.13 There were no European protected sites within 30km of the Scheme for which bats were listed as a qualifying feature.
- 9.3.14 The MAGIC website identified the presence of Ancient Woodland within 1km of the Scheme at the western end of Sherwood Heath. The woodland is part of the Birklands West and Ollerton Corner SSSI and is a type of oak-birch woodland that is typical of the Sherwood Forest area.

Habitats

- 9.3.15 The following habitats were recorded within and up to 50m of the site boundary during the extended Phase 1 Habitat Survey undertaken on the 20th February 2019 by Bakers Consultants Ltd:
- Amenity grassland;

- Poor semi-improved grassland;
- Arable;
- Improved grassland;
- Unimproved neutral grassland;
- Acid grassland;
- Dry heath;
- Continuous bracken;
- Broadleaved woodland;
- Plantation woodland;
- Scattered broadleaved woodland;
- Dry ditch;
- Hard standing;
- Introduced shrub;
- Intact species-poor hedgerow; and
- Species-poor hedgerow with trees.

Protected and Notable Species

9.3.16 Table 9-3 presents the protected and notable species, including invasive non-native plant species, that have been identified as present or potentially present within the Scheme boundary and relevant Zol. The baseline conditions have drawn upon various sources of information as stated in paragraph 9.3.2.

Table 9-3: Summary of Baseline Details for Protected and Notable Species located within the Ollerton Roundabout Study Area

Species	Baseline Detail
Bats	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> • The desk study returned 42 records of at least seven species of bats, including common and soprano pipistrelles <i>Pipistrellus sp.</i>, Leisler's bat <i>Nyctalus leisleri</i>, noctule <i>Nyctalus noctula</i>, brown long-eared <i>Plecotus auritus</i>, natterer's bat <i>Myotis nattereri</i> and Daubenton's bat <i>Myotis daubentonii</i>. • One of the desk study records was a confirmed roost, located 0.85km from the Scheme boundary in Ollerton. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> • None of the trees within the site were of sufficient size/age to provide roosting opportunities. None of the buildings, including retail and food

Species Baseline Detail

outlets and private dwellings, were checked for bats as they are outside of the Scheme boundary.

- The woodlands, hedgerows and heathland habitats provide potential dispersal and foraging habitat for bats, including the species returned by the desk study.

Badger

Desk Study:

- The desk study returned two records of badger *Meles meles* with the search area. A sett is present approximately 1km from the Scheme and a roadkill was observed on the A614.

Field Study:

- No signs of badger were located during the Phase 1 Habitat Survey, but the woodlands, hedgerows, semi-improved grassland and heathland provide potential habitat for badger.
- No signs of badger were recorded during the field survey.

Other Mammals

Desk Study:

- The desk study returned records of hedgehog *Erinaceus europaeus* within the study area, the nearest being 200m from Ollerton Roundabout.

Field Study:

- Habitats including hedgerows, heathland, woodland and gardens are all suitable for hedgehog, although the mown roadside verges are less suitable, because of a lack of cover and foraging opportunities.

Amphibians

Desk Study:

- The desk study returned records for common toad *Bufo bufo* and a common frog *Rana temporaria*. All records were over 500m from the Scheme.
- No records for GCN were returned within the desk study.

Field Study:

- The woodland, heathland, hedgerow and garden habitats provide suitable terrestrial habitat for amphibians. However, a lack of standing water within 500m of the site is likely to significantly reduce the suitability of the habitat and protected amphibians at this site are not anticipated.

Reptiles

Desk Study:

- The desk study returned nine records of common lizard *Zootoca vivipara* associated with Sherwood Heath which is located partially within the Scheme boundary.

Species Baseline Detail

Field Study:

- The habitats on the heathland, open areas of woodland, unmown grass verges and section of unmanaged hedgerow provide suitable opportunities and refugia for common lizard.
- Targeted surveys within and up to 50m from the Scheme boundary were undertaken during April 2019 and April/May 2021 and have reported the presence of common lizard.

Birds

Desk Study:

- No bird records were included with data from the NGBRC.

Field Study:

- During the Phase 1 Habitat Survey undertaken in 2019 and updated in 2020, incidental records of birds included a Blue tit *Cyanistes caeruleus*, great tit *Parus major*, goldfinch *Carduelis carduelis*, robin *Erithacus rubecula*, black bird *Turdus merula*, long-tailed tit *Aegithalos caudatus*, carrion crow *Corvus corone* and black-headed gull *Chroicocephalus ridibundus* were recorded.
- Suitable nesting and foraging habitat is present for nightjar and woodlark within the Scheme boundary. Therefore, effects to both species due to the removal of suitable habitat as part of the works and therefore potential impacts to the ppSPA, cannot be discounted.
- Habitats within the Scheme boundary provide potential nesting and/or foraging habitat for a range of common bird species.

Invasive, non-native plant species

Desk Study:

- The desk study returned records of Himalayan Balsam *Impatiens glandulifera* in the vicinity of Ollerton, for the most part associated with watercourses.

Field Study:

- No non-native invasive plant species were identified within the Scheme boundary during the Phase 1 Habitat Survey.

Invertebrates

Desk Study:

- The desk study returned 22 butterfly records and 14 moth records. This included four butterfly species and 14 moth species, all recorded on Sherwood Heath.
- Small heath butterfly *Coenonympha pamphilus* is a Species of Principal Importance, but only for research and monitoring. Two of

Species Baseline Detail

the moth species are Grade 2² species in Nottinghamshire and the remaining 12 species are Grade 3³ species in Nottinghamshire.

Field Study:

- No records were observed during the field survey, but the timing was sub-optimal for this.

Mickledale Lane Junction (Options 1 and 2)

Designated Sites and Ancient Woodland

9.3.17 Designated sites identified within the study area are detailed in Table 9-4. Some additional information is provided in paragraphs 9.3.19 to 9.3.22. The location of designated sites can be viewed on Figures 5-2 and 5-3.

Table 9-4: Designated Statutory and Non-Statutory Sites located within the Mickledale Lane Junction (Options 1 and 2) Study Area

Name	Status	Location/ distance from Option 1	Location/ distance from Option 2	Interest
Sherwood Forest Area	ppSPA	600 m to the west	600 m to the west	Nightjar and woodlark
Clipstone Forest	LWS,	800 m to the north-east	900 m to the north-east	Botanical, moth, amphibian, reptiles.
Alder Carr	LWS	360 m south	Adjacent to south-west boundary	Botanical – open wet woodland
Bilsthorpe Grassland	LWS	515 m to the south-east	430 m to the east	Butterfly – grassland species
Rainworth Water	LWS	950 m to the south-west	900 m to the west	A mosaic of lowland heathland, acid grassland, plantation woodland and fen habitats along Rainworth Water
Bilsthorpe Colliery	LWS	1.2 km to the east	1.1 km to the east	Bird, amphibian and reptile interest – An important site for breeding wading birds
Cutts Wood	LWS	1.5 km to the north-east	1.7 km to the north-east	Botanical – A mature deciduous

² Grade 2: Includes all Nationally Notable Group B species recorded from more than five 10km squares in Nottinghamshire since 1990, together with all Nationally Local species recorded from five or fewer 10km squares in Nottinghamshire since 1990.

³ Grade 3: Includes all Nationally Local species recorded from more than five 10km squares in Nottinghamshire since 1990, together with all Nationally Common species recorded from five or fewer 10km squares in Nottinghamshire since 1990

				compartment of semi-natural character
Farnsfield Disused Railway	LWS	1.7 km to the south-east	1.5 km to the south-east	Botanical – A sizeable linear habitat of dry grassland and scrub
Eakring Brail Wood	LWS	N/A	1.9 km to the east	Botanical – An old woodland site retaining considerable interest in spite of large-scale replanting

9.3.18 Eight LWSs located within the search are separated from the road junction by large arable fields. Given the geographical separation from the Scheme, an adverse impact on the scientific interest of the site is not anticipated.

9.3.19 There were no European protected sites within 30 km of the Scheme for which bats were listed as a qualifying feature.

9.3.20 No records of ancient woodland were identified within the study area.

Habitats

9.3.21 The following habitats were recorded within and up to 50 m of the site boundary during the extended Phase 1 Habitat Survey undertaken in December 2020 by Bakers Consultants Ltd:

- Broadleaved plantation woodland;
- Scattered scrub;
- Broadleaved parkland / scattered trees
- Coniferous parkland / scattered trees;
- Unimproved neutral grassland;
- Improved grassland;
- Arable land;
- Introduced scrub;
- Buildings;
- Bare ground;
- Hard standing;
- Species poor intact hedgerow;
- Species poor hedgerow with trees;
- Fence; and

- Dry ditch.

Protected and Notable Species

9.3.22 Table 9-5 presents the protected and notable species, including invasive non-native plant species, that have been identified as present or potentially present within the Scheme boundary and relevant Zol. The baseline conditions have drawn upon various sources of information as stated in paragraph 9.3.2.

Table 9-5: Summary of Baseline Details for Protected and Notable Species within the Mickledale Lane Junction (Options 1 and 2) Study Area

Species	Baseline Detail
Bats	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> • The desk study returned 21 records of at least four bat species within the study area including common and soprano pipistrelle Leisler's bat and Noctule. No roosts were identified within the desk study data. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> • None of the buildings, including retail and private dwellings, were checked for bats as they are outside of the Scheme boundary. Many of the lime trees on Inkersall Lane were considered to have potential to support roosting bats, but these are located outside the Scheme red line boundary for both options and are unlikely to be affected by the proposed development. • Two lime trees (<i>Tilia x europaea</i>) in the Limes Café car park at OSGR SK 6373 6095 and SK 6371 6095 respectively were considered to have low potential for roosting bats, because of ephemeral rot holes and die-back of some of the outer branches in the crowns. Under current proposals both these trees are included within the red line boundary for Option 1 but are not included for Option 2. • A mature common lime in the field corner at OSGR SK 6373 6093 was considered to have low potential because of a few rot holes in the lower limbs. This tree is included within the red line boundary for Option 1 but not for Option 2. • The hedgerow/lines of trees on Inkersall Lane and the dismantled railway line to the north of the site (outside of the Scheme boundaries) form a network of potential dispersal and foraging routes.
Badger	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> • The desk study returned a single record of badger, a roadkill on the A614, approximately 800 m to the north. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> • The immediate surrounds of the junction are not particularly suitable for badger and no signs were detected during the field survey. • The dismantled railway line to the north and the habitat alongside Inkersall Lane provide suitable foraging and potential sett building habitat for badgers.

Species **Baseline Detail**

- Narrow tracks at opposite location through grass verges on Inkersall Lane were recorded in December 2020 at OSGR SK 6358 6095, that may indicate a mammal crossing location.

Other mammals

Desk Study:

- The desk study returned a single hedgehog record, at approximately 500 m distance.

Field Study:

- The verges on Inkersall Lane provide suitable habitat and gardens of the houses next to the junction are also suitable. However, the roadside verges lack cover and the hedgerow bottoms are very open, and the site is, therefore, largely unsuitable for hedgehog.

Amphibians

Desk Study:

- The desk study did not return any amphibian records.

Field Study:

- One pond is located approximately 30m to the south of Option 2 and 280 m from Option 1. A Habitat Suitability Index (HSI) assessment was undertaken on the April 2021 which concluded that the pond had 'poor' suitability for GCN. Additionally, eDNA analysis undertaken in April 2021 came back negative for GCN DNA, therefore it is considered that there is a likely absence of GCN from this pond.

Reptiles

Desk Study:

- The desk study returned a record of common lizard *Zootoca vivipara*, approximately 600m to the north on the verge of the A614 Highway.

Field Study:

- The grassland verges on the A614 Highway are wide and located on sandy soils with mature trees in addition to the hedgerows. Arable field are present beyond the verges.
- The grassland and bracken strips on Inkersall Lane and to a less extent on the west side of the A614 Highway provide the best quality potential habitat for common lizard because there are foraging resting and basking opportunities.
- The other verges have fairly short grassland and their associated hedgerows have open bases affording little cover.
- Targeted surveys of suitable habitat for reptile during April 2021 (ongoing) have detected the presence of common lizard. Previous surveys undertaken in April 2019 did not detect any reptiles at site.

Birds

Desk Study:

- No bird records were included with data from the NGBRC.

Species Baseline Detail

Field Study:

- During the Phase 1 Habitat Survey undertaken in 2019 and updated in 2020, incidental records of birds included a Black headed gull *Chroicocephalus ridibundus*, a carrion crow, kestrel *Falco Tinnunculus*, and fieldfare *Turdus pilaris* were noted.
- The networks of hedgerows, mature trees on Inkersall Lane and habitats associated with the dismantled railway line to the north provide potential resting, breeding and foraging habitat for a wide range of bird species, if they are present in the local area.

Invasive
non-native
plant species

Desk Study:

- Invasive non-native plant species were not identified during the desk study.

Field Study:

- No invasive, non-native plant species were noted during the Phase 1 Habitat Survey.

Invertebrates

Desk Study:

- Records returned three butterfly records from Bilsthorpe Grassland LWS Wildlife Site. Records included three species, common blue *Polyommatus icarus*, brown argus *Aricia agestis* and small copper *Lycaena phlaeas*. These are all butterflies of grassland, particularly herb-rich examples. The verges on Inkersall Lane may be able to support some butterfly species, but on the other roads the opportunities for butterflies are limited because of the lack of suitable herbs.

Field Study:

- No incidental records of invertebrate species were observed during the field survey, but the timing was sub-optimal for this.

White Post Roundabout

Designated Sites and Ancient Woodland

9.3.23 Designated sites identified within the study area are detailed in Table 9-6. Some additional information is provided in the subsequent text. The location of designated sites can be viewed on Figure 5-4.

Table 9-6: Designated Statutory and Non-Statutory Sites located within the White Post Roundabout Study Area

Name	Status	Location/distance	Interest
Farnsfield Disused Railway	LWS	300 m to the north	Botanical – dry grassland and scrub
Southwell Trail	LNR	900 m to the north-east	Same as Farnsfield Disused Railway but boundary of LNR does not extend as far east.

- 9.3.24 The Farnsfield Disused Railway LWS, part of which is the Southwell Trail LNR, is located 300 m to the north of the roundabout. It is geographically separated from the potential development area by buildings and hard standing (car parks). In addition, the botanical interest in this section of the LWS/ LNR is located towards the top of the railway embankments several metres above the surrounding land. The Scheme is located within a narrow corridor and consequently an adverse impact is not anticipated.
- 9.3.25 The Scheme is located within an SSSI Impact Risk Zone (IRZ)⁴. However, it is not considered to pose a significant constraint because infrastructure is not listed as one of the development types that could have an adverse impact on the scientific features of the SSSI.
- 9.3.26 There are no European protected sites within 30 km of the Scheme for which bats are listed as a qualifying feature.
- 9.3.27 No records of ancient woodland were identified within the study area.

Habitats

- 9.3.28 The following habitats were recorded within and up to 50 m of the site boundary during the extended Phase 1 Habitat Survey undertaken in February 2019 by Bakers Consultants Ltd:

- Intact species-poor hedgerow;
- Species-poor hedgerow with trees;
- Amenity grassland;
- Improved grassland;
- Unimproved neutral grassland;
- Tall ruderal;
- Scattered broadleaved woodland;
- Scattered coniferous woodland;
- Dry ditch;
- Hard Standing; and
- Introduced Scrub.

Protected and Notable Species

- 9.3.29 Table 9-7 presents the protected and notable species, including invasive non-native plant species, that have been identified as present or potentially present within the Scheme boundary and relevant ZoI. The baseline conditions have drawn upon various sources of information as stated in Paragraph 9.3.2.

⁴ The Impact Risk Zones (IRZs) are a GIS tool developed by Natural England to make a rapid initial assessment of the potential risks to SSSIs posed by development proposals. They define zones around each SSSI which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts.

Table 9-7: Summary of Baseline Details for Protected and Notable Species within the White Post Roundabout Study Area

Species	Baseline Detail
Bats	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> The desk study returned 23 records of at least six bat species including soprano pipistrelle <i>pipistrellus pygmaeus</i>, a <i>Myotis sp.</i>, common pipistrelle <i>pipistrellus pipistrellus</i>, noctule, brown long-eared bat <i>Plecotus auratus</i>, and Leisler’s bat <i>Nyctalus leisleri</i>. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> None of the buildings near the roundabout were examined for potential bat roosting features because they will not be affected by the proposed development. The trees within the site lack any features with the potential to support roosting bats and their presence on site is not anticipated. The hedgerows, field of dense bramble scrub and lines of Leyland cypress, <i>Cupressus x leylandii</i> provide potential foraging and dispersal habitat.
Badger	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> The desk study did not return any records for badger within the search area. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> The land to the north of the roundabout including the white post farm centre, car showroom, nursery and theme park are not suitable for badger. The abandoned field containing bramble (east of the A614) and the improved grasslands (west of the A614) provide suitable habitat if badger is present in the local area.
Other Mammals	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> The desk study returned four records of hedgehog, the nearest being 100m distance from the roundabout The desk study returned a single polecat record to the south of the Scheme on the A614 highway: The theme park, farm centre, residential gardens and lines of conifers provide suitable habitat for hedgehog, but the grassland verges on the roadside are considered to be sub-optimal because the vegetation is too short and disturbed.
Amphibians	<ul style="list-style-type: none"> The desk study did not return any amphibian records and there was no standing water in the roadside drains. White Post Farm Centre and the theme park contain ponds, but they are ornamental or duck ponds and therefore, sub-optimal for amphibians.

Species	Baseline Detail
Reptiles	<ul style="list-style-type: none"> The desk study did not return any reptile records within the search area. No signs of reptiles were found during the Phase 1 Habitat Survey, but the timing was sub-optimal to detect reptiles. There is very little suitable habitat for reptiles surrounding the junction. Given the lack of records and low suitability of the site, reptiles are not considered any further at this site, in this report.
Birds	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> Bird records were not included within Ecological Appraisal Report (Baker Consultants, 2020). <p><u>Field Study:</u></p> <ul style="list-style-type: none"> Wood pigeon <i>Columba palumbus</i> and carrion crow were observed during the Phase 1 Habitat Survey and both were flying over. The hedgerows, lines of Leyland cypress trees and dense scrub provide potential nesting habitat for birds.
Invasive non-native plant species	<ul style="list-style-type: none"> Invasive non-native plant species were not identified during the desk study. No invasive, non-native plant species were noted during the Phase 1 Habitat Survey.
Invertebrates	<ul style="list-style-type: none"> No record of invertebrates were noted in the desk study or during the Phase 1 Habitat Survey.

Warren Hill Junction

Designated Sites and Ancient Woodland

9.3.30 No designated sites or records of ancient woodland were identified within the study area.

9.3.31 Warren Hill is located within an SSSI IRZ. However, it is not considered to pose a significant constraint because infrastructure is not listed as one of the development types that could have an adverse impact on the scientific features of the SSSI.

Habitats

9.3.32 The following habitats were recorded within and up to 50 m of the site boundary during the extended Phase 1 Habitat Survey undertaken in February 2019 by Bakers Consultants Ltd:

- Plantation coniferous woodland;
- Scattered broadleaved woodland;
- Dense scrub;
- Amenity grassland;
- Unimproved acid grassland;
- Semi-improved acid grassland;

- Unimproved neutral grassland;
- Improved grassland;
- Species-poor intact hedge;
- Species-poor intact hedge with trees;
- Species-rich intact hedge with trees;
- Dry ditch;
- Continuous bracken; and
- Hard standing.

Protected and Notable Species

9.3.33 Table 9-8 presents the protected and notable species, including invasive non-native plant species, that have been identified as present or potentially present within the scheme boundary and relevant Zol. The baseline conditions have drawn upon various sources of information as stated in Paragraph 9.3.2.

Table 9-8: Summary of Baseline Details for Protected and Notable Species

Species	Baseline Detail
Bats	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> • The desk study returned two noctule bat records, the nearest being 780 m distance from the site. No records of roosting bats were provided. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> • None of the trees within the site had any potential to support roosting bats • The stand of conifer trees, and hedgerows may provide dispersal and foraging habitat for bats, however it is considered sub-optimal due to the limited size of hedgerows.
Badger	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> • The desk study did not return any records for badger within the search area. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> • A potential outlier sett was located in a steep bank on the west side of the A614 verge. • Although the arable fields are of low quality for badger, there are several plantation woodland and mature plantations and semi-nature woodland in the local area, connected by a network of hedgerows.

Species Baseline Detail

- A remote camera was deployed to check for occupancy of the potential sett, which did not detect badger entering or exiting the burrow. A badger passed the entrance of the burrow on the evening of the 4th April 2019 but did not stop to investigate. No further badger activity was noted. Photographs indicated that the burrow was being used by brown rat *Rattus norvegicus*.
- An updated badger survey was undertaken on the 22nd March 2021 by Via. The potential outlier sett had subsequently collapsed since the initial site visit in 2019 and was considered to not be in use by badger at the time of the updated survey.

Other mammals

Desk Study:

- The desk study returned three records of hedgehog, the nearest being at 220 m distance on the west side of the A614 trunk.
- The desk study returned three brown hare *Lepus europaeus* records; the nearest being at 280 m distance.

Field Study:

- The unmanaged and scrubby roadside verges and dense scrub on the traffic island provide potential foraging and resting habitat.
- No signs of brown hare were located during the field survey.
- The arable fields and associated grassland margins provide suitable habitat for brown hare.

Amphibians

- The desk study did not return any amphibian records and the given lack of standing water within the local area, the presence of amphibians is not anticipated. As such, amphibians are not considered, for this site, any further within this report.

Reptiles

- The desk study did not return any reptile records within the search area, additionally no signs of reptile were found during the Phase 1 Habitat Survey, but the timing was sub-optimal to detect reptiles. The dense, unmanaged vegetation on the roadside verges and the traffic island could provide some suitable habitat, but it is considered to be sub-optimal because of the vibration from road traffic and the relative isolation of the traffic island.
- Given the lack of records and low suitability of the site, reptiles are not considered any further at this site.

Species Baseline Detail

Birds	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> Bird records were not included within Ecological Appraisal Report (Baker Consultants, 2020). <p><u>Field Study:</u></p> <ul style="list-style-type: none"> Chaffinch <i>Fringilla coelebs</i>, pheasant <i>Phasianus colchicus</i>, great tit <i>Parus major</i> and robin were observed during the Phase 1 Habitat Survey. The hedgerows, and the mosaic of dense scrub, scattered trees and conifer plantation provide potential nesting habitat for birds.
Invasive non-native plant species	<ul style="list-style-type: none"> The desk study did not return any relevant records, and no signs of invasive species were located during the field survey. Therefore, invasive species are not considered any further at this site in this report.
Invertebrates	<ul style="list-style-type: none"> No records of invertebrates were noted in the desk study or during the Phase 1 Habitat Survey.

Lowdham Roundabout

Designated Sites and Ancient Woodland

9.3.34 Designated sites identified within the study area are detailed in Table 9-9. Some additional information is provided in the subsequent text. The location of designated sites can be viewed on Figure 5-6.

Table 9-9: Designated Statutory and Non-Statutory Sites located within the Lowdham Roundabout Study Area

Name	Status	Location/distance	Interest
Lowdham Pasture	LWS	750 m to the north-east	Botanical – species-rich sloping pasture
Caythorpe Grassland	LWS	750 m to the east	Botanical – ridge and furrow, species-rich
Caythorpe Damp Meadow	LWS	1.1 km to the south-east	Botanical – species-rich grassland
Ivy Cottage Pastures	LWS	1.1 km to the north	Botanical – two herb-rich pastures with sizeable communities of hydrophilic species along Dover Beck
Gonalston Road Grassland, Epperstone	LWS	1.4 km to the north north-west	Botanical – A species-rich damp grassland with valuable drains
Gonalston Marsh	LWS	1.3 km to the north-east	Botanical – Marshy grassland community in a pasture

Name	Status	Location/distance	Interest
Gonalston Lane Pit	LWS	1.2 km to the north-east	Botanical, birds – Gravel pit with a notable aquatic and marginal flora
Gunthorpe Lakes	LWS	1.2 km to the south	Bat, botanical – A large area of abandoned gravel workings of botanical and zoological importance

9.3.35 The desk study identified eight LWSs within the search area, the closest being at 750 m distance. Given the geographical separation of farmland, urban areas and roads between the sites and the roundabout and the localised development footprint, an adverse impact on the scientific interest of the LWSs is not anticipated.

9.3.36 There were no European protected sites within 30 km of the Scheme for which bats were listed as a qualifying feature.

9.3.37 No records of ancient woodland were identified within the study area.

Habitats

9.3.38 The following habitats were recorded within and up to 50m of the site boundary during the extended Phase 1 Habitat Survey undertaken in February 2019 and updated in December 2020 by Bakers Consultants Ltd:

- Scattered coniferous woodland;
- Scattered broadleaved woodland;
- Amenity grassland;
- Arable;
- Unimproved neutral grassland;
- Introduced shrub;
- Dense scrub;
- Species-poor intact hedgerow;
- Species-poor intact hedge with trees;
- Tall ruderal; and
- Hard standing.

Protected and Notable Species

9.3.39 Table 9-10 presents the protected and notable species, including invasive non-native plant species, that have been identified as present or potentially present within the scheme boundary and relevant Zol. The baseline conditions have drawn upon various sources of information as stated in paragraph 9.3.2.

Table 9-10: Summary of Baseline Details for Protected and Notable Species within the Lowdham Roundabout Study Area

Species	Baseline Detail
Bats	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> The desk study returned 30 bat records of at least four species including soprano pipistrelle, common pipistrelle, noctule and an unknown Myotis bat; the nearest records being 150m away. None of the desk study records were confirmed roosts. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> Within the survey area, no residential properties were assessed for their suitability to support roosting bats. All of the trees assessed from the ground were devoid of any features considered to be suitable to support roosting bats. The lines of trees associated with the recreation ground. The hedgerows on the south section of the A6097 and dense scrub have some potential to provide foraging and dispersal habitat for bats, but some of the trees contain artificial lights and street lighting is also present.
Badger	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> The desk study returned three badger roadkill records, the nearest being 600 m distance from the Scheme. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> No signs of badger were located during the field survey and the residential areas, recreation ground and arable field are considered to be sub-optimal habitat for badger.
Other Mammals	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> The desk study returned six hedgehog records, the nearest being 300 m distance from the site. The desk study returned a single Western polecat <i>Mustela putorius</i> record from a garden approximately 450 m from the Scheme. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> No signs of hedgehog were located during the field surveys, but the timing was sub-optimal to detect the species. The dense scrub, residential gardens and unmown grassland verges provide potential habitat for hedgehog. No signs of polecat were observed during the survey and the site was considered to be sub-optimal because of disturbance from management and pedestrians. Suitable resting habitat for the species is also absent.

Species Baseline Detail

Amphibians

Desk Study:

- The desk study returned 17 records of common frog *Rana temporaria* within the search area, originating from garden ponds, drains and rough grassland.

Field Study:

- During February 2019, all the roadside drains were dry and most of the grassland verges were mown apart from the verges to the south-west of the roundabout.
- It was considered that suitable breeding habitat for amphibians was probably not present and terrestrial habitat was also very limited within the survey area.
- During the December 2020 survey, an isolated ditch was noted that held approximately 1-2 feet of water. This short section of standing water was isolated from the other ditches at the junction, had very little field margin to provide cover and it was considered that the road serves as a significant barrier to dispersal.

Reptiles

Desk Study:

- The desk study did not return any records of reptiles within the search area.

Field Study:

- No signs of reptiles were found during the Phase 1 Habitat Survey, but the timing was sub-optimal to detect reptiles. Habitats within the survey area are considered to be sub-optimal because of a lack of cover and potential hibernacula, together with disturbance caused by mowing and pedestrians using the tarmac footpaths alongside the roads. As such, reptiles are not considered any further at this site in this report.

Birds

Desk Study:

- No bird records were included within Ecological Appraisal Report (Baker Consultants, 2020).

Field Study:

- Robin *Erithacus rubecula* and blackbird *Turdus merula* were observed during the Phase 1 Habitat Survey.
- The hedgerows, scattered trees and dense scrub provide potential nesting habitat, but noise traffic could affect the suitability of the site.

Invasive, non-native plant species

Desk Study:

- The desk study returned 25 records for Himalayan balsam and two records of Japanese knotweed *Fallopia japonica*.

Species Baseline Detail

Field Study:

- Himalayan balsam and Japanese knotweed were not noted during the initial Phase 1 Habitat Survey in February 2019, or during the updated survey in December 2020.
- The roadside ditches are suitable habitat for Himalayan balsam and given the close proximity of many of the records, the presence of Himalayan balsam during the summer months cannot be discounted. Therefore, further survey effort may be required.

-
- Invertebrates
- No records of invertebrates were noted in the desk study or during the Phase 1 Habitat Survey.

Kirk Hill Junction

Designated Sites and Ancient Woodland

9.3.40 Designated sites identified within the study area are detailed in Table 9-11. Some additional information is provided in the subsequent text. The location of designated sites can be viewed on Figure 5-7.

Table 9-11: Designated Statutory and Non-Statutory Sites located within the Kirk Hill Junction Study Area

Name	Status	Location/distance	Interest
Trent Hills Wood	LWS	500 m to the north-east	Botanical – Wooded cliff stretched along a section of the southern bank of the River Trent.
Gunthorpe Riverside Gravel Pits	LWS	1.35 km to the north-west	Comprises a large flooded gravel pits, used for angling, with some islands and a well indented shoreline.
Shelford Manor Pond	LWS	1.6 km to the west	Large rectangular pond within the ground of a farm and equestrian centre.
Gunthorpe Lakes	LWS	1.8 km to the north-west	Comprise a series of flooded gravel pits, used for anglings, situated next to the River Trent.
Trent Hills, East Bridgford	LWS	2 km to the north-east	Steep sided gully which has been colonised by a developing woodland of hawthorn <i>Crataegus monogyna</i> , ash <i>Fraxinus excelsior</i> and elder <i>Sambucus nigra</i> growing over ground flora that

Name	Status	Location/distance	Interest
			contains species indicative of ancient woodland.
Shelford Carr	LWS	2 km to the west	Site is situated next to the River Trent and comprises mostly improved cattle-grazed grassland with seasonally wet depressions, to the south-east are areas of wet woodland with swamp and open water.
East Bridgford Bank Pasture	LWS	2 km to the north-east	The site comprises a steep scrub covered river cliff above the River Trent, with a grassland community below it.
East Bridgford Pasture	LWS	2 km to the north-east	Pasture situated on a north-facing slope on the southern edge of the Trent Valley.
River Trent: Burton Joyce to Lowdham	LWS	2 km to the west	Stretch of the River Trent that has notable marginal and inundation plant communities. Species include Reed sweet-grass <i>Glyceria maxima</i> , hemlock water-dropwort <i>Oenanthe crocata</i> and branched bur-reed <i>Sparganium erectum</i> .
Dover Beck, Caythorpe	LWS	2 km to the north	Section of the Dover Beck, which runs through arable land and pasture flows to the north of Caythorpe. It supports a notable community of aquatic plants.

9.3.41 A total of ten LWSs are located within the search area. The LWSs are separated from the Scheme by a large arable field and a main road. Given the geographical separation of farmland, urban areas and roads between the sites and the junction, and the localised development footprint, an adverse impact on the scientific interest of the LWSs is not anticipated.

9.3.42 There were no European protected sites within 30 km of the Scheme for which bats were listed as a qualifying feature.

9.3.43 No records of ancient woodland were identified within the study area.

Habitats

9.3.44 Habitat surveys are yet to be conducted for Kirk Hill Junction, initial desk-based review and informal visual assessment indicate the presence of the following habitats:

- Broadleaved woodland;
- Neutral grassland
- Scrub;
- Hardstanding; and
- Hedgerows

Protected and Notable Species

9.3.45 Table 9-12 presents the outcomes of the initial survey work undertaken to date. Further survey work is yet to be completed.

Table 9-12: Summary of Baseline Details for Protected and Notable Species

Species	Baseline Detail
Bats	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> • The desk study returned multiple bat records of ten bat species including soprano pipistrelle, common pipistrelle, noctule, an unknown Myotis bat species, Daubenton’s bat, Brandt’s <i>Myotis brandti</i>, Whiskered <i>Myotis mystacinus</i> and Natterer’s bat, the nearest records being 60 m from the site boundary. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> • Yet to be completed.
Badger	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> • The desk study returned roadkill records for badger within 300 m of the Scheme boundary. • The desk study returned sensitive records for badger within 500 m of the site boundary indicating that setts are located within 500 m to the Scheme. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> • Yet to be completed.
Other mammals	<p><u>Desk Study:</u></p> <ul style="list-style-type: none"> • The desk study returned 14 hedgehog records, the nearest being 260 m distance from the site. • The desk study returned four brown hare records the nearest being 650 m distance from the site. • The desk study returned two Reeves Muntjac <i>Muntiacus reevesi</i> records the nearest being 1 km distance from the site. <p><u>Field Study:</u></p> <ul style="list-style-type: none"> • Yet to be completed.

Species Baseline Detail

Amphibians

Desk Study:

- No records for great crested newts *Triturus cristatus*, or other common amphibians were returned within the desk study.

Field Study:

- No waterbodies were located within the site boundary. Eight waterbodies were located within 500 m of the site boundary. Five out of the eight ponds were dry at the time of the survey, one pond had been infilled and one pond was subject to HSI assessment and considered to have 'below average' suitability for GCN. The remaining pond is separated from the Scheme by dispersal barriers.
 - Suitable breeding habitat for GCN is not present within the site boundary. The hedgerows within the site boundary may provide some suitable terrestrial habitat but are separated from suitable breeding habitat by main roads and arable fields. Additionally, it is considered that the majority of the works are restricted to hard standing and short managed grassland, therefore it is considered highly unlikely that GCN will be present within the Scheme boundary.
-

Reptiles

Desk Study:

- The desk study returned one record for grass snake within 700m of the site.

Field Study:

- Yet to be completed.
-

Birds

Desk Study:

- The desk study returned multiple records for bird species within the search area.

Field Study:

- The presence of hedgerows, trees and scrub on site are likely to provide potential nesting habitat for a range of bird species.
-

Invasive non-native plant species

Desk Study:

- The desk study returned no records of invasive none-native plant species.

Field Study:

- Yet to be completed.
-

Invertebrates

Desk Study:

- No records of invertebrates were noted in the desk study.

Field Study:

- Yet to be completed.

9.4 Value of Environmental and Resource Receptors

9.4.1 In line with the Chartered Institute of Ecology and Environmental Management approach to Ecological Impact Assessment guidelines (CIEEM 2018) data received through consultation, desk-based investigations and field-based investigations will be used to identify relevant ecological features (including designated sites, ecosystems, habitat and species) of value (or potential value) and to describe the main factors contributing to their value in relation to available guidance.

9.4.2 Relevant reasons for which an ecological feature is important will be described and considered in order to assign each relevant ecological feature an overall value in accordance with the following geographical frames of reference:

- International;
- National;
- Regional;
- County;
- District;
- Local/parish;
- Site; and
- Negligible (used where the value is lower than the Site level).

9.5 Potential Effects

Construction

Designated Sites

9.5.1 Construction of the Ollerton Roundabout Scheme would have a direct impact, through habitat loss from the following designated sites:

- Birklands West and Ollerton Corner SSSI;
- Birklands and Bilhaugh LWS; and
- Sherwood Heath LWS and LNR

9.5.2 Additionally, this Scheme could have an impact on the Sherwood Forest Area ppSPA, which may be considered for designation as a SPA.

9.5.3 Initial consultation with Natural England regarding designated site habitat loss at Ollerton Roundabout was undertaken in July 2019. In exchange for loss of habitat within the Birklands West and Ollerton Corner SSSI various proposals were discussed to mitigate the impacts.

9.5.4 The following mitigation proposed may potentially mitigate the impacts however further consultation will be required:

- Mixed hedgerows with trees replanted along within the Scheme boundary; and

- Heather creation/ bracken control on Sherwood Heath and/or Cockglode Wood (off-site mitigation).
- 9.5.5 Further assessment, including Biodiversity Net Gain (BNG) calculations will be undertaken to ensure that an appropriate level of mitigation is planned for, including securement of off-site mitigation and land agreements. A method statement will be required detailing finalised mitigation measures to offset any potential impacts on the SSSI.
- 9.5.6 Due to the small amount of land loss (approximately 0.43 ha of the SSSI lost from a total of 188 ha) from the designated sites at Ollerton Roundabout, it is considered that this loss will be insignificant provided appropriate mitigation is provided.
- 9.5.7 None of the other Schemes would incur direct habitat losses to designated sites, or ancient woodland from Scheme construction.
- 9.5.8 All of the Schemes, with the exception of Warren Hill Junction, are located within 2 km of designated sites (either statutory and/or non-statutory) and therefore there is potential for these sites to incur indirect impacts. This may occur through the degradation of habitats, which may occur due to decreased air quality (i.e. increased deposition of Nitrogen Oxides within habitats) and hydrology (including decreased water quality, as a result of a larger impermeable area resulting in more run-off). With the exception of Ollerton Roundabout and Mickledale Lane Junction, given the geographical distance (separation) from the identified designated sites and the intention to manage the works in line with construction best practice, it is considered unlikely that significant adverse effects on designated sites would arise. However, due to the limited geographical distance (separation) between the Ollerton and Mickledale Lane Schemes and the identified designated sites, there is potential for significant adverse effects in relation to these Scheme's.

Habitats and Species

- 9.5.9 The Ollerton Roundabout, Mickledale Lane Junction, Lowdham Roundabout and Kirk Hill Junction Schemes have the potential to result in permanent and temporary land-take resulting in habitat loss for new junction alignment and construction.
- 9.5.10 Following the Phase 1 Habitat Surveys undertaken at Ollerton Roundabout, Mickledale Lane Junction and Lowdham Roundabout, the habitats identified can in the most part be described as low quality (species poor) and are considered to be of a local level value. The hedgerows identified do not qualify as an 'important' hedgerow under the Hedgerow Regulations 1997. Hedgerows are, however, Habitats of Principal Importance and are included in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006) whereby the public authority must have regard to conserving biodiversity. Habitat surveys of Kirk Hill Junction are yet to be undertaken and potential loss of important habitats cannot be ruled out.
- 9.5.11 Habitat loss as a result of construction may be of value to various species including:
- **Bats** – permanent and/ or temporary loss of suitable foraging/ commuting habitat. Trees with low bat roost potential were identified at Mickledale Lane Junction; removal of these trees could result in harm or injury to bats. Further survey work is needed at Kirk Hill Junction where potential loss of bat roosts cannot be ruled out at this stage;

- **Badger** – survey work undertaken to date suggests badger are currently absent from the Schemes' locations and immediate surrounding areas, with exception to Kirk Hill where further survey work is needed. The presence of badger could result in disturbance or harm during the construction phase. Dependent upon the construction start date, updated field surveys for badger, as a mobile species, may be required;
- **Birds** - clearance of suitable nesting habitat during the nesting season could have an adverse impact on common nesting bird species at all Scheme locations. At Ollerton Roundabout, woodlark and nightjar have been noted breeding within the Birklands West and Ollerton Corner SSSI, however the locations of these nests were within the middle of the SSSI where there is limited disturbance from both the road and the general public. Therefore, the clearance of suitable nesting habitat along the periphery of the SSSI is not considered likely to cause an adverse impact to either of these species;
- **Other mammals** – there is potential for injury or harm to hedgehogs (NERC Act species);
- **Reptiles** – common lizard are known to be present at both Ollerton Roundabout and Mickledale Lane Junction where construction could lead to harm or injury;
- **GCN** – survey work undertaken to date at all sites indicates that adverse impacts on amphibians are not anticipated, due to lack of suitable nearby breeding habitat;
- **Invasive, non-native plant species** – potential presence of non-native invasive at all sites; and
- **Terrestrial invertebrates** - habitats identified to date (including an initial visual assessment of Kirk Hill Junction) are sub-optimal for important terrestrial invertebrates and therefore, adverse impacts are not anticipated.

9.5.12 There is also potential for the Ollerton, Mickledale Lane, Lowdham and Kirk Hill Schemes to cause temporary disturbance (both displaced and physical disturbance) to wildlife, habitats and designated sites from indirect impacts such as noise, pollution/ sedimentation, dust, affecting adjacent terrestrial areas and potentially watercourses downstream of construction. This will be assessed in the ES.

9.5.13 The junction improvements at White Post Roundabout and Warren Hill Junction are restricted to the existing road surface only, therefore adverse effects from construction of these two Schemes are not anticipated.

Operation

9.5.14 The Project has potential for disturbance (both displaced and physical disturbance) to species, habitats and designated sites resulting from indirect impacts such as noise, pollution/sedimentation, dust and lighting from changes in traffic flows.

9.5.15 There is also potential for mortality of wildlife from operational traffic e.g. collision with motor vehicles; pollution from surface water run-off, or changes in the composition of vegetation due to changes in air quality. The Project will be assessed in the context of the existing road network.

9.6 Proposed Level and Scope of Assessment

9.6.1 Based on the findings of the ecological appraisal undertaken to date the following Schemes can be scoped out of the biodiversity assessment:

- Warren Hill Junction; and
- White Post Roundabout.

9.6.2 These Schemes comprise minor improvements to the existing junctions, with works limited to the footprint of the current highway. Therefore, no significant ecological effects are anticipated during the construction and operation of these Schemes.

9.6.3 The assessment of the remaining four Schemes will cover the construction and operational phases.

Habitats Regulations Assessment (HRA)

9.6.4 Due to the presence of a European designated site (Birklands and Bilhaugh SAC) within 2 km of the Ollerton Roundabout Scheme, potential pathways for impacts and any likely significant effects will be considered through a formal HRA process.

9.6.5 The Ollerton and the Mickledale Lane (Options 1 and 2) Schemes are located within 2 km of the Sherwood Forest Area ppSPA. A ppSPA is not normally assessed via the HRA process and it is currently unclear if and when the site may be upgraded to pSPA status and, therefore, it is proposed that the Sherwood Forest Area ppSPA is not included in the HRA for these Schemes. However, this should be reviewed during the production of the ES and if the ppSPA is upgraded to an pSPA, then this should be included within the HRA.

Further Surveys

9.6.6 A number of further surveys will be required to support the ES, as detailed below:

- A site walkover of Ollerton Roundabout, Mickledale Lane Junction, Lowdham Roundabout and Kirk Hill Junction to check for invasive non-native plants during the growing season;
- Reptile surveys at Ollerton Roundabout and Mickledale Lane Junction are currently ongoing;
- Trees with bat roost potential at Mickledale Lane Junction – dependent upon design finalisation, any removal of the lime trees with bat roost potential will require further survey effort; and
- Phase 1 Habitat Survey and any further targeted specie surveys as required at Kirk Hill Junction.

9.6.7 Survey data is considered valid if it is from the current or previous active season. However, surveys up to three years old may be considered acceptable if the habitats have not significantly changed in the intervening period. Walkover surveys may be undertaken to confirm that these habitats remain in a similar condition.

Biodiversity Net Gain

9.6.8 A biodiversity net gain calculation will be prepared for the Project. This will include consideration of any required off-site mitigation.

9.7 Proposed Assessment Methodology Including Significance

Habitat Regulations Assessment

- 9.7.1 The Scheme could affect one internationally designated site and therefore likely significant effects will be considered through a formal HRA process, in accordance with DMRB LA 115. Early consultation with Natural England must be undertaken to inform this.

Determining Construction and Operational Effects

- 9.7.2 The assessment of impacts and effects and their significance will follow the guidance set out in DMRB LA 108, and CIEEM best practice guidance (CIEEM, 2018). This outlines the process for the reporting of baseline information, evaluation of features and the assessment of impacts and effects.
- 9.7.3 In accordance with this guidance the assessment of construction and operational effects on biodiversity will be informed by collection of relevant baseline information as described within earlier sections of this chapter. Baseline conditions will be described, including a summary of legislation/policy relevant to the baseline conditions. The assessment will cover both the current baseline, as determined by the desk study and ecological field surveys, and the future baseline. Environmental factors from other assessments including air quality; noise and vibration; and road drainage and the water environment will also be considered in line with guidance set out in the relevant chapters of this scoping report.
- 9.7.4 The assessment will describe the methods used to identify and assess the potential significant effects of each Scheme during both the construction and operational phases. The potential impacts will then be identified and characterised (quantitatively wherever possible).
- 9.7.5 The level of impact upon ecological features as a result of the Scheme and the associated effects will take into consideration the following characteristics:
- Positive or negative – whether the impact will result in loss or degradation of an important ecological feature or whether it would improve or enhance it;
 - Magnitude – the size and intensity of the impact measured in relevant terms, e.g. number of individuals lost or gained, area of habitat lost or created, the degree of change to existing conditions;
 - Extent – the spatial scope of the impact;
 - Reversibility – the extent to which impacts are reversible, either spontaneously or through mitigation;
 - Duration – the length of time over which the impact occurred; and
 - Timing and frequency – consideration of the timing of events in relation to ecological change; some effects might be of greater significance if they took place at certain times of year.
- 9.7.6 Subsequently the impact assessment will consider embedded avoidance and mitigation measures that are inherent to the design (e.g. the retention of a hedgerow), including the use of best practice construction methods (e.g.

implementation of methods to suppress dust generation or avoid pollution of water courses).

9.7.7 Additional (essential) mitigation, compensation and enhancement measures will then be described, followed by the impact after mitigation and significance of residual effects. A summary of the assessment will be presented together with relevant conclusions.

9.7.8 For each phase of the Schemes (e.g. construction, operation), the assessment will be structured and reported by ecological receptor with relevant potential impacts on that feature described in turn, and then the overall effect arising from those impacts reported. For example, any impacts on bat roosting habitat and light disturbance on retained roosts will be documented, before a conclusion is reached on the overall effect on the conservation status of the of the local bat population concerned.

Significance of Potential Effects

9.7.9 The relative importance of the biodiversity resources would be established using the guidance provided in Table 9-13 as based upon DMRB LA 108.

Table 9-13: Biodiversity Resource Importance

International or European importance

Sites	<p>Sites including:</p> <ol style="list-style-type: none"> 1) European sites: <ol style="list-style-type: none"> a) Sites of Community Importance (SCIs); b) Special Protection Areas (SPAs); c) Potential SPAs (pSPAs); d) Special Areas of Conservation (SACs); e) Candidate or possible SACs (cSACs or pSACs); f) Wetlands of International Importance (Ramsar sites). 2) Biogenetic Reserves, World Heritage Sites (where recognised specifically for their biodiversity value) and Biosphere Reserves. 3) 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 can be considered at an international or European level where:</p> <ol style="list-style-type: none"> 1) The loss of these populations would adversely affect the conservation status or distribution of the species at an international or European scale; or 2) The population forms a critical part of a wider population at this scale; or 3) The species is at a critical phase of its life cycle at an international or European scale.

UK or national importance

Sites	<p>Sites including:</p> <ol style="list-style-type: none"> 1) Sites of Special Scientific Interest (SSSIs) or Areas of Special Scientific Interest (ASSIs); 2) National Nature Reserves (NNRs); 3) National Parks; 4) Marine Protected Areas (MPAs) including Marine Conservation Zones
-------	---

- (MCZs); or
- 5) Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.

Habitats	<p>Habitats including:</p> <ol style="list-style-type: none"> 1) areas of UK BAP priority habitats; 2) habitats included in the relevant statutory list of priority species and habitats; and 3) areas of irreplaceable habitats including: <ol style="list-style-type: none"> a) ancient woodland; b) ancient or veteran trees; c) blanket bog; d) limestone pavement; e) sand dunes; f) salt marsh; g) lowland fen. 4) 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 can be considered at an international, European, UK or national level where:</p> <ol style="list-style-type: none"> 1) the loss of these populations would adversely affect the conservation status or distribution of the species at a UK or national scale; or 2) the population forms a critical part of a wider population at this scale; or 3) the species is at a critical phase of its life cycle at a UK or national scale.
---------	--

Regional importance

Sites	Designated sites (non-statutory) including heritage coasts.
Habitats	Areas of habitats identified (including for restoration) in regional plans or strategies (where applicable).

Species	<p>Species including:</p> <ol style="list-style-type: none"> 1) resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: <ol style="list-style-type: none"> a) the loss of these populations would adversely affect the conservation status or distribution of the species at a regional scale; or b) the population forms a critical part of a wider regional population; or c) the species is at a critical phase of its life cycle; 2) Species identified in regional plans or strategies.
---------	--

County or equivalent authority importance

Sites	<p>Wildlife / nature conservation sites designated at a county (e.g. Nottinghamshire) level including:</p> <ol style="list-style-type: none"> 1) Local Wildlife Sites (LWS); 2) Local Nature Conservation Sites (LNCS); 3) Local Nature Reserves (LNRs); 4) Sites of Importance for Nature Conservation (SINCs);
-------	--

	5) Sites of Nature Conservation Importance (SNCIs); 6) County Wildlife Sites (CWSs).
Habitats	Areas of habitats identified within the Nottinghamshire Local Biodiversity Action Plan.
Species	Species including: 1) resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: a) the loss of these populations would adversely affect the conservation status or distribution of the species at a county or unitary authority scale; or b) the population forms a critical part of a wider county or equivalent authority area population, e.g. metapopulations; or c) the species is at a critical phase of its life cycle. 2) Species identified in a county or equivalent authority area plans or strategies.

Local importance

Sites	Wildlife / nature conservation sites designated at a local level including: 1) Local Wildlife Sites (LWS); 2) Local Nature Conservation Sites (LNCS); 3) Local Nature Reserves (LNRs); 4) Sites of Importance for Nature Conservation (SINCs); 5) Sites of Nature Conservation Importance (SNCIs); 6) Sites of Local Nature Conservation Importance (SLNCIs).
Habitats	Areas of habitat considered to appreciably enrich the habitat resource within the local context 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.

9.7.10 Based upon the CIEEM best practice guidance (CIEEM, 2018) and DMRB LA 108, when describing potential impacts, reference is made to the following, where applicable:

- Positive or negative impacts (e.g. adverse / beneficial);
- Duration (e.g. permanent / temporary);
- Reversibility (e.g. irreversible / reversible);
- Extent / magnitude; and
- Frequency and timing.

9.7.11 When determining the level of impacts of biodiversity, resources shall be reported in accordance with the below criteria, based upon DMRB LA 108.

Table 9-14: Level of Impact and Typical Descriptions

Level of Impact (change)	Typical Description
Major	Adverse 1) Permanent/irreversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.
	Beneficial 1) Permanent addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Moderate	Adverse 1) Temporary/reversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.
	Beneficial 1) Temporary addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Minor	Adverse 1) Permanent/irreversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
	Beneficial 1) Permanent addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.

9.7.12 The importance of the resource, and level of impact will then be used to determine the significance of effect based on Table 9-15 and the principals of DMRB LA 104 Environmental assessment and monitoring (Highways England, 2020). Significant effects typically comprise effects that remain within the moderate, large or very large categories once mitigation has been taken into account.

Table 9-15: Significance Matrix

Resource importance	Level of impact				
	No change	Negligible	Minor	Moderate	Major
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

Resource importance	Level of impact				
	No change	Negligible	Minor	Moderate	Major
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

9.7.13 The level of impact should also be informed by the outcomes of the modelling and assessment of other environmental factors, where relevant.

9.8 Assumptions and Limitations

9.8.1 Further surveys and assessment work are required to establish the potential impacts and effects of the Project, particularly for the Kirk Hill Junction Scheme. These will be undertaken and presented in the ES.

10. GEOLOGY AND SOILS

10.1 Introduction

- 10.1.1 Via has prepared this chapter to outline the scope of assessment with regard to the Project.
- 10.1.2 This chapter sets out the approach and methodology that will be used in the assessment of geology and soils effects during the construction and operation of the Schemes.
- 10.1.3 Where relevant, ecological and water receptors are considered in the baseline, in relation to potential for effects due to mobilisation of contaminants. However, the impact on these receptors is considered in the Biodiversity and Road Drainage and the Water Environment Chapters of this report (Chapters 9 and 14 respectively).

10.2 Study Area

- 10.2.1 For the purposes of the geology and soils assessment, the study area includes the extents of each Scheme and the associated temporary works, as defined by the scoping boundary and a buffer of 250 m from the scoping boundary. However, any baseline information related to soil geochemistry will be limited to the site boundaries only.
- 10.2.2 In the case of controlled waters receptors, the study area is extended to include relevant features within 1 km of the scoping boundary. This includes groundwater Source Protection Zones (SPZ), water abstractions, discharge consents and surface water receptors. It is noted that surface water receptors could potentially be impacted by the Scheme over greater distances than 1km downstream. This will be taken into account in the assessment, where relevant.
- 10.2.3 The study areas for the Schemes are shown in Figure 10-1 to Figure 10-7.

10.3 Existing and Baseline Conditions

Sources of Information

- 10.3.1 With the exception of White Post Roundabout and Warren Hill Junction, the baseline information within the scoping assessment is largely based on the Phase 1 geo-environmental desk studies, which are currently in preparation by Via. The desk studies include Envirocheck reports.
- 10.3.2 It should be noted that the Schemes have been updated since the Envirocheck reports were obtained, in November 2020. This has been taken into account in the review of the baseline information, where possible. The Envirocheck reports will be updated in advance of the ES, if required.
- 10.3.3 Phase 1 geo-environmental desk study reports are not required for White Post Roundabout and Warren Hill Junction. These Schemes comprise improvements and upgrades to the existing junctions, with no ground works or additional land take required for the construction and operation of the Schemes. Therefore, no geology and soils effects are expected.
- 10.3.4 Other sources of information used to inform the scoping assessment include:
- 1:50,000 geological map series. 113 Ollerton. Solid and Drift (British Geological Survey, 1996);

- 1:50,000 geological map series. 126 Nottingham. Solid and Drift (British Geological Survey, 1996);
- British Geological Survey. GeoIndex Onshore. Available at: <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>. Date Accessed: 7th December 2020;
- Multi-Agencies Geographic Information for Countryside (MAGIC) (Department for Environment, Food and Rural Affairs and Environment Agency, 2020). Available at: <https://magic.defra.gov.uk/>. Date Accessed: 7th December 2020;
- Soilscales (Cranfield Soil and Agrifood Institute). Available at: <http://www.landis.org.uk/soilscales/>. Date Accessed: 10th December 2020;
- Historic Landfill Sites (Environment Agency, 2020). Available at: <https://data.gov.uk/dataset/17edf94f-6de3-4034-b66b-004ebd0dd010/historic-landfill-sites>. Date Accessed: 8th January 2021;
- Permitted Waste Sites – Authorised Landfill Site Boundaries (Environment Agency, 2020). Available at: <https://data.gov.uk/dataset/ad695596-d71d-4cbb-8e32-99108371c0ee/permitted-waste-sites-authorised-landfill-site-boundaries>. Date Accessed: 8th January 2021;
- Information from the EA, including groundwater and surface water abstractions, pollution incidents within the last five years and waste sites;
- Information from NSDC on private water supply abstractions;
- Information from Nottinghamshire Biological and Geological Records Centre on local geological sites (LGS) within 1 km of Ollerton Roundabout, Mickledale Lane Junction, Lowdham Roundabout and Kirkhill Junction; and
- Google satellite mapping. Available at: <https://www.google.com/maps>. Date accessed: 10th December 2020.

10.3.5 Additional consultation would also be carried out with relevant stakeholders and interested parties, if required.

Ollerton Roundabout

10.3.6 The baseline conditions for Ollerton Roundabout are summarised in Table 10-1.

Table 10-1: Baseline Conditions for Ollerton Roundabout

Category	Baseline conditions	
Geology	Artificial deposits	No deposits of artificial ground are shown on the geological mapping sources. However, due to the development history of the Scheme, shallow deposits of made ground are expected to be present across much of the study area.
	Superficial deposits	The published British Geological Survey (BGS) geological mapping indicates that Alluvium underlies the existing roundabout and surrounding area to the north-east, east

Category

Baseline conditions

		<p>and south-west. This is described as clay, silt, sand and gravel.</p> <p>Glaciofluvial deposits are locally mapped in the north-western part of the study area. These deposits are described as sand and gravel.</p> <p>Superficial deposits are largely absent in the western part of the study area.</p>
	Bedrock geology	The published BGS geological mapping identifies the bedrock geology within the site and surrounding study area as the Sherwood Sandstone Group, Chester Formation. The Chester Formation is described as pinkish red or buff-grey, medium- to coarse-grained, pebbly, cross-bedded, friable sandstone.
	Faults	No faults are mapped within the study area.
Designated sites	RIGS / LGS	No designated regionally important geological sites (RIGS) or local geological sites (LGS) have been identified within the study area. This is based on the MAGIC application and information from the Nottinghamshire Biological and Geological Records Centre (NBGRC).
	Other designated sites	<p>Birklands West and Ollerton Corner SSSI lies immediately to the north and west of the Scheme. The designation was awarded in 2001. The SSSI condition is classed as unfavourable (no change). The scoping boundary encroaches the SSSI land to the north-west of the existing roundabout, between the A616/Worksop Road and the A614/Blyth Road. The scoping boundary also encroaches into the SSSI land at the north-western extent, along the roadside verges of Worksop Road.</p> <p>The Scheme includes land that is indicated to be part of Sherwood Heath LNR, immediately to the west of the existing roundabout. Most of the LNR is also part of the designated SSSI.</p> <p>However, the Scheme includes an area, immediately west of the existing roundabout, that is part of the designated LNR, but not part of the SSSI. This area has recently been developed with a public house and car park.</p> <p>A ppSPA is located adjacent to the Scheme (Sherwood Area). This is a site that may be added to the list of candidate sites, with regards to designation as a SPA.</p>
Hydrogeology	Aquifers	<p>The superficial deposits (Alluvium and glacio-fluvial deposits) are classified as Secondary A Aquifers.</p> <p>The bedrock geology (Chester Formation) is classified as a Principal Aquifer.</p>
	Groundwater vulnerability	Groundwater vulnerability is classed as high in relation to the superficial and bedrock geology.

Category

Baseline conditions

		<p>High vulnerability is defined as 'areas able to easily transmit pollution to groundwater. They are characterised by high-leaching soils and the absence of low-permeability superficial deposits.</p>
	<p>Source Protection Zones (SPZ) and Drinking Water Groundwater Safeguard Zones (SgZ)</p>	<p>SPZ are defined around large and public potable groundwater abstraction sites. The study area is located within Zone III (total catchment area) of a groundwater SPZ. This relates to the Sherwood Sandstone Principal Aquifer. A number of SPZ I (Inner Protection) areas around public water supply sources are located on the Sherwood Sandstone Group; however, none are located within 1 km of the scoping boundary.</p> <p>No Drinking Water SgZ for groundwater are located within 1 km of the Scheme. The closest is approximately 1.2 km from the scoping boundary, to the north-east. Drinking Water SgZ are established around public water supplies where additional pollution control measures are needed.</p>
	Groundwater abstractions	<p>Information provided by the Environment Agency indicates that there are no Environment Agency licenced groundwater abstractions within 1 km of the Scheme.</p> <p>No private groundwater abstractions have been identified by NSDC within 1 km of the Scheme.</p>
	Discharge consents to groundwater	<p>Information on discharge consents is based on the Envirocheck report only.</p> <p>The Envirocheck report includes records for 11 discharge consents to groundwater within 1 km of the Scheme.</p> <p>The closest records relate to a former tourist information centre and a private property located immediately west of the scoping boundary, at Ollerton Roundabout. The discharge consents relate to sewage discharges – final treated effluent.</p> <p>The remaining discharge consents relate to sewage and trade discharges to land/soakaways.</p> <p>It is possible that additional discharge consents could be located to the south-west of the site, due to updates to the scoping boundary. However, this is not considered to be significant to the geology and soils scoping.</p>
Hydrology	Surface water features	<p>The River Maun and tributaries are located to the east of the Scheme, flowing to the east and north-east across the study area.</p> <p>A spur of this river flows along the south-eastern boundary of a field located in the south-western area of the site. The spur is culverted underneath two petrol filling stations and the A614/Old Rufford Road, in the southern area of the Scheme. The watercourse is in open channel to the east of the petrol filling stations. A bridge crosses the stream on Newark Road, to the south-east of the Scheme.</p>

Category

Baseline conditions

	<p>The River Maun is approximately 100 m from the scoping boundary at its closest point. The River Maun was given a GQA Grade C for river quality in 2000 at a monitoring point to the east of the Scheme.</p> <p>Fishing lakes are located upstream of the Scheme, approximately 375 m to the north-east of the scoping boundary. These ponds are adjacent to the River Maun and appear to be artificially constructed (possibly former gravel pits).</p> <p>Small pond features are indicated on current mapping within Sherwood Heath LNR, to the west of the existing roundabout and a public open space at Fairfield Park to the south-east.</p>
<p>Surface water abstractions</p>	<p>Information provided by the Environment Agency indicates that there are seven current surface water abstractions within 1 km of the scoping boundary.</p> <p>The closest abstraction is located approximately 150 m south-east of the Scheme and is related to production of energy (milling and water power).</p> <p>The remaining abstractions are related to general agricultural use and private non-industrial amenity use.</p> <p>One additional abstraction for general agriculture is included within the Envirocheck report, approximately 300 m north-east of the Scheme. It is possible that this abstraction is no longer active, although no end date has been supplied.</p>
<p>Discharge consents to surface water</p>	<p>Information on discharge consents is based on the Envirocheck report only.</p> <p>The Envirocheck report includes records for four surface water discharge consents within 1 km of the scoping boundary.</p> <p>The closest was located approximately 30 m south of the Scheme and relates to sewage discharge of final treated effluent to Ollerton Brook. The discharge consent was revoked in 1991.</p> <p>The remaining discharge consents relate to sewage discharge of final treated effluent and discharge of other matter.</p> <p>It is possible that additional records could be located to the south-west of the site, due to updates to the scoping boundary. However, this is not considered to be significant to the geology and soils scoping.</p>

Category

Baseline conditions

Category	Baseline conditions
Drinking Water Surface Water Safeguard Zones (SgZ)	No Drinking Water SgZ for surface water are located within 2 km of the Scheme.
Pollution Incidents	<p>The Envirocheck report includes eight incidents within 1 km of the scoping boundary, between 1996 and 1999. All were Category 3 (minor) incidents.</p> <p>It is possible that additional records could be located to the south-west of the site, due to updates to the Scoping boundary. However, this is not considered to be significant to the geology and soils scoping.</p>
Substantiated Pollution Incidents Register (from 1999)	<p>The Environment Agency has provided information on substantiated pollution incidents in the last five years. Two incidents were located within 1 km of the site boundaries. The closest incident was approximately 150 m south-east of the scoping boundary. The incident was a Category 3 (minor) incident to land and water, caused by a combined sewage overflow.</p> <p>The Envirocheck report includes two incidents prior to 2015 within 1 km of the site. The closest was 150 m south-east of the Scheme in 2012 and was a Category 2 (significant) incident, impacting water. The pollutants were described as inert mineral materials and ammonia solutions.</p> <p>It is possible that additional records could be located to the south-west of the Scheme, due to updates to the Scoping boundary. However, this is not considered to be significant to the geology and soils scoping.</p>
Land uses	<p>The existing Ollerton roundabout is located in the centre of the study area. The roundabout was constructed in the late-1930s. The centre of the roundabout is grass-covered, with curb stone edging. Grass verges are located around the outer perimeter of the roundabout. During a site walkover carried out by Via in December 2020, various service manhole covers were observed within the verges.</p> <p>Six roads branch out from the roundabout, comprising the A614/Blyth Road to the north, the A614/Old Rufford Road to the south, the A616/Worksop Road to the north-west, Newark Road to the south-east, the A6075/Mansfield Road to the west and the A6075/Ollerton Road to the east.</p> <p>A forested area is located immediately to the north-west of the roundabout. A small takeaway café is also located in this part of the study area.</p> <p>A residential property is located immediately to the north-east of the roundabout. The Scheme encroaches into the southern part of the garden attached to this property.</p>

Category

Baseline conditions

	<p>Agricultural fields are located to the north and east of the property.</p> <p>Agricultural fields are located immediately to the east of the roundabout, beyond which is the village of Ollerton. The Scheme includes the corner of a field in this area.</p> <p>Two food establishments, 'Costa Coffee' and 'McDonalds', are located immediately to the south of the roundabout. The Costa Coffee and car park are included within the scoping boundary.</p> <p>Two petrol filling stations are located on either side of the A614, approximately 50 m south of the existing roundabout. The petrol filling stations, currently operated by Esso and Shell, have been present since at least the early 1970s. The Scheme will slightly encroach across the boundaries of the petrol filling stations.</p> <p>Agricultural land is located to the south of the petrol filling stations. This land is partially included within the Scoping boundary.</p> <p>A recently constructed public house, 'The Alders', is located immediately to the west of the roundabout. The Scheme will slightly encroach into the land associated with the public house, including landscaping areas and a car park.</p> <p>Sherwood Heath LNR is located in the western part of the study area, beyond the public house land.</p>
<p>Historical land uses</p>	<p>Old gravel pits are shown on historical maps in the north-west and west of the study area. A sand pit is also shown in the south-west of the study area. These pits appear to have been infilled by 1960. The former gravel pit in the north-west of the study area underlies the Scheme in the forested area immediately west of the A614 Blyth Road and could potentially underlie the existing road.</p> <p>The Envirocheck report includes one record of potentially infilled land (water) within the Scheme area. This is approximately in the location of a culverted watercourse under Newark Road.</p> <p>The Scheme is located in an area historically used for deep coal mining, with the former Thoresby Colliery to the west and the former Ollerton Colliery to the east. There are no former collieries within the study area; however, it is considered possible that coal mining waste (colliery spoil) could have been historically deposited within the study area. The potential risks from mine gas within the study area are likely to be low due to the depth of the coal seams (approximately 450 m and 670 m below ground level).</p> <p>Prior to the recent construction of the public house, Sherwood Heath LNR extended to the western boundary of the existing roundabout. A public information centre</p>

Category		Baseline conditions
		building was previously located in this part of the study area, along with a paved area, trees and vegetated areas.
	Waste sites	No registered or historical landfill or waste transfer sites have been identified within the study area. However, as noted above, there is evidence of possible gravel pits in the area, including one located within the north-western area of the Scheme. The pits appear to have been infilled with unknown materials.
Agricultural land and soil resources	Agricultural land classification	<p>The scoping boundary includes small areas of agricultural land (approximately 0.3 ha in total) on the eastern side of the study area, located between the Ollerton Road and Newark Road arms of the existing roundabout and along a narrow strip to the north of Ollerton Road.</p> <p>The scoping boundary also includes an area of agricultural land (0.6 ha) to the south-west of the existing roundabout, adjacent to Mansfield Road.</p> <p>The MAGIC application does not include any existing Agricultural Land Classification (ALC) data within the study area. However, an area of Grade 3a land is shown approximately 800 m to the north-east of the Scheme, covering an area of approximately 25 ha.</p>
	Soil types	<p>The soils within the study area are largely described as freely draining, slightly acid sandy soils, with low fertility and low carbon. This type of soil is vulnerable to leaching of nitrate and pesticides to groundwater and erosion under arable and vegetable crops, where sloping.</p> <p>Soils associated with the River Maun, to the east of the existing roundabout, are described as naturally wet, very acid, sandy and loamy soils of very low fertility and medium carbon. This type of soil is also vulnerable to leaching of nitrate and pesticides to groundwater and is vulnerable to wind erosion during dry weather.</p>

Mickledale Lane Junction

- 10.3.7 The baseline conditions for Mickledale Lane Junction are summarised in Table 10-2. Unless otherwise stated, the baseline information relates to both Option 1 and Option 2.

Table 10-2: Baseline Conditions for Mickledale Lane Junction

Category		Baseline conditions
Geology	Artificial deposits	No deposits of artificial ground are shown on the geological mapping sources. However, due to the development history of the Scheme, shallow deposits of made ground are expected to be present across much of the study area.

Category

Baseline conditions

	Superficial deposits	<p>No superficial deposits are mapped within the site boundaries.</p> <p>Deposits of Alluvium are shown within the study area, to the east and south of the Scheme, following a surface watercourse. These deposits comprise clay, silt, sand and gravel.</p>
	Bedrock geology	<p>The published BGS geological mapping identifies the bedrock geology within the site boundaries and the surrounding study area as the Sherwood Sandstone Group, Chester Formation. The Chester Formation is described as pinkish red or buff-grey, medium to coarse grained, pebbly, cross-bedded, friable sandstone.</p>
	Faults	<p>No faults are mapped within the study area.</p>
Designated sites	RIGS / LGS	<p>No designated regionally important geological sites (RIGS) or local geological sites (LGS) have been identified within the study area. This is based on the MAGIC application and information from the Nottinghamshire Biological and Geological Records Centre (NBGRC).</p>
	Other designated sites	<p>No designated sites are indicated within the study area. However, the Scheme is located within a SSSI Impact Risk Zone, related to several SSSIs to the west, including Sherwood Forest Golf Course, Clipstone Heath, Strawberry Hill and Rainworth Heath.</p>
Hydrogeology	Aquifers	<p>The Alluvium, to the east and south of the Scheme, is classified as a Secondary A Aquifer.</p> <p>The bedrock geology (Chester Formation) underlying the Scheme is classified as a Principal Aquifer.</p>
	Groundwater vulnerability	<p>Groundwater vulnerability is classed as medium in relation to the limited superficial deposits within the study area (Alluvium).</p> <p>Groundwater vulnerability is classed as high in relation to the bedrock geology. High vulnerability is defined as 'areas able to easily transmit pollution to groundwater. They are characterised by high-leaching soils and the absence of low-permeability superficial deposits'.</p>
	Source Protection Zones (SPZ) and Drinking Water Groundwater Safeguard Zones (SgZ)	<p>SPZ are defined around large and public potable groundwater abstraction sites. Zone I of a SPZ (inner protection zone) for a public water supply is located within the study area, approximately 150 m west of Option 1 and 330 m west of Option 2.</p> <p>The western part of the study area is located within Zone II (outer zone) of a SPZ. This includes the majority of Option 1 and the western half of Option 2.</p> <p>The eastern part of the study area is located within Zone III (total catchment area) of a SPZ. This is limited to the</p>

Category

Baseline conditions

		<p>eastern half of Option 2 and the eastern edge of Option 1.</p> <p>The whole site is also located within a Drinking Water SgZ for groundwater, with the exception of the eastern margins of Option 2. This is related to the public water supply to the west of the Scheme. Drinking Water SgZ are established around public water supplies where additional pollution control measures are needed.</p>
	Groundwater abstractions	<p>Information from the Environment Agency identifies five current groundwater abstractions for public water supply within 1 km of the Scheme. The exact locations have not been provided; however, the Envirocheck report also includes records related to the same cluster of five boreholes, within the SPZ Zone I. The closest borehole is approximately 500 m west of Option 1 and 500 m north-west of Option 2.</p> <p>In addition, the Environment Agency information and Envirocheck report include records for three groundwater abstractions for general agriculture within 1 km of Option 2, two of which are within 1 km of Option 1. The records relate to spray irrigation, approximately 750 m south-west of Option 1 and 750 m west of Option 2 and abstractions for spray irrigation and vegetable washing approximately 940 m south of Option 2.</p> <p>No private groundwater abstractions have been identified by NSDC within 1 km of the Scheme.</p>
	Discharge consents to groundwater	<p>Information on discharge consents is based on the Envirocheck report only.</p> <p>The Envirocheck report indicates that there are six discharge consents to groundwater within 1 km of the scoping boundary for Option 2, three of which are also within 1 km of the scoping boundary for Option 1. These relate to sewage and trade discharges to land / soakaways.</p> <p>The closest discharge consent is located approximately 75 m east of Option 2 and 250 m east of Option 1.</p> <p>It is possible that additional records could be located to the west of the Scheme, due to updates to the scoping boundary. However, this is not considered to be significant to the geology and soils scoping.</p>
Hydrology	Surface water features	<p>The nearest surface water feature is Rainworth Water, which is located approximately 100 m south of Option 2 and 400 m south of Option 1, flowing east. Old Rufford Road crosses the river on a bridge. The river then flows to the north-east, approximately 160 m east of Option 2 and 300 m east of Option 1.</p>

Category

Baseline conditions

		<p>Rainworth Water recorded a GQA Grade C (fairly good) for river quality in 2000 at a monitoring point to the east of the Scheme.</p> <p>Two ponds are located adjacent to Rainworth Water, to the south and south-west of the Scheme.</p> <p>Isolated ponds are also located within the wider study area, to the north-east and south of the Scheme.</p>
Surface water abstractions		<p>Information from the Environment Agency indicates that there are three current surface water abstractions within 1 km of the Scheme, to the north-east, east and south-east. These relate to spray irrigation (general agriculture). The closest abstraction is recorded approximately 80 m east of Option 2 and 230m east of Option 1.</p> <p>The Envirocheck report also indicates that there is an abstraction located approximately 875 m west of Option 2 and 930 m south-west of Option 1. This is related to spray irrigation (general agriculture). It is possible that this abstraction is no longer active, as it is not included within the Environment Agency data; however, no end date is supplied in the Envirocheck report.</p>
Discharge consents to surface water		<p>Information on discharge consents is based on the Envirocheck report only.</p> <p>The Envirocheck report includes records of three surface water discharge consents within 1 km of the Scheme. The closest is located approximately 90 m east of Option 2 and 250 m east of Option 1. This was related to discharge of surface water from a storm tank on the sewerage network, which was revoked in 2000.</p> <p>The remaining records are for the same discharge consent, which is a sewage discharge for final / treated effluent to Rainworth Water.</p> <p>It is possible that additional records could be located to the west of the Scheme, due to updates to the scoping boundary. However, this is not considered to be significant to the geology and soils scoping.</p>
Drinking Water Surface Water Safeguard Zones (SgZ)		<p>No Drinking Water SgZ for surface water are located within 2 km of the Scheme.</p>
Pollution Incidents	Pollution incidents to Controlled Waters (up to 1999)	<p>The Envirocheck report includes 12 incidents within 1km of the Scheme. All were Category 3 (minor) incidents. The closest incident was approximately 140 m east of the scoping boundary for Option 2 and 330 m east of the scoping boundary for Option 1 in 1997, involving oils (diesel) and impacting Rainworth water.</p>

Category

Baseline conditions

	<p>Substantiated Pollution Incidents Register (from 1999)</p>	<p>The Environment Agency has provided information on substantiated pollution incidents in the last five years. Two incidents were located within 1 km of the site boundaries. The closest incident was approximately 40 m west of the scoping boundary for Option 1 and 110 m north-west of Option 2. The incident was Category 3 (minor) incident to land and was caused by an illegal waste site.</p> <p>The Envirocheck report includes one incident prior to 2015 within 1 km of the Scheme. This was a Category 1 (major) incident in relation to water impact and a Category 3 (minor) incident in relation to air impact. The pollutant was diesel (including agricultural). The incident occurred approximately 140 m east of Option 2 and 290 m east of Option 1 in 2008, impacting Rainworth Water.</p>
<p>Land uses</p>	<p>Current land uses</p>	<p>The existing junction is located in the northern area of the Scheme. The A614/Old Rufford Road runs north to south through the Scheme, Mickledale Lane runs east from the junction and Inkersall Lane runs west from the junction. Old Rufford Road and Mickledale Lane are largely bordered with grass verges and hedges through the Scheme area, with occasional trees. Inkersall Lane is bordered with mature trees on both sides.</p> <p>A bituminous hardstand covered footpath is present on the western side of Old Rufford Road, to the south of the junction and continues to the east of the junction along Mickledale Lane. A bus stop with bituminous hardstand paved area is located on the northern side of Mickledale Lane, within the Scheme area.</p> <p>At the northern boundary of Option 1, there is a disused railway bridge over the A614/Rufford Road. The former railway line, running west to east is now used as a public footpath. The northern extent of Option 2 is located to the south of the railway bridge.</p> <p>The Limes Café and car park is located immediately north-west of the existing junction, beyond which is agricultural land. The car park is unpaved, with some gravel cover. A building has been present in this location since at least 1955.</p> <p>Agricultural land is located immediately to the north-east and south-west of the existing junction. Option 1 includes an area of the field immediately to the south-west of the existing junction. Option 2 includes a smaller area of the same field, which is mostly located further to the south.</p> <p>Four semi-detached houses with gardens are located immediately south-east of the junction, on Old Rufford Road, beyond which is agricultural land to the east and south. Houses have been present at this location since at least 1919. The houses are outside the Scoping boundary. Option 2 includes the southern half of the field</p>

Category

Baseline conditions

to the south-east of the existing junction, a strip of land along the eastern boundary of the field, leading to Mickledale Lane, a strip of land to the south of Mickledale Lane and a strip of land within the field to the north of Mickledale Lane.

A small agricultural industrial estate is located on the farm in the eastern part of the study area. The industrial estate comprises a number of buildings with hardstanding areas used for parking and yard areas. Rainworth Water is located immediately east of the industrial estate.

The eastern boundary of Option 2 runs alongside the western boundary of the agricultural industrial estate and slightly encroaches into the estate, to form two access points. The Envirocheck mapping suggests that there is a possible drop in ground elevation between the edge of the Scheme and the industrial estate. Information obtained from the landowner indicates that there is a soil bund along this boundary of the industrial estate.

A petrol filling station and garage business is located approximately 200 m east of Option 2 and 350 m east of Option 1.

Forested areas are located in the southern part of the study area.

Service junction boxes and service covers are located immediately south-east of the existing junction, at the corner of Old Rufford Road and Mickledale Lane. An overhead electricity cable crosses Old Rufford Road immediately south of the existing junction. Overhead lines also run along the western verge of Old Rufford Road, to the south of the junction and across Old Rufford Road to each of the houses located to the south-east of the existing junction.

Historical land uses

Roads have been present running through the Scheme from north to south and from east to west since pre-1900.

The Scheme is located in an area historically used for deep coal mining, with the former Bilsthorpe Colliery to the north-east. There are no former collieries within the study area. The potential risks from mine gas within the study area are likely to be low due to the depth of the coal seams (approximately 500 m and 830 m below ground level).

A railway line (Bilsthorpe Colliery Branch), with embankments and a bridge had been constructed inside the northern scoping boundary for Option 1 and approximately 160 m north of the scoping boundary for Option 2 by 1938, running from west to east. The historical maps identify this as a mineral railway until 2006. Bilsthorpe Colliery closed in 1997.

Category

Baseline conditions

		<p>The agricultural industrial estate to the east of the Scheme was constructed on an existing farm property by 1986. A tank is shown within the industrial estate, approximately 50 m east of Option 2 and 240 m east of Option 1. It is not known if the tank is still present.</p> <p>A pond is identified on historical mapping to the south of the Scheme from 1986 onwards. This is located at the southern extent of the agricultural industrial estate in a former forested area and drains into Rainworth Water.</p> <p>The Envirocheck report includes one record of potentially infilled land (water) within the study area. This is located approximately 150 m east of Option 2 and 300 m east of Option 1.</p> <p>An aerial image from 1999 shows pig pens on the field to the south-west of the existing junction.</p>
	Waste sites	No registered or historical landfill or waste transfer sites have been identified within 250 m of the Scheme.
Agricultural land and soil resources	Agriculture land classification	<p>The scoping boundary for Option 1 includes a small area of agricultural land (< 1 ha) immediately to the south-west of the existing junction. The MAGIC application does not include any existing ALC data for this land.</p> <p>A small area of the same field (approximately 1.5 ha) is also included within Option 2; however, the location of the temporary works is further to the south of the Option 1 scoping boundary.</p> <p>Option 2 includes an area of agricultural land (approximately 5ha) immediately to the east of the A614/Old Rufford Road. Part of the existing field would be included within the permanent works, comprising a new roundabout and road running through the field between Old Rufford Road and Mickledale Lane. The remainder would be used for the temporary works and could be returned to agricultural use.</p> <p>A small strip of this field, to the south-east of the existing junction, would also be included within the permanent works for Option 1, relating to an access track bordering the houses.</p> <p>The whole field is largely classed as Grade 3a, which is considered to be best and most versatile (BMV) agricultural land. Small areas of Grade 3b land are located at the northern and southern extents of the field.</p>
	Soil types	<p>The soils within the study area are largely described as freely draining, slightly acid sandy soils, with low fertility and low carbon. This type of soil is vulnerable to leaching of nitrate and pesticides to groundwater and erosion under arable and vegetable crops, where sloping.</p> <p>Soils associated with Rainworth Water, at the eastern and southern extents of the study area are described as</p>

Category

Baseline conditions

naturally wet, very acid, sandy and loamy soils of very low fertility and medium carbon. This type of soil is also vulnerable to leaching of nitrate and pesticides to groundwater and is vulnerable to wind erosion during dry weather.

White Post Roundabout

- 10.3.8 A limited review of the baseline conditions has been carried out for White Post Roundabout, using available sources of information. A Phase 1 Geo-environmental Desk Study has not been prepared for this Scheme and no Envirocheck report has been obtained, due to the limited proposed scope of works.
- 10.3.9 Relevant information obtained from the Environment Agency was limited to details of licenced groundwater abstractions and waste sites.
- 10.3.10 The baseline conditions for White Post Roundabout are summarised in Table 10-3.

Table 10-3: Baseline Conditions for White Post Roundabout

Category

Baseline conditions

Geology	Artificial deposits	No deposits of artificial ground are shown on the geological mapping sources. However, due to the development history of the Scheme, shallow deposits of made ground are expected to be present across much of the study area.
	Superficial deposits	No superficial deposits are mapped within the study area.
	Bedrock geology	The published BGS geological mapping identifies the bedrock geology within the scoping boundary and the surrounding study area as Sherwood Sandstone Group, Chester Formation. The Chester Formation is described as pinkish red or buff-grey, medium to coarse grained, pebbly, cross-bedded, friable sandstone.
	Faults	No faults are mapped within the study area.
Designated sites	RIGS / LGS	No designated regionally important geological sites (RIGS) or local geological sites (LGS) have been identified within the study area. This is based on the MAGIC application only.
	Other designated sites	No designated sites are indicated within the study area. However, the Scheme is located within a SSSI Impact Risk Zone, related to Rainworth Heath SSSI and Rainworth Lakes SSSI.
Hydrogeology	Aquifers	The bedrock geology (Chester Formation) is classified as a Principal Aquifer.
	Groundwater vulnerability	Groundwater vulnerability is classed as high in relation to the bedrock geology.

Category

Baseline conditions

		High vulnerability is defined as 'areas able to easily transmit pollution to groundwater. They are characterised by high-leaching soils and the absence of low-permeability superficial deposits.
	Source Protection Zones and Drinking Water Groundwater Safeguard Zones (SgZ)	The study area is located within Zone III (total catchment area) of a groundwater SPZ. An SPZ Zone I, associated with the Far Baulker public water supply abstraction, is located approximately 2.8 km south-west of the scoping boundary. No Drinking Water SgZ for groundwater are located within 2 km of the Scheme.
	Groundwater abstractions	Information on licenced groundwater abstractions has been obtained from the Environment Agency. There are four abstractions within 1 km of the site. The closest abstractions are approximately 620 m south-west and 620 m north-east of the scoping boundary and are related to spray irrigation for general agriculture. No private groundwater abstractions have been identified by NSDC within 1 km of the Scheme.
Hydrology	Surface water features	The closest water feature to the Scheme is a pond within White Post Farm, 15 m to the north of the scoping boundary. Two other pond features are located within the study area, to the north of the Scheme. There are no watercourses within 1 km of the Scheme.
	Drinking Water Surface Water Safeguard Zones (SgZ)	No Drinking Water SgZ for surface water are located within 2 km of the Scheme.
Land uses	Current land uses	The Scheme area entirely comprises the existing roundabout and roads. The centre of the roundabout is planted with shrubs and has brick and curb stone edging. Two roads cross the roundabout, comprising the A614 Old Rufford Road to the north and south and Mansfield Road to the east and west. A property, including a building, driveway and grassed grounds (possible private residence or business) is located to the north-west of the roundabout and is separated from the roundabout by a grass verge, footpath and hedge. Robin Hoods Wheelgate theme park is located immediately north of the property, on Rufford Road and an escape games venue is located to the west of the property, on Mansfield Road. White Post Farm is located to the north-east of the roundabout, with a footpath, grassed verge and hedge

Category **Baseline conditions**

		<p>separating the roundabout and the farm. The farm is a tourist attraction and farm centre.</p> <p>The White Post public house is located to the south-east of the roundabout, with a footpath and grass verge separating the roundabout and public house property.</p> <p>A plant hire and sales business is located to the south-west of the roundabout, with a grass verge between the edge of the property and the roundabout. Prior to 2009, this was a garage for vehicle servicing and repairs, as well as second-hand 4x4 car sales.</p> <p>Agricultural land is located to the south of the public house and plant hire and sales business.</p>
	Waste sites	No registered or historical landfill or waste transfer sites have been identified within 250 m of the Scheme.
Agricultural land and soil resources	Agriculture land classification	<p>The scoping boundary does not include any agricultural land within the temporary or permanent works.</p> <p>The MAGIC application does not include any existing ALC data within the study area.</p>
	Soil types	The soils within the study area are largely described as freely draining, slightly acid sandy soils, with low fertility and low carbon. This type of soil is vulnerable to leaching of nitrate and pesticides to groundwater and erosion under arable and vegetable crops, where sloping.

Warren Hill Junction

- 10.3.11 A limited review of the baseline conditions has been carried out for Warren Hill Junction, using available sources of information. A Phase 1 Geo-environmental Desk Study has not been prepared for this Scheme and no Envirocheck report has been obtained, due to the limited proposed scope of works.
- 10.3.12 Relevant information obtained from the Environment Agency was limited to details of licenced groundwater abstractions and waste sites.
- 10.3.13 The baseline conditions for Warren Hill Junction are summarised in Table 10-4.

Table 10-4: Baseline Conditions for Warren Hill Junction

Category	Baseline conditions
Geology	<p>Artificial deposits No deposits of artificial ground are shown on the geological mapping sources. However, due to the development history of the Scheme, shallow deposits of made ground are expected to be present across much of the study area.</p>
	<p>Superficial deposits No superficial deposits are mapped within the study area.</p>
	<p>Bedrock geology The published BGS geological mapping identifies the bedrock geology within the scoping boundary and most</p>

Category

Baseline conditions

		<p>of the surrounding study area as Sherwood Sandstone Group, Chester Formation. The Chester Formation is described as pinkish red or buff-grey, medium to coarse grained, pebbly, cross-bedded, friable sandstone.</p> <p>The Tarporley Siltstone Formation underlies the south-eastern edge of the study area. The Tarporley Siltstone Formation is described as interlaminated siltstones, mudstones or sandstones.</p>
	Faults	No faults are mapped within the study area.
Designated sites	RIGS / LGS	No designated regionally important geological sites (RIGS) or local geological sites (LGS) are indicated on the MAGIC application within the study area.
	Other designated sites	No designated sites are indicated within the study area. However, the Scheme is located within a SSSI Impact Risk Zone, related to Rainworth Heath SSSI and Rainworth Lakes SSSI.
Hydrogeology	Aquifers	The Chester Formation, which underlies the Scheme, is classified as a Principal Aquifer. The Tarporley Siltstone Formation, at the south-eastern edge of the study area, is classified as a Secondary B Aquifer.
	Groundwater vulnerability	<p>Groundwater vulnerability is classed as high across the study area.</p> <p>High vulnerability is defined as 'areas able to easily transmit pollution to groundwater. They are characterised by high-leaching soils and the absence of low-permeability superficial deposits.</p>
	Source Protection Zones and Drinking Water Groundwater Safeguard Zones (SgZ)	<p>The study area is located within Zone III (total catchment area) of a groundwater SPZ. An SPZ Zone I, associated with the Far Baulker public water supply abstraction, is located approximately 1.1 km south-west of the scoping boundary.</p> <p>There are no Drinking Water SgZ for groundwater within 2 km of the Scheme.</p>
	Groundwater abstractions	<p>Information on licenced groundwater abstractions has been obtained from the Environment Agency. There are three groundwater abstractions within 1km of the scoping boundary. The closest is approximately 460m to the west of the site and is related to spray irrigation and trickle irrigation for general agriculture.</p> <p>Three public water supply boreholes are located approximately 1.3 km south-west of the existing junction, at Far Baulker Farm.</p> <p>No private groundwater abstractions have been identified by NSDC within 1 km of the Scheme.</p>

Category	Baseline conditions	
Hydrology	Surface water features	<p>The closest watercourse is a tributary of Dover Beck, located approximately 350 m to the east of the existing junction. This flows south and joins with Dover Beck, approximately 1.4 km to the south of the junction.</p> <p>There are four ponds located within 1km of the junction.</p>
	Drinking Water Surface Water Safeguard Zones (SgZ)	No Drinking Water SgZ for surface water are located within 2 km of the Scheme.
Land uses	Current land uses	<p>The Scheme area entirely comprises the existing junction of the A614 Old Rufford Road and the A6097 Ollerton Road. The central area of the junction contains grass and dense vegetation cover, with clusters of trees.</p> <p>Two local roads branch from the A614 Rufford Road in the northern part of the study area. Rob Lane runs to the south-east and a private farm access track runs to the north-west. A caravan dealer is located to the north-east of the existing junction, on Rob Lane.</p> <p>The remainder of the study area comprises agricultural land.</p>
	Waste sites	No registered or historical landfill or waste transfer sites have been identified within 250 m of the Scheme.
Agricultural land and soil resources	Agriculture land classification	<p>The scoping boundary does will not include any agricultural land within the temporary or permanent works.</p> <p>The MAGIC application does not include any existing ALC data within the study area.</p>
	Soil types	The soils within the study area are largely described as freely draining, slightly acid sandy soils, with low fertility and low carbon. This type of soil is vulnerable to leaching of nitrate and pesticides to groundwater and erosion under arable and vegetable crops, where sloping.

Lowdham Roundabout

10.3.14 The baseline conditions for Lowdham Roundabout are summarised in Table 10-5.

Table 10-5: Baseline Conditions for Lowdham Roundabout

Category	Baseline conditions	
Geology	Artificial deposits	No deposits of artificial ground are shown on the geological mapping sources. However, due to the development history of the Scheme, shallow deposits of made ground are expected to be present across much of the study area.

Category

Baseline conditions

	Superficial deposits	<p>The published BGS geological mapping identifies Alluvium across the whole site area. This is described as clay, silt, sand and gravel.</p> <p>Head deposits are located in the western and eastern parts of the study area. These deposits are described as clay, silt, sand and gravel.</p> <p>Deposits of Holme Pierrepont Sand and Gravel Member are locally present in the south-eastern part of the study area. These deposits comprise sand and gravel.</p>
	Bedrock geology	<p>The published BGS geological mapping identifies the bedrock geology within most of the study area as the Sidmouth Mudstone Formation, Radcliffe Member. This is described as finely interlaminated mudstone, siltstone and very fine-grained sandstone.</p> <p>The Sidmouth Mudstone Formation, Gunthorpe Member underlies the temporary work areas in the western part of the site and the study area lying to the west of the Scheme. This is described as red-brown mudstone with subordinate greenish grey dolomitic siltstone and fine-grained sandstone. Gypsum veins and nodules are common.</p>
	Faults	No faults are mapped within the study area.
Designated sites	RIGS / LGS	No designated regionally important geological sites (RIGS) or local geological sites (LGS) have been identified within the study area. This is based on the MAGIC application and information from the Nottinghamshire Biological and Geological Records Centre.
	Other designated sites	No designated sites are indicated within the study area. The Scheme is not located within a SSSI impact risk zone.
Hydrogeology	Aquifers	<p>The Alluvium is classified as a Secondary A Aquifer and the Head deposits are classified as a Secondary Aquifer (undifferentiated).</p> <p>The Radcliffe Member and Gunthorpe Member are classified as Secondary B Aquifers.</p>
	Groundwater vulnerability	Groundwater vulnerability is classed as high in relation to the superficial and bedrock geology. High vulnerability is defined as 'areas able to easily transmit pollution to groundwater. They are characterised by high-leaching soils and the absence of low-permeability superficial deposits'.
	Source Protection Zones (SPZ) and Drinking Water Surface	The Scheme is not located within or near to a groundwater SPZ. A SPZ III (total catchment area) is located approximately 1km north of the Scheme. This is

Category

Baseline conditions

	<p>Water Safeguard Zones (SgZ)</p>	<p>for a public water supply abstraction located approximately 2 km to the north-west of the Scheme.</p> <p>The study area is not located within a Drinking Water SgZ for groundwater. However, a Drinking Water SgZ is located approximately 1.2 km north-west of the site.</p>
	<p>Groundwater abstractions</p>	<p>Information from the Environment Agency indicates that there are no current licenced groundwater abstractions within 1km of the scoping boundary.</p> <p>One Environment Agency licenced groundwater abstraction has been identified in the Envirocheck report within 1 km of the scoping boundary. This relates to spray irrigation for a cricket club and is located approximately 870 m east of the Scheme. It is possible that this abstraction is no longer active, as it is not included within the Environment Agency data. However, no end date has been supplied for the licence.</p> <p>No private water supply boreholes have been identified by NSDC within 1 km of the scoping boundary. Two boreholes are located approximately 1.4 km and 1.8 km from the existing roundabout.</p>
	<p>Discharge consents to groundwater</p>	<p>Four discharge consents to groundwater have been identified within 1 km of the scoping boundary. These relate to sewage effluent discharges to groundwater. The closest discharge consent record is approximately 115 m north-east of the scoping boundary.</p>
<p>Hydrology</p>	<p>Surface water features</p>	<p>There are two surface water features in the southern area of the Scheme. These comprise a short ditch, which follows the south-western edge of the A6097/Epperstone Bypass and a stream which flows to the north-east along the south-eastern edge of the A612/Nottingham Road before changing direction and flowing to the south-east along the north-eastern boundary of the adjacent field. This stream connects with other land drains to the south of the Scheme.</p> <p>A river, identified as Cocker Beck, is located to the north and east of the Scheme and is approximately 80 m from the Scheme at the closest point. The Cocker Beck flows south to the River Trent, which is approximately 2 km south of the scoping boundary. Cocker Beck recorded a GQA Grade C for river quality in 2000 at a monitoring point to the north-west of the Scheme.</p> <p>Dover Beck is located approximately 1km to the north-east of the Scheme, flowing south-east to the River Trent, and several land drains are located on agricultural land lying between Cocker Beck and Dover Beck.</p> <p>There are several pond features within 1 km of the site. The closest pond is approximately 300 m to the south-west of the Scheme.</p>

Category

Baseline conditions

	Surface water abstractions	Information from the Environment Agency and the Envirocheck report indicates that there is one surface water abstraction within 1 km of the scoping boundary. The Envirocheck report includes four records for the abstraction, which is located approximately 700 m south of the scoping boundary and is used for spray irrigation (general agriculture).
	Discharge consents to surface water	<p>Six surface water discharge consents have been identified in the Envirocheck report within 1 km of the scoping boundary. The closest is located approximately 45 m north-east of the Scheme and relates to discharge of surface water from a storm tank. The status is listed as surrendered.</p> <p>The remaining discharge consents relate to discharge of surface water, final effluent from sewage treatment works and sewage discharges (final/treated effluent) from a domestic property.</p>
	Drinking Water Surface Water Safeguard Zones (SgZ)	No Drinking Water SgZ for surface water are located within 2 km of the Scheme.
Pollution Incidents	Pollution incidents to Controlled Waters (up to 1999)	Ten incidents have been identified within 1km of the Scheme in the Envirocheck report, between 1996 and 1999. All were Category 3 (minor) incidents.
	Substantiated Pollution Incidents Register (from 1999)	<p>The Environment Agency has provided information on substantiated pollution incidents in the last five years. One incident was located within 1 km of the scoping boundary and occurred in 2017. The incident was approximately 570 m east of the scoping boundary and was caused by sewage materials from an underground storage tank failure (domestic and residential). This was a Category 3 (minor) incident to water.</p> <p>No substantiated pollution incidents between 1999 and 2014 were identified in the Envirocheck report within 1 km of the Scheme.</p>
Land uses	Current land uses	<p>The existing Lowdham roundabout is located in the central part of the study area. The roundabout was constructed approximately in the late 1950s – early 1960s. The centre of the roundabout is grass-covered, with curb stone edging.</p> <p>Four roads branch out from the roundabout, comprising the A6097/Epperstone Bypass to the north-west and south-east and the A612/Nottingham Road to the north-east and south-west.</p>

Category

Baseline conditions

Southwell Road is also located within the study area, branching from Nottingham Road to the north-east of the roundabout.

A central grass covered reservation is located on the northern section of Epperstone Bypass and an asphalt covered paved section on the southern section. Grass verges are located around the outer perimeter of the roundabout. Manhole covers for buried services were observed sporadically during a walkover survey carried out in December 2020.

Agricultural land is located immediately west of the existing roundabout. The scoping boundary includes a portion of the agricultural field adjacent to the roundabout, comprising approximately 1.1 ha.

Four residential dwellings are located immediately south of the roundabout. The houses are not within the scoping boundary.

Agricultural fields, farm buildings (Brakes Farm) and residential dwellings are located to the south-west of the roundabout. The scoping boundary includes a portion of a field on the south-eastern side of Nottingham Road, comprising less than 0.5 ha.

Further residential dwellings are located immediately east of the roundabout but are not within the scoping boundary.

To the north of the roundabout, there is an area of grass and trees, beyond which is a cricket club/sports field. This land is also outside of the scoping boundary.

A railway line is located approximately 300 m south-east of the existing roundabout, running north-east to south-west. Lowdham Railway Station is also located within the study area, adjacent to the railway line.

Historical land uses

The Scheme was historically developed as a road prior to 1883, which ran through the site approximately north-east to south-west. Additional roads were constructed in the 1930s, forming the north-western and south-eastern branches of the existing junction.

Other historical land uses within the study area include a tan yard to the north-east and a brickyard to the north (both pre-1900). A brick works was also located to the south-west of the Scheme (pre-1950).

A depot and chimney were located to the east of the Scheme, approximately from the 1960s. This area had been redeveloped for residential use by 1991.

The historical maps indicate a water filled feature to the south of the Scheme in 1914, which later appears to have been infilled, around the time the existing farm was developed (circa. 1938).

Category		Baseline conditions
	Waste sites	No registered or historical landfill or waste transfer sites have been identified within the study area.
Agricultural land and soil resources	Agriculture land classification	<p>The scoping boundary includes two areas of agricultural land, comprising an area of approximately 1.1 ha immediately west of the existing roundabout and an area of <0.5ha to the south-west of the existing roundabout.</p> <p>The MAGIC application does not include any existing ALC data within the study area. In the wider area (approximately 750 m – 1 km from the Scheme), there are three areas of classified land. These areas are largely Grade 3b land, with local regions of Grade 3a and / or Grade 2 land.</p>
	Soil types	The soils within the study area are described as loamy and clayey floodplain soils with naturally high groundwater. These soils have moderate fertility and medium carbon content. Close proximity to rivers can lead to pollution risks from floodwater scouring and from drainage water after spreading of fertiliser or slurry.

Kirk Hill Junction

10.3.15 The baseline conditions for Kirk Hill Junction are summarised in Table 10-6.

Table 10-6: Baseline Conditions for Kirk Hill Junction

Category		Baseline conditions
Geology	Artificial deposits	No deposits of artificial ground are shown on the geological mapping sources. However, due to the development history of the Scheme, shallow deposits of made ground are expected to be present across much of the study area.
	Superficial deposits	No superficial deposits are mapped within the area of the Scheme. However, the published BGS geological mapping identifies glacial till at the south-eastern edge of the study area.
	Bedrock geology	<p>The published BGS geological mapping identifies the bedrock geology within the scoping boundary and most of the surrounding study area as the Sidmouth Mudstone Formation, Edwalton Member. This is described as red-brown and greenish grey mudstone and siltstone, with beds of variably dolomitic siltstone and very fine-grained sandstone common in the lower half and finely disseminated gypsum common in the upper half. Skerries of green dolomitic siltstone are mapped partially in a swathe running through the central area of the Scheme.</p> <p>The Sidmouth Mudstone Formation, Gunthorpe Member largely underlies the north-western part of the study area. This is described as red-brown mudstone with</p>

Category

Baseline conditions

		<p>subordinate greenish grey dolomitic siltstone and fine-grained sandstone. Gypsum veins and nodules are common.</p> <p>The Sidmouth Mudstone Formation, Cotgrave Sandstone Member locally underlies the north-western part of the study area, between the Edwalton Member and Gunthorpe Member. This is described as pale greenish grey, fine to medium grained sandstone, interbedded with mudstone and siltstone, with common gypsum nodules.</p>
	Faults	<p>The BGS 1:50,000 map 126 Nottingham identifies a fault trending approximately west-north-west to east-south-east within the Scheme area. This fault crosses the A6097 Bridgford Street in the north-western area of the Scheme. The fault also crosses Kirk Hill, on the northern side of the existing junction. The downthrow of the fault is to the north-north-east.</p> <p>A fault trending approximately north-north-west to south-south-east is located to the south of the Scheme and crosses East Bridgford Road. The downthrow of the fault is to the east-north-east.</p> <p>The two faults converge in the north-western part of the study area.</p>
Designated sites	RIGS / LGS	<p>No designated regionally important geological sites (RIGS) or local geological sites (LGS) are indicated on the MAGIC application within the study area.</p> <p>Information from the NBGRC indicates that there are no RIGS / LGS within the study area; however, Gunthorpe Weir LGS was identified approximately 700 m north of the Scheme.</p>
	Other designated sites	<p>No designated sites are indicated within the study area. The Scheme is not located within a SSSI impact risk zone.</p>
Hydrogeology	Aquifers	<p>The glacial till, which underlies the south-eastern part of the study area, is classed as a Secondary Aquifer (undifferentiated).</p> <p>The Edwalton Member (mudstone) and Gunthorpe Member are Secondary B Aquifers, while the Edwalton Member (siltstone) and the Cotgrave Sandstone Member are Secondary A Aquifers.</p>
	Groundwater vulnerability	<p>Groundwater vulnerability is classed as high in relation to the bedrock geology. High vulnerability is defined as 'areas able to easily transmit pollution to groundwater. They are characterised by high-leaching soils and the absence of low-permeability superficial deposits'.</p>

Category

Baseline conditions

	Source Protection Zones and Drinking Water Groundwater Safeguard Zones (SgZ)	The study area is not located within or near to a groundwater SPZ or a Drinking Water SgZ for groundwater.
	Groundwater abstractions	<p>No licenced groundwater abstractions have been identified within the Scheme or within 1 km of the scoping boundary.</p> <p>No private water supply boreholes have been identified by NSDC within 1 km of the scoping boundary. One borehole is located approximately 1.8 km north of the site.</p>
	Discharge consents to groundwater	<p>Information on discharge consents is based on the Envirocheck report only.</p> <p>There are five discharge consents listed in the Envirocheck report within 1 km of the scoping boundary, one of which has been revoked. The closest is located approximately 100 m north-west of the scoping boundary, at Hill Farm. The discharge consents relate to sewage effluent discharges to groundwater or land / soakaway.</p> <p>It is possible that additional records could be located to the west of the Scheme, due to updates to the scoping boundary. However, this is not considered to be significant to the geology and soils scoping.</p>
Hydrology	Surface water features	<p>A land drain is located approximately 220 m to the north-west of the existing junction. The drain flows approximately south-east to north-west between Bridgford Road and a water reclamation works to the north-west.</p> <p>The drain is indicated to be a tributary of the River Trent, which is located approximately 890 m north of the junction, flowing from west to east in the area of the Scheme, with a change in direction to the north-east beyond.</p> <p>A small pond is located within the south-eastern section of the drain and a larger pond is located at the north-western end of the drain, at the water reclamation works.</p> <p>Several land drains and small pond features are located within the agricultural land to the south and west of the Scheme and pond features are also indicated to the north and east.</p>
	Surface water abstractions	Information from the Environment Agency and the Envirocheck report indicates that there is one surface water abstraction within 1 km of the scoping boundary. This is related to hydroelectric power generation, with a daily quantity of 1,728,000 L.

Category

Baseline conditions

		<p>There are five surface water abstractions listed in the Envirocheck report within 1 km of the scoping boundary. The closest is located approximately 700 m north of the Scheme and is related to hydroelectric power generation.</p> <p>The remaining abstractions are related to mineral washing from the River Trent at Gunthorpe Lock.</p>
	Discharge consents to surface water	<p>Information on discharge consents is based on the Envirocheck report only.</p> <p>There are 15 records of surface water discharge consents in the Envirocheck report within 1km of the Scheme. The closest is located approximately 500m north-west. Most of the discharge consents are related to sewage discharges.</p> <p>It is possible that additional records could be located to the west of the Scheme, due to updates to the scoping boundary. However, this is not considered to be significant to the geology and soils scoping.</p>
	Drinking Water Surface Water Safeguard Zones (SgZ)	<p>No Drinking Water SgZ for surface water are located within 2 km of the Scheme.</p>
Pollution Incidents	Pollution incidents to Controlled Waters (up to 1999)	<p>There are four records for incidents within 1 km of the scoping boundary in the Envirocheck report. The closest was approximately 780 m north of the Scheme and was related to crude sewage due to a blocked sewer at a domestic property in 1999.</p> <p>The remaining incidents were related to unidentified foam in the River Trent, to the north of the Scheme.</p>
	Substantiated Pollution Incidents Register (from 1999)	<p>The Environment Agency has provided information on substantiated pollution incidents in the last five years. Within 1km of the site, one incident was recorded in 2018 and three incidents were recorded in 2020. The closest to the site was approximately 540 m south-west of the site and was a category 3 (minor incident) to land and water. This was related to diesel pollution from a road traffic accident.</p> <p>No substantiated pollution incidents between 1999 and 2014 were identified in the Envirocheck report within 1km of the Scheme.</p>
Land uses	Current land uses	<p>The existing junction is located in the centre of the Scheme, with the A6097 Bridgford Road running north-west to south-east through the Scheme area. Kirk Hill branches off at the junction to the north-east, with a tight bend to the north-west. East Bridgford Road branches off at the junction to the south-west.</p> <p>The roadside verges on Bridgford Road are variably grass covered, with hard covered footpath areas, hedges</p>

Category

Baseline conditions

and trees. The south-eastern verge on Bridgford Road is slightly raised above the level of the road. Various service covers are present alongside the road.

A pedestrian crossing is located on Bridgford Road, to the south-east of the junction. Two utility boxes are located on the south-western verge, in line with the pedestrian crossing.

Agricultural fields are located within the study area, to the south-west of Bridgford Road and to the north-east of Kirk Hill. A portion of the field to the south-west of Bridgford Road (<1 ha) is also located within the scoping boundary (temporary works).

Farm buildings (Hill Farm) are located in the northern part of the study area, adjacent to Kirk Hill.

Terraced houses are located adjacent to the scoping boundary, on Kirk Hill.

A house and garden are located at the edge of the study area, to the north-east of the Scheme.

Small woodland areas are located in the north-western part of the study area, to the south-west and north-east of Bridgford Road.

A water reclamation works is located approximately 300 m north-west of the scoping boundary and is downstream of the study area.

The village of East Bridgford is located immediately north-east of the study area.

Historical land uses

The Scheme was historically developed as a road prior to 1883, which ran through the site approximately north-east to south-west, with a bend to the north-west in the northern section of the Scheme. The A6097/Bridgford Road had been constructed by 1952, running north-west to south-east through most of the Scheme area.

An area of worked ground (possible pit) was located in the western area of the Scheme in the early 1900s. The northern part of the pit underlies the existing Bridgford Road. To the south-west of the road, the feature is shown on historical maps up until 2000. The Envirocheck report includes a record of potentially infilled ground (non-water) at this location.

A council yard was located immediately north of the Scheme, on a narrow strip of land between Bridgford Road and Kirk Hill, from circa. 1967. During a site walkover in December 2020, this site was identified as a former plumbing and heating engineers (now closed). Piles of rubble and building debris were observed within the yard, which could include asbestos-containing materials (ACM).

Category

Baseline conditions

		Allotment gardens are shown on historical mapping at the edge of the study area, to the north-east of the Scheme until at least 1989. This land appears to have been redeveloped as a residential garden.
	Waste sites	No registered or historical landfill or waste transfer sites have been identified within 250 m of the scoping boundary. However, as noted above, there is evidence of a possible pit filled with unknown materials in the north-western area of the Scheme.
Agricultural land and soil resources	Agriculture land classification	The scoping boundary includes <1 ha of agricultural land, comprising a larger area to the west of the existing road junction and small areas to the east and south-east of the existing junction. The MAGIC application does not include any existing ALC data within the study area.
	Soil types	The soils within the study area are described as slightly acid loamy and clayey soils with impeded drainage. These soils have moderate to high fertility and low carbon content. Water resources are vulnerable to pollution run-off and rapid through-flow to streams as farmed land is drained. Surface capping can trigger erosion of the sediment.

10.4 Value of Environmental and Resources Receptors

10.4.1 Based on DMRB LA 109 Geology and Soils (Highways England, 2019b), the key potential environmental and resources receptors to be considered in the geology and soils assessment are as follows:

- Human receptors (on-site and off-site);
- Groundwater receptors (e.g. aquifers, abstractions);
- Surface water receptors (e.g. rivers, ponds);
- Designated geological sites (e.g. RIGS or LGS); and
- Agricultural land and soil resources.

10.4.2 The value (sensitivity) of human receptors will be based on the land uses during the construction and operation of the Scheme. Higher sensitivity land uses include residential and public open space, while lower sensitivity land uses include industrial and transport uses.

10.4.3 The value of groundwater and surface water receptors will be determined based on the regional and local importance of the features, in relation to drinking water resources and ecological quality.

10.4.4 The value of designated geological sites will be based on the national, regional or local importance of the sites.

- 10.4.5 The value of agricultural soil resources will be based on the ALC Grade, where land that is classified as Grade 1, Grade 2 and Grade 3a is considered to be the best and most versatile. The value of other soil resources will be based on the soil quality and national, regional or local importance of the sites.

10.5 Potential Effects

Construction

- 10.5.1 The potential geology and soils effects related to the construction of a road scheme can be both adverse and beneficial. Examples of potential adverse and beneficial effects are described in the following sections.

Adverse

- Increased mobilisation of contaminants during construction such as dust, which could be inhaled or ingested by human receptors or deposited onto surrounding land;
- Increased mobilisation of contaminants through leaching of contaminated materials exposed or disturbed during construction, which could impact groundwater and surface water receptors;
- Mobilisation of ground gas or vapours during construction, which could impact construction workers or off-site receptors;
- Soil or groundwater contamination from hazardous materials or substances used during construction (e.g. fuel spills, air borne contaminants and spray);
- Unplanned release of contaminated materials onto surrounding transport routes during transport of contaminated materials from a construction site;
- Damage to best and most versatile agricultural land or important soil resources; and
- Damage of important geological features.

Beneficial

- Removal of older road surfacing materials, which may contain contaminants, such as road tar;
- Removal or stabilisation of contaminated soils and other materials in the ground during the construction works; and
- Removal or remediation of contaminated groundwater during the construction works.

Operation

- 10.5.2 The potential geology and soils effects during operation of a road scheme can be both adverse and beneficial. Examples of potential adverse and beneficial effects are described in the following sections.

Adverse

- Increased release of soil contaminants into the environment due to inappropriate placement of contaminated materials, for example, within new

embankments. This could have an impact on human receptors, through inhalation, ingestion, or dermal contact;

- Increased leaching of soil contaminants into the environment, due to inappropriate placement of contaminated materials. This could have an impact on controlled waters receptors, through vertical and lateral migration in groundwater;
- Release of highways related contaminants into the environment, for example in spray or spills. This could occur as a result of general traffic movements over time, routine road maintenance activities and road traffic collisions or other incidents;
- Increased soil erosion impacts, for example within cuttings and embankments; and
- Permanent loss of best and most versatile agricultural land and important soil resources. Most of the agricultural land required will be used for the temporary works and will be returned to agricultural use following completion of the construction works, however some soils will be permanently lost to the Project. Permanent loss of important geological features, or permanently reduced access.

Beneficial

- Reduced future risks from soil and groundwater contaminants due to ground improvements; for example, removal or treatment of contaminated soils and groundwater, or appropriate placement of potentially contaminated materials in low risk areas;
- Reduced future risks from highways related contaminants due to improved design and materials; for example, improved drainage, improved hardstanding materials and better traffic management and flow;
- Improved access to designated sites or potential to uncover new features of interest; for example, new geological exposures in road cuttings; and
- Mitigation of existing adverse soil erosion effects through improved drainage.

10.6 Proposed Level and Scope of Assessment

10.6.1 It is proposed that the following Schemes are scoped out of the geology and soils assessments:

- White Post Roundabout; and
- Warren Hill Junction.

10.6.2 These two Schemes constitute minor improvements to the existing junctions, with no ground works or additional land take required. Therefore, no significant geology and soils effects are expected during the construction and operation of these Schemes.

10.6.3 The geology and soils assessments will be undertaken in accordance with DMRB LA 109 Geology and Soils and LA 104 Environmental Assessment and Monitoring (HE, 2020).

- 10.6.4 The scope of the assessments, as outlined in DMRB LA 109, will include the following elements:
- Effects on bedrock geology and superficial deposits, including geological designations and sensitive / valuable non-designated features;
 - Effects on soil resources; and
 - Effects from contamination on human health, surface water and groundwater.
- 10.6.5 A Phase 2 intrusive ground investigation will be carried out for each Scheme, excluding White Post Roundabout and Warren Hill Junction. At the time of writing, only the investigations for Ollerton Roundabout and Kirk Hill Junction have commenced. However, any information available from the ground investigations will be used to refine the baseline assessments for the ES.
- 10.6.6 In addition, ALC and soil resource surveys will be carried out by a land quality specialist for areas of agricultural land within the site boundaries. A soil resource survey will also be carried out within the SSSI at Ollerton Roundabout.
- 10.6.7 The findings of the surveys will be used to assess the effects of the Project on BMV land and soil resources within the SSSI and to develop a soil resource plan. The soil resource plan will assist in ensuring that any areas of agricultural land or SSSI used for the temporary works are restored appropriately for return to the landowners on completion of the construction phase.

10.7 Proposed Assessment Methodology including Significance

- 10.7.1 The proposed methodology for the geology and soils assessments is based on the guidance in DMRB LA 109, LA 113 and LA 104.
- 10.7.2 In addition to the DMRB guidance, the proposed methodology takes account of relevant UK guidance related to contaminated land assessment, including:
- Land contamination risk management (LCRM) (Environment Agency, 2020). Available at <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>;
 - BS 10175+A2 Investigation of Potentially Contaminated Sites – Code of Practice (British Standards, 2017);
 - BS 5930:2015 Code of Practice for Ground Investigations (British Standards, 2015);
 - BS 3882:2015 Specification for Topsoil and Requirements for Use (British Standards, 2015);
 - Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA, 2009);
 - C552 Contaminated Land Risk Assessment. A Guide to Good Practice (CIRIA, 2001);
 - C665 Assessing Risks Posed by Hazardous Ground Gases to Buildings (CIRIA, 2007);

- The Definition of Waste: Development Industry Code of Practice, V2 (Contaminated Land: Applications in Real Environments (CL:AIRE), 2011);
- Control of Asbestos Regulations 2012. Interpretation for Managing and Working with Asbestos in Soil and Construction Materials: Industry Guidance (CL:AIRE, 2016);
- Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (DEFRA, 2012);
- Waste Classification. Guidance on the classification and assessment of waste (1st Edition v1.1). Technical Guidance WM3 (Environment Agency, 2018); and
- TR P5-065/TR: Technical Aspects of Site Investigation (Volumes 1 & 2) (Environment Agency, 2002).

10.7.3 The proposed methodology also takes account of relevant UK guidance on the protection of soil resources, in particular:

- Information Note TIN049. Agricultural Land Classification: protecting the best and most versatile agricultural land (Natural England, 2012).

10.7.4 Information Note TIN049 sets out the requirement for Natural England to consider proposals which individually or collectively involve the loss of more than 20 ha of best and most versatile agricultural land.

Baseline Conditions

10.7.5 The baseline conditions will be determined using the sources referenced in Section 10.3, the results of the ALC and soil resource surveys and, if available, any initial information from the intrusive ground investigations. This will be the basis for identifying the key potential source, pathway and receptor linkages for each Scheme.

Receptor Sensitivity

10.7.6 A value (sensitivity) will be attributed to each of the receptors identified for each Scheme. The receptor sensitivity will be assessed using the criteria in Table 10-7. This is based on Table 3.11 of DMRB LA 109 for geology, soils and human health receptors and Table 3.70 of DMRB LA 113 for surface water and groundwater receptors.

Table 10-7: Environmental Value (Sensitivity) and Descriptions (based on DMRB LA 109 and LA 113)

Receptor value (sensitivity)	Description	Typical examples
Very high	Geology	Very rare and of international importance with no potential for replacement (e.g. UNESCO World Heritage Sites, UNESCO Global Geoparks, SSSIs and GCR sites where citations indicate features of international importance). Geology meeting international designation citation criteria which is not designated as such.

Receptor value (sensitivity)	Description	Typical examples
	Soils	Soils directly supporting an EU designated site (e.g. SAC, SPA, Ramsar). Agricultural land classification (ALC) grade 1 & 2 or LCAC grade 1 & 2.
	Contamination – human health	Very high sensitivity land use such as residential or allotments.
	Contamination – surface water	Watercourse having a WFD classification shown in a RBMP and $Q_{95} \geq 1.0 \text{ m}^3/\text{s}$. Site protected under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water). Species protected by EC legislation.
	Contamination – groundwater	Principal aquifer providing a regionally important resource and / or supporting a site protected under EC and UK legislation. Groundwater that locally supports GWDTE. SPZ I.
High	Geology	Rare and national importance with little potential for replacement (e.g. geological SSSI, ASSI, NNR). Geology meeting national designation citation criteria which is not designated as such.
	Soils	Soils directly supporting a UK designated site (e.g. SSSI). ALC grade 3a.
	Contamination – human health	High sensitivity land use such as public open space.
	Contamination – surface water	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.
	Contamination – groundwater	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater that supports a GWDTE SPZ2.
Medium	Geology	Geology of regional importance with limited potential for replacement (e.g. RIGS). Geology meeting regional designation citation criteria which is not designated as such.
	Soils	Soils supporting non-statutory designated sites (e.g. LNRs, LGSSs, SNCIs). ALC grade 3b.

Receptor value (sensitivity)	Description	Typical examples
	Contamination – human health	Medium sensitivity land use such as commercial or industrial.
	Contamination – surface water	Watercourses not having a WFD classification shown in a RBMP and $Q_{95} > 0.001 \text{ m}^3/\text{s}$.
	Contamination – groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.
Low	Geology	Geology of local importance / interest with potential for replacement (e.g. non designated geological exposures, former quarries / mining sites).
	Soils	ALC grade 4 & 5. Soils supporting non-designated notable or priority habitats.
	Contamination – human health	Low sensitivity land use such as highways and rail.
	Contamination – surface water	Watercourses not having a WFD classification shown in a RBMP and $Q_{95} \leq 0.001 \text{ m}^3/\text{s}$.
	Contamination – groundwater	Unproductive strata.
Negligible	Geology	No geological exposures, little / no local interest.
	Soils	Previously developed land formerly in 'hard uses' with little potential to return to agriculture.
	Contamination – human health	Undeveloped surplus land / no sensitive land use proposed.
	Contamination – surface water	N/A
	Contamination – groundwater	N/A

10.7.7 DMRB LA 109 also notes that soils not categorised as best and most versatile or prime land can be allocated in a higher sensitivity category where particular agricultural practices contribute to the quality and character of the environment or local economy (e.g. in upland areas where lower quality agricultural land is integral to agricultural practices).

Magnitude of Change

10.7.8 The magnitude of impact on the receptors during the construction and operation of each Scheme will be determined using the criteria in Table 10-8. This is based on Table 3.12 of DMRB LA 109 for geology, soils and human health receptors. The relevant sensitivity criteria in Table 3.71 of DMRB LA 113 have been used for surface water and groundwater receptors.

Table 10-8: Magnitude of Impact (based on DMRB LA 109 and LA 113)

Magnitude of impact (change)	Description	Typical examples
Major	Geology	Loss of geological feature / designation and / or quality and integrity. Severe damage to key characteristics, features or elements.
	Soils	Physical removal or permanent sealing of soil resource or agricultural land.
	Contamination – human health	Significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels (CL:AIRE, 2014)) with potential for significant harm to human health. Contamination heavily restricts future use of land.
	Contamination – surface water	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.
	Contamination – groundwater	Loss or, 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 pollution from spillages $\geq 2\%$ annually (Spillage assessment). Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification.
Moderate	Geology	Partial loss of geological feature / designation, potentially adversely affecting the integrity. Partial loss of / damage to key characteristics, features or elements.
	Soils	Permanent loss / reduction of one or more soil function(s) and restriction to current or approved

Magnitude of impact (change)	Description	Typical examples
		future use (e.g. through degradation, compaction, erosion of soil resource).
	Contamination – human health	<p>Contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category 4 screening levels (CL:AIRE, 2014)).</p> <p>Significant contamination can be present. Control / remediation measures are required to reduce risks to human health / make land suitable for intended use.</p>
	Contamination – surface water	<p>Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values.</p> <p>Calculated risk of pollution from spillages ≥ 1 % annually and < 2 % annually.</p> <p>Partial loss in productivity of a fishery.</p> <p>Degradation of regionally important public water supply or loss of major commercial / industrial / agricultural supplies.</p> <p>Contribution to reduction in water body WFD classification.</p>
	Contamination – groundwater	<p>Partial loss or change to an aquifer.</p> <p>Degradation of regionally important public water supply or loss of significant commercial / industrial / agricultural supplies.</p> <p>Potential medium risk of pollution to groundwater from routine runoff – risk score 150-250.</p> <p>Calculated risk of pollutant from spillages ≥ 1 % annually and < 2 % annually.</p> <p>Partial loss of the integrity of GWDTE.</p> <p>Contribution to reduction in water body WFD classification.</p>
Minor	Geology	<p>Minor measurable change in geological feature / designation attributes, quality or vulnerability.</p> <p>Minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.</p>
	Soils	Temporary loss / 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 are below relevant screening criteria (e.g. category 4 screening levels (CL:AIRE, 2014)).

Magnitude of impact (change)	Description	Typical examples
		<p>Significant contamination is unlikely with a low risk to human health.</p> <p>Best practice measures can be required to minimise risks to human health.</p>
	Contamination – surface water	<p>Failure of either acute soluble or chronic sediment related pollutants in HEWRAT.</p> <p>Calculated risk of pollution from spillages ≥ 0.5 % annually and < 1 % annually.</p> <p>Minor effects on water supplies.</p>
	Contamination – groundwater	<p>Potential low risk of pollution to groundwater from routine runoff – risk score < 150.</p> <p>Calculated risk of pollution from spillages ≥ 0.5 % annually and < 1 % annually.</p> <p>Minor effects on an aquifer, GWDTEs, abstractions.</p>
Negligible	Geology	<p>Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature / designation.</p> <p>Overall integrity of resource not affected.</p>
	Soils	<p>No discernible loss / reduction of soil function(s) that restrict current or approved future use.</p>
	Contamination – human health	<p>Contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. category 4 screening levels (CL:AIRE, 2014)). No requirement for control measures to reduce risks to human health / make land suitable for intended use.</p>
	Contamination – surface water	<p>No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants).</p> <p>Risk of pollution from spillages < 0.5 %.</p>
	Contamination – groundwater	<p>No measurable impact upon an aquifer and / or groundwater receptors and risk of pollution from spillages < 0.5 %.</p>
No change	Geology	<p>No temporary or permanent loss / disturbance of characteristics, features or elements.</p>
	Soils	<p>No loss / reduction of soil function(s) that restrict current or approved future use.</p>
	Contamination – human health	<p>Reported contaminant concentrations below background levels.</p>
	Contamination – surface water	<p>No loss or alteration of characteristics, features or elements; no observable impact in either direction.</p>

Magnitude of impact (change)	Description	Typical examples
------------------------------	-------------	------------------

	Contamination – groundwater	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
--	-----------------------------	---

10.7.9 DMRB LA 109 also requires improvements from baseline conditions (beneficial effects) to be identified and reported within the assessment.

Impact Significance

10.7.10 The significance of the effect (described as adverse, neutral or beneficial) will be determined using the significance matrix taken from LA 104, which has been reproduced in Chapter 5 of this report. This is based on the environmental value vs the magnitude of change.

10.7.11 Major and moderate effects are considered to be significant, while minor and negligible effects are considered to be manageable and not significant.

10.7.12 The geology and soils assessments will take into account the Scheme designs and any embedded measures that would be expected to avoid or reduce adverse impacts to geology and soils.

10.7.13 The assessments will consider mitigation and management actions (essential mitigation) and determine the residual effects that would be expected following implementation of any mitigation measures.

10.8 Assumptions and Limitations

10.8.1 The baseline assessments in this Scoping Report are based on the information available at the time of reporting and are based on the Scheme designs as described in Chapter 2, including the likely extents of land take required for the construction and operation of each Scheme.

10.8.2 The red line boundaries for the Schemes have been updated since the Envirocheck reports were obtained. It is possible that some environmental features located more than 1km from the current red line boundaries may not have been identified. This is because the Envirocheck Report may be based on a slightly smaller search area than would be required for the updated scoping boundary. However, this is not expected to significantly change the impact on the baseline assessments within this Scoping Report.

10.8.3 Following completion of the intrusive ground investigations, Phase 2 ground investigation interpretive reports will be completed for Ollerton Roundabout, Mickledale Lane Junction, Lowdham Roundabout and Kirk Hill Junction. The reports will include environmental risk assessments for human health and controlled waters. The risk assessments will be used to update the conceptual site models (CSM) for the Schemes and will be used to inform any specific mitigation requirements related to contamination, if present. The CSM will also be used to inform the management of soil materials for re-use and disposal during construction of the Schemes.

10.8.4 Re-use or disposal of materials will be carried out in accordance with the Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011) or relevant waste or landfill regulations, as appropriate.

- 10.8.5 The geology and soils assessments will not include any assessment of risks associated with geotechnical hazards and land stability. Geotechnical testing will be carried out as part of each Phase 2 ground investigation, which will be used to develop a geotechnical risk assessment. This will be reported within the ground investigation interpretive report.

11. MATERIAL ASSETS AND WASTE

11.1 Introduction

- 11.1.1 AECOM have prepared this chapter to outline the scope of assessment with regard to the Project.
- 11.1.2 This chapter sets out the approach and methodology that will be used in the assessment of effects in relation to material assets and waste during the construction and operation of the Schemes.
- 11.1.3 For the purpose of this Scoping Report, material assets and waste are defined as comprising:
- The use of material assets; and
 - The generation and management of waste.

11.2 Study Area

- 11.2.1 The study area for waste generation is defined by the proposed development boundary, within which waste would be generated. The study area is deemed to include the footprint of the proposed works, together with any temporary land requirements during the construction. This may include temporary offices, compounds and storage areas.
- 11.2.2 The study area for waste management comprises the wider region within which waste management infrastructure (specifically landfill capacity) is located i.e. the East Midlands region (including Derbyshire, Leicestershire, Nottinghamshire, Northamptonshire and Lincolnshire).
- 11.2.3 The study area for the use of material assets in the construction of the Project and for consideration of the sterilisation of mineral safeguard sites and peat resources is defined by the scoping boundaries.
- 11.2.4 The study area for alternative materials (secondary and recycled aggregates) is the East Midlands region as defined above.

11.3 Existing and Baseline Conditions

Material Assets

- 11.3.1 Material assets are defined as:
- Construction materials and products (from primary natural assets, recycled or secondary and renewable sources); and
 - Built assets such as landfill capacity, mineral safeguarding sites and peat resources.
- 11.3.2 The national target for recovery of construction and demolition waste is 70% by weight, as set out in the Waste Framework Directive (2008/98/EC) and the Waste Management Plan for England. Uncontaminated excavated soil and stones (European Waste Code 17 05 04) are specifically excluded from this target.

- 11.3.3 DMRB LA 110 Material Assets and Waste (Highways England, 2019c) states that projects should aim to achieve at least 90% (by weight) material recovery of non-hazardous construction and demolition waste.
- 11.3.4 The baseline guidelines for alternative aggregates (which comprise both secondary aggregates, which are by-products from industrial and mining operations, and recycled aggregates, which are produced from construction waste) are set out in the National and Regional Guidelines for Aggregates Provision in England 2005 -2020 (Department for Communities and local Government, 2009) and are summarised in Table 11-3. The Highways England derived target for the proposed development is the 14% for the East Midlands region as outlined in Annex E/1 of DMRB LA 110.

Table 11-1: Recycled Aggregate Targets for England

Region	Guideline for land-won production		Assumptions			Total aggregate provision (million tonnes)	Highway England alternative material target
	Land-won sand and gravel	Land-won crushed rock	Marine sand and gravel	Alternative materials	Net imports to England		
East Midlands	174	500	0	110	0	784	14%
England (total)	1028	1492	259	993	136	3,908	25%

- 11.3.5 The Project is not located within any Mineral Safeguarding Areas according to the Nottinghamshire Local Minerals Plan (NCC, 2021).
- 11.3.6 No peat resources have been identified within the scoping boundary, see Chapter 10 – Geology and Soils.

Waste

- 11.3.7 Waste is defined as per the Waste Framework Directive (2008/98/EC) as “any substance or object which the holder discards or intends or is required to discard”.
- 11.3.8 Baseline information is based on the current landfill capacity in Nottinghamshire, and in the wider East Midlands region as outlined in the Environment Agency’s 2019 Remaining Landfill Capacity data (Data.gov.uk, accessed 2021), and is summarised in Table 11-2Table 11-2.

Table 11-2: Nottinghamshire and East Midlands Landfill Capacity 2019

Landfill Type	Nottinghamshire landfill capacity (m ³)	East Midlands landfill capacity (m ³)
Hazardous Merchant	0	1,156,170
Hazardous Restricted	0	7,550
Non-Hazardous with SNRHW* cell	0	16,681,131
Non-Hazardous	3,775,606	15,293,021

Landfill Type	Nottinghamshire landfill capacity (m ³)	East Midlands landfill capacity (m ³)
Non-Hazardous Restricted	0	0
Inert	3,947,893	8,680,094
Total	7,723,499	41,817,966

*SNRHW = stable non-reactive hazardous waste

11.3.9 The Waste Local Plan (NCC and Nottingham City Council, 2002) was originally adopted in 2002, and has been partially replaced by a new Waste Core Strategy (NCC and Nottingham City Council, 2013), states that *“provision will be made for capacity to manage the principal waste streams in a way that provides for the maximum diversion of waste from landfill”*. Nottinghamshire has set a target recycling rate of 70% for all wastes, including construction, demolition and excavation by 2025, and acknowledges that the industry is already exceeding this target within the County.

11.3.10 There are no safeguarded waste management facilities within the scoping boundaries.

11.4 Potential Effects

Construction Phase

11.4.1 Early indicative estimates of materials and waste arisings have been prepared on the emerging design, as detailed in Table 11-3 below. It is concluded that the nature and relatively small scale of works proposed corresponds with low quantities of material use and waste generation.

11.4.2 Where possible, recovery and reuse of as much on-site material will be prioritised, therefore reducing the requirement for import and export of material. The detailed design will identify opportunities for the reuse of recycled/ secondary materials in order to reduce use of primary materials.

11.4.3 No safeguarded mineral or waste site, or peat resources are located within the Project (Scheme boundaries), so there is low potential for the Project to affect these resources.

Table 11-3: Estimated Quantities of Material Use

Scheme Name	Bulk volume of construction materials m ³	Quantity of construction waste m ^{3*}
Ollerton Roundabout	2000	2000
Mickledale Lane Junction Option 1	2500	2250
Mickledale Lane Junction Option 2	5200	5200
White Post Roundabout	200	200
Warren Hill Junction	200	200
Lowdham Roundabout	610	248

Scheme Name	Bulk volume of construction materials m ³	Quantity of construction waste m ³ *
Kirk Hill Junction	1750	8700

*This is an estimate of material to be removed from site, for which the majority is expected to be diverted from landfill and sent for reuse or recovery.

11.5 Proposed Scope and Level of Assessment

Construction Phase

11.5.1 The following scoping questions, as derived from DMRB LA 110 have been used to determine whether further assessment is required:

- Is the project likely to recover/reuse little on site material thereby requiring materials to be imported to site?

The Project is likely to reuse materials on site where possible. There will be a limited requirement for the import of materials to site.

- Is the project likely to use little/no recycled secondary materials thereby requiring the majority of material used on the project to comprise primary materials?

The Project will use a mix of primary and secondary materials. There will be a limited requirement for the import of materials (including primary materials) to site.

- Is the project likely to sterilise (substantially constrain/prevent existing and future use of) mineral sites or peat resources?

There are no safeguarded minerals sites or peat resources within the scoping boundaries, therefore no potential to sterilise these resources.

- Would the project generate large quantities of waste relative to landfill capacity?

No, the amount of waste likely to be generated is relatively small in comparison to remaining landfill capacity in Nottinghamshire and the East Midlands.

- Will the project have an effect on the ability of waste infrastructure within the region to continue to accommodate waste from other sources?

No, the amount of waste likely to be generated is relatively small in comparison to remaining landfill capacity in Nottinghamshire and the East Midlands.

11.5.2 On the basis of the responses to the questions above, it is proposed that the material assets and waste topic will be scoped out of further assessment.

11.5.3 Whilst it is proposed that no further assessment of material assets and waste is required, a Construction Environmental Management Plan (CEMP) would be prepared by the construction contractor. The CEMP would include the implementation of industry standard practice and control measures for environmental impacts arising during construction, such as the control of dust and

the approach to waste management on site. The CEMP would be produced prior to works commencing and would include a Site Waste Management Plan (SWMP).

Operational Phase

- 11.5.4 The exact types and quantity of material asset use, and waste generation associated with the operation of the existing road is currently unknown. Routine maintenance would include gully emptying and litter collection. Periodically, maintenance activities such as resurfacing would be required. Waste arising from these maintenance activities is expected to be generally the same (in both type and quantity) to that generated by the existing road layout; and the wastes would be managed using the established procedures and facilities that are used across the County. Therefore, material asset use and waste generation during the operational phase of the Project are scoped out of the assessment.

11.6 Assumptions and Limitations

- 11.6.1 Whilst estimates have been prepared for the purposes of scoping, the exact material types and quantity of material use and waste generation may change through design development. However due to the nature and relatively small scale of the works proposed, it is concluded that the low quantities of materials and waste would be required/ generated and would consequently have a low likelihood of significant effects on the environment.

12. NOISE AND VIBRATION

12.1 Introduction

- 12.1.1 Via have prepared this chapter to outline the scope of assessment with regard to the Project.
- 12.1.2 This chapter sets out the approach and methodology that will be used in the assessment of noise and vibration effects at identified sensitive receptors during the construction and operation of the Schemes.
- 12.1.3 The proposed scope and methodology of the assessment is based on the guidance set out within the DMRB LA 111 Noise and Vibration (Highways England, 2020g).
- 12.1.4 The other key legislation and policies, at the time of writing, are listed below:
- Noise Policy Statement for England (NPSE) (DEFRA, 2010);
 - British Standard (BS) 5228-1&2:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites;
 - European Noise Directive 2002/49/EC (END) (European Commission (EC), 2002);
 - Environmental Noise Guidelines for the European Region (World Health Organization (WHO), 2018);
 - Calculation of Road Traffic Noise (CRTN) (Department of Transport, 1988);
 - Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments – Version 4 (Institute of Acoustics and Association of Noise Consultants, 2020); and
 - National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019).

12.2 Study Area

- 12.2.1 As described in DMRB LA 111 it is standard practice to consider noise and vibration impacts during the construction activities and during the operational phase.

Construction Phase

- 12.2.2 As detailed in DMRB LA 111 noise impacts from construction activities are assessed up to a maximum distance of approximately 300m from the works, and vibration impacts up to a maximum distance of approximately 100m from the works, as no impacts would be anticipated beyond these distances.
- 12.2.3 The study area for the construction phase noise and vibration impacts focuses on quantifying the potential impacts at the closest existing identified sensitive receptors to the various works, with some additional receptors selected to represent the impacts further away from the works. The selected receptors are collectively representative of all identified potentially sensitive receptors in the study area. By focussing on a selection of the closest identified potentially

sensitive receptors the reported impacts at these receptors will, therefore, be typical of the worst affected receptors and all potentially significant effects will be identified. The receptors selected further away from the works will demonstrate how the impact will reduce further away from the works.

- 12.2.4 The impact of construction traffic is expected to be minimal as it will access the Scheme construction areas primarily using the A614/A6097 (Principal Roads) on which the Schemes are located.
- 12.2.5 As required by DMRB LA 111, any other areas “*where there is reasonable stakeholder expectation*” that a construction phase assessment is undertaken will also be considered. Any such areas will be identified through consultation responses and discussions with NCC and the local district authorities.

Operational Phase

- 12.2.6 The study area will comprise an area 600m from the roads physically changed by the Project.
- 12.2.7 As required by DMRB LA 111, any other areas “*where there is reasonable stakeholder expectation*” that a traffic noise assessment is undertaken will also be considered. Any such areas will be identified through consultation responses and discussions with NCC environmental health.
- 12.2.8 The construction and operational study areas for each Scheme are illustrated on Figures 12-1 to 12-7.

12.3 Existing and Baseline Conditions

Existing Conditions

Ollerton Roundabout

- 12.3.1 There are three residential properties and several commercial developments, all in very close proximity to the existing roundabout. Further to the east and south-east there are several properties in Ollerton Village which lie within the 600 m study area of the Scheme.
- 12.3.2 The existing noise climate at the three adjacent residential properties immediately to the north of the roundabout on Blyth Road is dominated by traffic noise, both free flowing and stationary, during periods of congestion on the southbound approach to the roundabout.
- 12.3.3 Three Noise Important Areas (NIA) were identified through the Extrinsic, England Noise and Air Quality Viewer (accessed December 2020) within 600m of the Ollerton Scheme: the NIA with the ID 7781 (located near the south arm of the roundabout), and the NIAs with the IDs 7780 and 14530 (both located near the east arm of the roundabout where the centre of Ollerton’s village is located). All these NIAs are the responsibility of NCC.

Mickledale Lane Junction

- 12.3.4 There are four residential properties which lie immediately adjacent to the south-eastern corner of the existing junction fronting onto Old Rufford Road. To the north-west corner of the junction is The Limes Café and a further residential receptor set back from the roadside by approximately 35m with an intervening informal car/lorry parking area associated with the neighbouring café.

12.3.5 There is a large commercial premise (Strawson's Ltd) located approximately 200-400 m south-east of the junction with the edge of Bilsthorpe village approximately 400 m to the east of the existing junction.

12.3.6 The existing noise climate at the nearest properties is likely to be dominated by traffic noise, with those located further east on the edge of Bilsthorpe village dominated by distant road traffic and occasional commercial and agricultural activity noise.

White Post Roundabout

12.3.7 There are several commercial receptors including a public house, amusement park, plant hire and sales business, nursery and a petting farm located immediately adjacent to the roundabout as well as residential receptors to the west and south of the roundabout within 100 m. The edge of Farnsfield village lies 1 km to the east outside of the study area.

12.3.8 The existing noise climate at the nearest properties is likely to be dominated by traffic noise.

12.3.9 Two NIAs (ID 8165 and ID 13995) were identified through the Extrium, England Noise and Air Quality Viewer (website accessed December 2020) within 600m of the Scheme. These two NIAs are the responsibility of NCC.

Warren Hill Junction

12.3.10 There is one commercial development located to the north of the junction and one residential receptor approximately 580m to the north-west of the junction within the study area.

12.3.11 The existing noise climate at the nearest property is likely to be dominated by distant road traffic, wildlife/livestock and occasional agricultural activity noise.

Lowdham Roundabout

12.3.12 The existing roundabout is adjacent to Lowdham Village. There are several sensitive receptors which are immediately adjacent to the junction fronting onto the A612 eastbound and westbound legs from the roundabout.

12.3.13 The greatest concentration of receptors within the study area is to the east/south-east in Lowdham Village.

12.3.14 The existing noise climate at the nearest properties is likely to be dominated by traffic noise, with those located further east/south-east on the edge of Lowdham Village dominated by distant road traffic, railway noise from the nearby railway line which passes through the village and occasional activities associated with agriculture.

12.3.15 Two NIAs were identified through the Extrium, England Noise and Air Quality Viewer (website accessed December 2020) within 600 m of the Scheme: the south arm of existing Scheme roundabout (ID 11650) and the other is located near the north arm of Lowdham Roundabout (ID 11649). These two NIAs are the responsibility of NCC.

Kirk Hill Junction Scheme

12.3.16 Three sensitive receptors were identified in the vicinity of the Scheme located to the north (less than 100 m). Further sensitive receptors are concentrated to the north-east of the junction on the edge of East Bridgford Village, within the 600 m study area.

- 12.3.17 The existing noise climate at the nearest properties is likely to be dominated by traffic noise, with those located further east on the edge of East Bridgford village dominated by distant road traffic, wildlife/livestock and occasional noise associated with agricultural activities.

Baseline Conditions

- 12.3.18 The Institute of Acoustics and the Association of Noise Consultants published a document called 'Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments – Version 4' at 21st April 2020 to help their members to adjust their baseline assessments during the COVID pandemic.
- 12.3.19 The current COVID restrictions have resulted in a significant decrease in the number of journeys being made compared to the pre-COVID travel patterns. This has prevented traditional baseline noise measurements from being undertaken due to potential unreliability and inaccuracy of the data.
- 12.3.20 The Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments suggests for transport schemes, the use of other sources of noise transport data available (like Defra noise maps), where possible, along with previously made direct site measurements to describe baseline conditions.
- 12.3.21 Due to the lack of current/historic noise data, data from DEFRA's noise maps will be used to describe the baseline conditions. These strategic noise maps cover the major sources of transport noise and were designed to provide a global view of noise exposure in line with the requirements of the Environmental Noise Directive (END) for reporting above 55 decibel (dB) L_{den} and 50 dB L_{night} .
- 12.3.22 These strategic maps covered the following roads of the Project: A614, A6097, Ollerton Road (A6075), Worksop Road (A616), and Nottingham Road (A612).
- 12.3.23 A review of the DEFRA noise maps indicates that there is a total of seven NIAs within the Scheme study areas. The NIAs highlight 'hotspot' locations where the highest 1% of noise levels at residential locations can be found.
- 12.3.24 The DEFRA noise maps will be used to validate the noise modelling undertaken to support the operational noise assessment.

12.4 Value of Environmental and Resource Receptors

- 12.4.1 Sensitive receptors within the study area that are most likely to be impacted by the Schemes have been determined from OS mapping. As part of the ES assessment, OS address base data on land use will be reviewed and discussed with NCC environmental health and the relevant District Authority to confirm the relevant potentially sensitive receptors have been identified. DMRB defines residential properties, educational buildings, medical buildings, community facilities (such as places of worship), END quiet areas or potential END quiet areas, designated ecological sites such as SACs, SPAs and SSSIs, and cultural heritage assets (such as Scheduled Monuments) as potentially sensitive to noise and/or vibration. Commercial uses such as offices and industrial premises are not normally considered to be noise or vibration sensitive.
- 12.4.2 No END quiet areas or potential END quiet areas have been identified in the study area; discussions will be held with the Environmental Health Officer at the relevant District Authority to determine if any 'tranquil areas' as referred to in the NPPF have been identified. However, publicly accessible open spaces, which may be

prized for their recreational and amenity value, will be identified based on the national OS Greenspace Registered Parks and Gardens data sets.

- 12.4.3 The potentially noise-sensitive receptors (NSR) were identified within the 600 m and within 300 m study areas for each Scheme. The list of NSR is summarized in Table 12-1.

Table 12-1: List of NSR from each Scheme (600 m and 300 m Buffers)

Scheme Name	Number of NSR (600 m Buffer)	Number of NSR (300 m Buffer)
Ollerton Roundabout	673	118
Mickledale Lane Junction Option 1	260	10
Mickledale Lane Junction Option 2	443	90
White Post Roundabout	12	9
Warren Hill Junction	1	0
Lowdham Roundabout	760	364
Kirk Hill Junction	287	53

12.5 Potential Effects

Construction Phase

- 12.5.1 The potential noise and vibration effects related to the construction of a road scheme can be both adverse and beneficial. Examples of potential adverse and beneficial effects are described in the following sections.

Adverse

- Increased noise levels associated with construction operations;
- Increased noise levels associated with construction traffic on wider road network; and
- Increased levels of vibration associated with construction operations.

Beneficial

- Reduction in road traffic noise levels associated with slower speeds and reduced capacity due to temporary traffic management arrangements.

Operational Phase

- 12.5.2 The potential noise and vibration effects related to the operational phase of a road scheme can be both adverse and beneficial. Examples of potential adverse and beneficial effects are described in the following sections.

Adverse

- Increased noise levels due to closer proximity of traffic noise sources to sensitive receptors;
- Increased noise levels due to higher speeds; and

- Increased noise levels due to higher traffic volumes.

Beneficial

- Reduction in noise through opportunity to lay low noise road surfacing;
- Improved road construction and surface condition with fewer irregularities reducing risk of noise- and vibration-associated surface failure; and
- Opportunity to incorporate roadside noise barriers or alternative screening measures to reduce noise impacts.

12.6 Proposed Level and Scope of Assessment

- 12.6.1 The assessment of noise and vibration for the Schemes will be completed in accordance with the relevant guidance in the DMRB LA 111. The aim of the DMRB assessment is to determine and report likely significant effects on sensitive receptors due to construction noise, construction vibration, construction traffic noise and operational traffic noise.
- 12.6.2 The DMRB LA 111 scopes out operational vibration impacts as a maintained road surface would be free of irregularities as part of project design and general maintenance. As such, operational vibration does not have the potential to lead to significant adverse effects.
- 12.6.3 DMRB LA 111 states that the scoping assessment shall report on the following scoping assessment questions to gain an understanding of the need to undertake a further operational noise assessment:
- *“Is the project likely to cause a change in the Basic Noise Level (BNL) of 1 dB LA_{10,18hr} in the DM Opening Year (DMOY) compared to the DS Opening Year (DSOY)?*
 - *Is the project likely to cause a change in the BNL of 3 dB LA_{10,18hr} in the DS Future Year (DSFY) compared to the DMOY?*
 - *Does the project involve the construction of new road links within 600m of noise sensitive receptors?*
 - *Would there be a reasonable stakeholder expectation that an assessment would be undertaken?”*
- 12.6.4 The traffic data will be examined to determine the change in the BNL; however, it is known that there is potential for changes in noise levels where there is increased road capacity giving rise to potential increases in traffic flows and speeds. Therefore, further operational traffic noise assessment is required where any significant interventions are planned.
- 12.6.5 The traffic changes during construction are expected to be minimal, and use the Major Road Network, resulting in minimal increases in the proportion of HGVs within the traffic flows. Where short term diversions are required, these are expected to be diverted to the Strategic Road Network (SRN), which would be likely to result in minor changes to traffic flows on these roads during constructions. There is limited potential for construction traffic flows to result in significant effects. It is proposed that a construction traffic noise assessment is scoped out for all junctions for this reason.

12.6.6 It is proposed that the following Schemes are scoped out of the noise and vibration assessments for both the construction and operational phases, as these Schemes only involve minor improvements consistent with typical highway maintenance operations within the existing highway limits:

- White Post Roundabout; and
- Warren Hill Junction.

12.6.7 In summary, the assessment will cover the following junctions:

Construction Phase Noise and Vibration Assessment

- Ollerton Roundabout;
- Mickledale Lane Junction Options 1 and 2;
- Lowdham Roundabout; and
- Kirk Hill Junction.

Operational Phase Noise Assessment

- Ollerton Roundabout;
- Mickledale Lane Junction Options 1 & 2;
- Lowdham Roundabout; and
- Kirk Hill Junction.

12.7 Proposed Assessment Methodology Including Significance

Construction Assessment Methodology

12.7.1 A quantitative assessment of construction noise impacts is proposed for the identified Schemes, based on estimates of reasonable worst-case construction noise levels for a selection of potentially sensitive receptors within 300m of the works, including those closest to the works. Reasonable worst-case construction noise levels would be estimated in accordance with the methodology in BS 5228: 2009+A1: 2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites' (British Standards, 2009). At this stage, precise information on the construction works are not be available. However, it is anticipated that the contractor would be available at the ES stage to provide reasonable assumptions on the likely works.

12.7.2 Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; and
- a total number of days exceeding 40 in any six consecutive months.

12.7.3 BS 5228 (British Standards, 2009) contains several example methodologies for identifying significant construction noise effects based on fixed thresholds or noise

level changes. DMRB LA 111 set the threshold for the onset of potentially significant adverse effects (i.e. the Significant Observed Adverse Effect Level (SOAEL)) depending on the existing ambient noise level and the Lowest Observable Adverse Effect Level (LOAEL)) is set at as the existing ambient noise level. Table 12-2 is adapted from Table E.1 in BS5228 and, sets out the construction noise SOAEL and LOAEL proposed for this assessment.

Table 12-2: Construction Noise SOAEL Thresholds and LOAEL for All Receptors

Time of Day	SOAEL LA _{eq,T} (dB) Façade			LOAEL LA _{eq,T} (dB) Façade
	Category A ¹	Category B ²	Category C ³	
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75	Existing ambient noise level
Evenings (19:00 – 23:00 weekdays) and Weekends (13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays)	55	60	65	Existing ambient noise level
Night-time (23:00 – 07:00)	45	50	55	Existing ambient noise level

¹ **Category A:** threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

² **Category B:** threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as the category A values.

³ **Category C:** threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than the category A values.

NOTE: if the ambient noise level exceeds the Category C threshold values then the SOAEL and LOAEL are defined as equal to the existing ambient.

12.7.4 Construction vibration impacts will be assessed at potentially sensitive receptors within a maximum radius of 100m of any construction activities which are a potentially significant source of vibration, such as works using vibratory rollers/compactors. Vibration levels will be estimated in accordance with the relevant methodologies in BS 5228 (British Standards, 2009). Table 12-3 **Error! Reference source not found.** details Peak Particle Velocity (PPV) vibration levels and provides a semantic scale for the description of construction vibration effects on human receptors, based on guidance contained in BS 5228 (British Standards, 2009).

Table 12-3: Construction Vibration Criteria for Human Receptors (Annoyance)

PPV (in mms ⁻¹)	Description
10 mms ⁻¹	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

PPV (in mms^{-1}) Description

1.0 mms^{-1}	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.
0.3 mms^{-1}	Vibration might be just perceptible in residential environments.
0.14 mms^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.

12.7.5 The nature of the interventions proposed at this Project seems to indicate vibration levels during all the construction works below 1.0mms^{-1} PPV, the threshold vibration construction level tolerated for human receptors (in accordance with DMRB LA 111).

12.7.6 In addition to human annoyance, building structures may be damaged by high levels of vibration. The levels of vibration that may cause building damage are far in excess of those that may cause annoyance. Consequently, if vibration levels within buildings are controlled to those relating to annoyance (i.e. 1.0mms^{-1}), then it is highly unlikely that buildings would be damaged by construction vibration.

12.7.7 The magnitude of the impact (from construction noise and vibration levels) is considered on a scale from negligible to major, as detailed in Table 12-4 **Error! Reference source not found.**, adapted from DMRB LA 111.

Table 12-4: Magnitude of the Impacts from Construction Noise and Vibration.

Magnitude of the Impact	Construction noise level	Construction vibration level
Major	Above or equal to the SOAEL +5 dB	Above or equal to 10mms^{-1} PPV
Moderate	Above or equal to the SOAEL and below +5 dB	Above or equal to the SOAEL (1.0mms^{-1}) and below 10mms^{-1} PPV
Minor	Above or equal to the LOAEL and below the SOAEL	Above or equal to the LOAEL (0.3mms^{-1}) and below the SOAEL (1.0mms^{-1})
Negligible	Below LOAEL	Below LOAEL (0.3mms^{-1})

Operational Assessment Methodology

12.7.8 Noise from the road traffic source is generated by the vehicle engines and the interaction of tyres with the road surface. The traffic noise level at a receptor, such as an observer at the roadside or residents within a property, is influenced by a number of factors including: traffic flow, speed, composition (percentage of Heavy Goods Vehicles (HGV)), road gradient, the type of road surface, the distance from the road and the presence of any obstructions between the road and the receptor.

12.7.9 The index adopted by the UK Government in Calculation of Road Traffic Noise (CRTN) methodology to assess traffic noise is $\text{LA}_{10,18\text{h}}$. CRTN provides the standard methodology for predicting the $\text{LA}_{10,18\text{h}}$ road traffic noise level. This value is determined by taking the highest 10% of noise readings in each of the 18 one-

hour periods between 06:00 and 00:00, and then calculating the arithmetic mean. Noise levels are predicted at a point measured 1m horizontally from the external façade of buildings. DMRB LA 111 also requires the use of the indicator L_{night} .

- 12.7.10 The prediction of the $LA_{10,18hr}$ and L_{night} at the noise sensitive-receptors locations will be assessed by using the computing noise modelling software NoiseMap Five, through the creation of digital terrain models of the different Schemes, and to the different scenarios (DMOY, DMFY, DSOY and DSFY) within 600 m of the Scheme extents.
- 12.7.11 To create the noise maps the following set of data are required: terrain information (contour lines), buildings layouts and heights, the existence of barriers (if any), the noise sensitive-receptors locations, the road network layouts, the traffic flows, speeds and road surface characteristics.
- 12.7.12 A preliminary indication of any properties likely to qualify under the Noise Insulation Regulations (UK Government, 1975) would be provided in the assessment. A full assessment would be completed once the detailed design of each Scheme is finalised and in accordance with the timescales set out in the Regulations.
- 12.7.13 The results of the assessment as reported in the ES will include any noise mitigation measures embedded into the Scheme designs e.g. through the choice of horizontal and vertical alignment, and additional mitigation measures proposed (if required), such as noise barriers.
- 12.7.14 The SOAEL and the LOAEL for road traffic noise used in this assessment are detailed in Table 12-5, as defined in DMRB LA 111. No special circumstances have been identified for the Schemes which suggest an alternative SOAEL or LOAEL should be adopted.

Table 12-5: Noise SOAEL and LOAEL for All Receptors

Time of Day	SOAEL	LOAEL
06:00 – 00:00	68 dB $LA_{10,18h}$ (façade)	55 dB $LA_{10,18h}$ (façade)
23:00 – 07:00	55 dB $L_{night,outside}$ (free-field)	40 dB $L_{night,outside}$ (free-field)

- 12.7.15 DMRB LA 11 provides two classifications for the magnitude of the traffic noise impact of a proposed road scheme, as shown in Table 12-6 **Error! Reference source not found.**

Table 12-6: Magnitude of Change in Traffic Noise (short and long-term)

Short-Term Change		Long-term Change	
Noise level change (rounded to 0.1 dB) $LA_{10,18h}$ dB	Magnitude of the Impact	Noise level change (rounded to 0.1 dB) $LA_{10,18h}$ dB	Magnitude of the Impact
0	No change	0	No change
Less than 1.0	Negligible	Less than 3.0	Negligible
1.0 – 2.9	Minor	3.0 – 4.9	Minor
3.0 – 4.9	Moderate	5.0 – 9.9	Moderate

5.0+ Major 10.0+ Major

12.7.16 As proposed in DMRB LA 111, an initial identification of significant environmental effects would be carried out based on the magnitude of change in traffic noise levels due to the Schemes in the short term (Opening Year) as shown in Table 12-7.

Table 12-7: Initial Assessment of Operational Noise Significance

Significance	Short term magnitude of change
Significant	Major
Significant	Moderate
Not Significant	Minor
Not Significant	Negligible

12.7.17 Negligible changes in the short term would not cause changes to behaviour or response to noise, and as such, would not give rise to significant effects. For minor, moderate and major changes DMRB LA 111 outlines a range of additional factors which will be considered in identifying significant effects.

12.7.18 With regard to significant policy effects, the traffic noise SOAEL and LOAEL would be used to consider how each Scheme complies with the policy aims detailed in the NPPF, within the context of government policy on sustainable development, namely to:

- avoid noise from giving rise to significant adverse effects on health and quality of life resulting from noise from new development i.e. reduce traffic noise levels at receptors to below the SOAEL; and
- mitigate and reduce to a minimum, other adverse effects on health and quality of life resulting from noise from new development i.e. reduce traffic noise levels at receptors which are between the LOAEL and the SOAEL.

12.7.19 The assessment will also set out what mitigation measures have been incorporated into the Scheme designs to meet these aims, and also any measures which were not considered reasonable or practical to include.

12.8 Assumptions and Limitations

12.8.1 The main limitation is the reliance on the Defra noise maps to undertake validation of the noise model as it has not been possible to undertake site-based noise measurements due to non-typical traffic flows in the current COVID Pandemic. Site measurements at a range of receptors will be undertaken when traffic levels are considered to have returned to near normal levels, however this is unlikely to fit within the timescales for the noise assessment.

13. POPULATION AND HEALTH

13.1 Introduction

- 13.1.1 AECOM have prepared this chapter to outline the scope of assessment with regard to the Project.
- 13.1.2 In accordance with the latest DMRB LA 112 Population and Human Health (Highways England, 2020h) guidance, potential effects resulting from a Scheme (as described in Chapter 2 of this document) in relation to the following elements are considered:
- Land use and accessibility:
 - private property and housing;
 - community land and assets;
 - development land and businesses;
 - agricultural land holdings; and
 - walkers cyclists and horse riders (WCH).
 - Human Health:
 - environmental conditions relevant to human health (including changes to noise, air quality and landscape amenity); and
 - severance/accessibility and the ability of communities to access community land, assets and employment.

13.2 Study Area

- 13.2.1 The study area used to consider population and human health effects varies depending on the effect and the type of resource being considered.
- 13.2.2 For potential effects on land use and accessibility, the review has focussed on the area within the scoping boundary (including site compounds and temporary land take) and a 500 m area surrounding the scoping boundary.
- 13.2.3 For potential effects on human health, the study area includes all receptors that may have potential to be impacted by the proposed development. It should be noted, however, that it is not always possible to determine the catchment area for community facilities. Residents of an area are likely to utilise facilities located within different districts, counties or regions without regard for statutory boundaries.

13.3 Existing and Baseline Conditions

Overview

- 13.3.1 The six Schemes are located within two local authority areas, with the five most northern Schemes being located within the NSDC area, whilst Kirk Hill Junction, the most southern Scheme is in the RBC area. Both of these local authorities are located within Nottinghamshire in the East Midlands region.

Private Property and Housing

- 13.3.2 There are private and residential properties in close proximity to a number of the Schemes (detailed below). The closest properties to each are:
- **Ollerton Roundabout:** There are four residential properties adjacent to and to the north-east of junction (A614 Blyth Road arm of roundabout). A McDonald's restaurant and Costa Coffee shop have been built to the immediate south of the junction. A public house is situated to the west of the junction. Petrol filling stations are positioned on either side of Old Rufford Road leading into the junction from the south;
 - **Mickledale Lane Junction:** There are four residential properties adjacent to south-east of existing junction (A614 Old Rufford Road) and one property located next to the Limes Café to the north-west of the junction. Inkersall Lane leads to a small number of private properties set away from the junction. To the east, Mickledale Lane leads to the centre of Bilsthorpe village;
 - **White Post Roundabout:** There are business and residential properties surrounding this junction on all sides. The Wheelgate Family Theme Park situated 200 m away from the junction to the west. There is a Day Nursery and White Post Farm located to the north-east of the junction. There are four residential properties are located to the south-west of the roundabout located between the A614 Old Rufford Road (northbound) and Mansfield Road (heading west);
 - **Warren Hill Junction:** There are no residential properties within close proximity. A caravan sales site is located to the immediate north of the junction;
 - **Lowdham Roundabout:** There are four residential properties located to south-west of junction adjacent to the A612 Nottingham Road (westbound), additional properties are located further down this road. Properties are also located to the immediately east of the junction to the south of the Nottingham Road (eastbound) and also the wider residential area of Lowdham village to the east; and
 - **Kirk Hill Junction:** There are three residential properties located in an area of land between the A6097 and Kirk Hill.

Community Land and Assets

- 13.3.3 At Ollerton Roundabout there is a number of ecological assets including the Sherwood Heath LNR (also LWS) to the west, situated between Ollerton Road and A616 arms of the roundabout. Also, to the west is the Birklands and Bilhaugh LWS situated between the A616 and A614 arms of the roundabout, as well as the Birklands West and Ollerton Corner SSSI that overlaps the aforementioned designations. These areas are used for public recreation.
- 13.3.4 Lowdham Roundabout is the only Scheme with community land within close proximity; a village recreational ground is located between the A6097 northbound arm and Southwell Road (east arm), and a green open area is located partially within the Scoping boundary to the east, sandwiched between Southwell Road (east arm) and Nottingham Road.

Development and Business Land

- 13.3.5 Several of the Schemes have businesses in close proximity, including Ollerton Roundabout, Mickledale Lane Junction, White Post Junction, and Warren Hill Junction as noted above under Private Property and Housing.
- 13.3.6 Development land is located in close proximity to Ollerton Roundabout and Lowdham Roundabout.
- 13.3.7 Within the Ollerton urban boundary there are allocations for mixed use development and housing. There are no allocations within the scoping boundary.
- 13.3.8 Within the Lowdham urban boundary there are small housing allocations, however there are no allocations within the scoping boundary.

Agricultural Land

- 13.3.9 The route is largely rural with most junctions being located close to agricultural land. All junctions, with the exception of White Post Roundabout and Warren Hill, would result in the temporary and permanent use of agricultural land.
- 13.3.10 Chapter 10 Geology and Soils notes the presence of agricultural land and soils within the scoping boundary in detail.

Walkers, Cyclists and Horse Riders

- 13.3.11 As described in Chapter 8 Landscape and Visual, all junctions have interactions with footpaths and PRoW. Those within the scoping boundary include:
- **Ollerton Roundabout:** There are footways around the junction, with some splitter islands available to aid crossing;
 - **Mickledale Lane Junction:** Footpaths are available on both sides of the junction, and a dropped crossing and refuge have been provided to assist crossing movements to the north of the junction. Inkersall Lane is a Public Right of Way (PRoW) Bridleway (Rufford BW5). Route Number 645 of the National Cycle Network lies 210 m to the north of the junction and is a traffic free route;
 - **White Post Roundabout:** Footpaths are available on each of the roads leading to the junction, and a pedestrian refuge (with dropped crossings) has been provided on the A614 north arm. There is a PRoW footpath to the south of the junction (Farnsfield FP19);
 - **Warren Hill Junction:** There is a Public Right of Way (PRoW) Byway Open to All Traffic (BOAT) (Rob Lane – Oxtun BOAT No11) just to the north of the junction;
 - **Lowdham Roundabout:** Footpaths have been provided around the junction, and splitter islands are available to assist pedestrians crossing (albeit that they are also occupied by signage). There is a PRoW footpath (Lowdham FP2) to the south of the junction; and
 - **Kirk Hill Junction:** A narrow footpath runs east-west along the northern side of the A6097. At the junction with Kirk Hill, the footpath diverts from the A6097 and continues along Kirk Hill into the village of East Bridgford. There is no crossing provision for walkers, cyclists or horse riders at the junction currently. The Scheme is also looking to divert the existing bridleway BW27

in this location, which connects to Shelford FP 9 south of the A6097 (part of the Trent Valley Way) and FP28 alongside the A6097.

Human Health

13.3.12 Information on human health has been sourced from the following:

- Office for National Statistics (ONS), (2019); Population Estimates;
- ONS Small Area Population Estimates in England and Wales, (2015);
- ONS Mid-Year Population Estimates (2015); and
- ONS (2012), Census 2011.

13.3.13 In 2019, the populations of NSDC and RBC were approximately 122,400 and 119,184 respectively based on ONS population estimates. Between 2009 and 2019, the population of NSDC increased by 8% and RBC's population increased by 7% approximately. These rates are comparable to the population growth witnessed in the East Midlands region (8%) and England as a whole (8%) between 2009 and 2019.

13.3.14 Based on ONS Mid-Year Population Estimates, the population of Nottinghamshire is approximately 830,000; of which, approximately 1,900 live in the study area (based on the Lower Super Output Areas of Rushcliffe 001B and 003F and Newark and Sherwood 001F, 013A, 005A, 005B, 005C).

13.3.15 Based on ONS Mid-Year Population Estimates, the proportion of people aged 65 years or over in Newark and Sherwood (21.1%) and Rushcliffe (20.3%) is slightly higher than Nottinghamshire (20.3%) and England as a whole (20.1%). The proportion of people of working age (defined by the ONS as people aged between 18 and 64) in Newark and Sherwood (58.6%) and Rushcliffe (59%) is slightly lower than Nottinghamshire (59.7%) and England (61%).

13.3.16 In 2015 which is the latest year for which comparable data is available across all areas, 89% and 82% of residents in Newark and Sherwood and Rushcliffe were defined ethnically as White. The next largest ethnic groups within these two authorities are Black and Minority Ethnic (5% and 8% respectively). These statistics may not be representative of the population closest to the Project, which is only a small proportion of the population in these larger districts.

13.3.17 Based on 2011 Census data, the latest available at the time of writing (June 2021), 7% and 4.8% of the population in Newark and Sherwood and Rushcliffe reported bad or very bad health, respectively. These rates are higher and lower than statistics for East Midlands (6.6%) and England (6.6%). The proportion of the population who had a long-term health problem or disability which limited their day-to-day activities in Nottinghamshire was 20.32%, which is higher than in England as a whole (17.64%).

13.4 Potential Effects

Land Use and Accessibility

Private Property and Housing

13.4.1 As a result of Lowdham Roundabout and Mickledale Lane Junction Option 1 there would be a requirement to provide new access roads for a small number of

properties (four in total in the case of both Schemes). Consultation with these landowners has been undertaken and is ongoing as the design develops.

- 13.4.2 There is no requirement to demolish property as a result of the Project.
- 13.4.3 Overall impacts on private property are considered minimal and unlikely to result in significant effects.

Community Land and Assets

- 13.4.4 Only a small area of the SSSI and Birklands and Bilhough LWS would be permanently lost as a result of the Ollerton Roundabout Scheme. There may be some disruption to users near the junction, however the functionality and access to these assets would be unaffected.
- 13.4.5 No impacts are expected to the access and use of the recreational ground near Lowdham during the construction or operation of the Scheme. The space would still be accessible during the construction with only a very small corner of the grounds next to the roundabout being temporarily affected by disturbance from the works.

Development Land and Business Land

- 13.4.6 Mickledale Lane Junction Option 1 would result in some land loss to the front area of the Limes Café and lorry park, but this is not considered to impact the functionality of the business. Discussions have been undertaken with the business owners during the development of the designs. During construction it is likely that access to business may be disrupted. This would be managed in agreement with the proprietor.

Agricultural Land Holdings

- 13.4.7 All junctions, with the exception of White Post Roundabout and Warren Hill Junction would result in the temporary and permanent use of agricultural land.
- 13.4.8 Land which is used temporarily during construction would be returned to agricultural use post construction. This disruption would be short-term and managed with the landowner. In some locations field access points may need to be permanently relocated e.g. at Ollerton Roundabout, and both Mickledale Lane options.
- 13.4.9 Permanent losses of agricultural land are likely to be relatively small areas of the land close to the junctions as described in Chapter 10 - Geology and Soils. This is not likely to affect the viability of any farm businesses.

Walkers, Cyclists and Horse riders

- 13.4.10 There may be some temporary disruption to footways around junctions during construction. This would be a short-term effect on users, and alternative safe routes would be provided. Diversions are unlikely to be of excessive length and access will be managed/maintained by the contractor throughout the construction period.
- 13.4.11 There would be no new severance or loss of PRow. Improvements to crossing facilities would be made at Ollerton Roundabout and Lowdham Roundabout. The design for Kirk Hill Junction is also being developed with the potential to incorporate potential bridleway improvements around the junction.

Human Health

Environmental Conditions Relevant to Human Health

- 13.4.12 Potential human health impacts in relation to air quality, noise and landscape amenity will be covered in the dedicated chapters for these topics. Due to the relatively small scale of the Project and limited number of receptors within the study area, a dedicated chapter for human health is seen as disproportionate.

Severance and Accessibility

- 13.4.13 Due to the Project being one of road improvements along an existing road corridor and not the creation of new carriageway; with associated upgrades to crossing facilities for pedestrians and cyclists; it is considered that there would be no new severance or permanent accessibility issues regarding community access to community land and assets or employment.
- 13.4.14 During the construction period there is potential for short-term minimal accessibility issues relating to footways around the junctions. These impacts would be temporary and are not likely to be significant.

13.5 Proposed Level and Scope of Assessment

- 13.5.1 As noted in Section 13.4, whilst there are some impacts anticipated during construction, these are likely to be small scale and temporary. There is limited potential for permanent significant effects in relation to land use and accessibility, therefore it is proposed that this topic is scoped out of the EIA for all options except Mickledale Option 1. Should Mickledale Option 1 be taken forward as the preferred option, there should be consideration for the loss of land at Limes Café.
- 13.5.2 The impacts on human health in relation to air quality, noise and landscape amenity will be reported in dedicated chapters for these topics. Due to the relatively small scale of the Project, and limited potential for significant effects in relation to accessibility and severance, a dedicated chapter for human health is seen as disproportionate.

14. ROAD DRAINAGE AND THE WATER ENVIRONMENT

14.1 Introduction

14.1.1 AECOM has prepared this chapter to outline the scope of assessment with regard to the Project.

14.1.2 This chapter presents the proposed approach to the assessment of the Project's effects on road drainage and water environment. The water environment assessment will consider water quality, groundwater, hydromorphology, flood risk and drainage.

14.2 Study Area

14.2.1 For the purposes of the water resource (flow and quality) assessment, a study area of approximately 1km around the boundary of the Schemes will be considered, in order to identify surface and groundwater bodies that could reasonably be affected by direct impacts associated with the Scheme (i.e. there is a pathway between the Scheme and the waterbody).

14.2.2 Consideration has also been given to any attributes of surface water, groundwater or water dependent ecological sites outside this study area, as pollutants can propagate downstream. Professional judgement will be applied to identify the extent to which such features are included. This approach is consistent with the guidance within the DMRB LA 113 Road Drainage and the Water Environment (Highways England, 2021i).

14.3 Existing and Baseline Conditions

14.3.1 To inform the scoping exercise, data, information and records relating to the flowing water features, resources and receptors was gathered from a number of publicly available online sources as listed below:

- Ordnance Survey and aerial maps (Bing.com website, accessed 2021);
- UK climate average maps (Met Office website, accessed 2021);
- surface geology maps (British Geological Survey website, accessed 2021);
- catchment data (Environment Agency Catchment Data Explorer website, accessed January 2021);
- flood mapping (GOV.UK, accessed January 2021);
- British Geological Survey, Groundwater Flooding Susceptibility (Data.Gov website, accessed January 2021); and
- Nottingham City Council, Greater Nottingham Strategic Flood Risk Assessment (Nottingham City Council geoserver, accessed April 2021).

14.3.2 In addition, information on private water supply abstractions was obtained from NSDC.

14.3.3 Information and data collated covered the following topics:

- topography, land use, climate and geology;

- surface water features;
- water resources;
- groundwater;
- existing road drainage;
- water dependent ecological areas and relevant protected species⁵; and
- Flood risk.

Ollerton Roundabout

Topography, Land Use and Climate

- 14.3.4 The area is characterised by the topography sloping generally from west to east, as the site is on the western side of the River Maun floodplain. Elevations in the area on the Ordnance Survey mapping on the A616 show levels between 44 m and 47 m Above Ordnance Datum (AOD) east and west of the junction respectively.
- 14.3.5 The land use in the area is characterised by forestry to the west of the A6075 (to north-west, west and south-west of the junction), agricultural grassland within the floodplain of the River Maun and east of the river, the town of Ollerton with residential housing.
- 14.3.6 Based on the Met Office website (accessed January 2021), the nearest weather station is located at Watnall, approximately 26 km to the south-west of the Scheme. Using the data from this weather station, it is estimated that the study area experiences an average of 709 mm of rainfall per year, with it raining more than 1 mm on 124 days per year, which are both lower than the UK average.

Surface Water

- 14.3.7 The study area for the Scheme is contained within three Water Framework Directive (WFD) water body catchments. The area of the roundabout itself is within “Maun from Rainworth Water to Poulter” (GB104028058080) (Environment Agency Catchment Data Explorer website, accessed January 2021). This is part of the Idle River operational catchment of the Humber River Basin Management Plan.
- 14.3.8 A main river, the River Maun, is located approximately 250 m east of the circulatory of the roundabout and flows northwards under the A616 approximately 360m east of the junction. There is also a spur of the River Maun culverted under the A614 approximately 80 m south of the roundabout. The confluence of the River Maun and Rainworth Water is approximately 250 m south of the junction.
- 14.3.9 The WFD waterbody “Maun from Vicar Water to Rainworth Water” (GB 104028058040) is located upstream from the site and the catchment starts 250 m south on a tributary flowing from the south-west. To the south on a southern tributary, and upstream of the site, is the catchment for “Rainworth Water from Gallow Hole Dyke to Maun” (GB 104028052970).
- 14.3.10 According to the Environment Agency’s Catchment Data Explorer website (accessed January 2021), the “Maun from Rainworth Water to Poulter” is currently at Moderate Ecological Status (2019, with a target status of moderate by 2015 which it has met). Reasons for not achieving good status are stated as urban and

⁵ Other types of ecological sites are considered in Chapter 9: Biodiversity.

transport, water industry intermittent sewage discharges and agricultural and rural land management runoff. This has led to failures for mercury and its compounds, perfluorooctane sulfonate (PFOS) and p diphenyl ethers (PDBE). Within the physico-chemical elements, all are High, with the exception of phosphate which is Poor.

- 14.3.11 The “Maun from Vicar Water to Rainworth Water” is currently at Moderate Ecological Status (2019, with a target of Moderate by 2015 which it has met). Reasons for not achieving good status are stated as urban and transport, water industry intermittent and continuous sewage discharges and agricultural and rural land management runoff. This has led to failures for mercury and its compounds, Perfluorooctane Sulfonate (PFOS) and polybrominated diphenyl ethers (PDBE). Within the physico-chemical elements, all are High, with the exception of phosphate which is Poor, and ammonia which is Moderate.
- 14.3.12 The “Rainworth Water from Gallow Hole Dyke to Maun” is currently at Poor Ecological Status (2019, with a target of Poor by 2015 which it has met). Reasons for not achieving good status are stated as groundwater abstraction, sewage discharges, poor nutrient and livestock management. This has led to failures for mercury and its compounds, and polybrominated diphenyl ethers (PDBE). Macrophytes and phytobenthos combined are also poor. Within the physico-chemical elements, phosphate and dissolved oxygen are Poor, and pH is Moderate.
- 14.3.13 There is a river flow gauge located on the River Maun at Whitewater Bridge, approximately 2.5 km downstream (and north) of the site and has a flow measured at Q95 of 0.49 m³/sec for a catchment area of 157 km² (National River Flow Archive (NRFA) website, accessed January 2021). This flow would be expected to be similar to that within the study area.
- 14.3.14 There are several ponds located within the study area, as detailed in Table 14-1.

Table 14-1: Ponds Within 1 km of Ollerton Roundabout

Pond number and location	Grid reference
1: Isolated pond approximately 700 m west in woodland area.	X: 464402 Y: 367674
2: 550 m north-east of the Junction, to east of River Maun	X: 465542 Y: 367874
3: 650 m north-east of the Junction, to east of River Maun, Little John Lakes	X: 465564 Y: 367994
4: 700 m north-east of the Junction, to east of River Maun, Little John Lakes	X: 465636 Y: 368033
5: 800 m north-east of the Junction, to east of River Maun, Little John Lakes	X: 465648 Y: 368134
6: 850 m north-east of the Junction, to east of River Maun, Little John Lakes	X: 465658 Y: 368162
7: 800 m north-east of the Junction, to east of River Maun, Little John Lakes	X: 465709 Y: 368134
8: 600 m to the east, east of Back Lane	X: 465692 Y: 367446
9: 650 m to the east, east of Back Lane	X: 465735 Y: 367402

Pond number and location

Grid reference

10: 650 m to the east, east of Back Lane	X: 465756 Y: 367403
11: 650 m to the east, east of Back Lane	X: 465768 Y: 367403
12: 800 m east of Scheme	X: 465797 Y: 367408
13: 800 m east of Scheme	X: 465818 Y: 367408
14: 850 m east of Scheme	X: 465836 Y: 367409
15: 850 m east of Scheme	X: 465849 Y: 367410

Water Resources

- 14.3.15 The location of surface water, and groundwater abstractions, details of pollution incidents, and discharge consents have been requested from the Environment Agency and will be included within the ES.
- 14.3.16 Details of Private Water Supply (PWS) abstractions were requested from the local authority, and it was confirmed that no PWS abstractions are located within 2km of the Ollerton Roundabout.
- 14.3.17 The study area is located within Nitrate Vulnerable Zone S335 (River Idle from River Ryton to River Trent NVZ).
- 14.3.18 The study area is not contained within a Drinking Water Protected or Safeguard Zone for surface water. The area is not within a Safeguard Zone for groundwater, though there is one source located approximately 1.3 km north and downstream of the site (Defra's online MAGIC website, accessed January 2021).

Existing Road Drainage

- 14.3.19 Detailed information relating to existing road drainage is not available at this Scoping stage and will be reviewed as part of the assessment for the ES. It is suspected that there may be a soakaway feature in the verge between the A616 and the A614 northbound exits. The presence of this feature will be ground truthed during the site visit.

Water Dependent Designated Ecological Sites and Relevant Protected Species

- 14.3.20 The ecological designated sites within 1 km of the Scheme are detailed in Chapter 9: Biodiversity, Table 9-2. The reasons for designation do not have water dependent habitats or associated species.

Hydromorphology

- 14.3.21 Under the WFD, both the "Maun from Vicar Water to Rainworth Water" (GB 104028058040) and the "Maun from Rainworth Water to Poulter" (GB104028058080) watercourse are described as heavily modified, with the hydromorphological supporting elements as 'Supporting Good' potential. Rainworth Water from Gallow Hole Dyke to Maun (GB104028052970) is described as not designated artificial or heavily modified, with the supporting elements described as 'Supporting Good' potential.

Geology and Hydrogeology

- 14.3.22 The current groundwater levels across the Scheme are unknown, however, regionally it is likely to be providing baseflow to local watercourses.

- 14.3.23 As described in Chapter 10: Geology and Soils, Section 10.3- Existing and Baseline Conditions, Ollerton Roundabout is underlain by alluvial deposits (clay, silt, sand and gravel), and to the north-east, east and south-west. Glaciofluvial deposits (sands and gravel) are located to the north-west of the study area. The superficial deposits overlie the Sherwood Sandstone Group, Chester Formation (pinkish red or buff-grey, medium- to coarse-grained, pebbly, cross-bedded, friable sandstone). Whilst no man-made ground is shown on the geological mapping, it is expected that made ground would be present across much of the study area.
- 14.3.24 The bedrock geology is classified as a Principal Aquifer, with the areas of superficial alluvium being designated as a Secondary A Aquifer. The site also lies within an area of medium to high groundwater vulnerability.
- 14.3.25 The Scheme and study area lie within the WFD groundwater body "Idle Torne – PT Sandstone Nottinghamshire & Doncaster" (GB40401G301500). This has an overall status of Poor (2019). The status is poor for quantitative and chemical aspects. The objective is for Poor by 2015, due to the unfavourable balance of costs and benefits.
- 14.3.26 The whole area is contained within a Zone 3 Total catchment area Source Protection Zone (SPZ) for several abstractions. The two abstraction areas protected by this SPZ are located approximately 2.1km to the north-east and the south-west.

Fluvial Flooding

- 14.3.27 The Flood Map for Planning (GOV.UK website, accessed January 2021) shows the roundabout to be partially in Flood Zone 2 and Flood Zone 3 with some of the south and eastern approach roads shown to be Flood Zone 3, the western approach road in Flood Zone 2 and the northern approach roads in Flood Zone 1. Land and property in Flood Zone 3⁶ are considered to have a high probability of flooding from rivers or the sea and land or property in Flood Zone 2⁷ is considered to have a medium probability of flooding from rivers or the sea. Land and property in Flood Zone 1⁸ are considered to have a low probability of flooding from rivers or the sea.
- 14.3.28 The fluvial flood risk associated with these Flood Zones is from the River Maun which flows in a south-west to north-east direction along the edge of the village of Ollerton. The River Maun flows less than 500 m from the roundabout and approach roads (within 200 m of the approach roads in places) and the Environment Agency Flood Map does not show any defences along this reach.
- 14.3.29 The Environment Agency flood model of the River Maun is available for use in this assessment.

Surface Water and Sewer Flooding

- 14.3.30 The Flood Risk from Surface Water map (GOV.UK website, accessed January 2021) indicates that the risk of surface water flooding is generally classed as 'Very Low' to 'Low'.
- 14.3.31 A 'Low' risk means that each year the area has a chance of flooding from surface water of between 0.1% and 1%. A 'Very low' risk means that each year the area has a chance of flooding of less than 0.1%.

⁶ Land and property in Flood Zone 3 have a greater than 1 in 100 annual probability of river or sea flooding.

⁷ Land and property in Flood Zone 2 have an annual probability of river or sea flooding of between 1 in 100 and 1 in 1,000.

⁸ Land and property in Flood Zone 1 have a less than 1 in 1,000 annual probability of river or sea flooding.

14.3.32 The map explains that flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

14.3.33 The map does not indicate the probability of flooding from surface water sewers. However, as the map indicates the risk of flooding from surface water to be low or very low, it can also be inferred that the risk of flooding from surface water sewers is likely to be low. Furthermore, Via has not reported any known history of sewer flooding to the Schemes. It has been confirmed that Ollerton Roundabout does flood during heavy sustained rainfall.

Groundwater Flooding

14.3.34 The BGS 1:50,000 Groundwater Flood Susceptibility Map (accessed January 2021) shows consolidated bedrock aquifers (chalk, sandstone etc.) and superficial deposits. The mapping does not take account of the chance of flooding from groundwater rebound⁹. It shows the proportion of each 1km grid square where geological and hydrogeological conditions indicate that groundwater might emerge.

14.3.35 Ollerton Roundabout is within an area designated as a principal aquifer, but the overlying deposits mean that the risk of flooding from groundwater emergence at this site is considered to be low.

Artificial Sources

14.3.36 The Flooding Risk from Reservoir map (GOV.UK, accessed January 2021) indicates that the Scheme at Ollerton lies on the edge of an area considered to be at risk from reservoir flooding. The area shown to be at risk of reservoir flooding is along the River Maun corridor and covers a similar extent to the fluvial Flood Zones. The maximum flood depth likely from the reservoir has been assessed as low (<0.3 m) and medium (0.3 – 3 m).

14.3.37 The risk of flooding to the Scheme at Ollerton Roundabout from artificial sources is considered low to medium and an assessment of this risk will be included in the Flood Risk Assessment.

Mickledale Lane Junction

Topography, Land Use and Climate

14.3.38 The area around Mickledale Lane Junction is characterised by land sloping towards the east and Featherstone House Farm. The land is at approximately 73 mAOD on the A614 in the location of the Option 2 and being of similar height in the areas to north (in the location of Option 1) and south of the roundabout. The link road to Mickledale Lane proposed as part of Option 2 is on land of decreasing height to approximately 65 mAOD at the proposed new junction with Mickledale Lane. To the east of Featherstone Farm is a watercourse, Rainworth Water, flowing northwards towards the River Maun.

14.3.39 The west of the study area, the land rises towards the Clipstone Forest. The village of Bilsthorpe lies to the east of the study area. Approximately 200 m north of the current Mickledale Lane/A614 Junction is an old railway line which crosses the A614 road.

14.3.40 Based on the Met Office website (accessed January 2021), the nearest weather station is located at Watnall, approximately 20 km to the south-west of the

⁹ Groundwater rebound is the recovery of groundwater levels from the switching off of legacy coal mine pumping systems.

Scheme. Using the data from this weather station, it is estimated that the study area experiences an average of 709 mm of rainfall per year, with it raining more than 1 mm on 124 days per year, which are both lower than the UK average.

Surface Water

- 14.3.41 The majority of the study area for the Scheme is contained within one WFD water body catchment; “Rainworth Water from Source to Gallow Hole Dyke” (GB104028052940) (Environment Agency Catchment Data Explorer website, accessed January 2021), which is part of the Idle River operational catchment of the Humber River Basin Management Plan.
- 14.3.42 Rainworth Water flows through the study area passing eastwards under the A614, approximately 100 m south of the southern extent of Option 2 (approximately 400 m from the southern extent of Option 1). The watercourse turns northwards and flows to the east side of Featherstone House Farm, approximately 170 m eastwards of the new link road proposed under Option 2.
- 14.3.43 According to the Environment Agency’s Catchment Data Explorer website (accessed January 2021), it is currently at Moderate Ecological Status (2019, with a target status of moderate by 2015 which it has met). Reasons for not achieving good status are stated as water industry (continuous sewage discharges), agriculture and rural land management (poor livestock management, nutrient management and land drainage) and urban and transport (transport drainage). This has led to failures for mercury and its compounds, and PDBE. Within the physico-chemical elements, phosphate levels are Poor, with Ammonia moderate.
- 14.3.44 There are no river flow gauges in the immediate vicinity of the Scheme. A flow gauge is located 10 km downstream on the River Maun at Whitewater Bridge which is noted under the Ollerton Roundabout baseline (NRFA website, accessed January 2021). As this Scheme is a lot further upstream, the flow would be less than that monitored at Whitewater Bridge. The catchment area for Rainworth Water is approximately 40 km² for a point where the watercourse passes under Mickledale Lane, with an estimated Q95 flow of 0.12 m³/sec (or 120 l/s) based on a proportional reduction of the catchment area to flow.
- 14.3.45 There are four ponds located within the study area, as detailed in Table 14-2.

Table 14-2: Ponds within 1 km of Mickledale Lane Junction

Pond number and location	Grid reference
1: isolated field pond 400 m north-east of the Mickledale Lane Junction	X: 464093 Y: 361385
2: isolated pond at Letterbox Farm 800 m north-east of the Mickledale Lane Junction	X: 464476 Y: 361559
3: Potential balancing pond 125 m east of the southern extent of Option 2 (approximately 300 m south of the southern extent of Option 1)	X: 463798 Y: 360364
4: isolated pond 450 m south-east of the southern extent of Option 2 (approximately 700 m south of the southern extent of Option 1)	X: 463587 Y: 359648

Water Resources

- 14.3.46 The location of surface water, and groundwater abstractions, details of pollution incidents, and discharge consents have been requested from the Environment

Agency and will be included within the ES. Details of PWS abstractions have been requested from the local authority, and it was confirmed that no PWS abstractions are located within 2 km of Mickledale Lane Junction.

- 14.3.47 The area is located within Nitrate Vulnerable Zone S335 (River Idle from River Ryton to River Trent NVZ).
- 14.3.48 The area of Option 2 from the link road westwards lies within a Drinking Water Safeguard Zone (Groundwater). All of Option 1 lies within this Drinking Water Safeguard Zone (Groundwater). The waterbody ID is GB40401G301500 (“Idle Torne PT Sandstone Nottinghamshire & Doncaster” groundwater body), and the main pressure is nitrate. This is centred on an abstraction source located 500 m to the west of the Junction.
- 14.3.49 There are no Drinking Water Protected Areas for surface water, and no surface water Drinking Water Safeguard Zones in the study area.

Existing Road Drainage

- 14.3.50 Information relating to existing road drainage is not available at this Scoping stage and will be reviewed as part of the assessment for the ES.

Water Dependent Designated Ecological Sites and Relevant Protected Species

- 14.3.51 The ecological designated sites within 1 km of the Scheme (Options 1 and 2) are detailed in Chapter 9 - Biodiversity, Table 9-4.
- 14.3.52 With exception to Alder Carr LWS, the reasons for designation do not have water dependent habitats or known associated species. The reasons for designation of Alder Carr LWS includes open wet woodland. This is located alongside Rainworth Water, immediately adjacent to the south-west of Option 2. This site will be considered further in the ES.

Hydromorphology

- 14.3.53 Under the WFD, the “Rainworth Water from Source to Gallow Hole Dyke” (GB104028052940) watercourse is not described as being artificial or heavily modified, with the hydromorphological supporting elements as ‘Supporting Good’ potential. The morphology aspect is noted as ‘supports good’, however, it is noted that the hydrological regime ‘does not support good’ potential.

Geology and Hydrogeology

- 14.3.54 The current groundwater levels across the Scheme are unknown, however, regionally it is likely to be providing baseflow to both local watercourses.
- 14.3.55 From the Geology and Soils baseline (Chapter 10), there are no superficial deposits mapped within the area of the two Scheme options. There are some areas of superficial alluvial deposits (clay, silt, sand and gravel) associated with Rainworth Water. The bedrock geology is the Sherwood Sandstone Group, Chester Formation (pinkish red or buff-grey, medium- to coarse-grained, pebbly, cross-bedded, friable sandstone). Whilst no made ground is shown on the geological mapping it is expected that made ground would be present across much of the study area due to the development history of the Scheme area.
- 14.3.56 The Sherwood Sandstone bedrock is designated as a Principal aquifer, with the areas of superficial alluvium designated as a Secondary A aquifer. The Scheme also lies within an area of medium to high groundwater vulnerability.

- 14.3.57 The two Options lie within the WFD groundwater body “Idle Torne – PT Sandstone Nottinghamshire & Doncaster” (GB40401G301500). This has an overall status of Poor (2019). The status is poor for quantitative and chemical aspects. The objective is for Poor by 2015, due to the unfavourable balance of costs and benefits.
- 14.3.58 Zone I of a SPZ (inner protection zone) is located within the study area, approximately 150 m west of Option 1 and 330 m west of Option 2. The western part of the study area is located within Zone II (outer zone) of a SPZ. This includes the majority of Option 1 and the western half of Option 2. The eastern part of the study area is located within Zone III (total catchment area) of a SPZ. This is limited to the eastern half of Option 2 and the eastern edge of Option 1.

Fluvial Flooding

- 14.3.59 Mickledale Lane Junction is shown as being within Flood Zone 1 on the Flood Map for Planning (GOV.UK website, accessed January 2021). Land and property in Flood Zone 1 are considered to have a low probability of flooding from rivers or the sea. There is a small corridor of land nearby, approximately 500 m from the Scheme, shown in Flood Zone 3 (a high probability of flooding from rivers or the sea) associated with Rainworth Water as it crosses through Bilsthorpe but this does not impact the junction.

Surface Water and Sewer Flooding

- 14.3.60 The Flood Risk from Surface Water map (GOV.UK, accessed January 2021) indicates that the risk of surface water flooding at Mickledale Lane Junction is generally classed as ‘Very Low’ to ‘Low’.
- 14.3.61 A ‘Low’ risk means that each year the area has a chance of flooding from surface water of between 0.1% and 1%. A ‘Very low’ risk means that each year the area has a chance of flooding of less than 0.1%. The map explains that flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- 14.3.62 The map does not indicate the probability of flooding from surface water sewers. However, as the map indicates the risk of flooding from surface water to be low or very low, it can also be inferred that that risk of flooding from surface water sewers is likely to be low. Furthermore, Via has not reported any known history of sewer flooding at this Scheme.

Groundwater Flooding

- 14.3.63 The BGS 1:50,000 Groundwater Flood Susceptibility Map (accessed January 2021) shows consolidated bedrock aquifers (chalk, sandstone etc.) and superficial deposits. The mapping does not take account of the chance of flooding from groundwater rebound¹⁰. It shows the proportion of each 1 km grid square where geological and hydrogeological conditions indicate that groundwater might emerge.
- 14.3.64 Mickledale Lane Junction is located within an area designated as a principal aquifer, but the, risk of flooding from groundwater emergence at this site is considered to be low because of the overlying superficial deposits.

¹⁰ Groundwater rebound is the recovery of groundwater levels from the switching off of legacy coal mine pumping systems.

Artificial sources

- 14.3.65 The Flooding Risk from Reservoir map (GOV.UK website, accessed January 2021) indicates that the Scheme is not within an area at risk of flooding from reservoirs, and there are no other artificial sources of flooding in the vicinity.

White Post Roundabout

Topography, Land Use and Climate

- 14.3.66 White Post Roundabout is situated at a lower height than the surrounding area, with the land sloping towards the roundabout from all directions. The land is approximately 73 mAOD on Mansfield Road to the west, and 66 mAOD to the east. The A614 starts at approximately 96 mAOD to the north of the junction, lowering to 73 mAOD just north of the junction. To the south, the A614 rises to approximately 89 mAOD.
- 14.3.67 The roundabout is surrounded on all sides by commercial businesses whilst the land use in the wider locality is predominantly agricultural farmland.
- 14.3.68 Based on the Met Office website (accessed January 2021), the nearest weather station is located at Watnall, approximately 17km to the south-west of the Scheme. Using the data from this weather station, it is estimated that the study area experiences an average of 709mm of rainfall per year, with it raining more than 1mm on 124 days per year, which are both lower than the UK average.

Surface Water

- 14.3.69 The study area lies within the WFD surface water body catchment for the “Greet Catchment (trib of Trent)” (GB104028053410) (Environment Agency Catchment Data Explorer website, accessed January 2021), which is part of the Nottinghamshire South A operational catchment of the Humber River Basin Management Plan. However, there are no watercourses within 1km of the White Post Roundabout.
- 14.3.70 According to the Environment Agency’s Catchment Data Explorer website (accessed January 2021), it is currently at Poor Ecological Status (2019, with a target status of Moderate by 2027). Reasons for not achieving good status are stated as urban and transport, water industry (continuous sewage discharges), agriculture and rural land management (poor livestock management, and nutrient management). This has led to failures for mercury and its compounds, and PFOS, PDBE and Benzo(a)pyrene. Within the ecological parameters, Fish is classed as Poor. Within the physico-chemical elements, phosphate levels are Poor, with others being High.
- 14.3.71 There is a river flow gauging station downstream of the site on the River Greet at Southwell, approximately 9 km east, and downstream (NRFA website, accessed January 2021). As this Scheme is a lot further upstream, the flow would be less than that monitored at Southwell. The Q95 flow at Southwell is 0.103 m³/s (or 103 l/s).
- 14.3.72 There are three ponds located within the study area, as detailed in Table 14-3.

Table 14-3: Ponds within 1km of White Post Roundabout

Pond number and location	Grid reference
1: An isolated pond 120 m to north-east of the junction within the White Post Farm Complex	X: 462902 Y: 357108
2: An isolated pond 200 m to the north-east of the junction within the White Post Farm Complex	X: 462948 Y: 357196
3: An isolated pond 300 m to the north-west of the junction within the Wheel Gate Park Complex	X: 462642 Y: 357321

Water Resources

- 14.3.73 The location of surface water, and groundwater abstractions, details of pollution incidents, and discharge consents have been requested from the Environment Agency and will be included within the ES.
- 14.3.74 Details of PWS abstractions were requested from the local authority, and it was confirmed that no PWS abstractions are located within 2km of White Post Roundabout.
- 14.3.75 The roundabout is located within Nitrate Vulnerable Zone S328 (Hallhaughton Dumble Catchment (tributary of River Greet). The WFD Waterbody ID is GB40401G301400 ("Lower Trent Erewash – PT Sandstone Wollaton"). The overall classification is Poor, both the quantitative and chemical classifications.
- 14.3.76 There are no Drinking Water Protected Areas and no Drinking Water Safeguard Zones (surface water and groundwater) in the study area.

Existing Road Drainage

- 14.3.77 Information relating to existing road drainage is not available at this Scoping stage and will be reviewed as part of the assessment for the ES. The Drainage Manager at Via believes there are soakaway features local to the junction; these are poorly maintained assets, with no watercourse to drain to.

Water Dependent Designated Ecological Sites and Relevant Protected Species

- 14.3.78 The ecological designated sites within 1 km of the Scheme are detailed in Chapter 9 - Biodiversity, Table 9-6. The reasons for designation are not related to water dependent habitats or associated species.

Hydromorphology

- 14.3.79 There are no watercourses within 1 km of the White Post Roundabout.

Geology and Hydrogeology

- 14.3.80 The current groundwater levels across the Scheme are unknown, however, regionally it is likely to be providing baseflow to both local watercourses.
- 14.3.81 From the Geology and Soils baseline (Chapter 10), there are no superficial deposits mapped within the area. The bedrock geology is Sherwood Sandstone Group, Chester Formation. The Chester Formation is described as pinkish red or buff-grey, medium to coarse grained, pebbly, cross-bedded, friable sandstone.
- 14.3.82 The bedrock geology (Chester Formation) is designated as a principal aquifer. The Scheme also lies within an area of high groundwater vulnerability.

14.3.83 The junction lies within the WFD groundwater body “Lower Trent Erewash – PT Sandstone Wollaton” (GB40401G301400). This has an overall status of Poor (2019). The status is poor for quantitative and chemical aspects. The objective is for Poor by 2015, due to the unfavourable balance of costs and benefits.

14.3.84 The study area is located within Zone III (total catchment area) of a groundwater SPZ.

Fluvial Flooding

14.3.85 The junction is shown as being within Flood Zone 1 on the Flood Map for Planning (GOV.UK website, accessed January 2021). Land and property in Flood Zone 1 are considered to have a low probability of flooding from rivers or the sea.

Surface Water and Sewer Flooding

14.3.86 The Flood Risk from Surface Water map (GOV.UK, accessed January 2021) indicates that the risk of surface water flooding at White Post Roundabout is predominantly ‘Low’, with small areas of ‘Medium’ and ‘High’ within this.

14.3.87 A ‘Low’ risk means that each year the area has a chance of flooding from surface water of between 0.1% and 1%. A ‘Medium’ risk means that each year this area has a chance of flooding of between 1% and 3.3%. A ‘High’ risk means that each year this area has a chance of flooding of greater than 3.3%. The map explains that flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

14.3.88 The map does not indicate the probability of flooding from surface water sewers. However, as the map indicates the risk of flooding from surface water to be predominantly low with small areas at higher risk, it can also be inferred that that risk of flooding from surface water sewers is likely to be low. Furthermore, Via have not reported any known history of sewer flooding to the Scheme, however there are reports of localised flooding within the junction.

Groundwater Flooding

14.3.89 The groundwater flooding susceptibility information from the Nottingham City strategic flood risk assessment does not cover the area of White Post Roundabout.

Artificial Sources

14.3.90 The Flooding Risk from Reservoir map (GOV.UK website, accessed January 2021) indicates that the Scheme is not within an area at risk of flooding from reservoirs, and there are no other artificial sources of flooding in the vicinity.

Warren Hill Junction

Topography, Land Use and Climate

14.3.91 The land around Warren Hill Junction is relatively level, at between 87 mAOD and 92 mAOD.

14.3.92 Land use is predominantly agricultural farmland on all sides of the junction.

14.3.93 Based on the Met Office website (accessed January 2021), the nearest weather station is located at Watnall, approximately 15 km to the south-west of the Scheme. Using the data from this weather station, it is estimated that the study area experiences an average of 709 mm of rainfall per year, with it raining more than 1 mm on 124 days per year, which are both lower than the UK average.

Surface Water

- 14.3.94 The study area lies in two surface waterbody WFD catchment areas, both of which are part of the Nottinghamshire South A operational catchment of the Humber River Basin Management Plan:
- “Dover Beck (trib of Trent)” (GB104028053370) (Environment Agency Catchment Data Explorer website, accessed January 2021); and
 - “Greet Catchment (trib of Trent)” (GB104028053410) (Environment Agency Catchment Data Explorer website, accessed January 2021).
- 14.3.95 The nearest waterbody is a tributary to Dover Beck which is located approximately 350 m east of the Junction. This flows south, and joins with Dover Beck, over 1.4 km to the south of the junction.
- 14.3.96 According to the Environment Agency’s Catchment Data Explorer website (accessed January 2021), the Dover Beck it is currently at Moderate Ecological Status (2019, with a target status of Moderate by 2015 which it has met). Reasons for not achieving good status are stated as urban and transport, water industry (continuous and intermittent sewage discharges), agriculture and rural land management (poor livestock management, and nutrient management) and urban and transport. This has led to failures for mercury and its compounds, and PDBE. Within the physico-chemical elements, phosphate levels are Bad, with others being High.
- 14.3.97 According to the Environment Agency’s Catchment Data Explorer website (accessed January 2021), the “Greet Catchment (trib of Trent)” it is currently at Poor Ecological Status (2019, with a target status of Moderate by 2027). Reasons for not achieving good status are stated as urban and transport, water industry (continuous sewage discharges), agriculture and rural land management (poor livestock management, and nutrient management). This has led to failures for mercury and its compounds, and PFOS, PDBE and Benzo(a)pyrene. Within the ecological parameters, Fish is classed as Poor. Within the physico-chemical elements, phosphate levels are Poor, with others being High.
- 14.3.98 The Dover Beck downstream at Lowdham has a flow measured at Q95 of 0.051 m³/s (NRFA website, accessed January 2021). This is located approximately 8 km to the south-east, and downstream, of the site. The flow at within the watercourse most local to the site would be expected to be a lot lower than this and definitely less than the 1m³/s importance threshold.
- 14.3.99 There are four ponds located within the study area, as detailed in Table 14-4.

Table 14-4: Ponds within 1 km of Warren Hill Junction

Pond number and location	Grid reference
1: An isolated field pond 900 m to the east	463229 354838
2: An isolate Farm pond 980 m to the south-east	462777 354141
3: An isolate Farm pond 1 km to the south-west	461496 354341
4: An isolated field pond 1 km to the west	461224 354773

Water Resources

- 14.3.100 The location of surface water, and groundwater abstractions, details of pollution incidents, and discharge consents have been requested from the Environment Agency and will be included within the ES.
- 14.3.101 Details of PWS abstractions were requested from the local authority, and it was confirmed that no PWS abstractions are located within 2 km of Warren Hill Junction.
- 14.3.102 The junction is within Nitrate Vulnerable Zone S329 (Dover Beck Catchment (tributary of the Trent)). The area to the north of the junction is within Nitrate Vulnerable Zone S328 (Hallhaughton Dumble Catchment (tributary of River Greet)). The WFD Waterbody ID is GB40401G301400 ("Lower Trent Erewash – PT Sandstone Wollaton"). The overall classification is Poor, both the quantitative and chemical classifications
- 14.3.103 There are no Drinking Water Protected Areas and no Drinking Water Safeguard Zones (surface water and groundwater) in the study area.

Existing Road Drainage

- 14.3.104 Information relating to existing road drainage is not available at this Scoping stage and will be reviewed as part of the assessment for the ES. The Drainage Manager at Via currently has no information relating to existing road drainage features.

Water Dependent Designated Ecological Sites and Relevant Protected Species

- 14.3.105 There are no ecological designated sites within 1 km of the Scheme.

Hydromorphology

- 14.3.106 There is a minor watercourse which is located approximately 350 m east of the Junction, this is flowing south towards Dover Beck.

Geology and hydrogeology

- 14.3.107 The current groundwater levels across the Scheme are unknown, however, regionally it is likely to be providing baseflow to both local watercourses.
- 14.3.108 From the Geology and Soils baseline (Chapter 10), there are no superficial deposits mapped in the area. The bedrock geology is Sherwood Sandstone Group, Chester Formation. The Chester Formation is described as pinkish red or buff-grey, medium to coarse grained, pebbly, cross-bedded, friable sandstone.
- 14.3.109 The bedrock geology (Chester Formation) is designated as a Principal aquifer. The Scheme also lies within an area of high groundwater vulnerability.
- 14.3.110 The junction lies within the WFD groundwater body "Lower Trent Erewash – PT Sandstone Wollaton" (GB40401G301400). This has an overall status of Poor (2019). The status is poor for quantitative and chemical aspects. The objective is for Poor by 2015, due to the unfavourable balance of costs and benefits.
- 14.3.111 The study area is located within Zone III (total catchment area) of a groundwater SPZ.

Fluvial Flooding

- 14.3.112 The junction is shown as being within Flood Zone 1 on the Flood Map for Planning (GOV.UK website, accessed January 2021). Land and property in Flood Zone 1 are considered to have a low probability of flooding from rivers or the sea.

Surface Water and Sewer Flooding

- 14.3.113 The Flood Risk from Surface Water map (GOV.UK, accessed January 2021) indicates that the risk of surface water flooding at Warren Hill Junction is predominantly 'Low', with small areas of 'Medium' and 'High' within this.
- 14.3.114 A 'Low' risk means that each year the area has a chance of flooding from surface water of between 0.1% and 1%. A 'Medium' risk means that each year this area has a chance of flooding of between 1% and 3.3%. A 'High' risk means that each year this area has a chance of flooding of greater than 3.3%. The map explains that flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- 14.3.115 The map does not indicate the probability of flooding from surface water sewers. However, as the map indicates the risk of flooding from surface water to be predominantly low with small areas at higher risk, it can also be inferred that that risk of flooding from surface water sewers is likely to be low. Furthermore, VIA East Midlands Ltd have not reported any known history of sewer flooding to the Schemes. The Drainage Manager at Via reports there are no known surface water flooding issues at this junction.

Groundwater flooding

- 14.3.116 The groundwater flooding susceptibility information from the Nottingham City strategic flood risk assessment does not cover the area of Warren Hill Junction.

Artificial sources

- 14.3.117 The Flooding Risk from Reservoir map (GOV.UK website, accessed January 2021) indicates that the Scheme is not within an area at risk of flooding from reservoirs, and there are no other artificial sources of flooding in the vicinity.

Lowdham Roundabout

Topography, Land Use and Climate

- 14.3.118 The area of the junction is characterised by a relatively flat area of land at approximately 20 mAOD. Land to the east and south is flat lying, with the ground sloping upwards to the west (up to 60 mAOD within 1 km) and to the north (50 mAOD at Barker Hill situated north of Lowdham).
- 14.3.119 The land use in the area is characterised by the residential area of Lowdham located to the north of the A6097, to the north and east of the junction. Lying south and west of the junction, the area is agricultural with some residential houses along the A612 towards the south-west from the junction. The area is located within the floodplain of the Cocker Beck. A railway line is located 300m to the south-east, which is parallel to the A612 and is orientated in a north-east-south-western direction.
- 14.3.120 Based on the Met Office website (accessed January 2021), the nearest weather station is located at Watnall, approximately 17 km to the west of the Scheme. Using the data from this weather station, it is estimated that the study area

experiences an average of 709 mm of rainfall per year, with it raining more than 1 mm on 124 days per year, which are both lower than the UK average.

Surface Water

- 14.3.121 The study area lies within the Water Framework Directive (WFD) water body catchment for the “Cocker Beck (trib of Trent)” (GB104028053290) (Environment Agency Catchment Data Explorer website, accessed January 2021), which is part of the Nottinghamshire South A operational catchment of the Humber River Basin Management Plan.
- 14.3.122 A main river, the Cocker Beck, is located 160 m east of the junction. This is flowing to the south-east towards the River Trent approximately 2 km downstream of the Scoping boundary.
- 14.3.123 According to the Environment Agency’s Catchment Data Explorer website (accessed January 2021), it is currently at Moderate Ecological Status (2019, with a target status of good by 2027). Reasons for not achieving good status are stated as physical modification, private sewage treatment point sources, and diffuse pollution sources from livestock management. This has led to failures for mercury and its compounds, PDBE and benzo (g-h-i) perylene. Within the physico-chemical elements, all are High, with the exception of phosphate which is Moderate.
- 14.3.124 There are no river flow gauges on the Cocker Beck on the NRFA website (accessed January 2021), however an adjacent stream (the Dover Beck) to the north with a similar characteristic catchment has a flow gauge. The Dover Beck at Lowdham has a flow measured at Q95 of 0.051 m³/s. This is for a catchment area of 69km². Using the Flood Estimation Handbook Web Service (Flood Estimate Handbook Web Service, accessed January 2021) for a location on Cocker Beck as it flows under the A6097 at Marlock Bridge, approximately 500 m south-east of the junction, the catchment area is estimated to be 12 km². Using a pro-rata approach base on catchment size, then this would give an approximately flow Q95 at Marlock Bridge of 0.008 m³/s (or 8 l/s).
- 14.3.125 There are several ponds located within the study area, as detailed in Table 14-5.

Table 14-5: Ponds within 1km of Lowdham Roundabout

Pond number and location	Grid reference
1: Isolated field pond, south-west of the Scheme, approximately 300 m south-west of Brakes Farm	X: 466794 Y: 345606
2: Isolated field pond, south-west of the Scheme, approximately 300 m south-west of Brakes Farm	X: 466439 Y: 346452
3: Ponds around ‘Castle Mound’, 850 m north-west of the Junction	X: 466441 Y: 346738
4: Ponds around ‘Castle Mound’, 850 m north-west of the Junction	X: 466462 Y: 346765
5: Isolation field pond 900 m south-east of the Junction.	X: 467745 Y: 345433

Water Resources

- 14.3.126 The area is located within Nitrate Vulnerable Zone S326 (Cocker Beck catchment (tributary of the River Trent)).

14.3.127 There are no Drinking Water Protected Areas and no Drinking Water Safeguard Zones (surface water or groundwater) in the study area.

Existing Road Drainage

14.3.128 Information relating to existing road drainage is not available at this Scoping stage and will be reviewed as part of the assessment for the ES. The Via Drainage Manager reports the previously poorly maintained assets have been improved recently. There is a culvert that would benefit from improvement as part of this Scheme.

Water Dependent Designated Ecological Sites and Relevant Protected Species

14.3.129 The ecological designated sites within 1 km of the Scheme are detailed in Chapter 9 - Biodiversity, Table 9-8. The reasons for designation are not related to water dependent habitats or associated species.

Hydromorphology

14.3.130 Under the WFD, the “Cocker Beck Catchment (tributary of the River Trent)” (GB104028053290) is described as a heavily modified watercourse, with the hydromorphological supporting elements as ‘Supporting Good’ potential.

Geology and Hydrogeology

14.3.131 The current groundwater levels across the Scheme are unknown, however, regionally it is likely to be providing baseflow to both local watercourses.

14.3.132 From the Geology and Soils baseline (Chapter 10), Lowdham Roundabout is underlain by alluvium (clay, silt, sand and gravel), with Head deposits bordering the alluvial zones. The superficial deposits are overlying the Sidmouth Mudstone Formation, Radcliffe Member. This is described as finely interlaminated mudstone, siltstone and very fine-grained sandstone.

14.3.133 Whilst no made ground is shown on the geological mapping it is expected that made ground would be present across much of the study area due to the development history of the junction area.

14.3.134 The bedrock geology is classified as a Secondary B Aquifer, with the areas of superficial alluvium being designated as a Secondary A Aquifer, and the Head deposits being designated as a Secondary B Aquifer. The study area contains areas of medium to high groundwater vulnerability.

14.3.135 The Scheme and study area lie within the WFD groundwater body “Trent Lower Erewash – Secondary Combined” (GB40402G990300). This has an overall status of Good (2019). The status is good for quantitative and chemical aspects. The objective is for Good by 2027 which it has met.

14.3.136 The majority of study area is not within a catchment area for groundwater SPZ for any large abstraction sources. There is a small area in the very north of the 1km study area which is contained within a Zone III Total catchment area SPZ. This is for a public water supply abstraction located approximately 2km to the north-west of the Scheme.

Fluvial Flooding

14.3.137 The Lowdham Roundabout location is within Flood Zone 2 and Flood Zone 3 on the Flood Map for Planning (GOV.UK website, accessed January 2021). Land and property in Flood Zone 3 are considered to have a high probability of flooding from

rivers or the sea and land or property in Flood Zone 2 is considered to have a medium probability of flooding from rivers or the sea. At Lowdham, the source of this flood risk is the Cocker Beck which flows north-south through the village with areas of flood risk on both sides of the watercourse. The Cocker Beck is a tributary of the River Trent and downstream of the roundabout has a confluence with the River Trent at Gunthorpe, near East Bridgford. Here there is a wide expanse of floodplain associated with the River Trent and some Environment Agency flood defences.

- 14.3.138 The Environment Agency Flood Map shows the presence of some flood defences along the right and left banks of Cocker Beck as it flows through Lowdham. The Flood Map shows the area at high probability of flooding (Flood Zone 3) includes the roundabout and approach roads, from all directions, as well as the cricket pitch and recreation ground and many properties in the Station Road area.
- 14.3.139 The Environment Agency are considering a flood risk mitigation scheme north of Lowdham Roundabout. Discussions have been held to this scheme and existing flood defences are not adversely affected.

Surface Water and Sewer Flooding

- 14.3.140 The GOV.UK Flood Risk from Surface Water map (accessed January 2021) indicates that the risk of surface water flooding at Lowdham Roundabout is generally classed as 'Very Low' to 'Low'.
- 14.3.141 A 'Low' risk means that each year the area has a chance of flooding from surface water of between 0.1% and 1%. A 'Very low' risk means that each year the area has a chance of flooding of less than 0.1%. The map explains that flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- 14.3.142 The Environment Agency long term flood risk map does not indicate the probability of flooding from surface water sewers. However, as the map indicates the risk of flooding from surface water to be low or very low, it can also be inferred that that risk of flooding from surface water sewers is likely to be low. Furthermore, Via has not reported any known history of sewer flooding to the Schemes. Via reports that the whole area has historical problems linked to the volume of fluvial water and the proximity to the River Trent.

Groundwater Flooding

- 14.3.143 The BGS 1:50,000 Groundwater Flood Susceptibility Map (accessed January 2021) shows consolidated bedrock aquifers (chalk, sandstone etc.) and superficial deposits. The mapping does not take account of the chance of flooding from groundwater rebound¹¹. It shows the proportion of each 1 km grid square where geological and hydrogeological conditions indicate that groundwater might emerge.
- 14.3.144 Lowdham Roundabout is within an area designated as Secondary (B) Aquifer and is made up of Lower Permeable material, thus risk of flooding from groundwater emergence at this site is considered to be low.

¹¹ Groundwater rebound is the recovery of groundwater levels from the switching off of legacy coal mine pumping systems.

Artificial Sources

- 14.3.145 The Flooding Risk from Reservoir map (GOV.UK website, accessed January 2021) indicates that the Scheme is not within an area at risk of flooding from reservoirs.
- 14.3.146 There is a series of fishing lakes approximately 1.5 km to the east, and also to the south, of Lowdham, near the River Trent, away from the Scheme location. The Scheme location is upstream of these waterbodies and they would not pose a flood risk to the Scheme.
- 14.3.147 The risk of flooding from artificial sources to the Scheme at Lowdham is low. This will be included in the Flood Risk Assessment.

Kirk Hill Junction

Topography, Land Use and Climate

- 14.3.148 The land around Kirk Hill Junction is relatively level, at approximately 45m AOD, gradually sloping away to the north and south on the A614.
- 14.3.149 Land use surrounding the junction is predominantly agricultural farmland with the village of East Bridgford located approximately 0.4 km to the east.
- 14.3.150 Based on the Met Office website (accessed January 2021), the nearest weather station is located at Watnall, approximately 19 km to the north-west of the Scheme. Using the data from this weather station, it is estimated that the study area experiences an average of 709 mm of rainfall per year, with it raining more than 1 mm on 124 days per year, which are both lower than the UK average.

Surface Water

- 14.3.151 The study area for the Scheme is contained within three WFD water body catchments. The junction itself and land to the north and north-west of the junction sits within the WFD water body catchment; "Shelford Brook Catchment (trib of Trent)" (GB104028053112) (Environment Agency Catchment Data Explorer website, accessed January 2021), which is part of the Nottingham Urban catchment of the Humber River Basin Management Plan.
- 14.3.152 The WFD water body catchment; "Trent from Soar to The Beck" (GB104028053110) (Environment Agency Catchment Data Explorer website, accessed January 2021), lies to the north and north-east of the junction which is also part of the Nottingham Urban catchment of the Humber River Basin Management Plan.
- 14.3.153 To the south of the junction the study area sits within the WFD water body catchment; "Car Dyke" (GB104028052501) (Environment Agency Catchment Data Explorer website, accessed January 2021), which is located south of the junction and part of the Nottinghamshire South B operational catchment of the Humber River Basin Management Plan.
- 14.3.154 The nearest water body is a drain system is located approximately 220 m north-west of the junction which flows to the north and into Shelford Brook approximately 860 m north of the junction. According to the Environment Agency's Catchment Data Explorer website (accessed January 2021), it is currently at Bad Ecological Status (2019). Reasons for not achieving good status are stated as water industry (continuous and intermittent sewage discharges). This has led to failures for mercury and its compounds and PDBE. Within the physico-chemical elements, phosphate and dissolved oxygen are Bad, and ammonia is Poor.

14.3.155 The River Trent, a main river, lies 890m north of the junction. According to the Environment Agency’s Catchment Data Explorer website (accessed January 2021), the “Trent from Soar to Beck” is currently at Moderate Ecological Status (2019). Reasons for not achieving good status are stated as navigation, urban and transport (transport drainage), water industry (continuous sewage discharges) and government (modification). This has led to failures for mercury and its compounds, PDBE and PFOS. Within the physico-chemical elements, phosphate is Poor.

14.3.156 Other field drain systems lie to the west of the junction.

14.3.157 There are several ponds located within the study area, as detailed in Table 14-6.

Table 14-6 Ponds within 1km of Kirk Hill Junction

Pond number and location	Grid reference
1: An online pond to the ditch draining north, 300 m north of the Junction	468714 343030
2: An online pond to the ditch draining north, 670 m north of the junction	468486 343295
3: An isolated field pond located 725 m north-west of the junction	468561 343411
4: An isolated field pond located 610 m north-west of the junction	468741 343360
5: An isolated field pond located 475 m north of the junction	468961 343240
6: An isolated field pond located 570 m north of the junction	468973 343334
7: An isolated field pond located 640 m north of the junction	469020 343396
8: An isolated field pond located 350 m north of the junction	469202 342565
9: An isolated garden pond located 500 m east of the junction	469412 342787
10: An isolated field pond located 680 m east of the junction	469580 342624
11: An isolated field pond located 1.3 km east of the junction	469671 342773
12: An isolated field pond located 560 m south of the junction	468868 342188
13: An isolated field pond located 750 m south of the junction	468670 342050
14: An isolated pond in a small industrial estate located 850 m south of the junction	468947 341918
15: An isolated field pond located 970 m south of the junction	468800 341792
16: An isolated field pond located 1 km south of the junction	468494 341828
17: An isolated field pond located 925 m south-west of the junction	468423 341961
18: An isolated field pond located 460 m south-west of the junction	468524 342662
19: An isolated field pond located 860 m south-west of the junction	468228 342225
20: An isolated field pond located 870 m south-west of the junction	468176 342283

Water Resources

- 14.3.158 The location of surface water, and groundwater abstractions, details of pollution incidents, and discharge consents have been requested from the Environment Agency and will be included within the ES.
- 14.3.159 Details of PWS abstractions were requested from the local authority. There was one groundwater abstraction located 2km north of the Kirk Hill Junction, but this is outside of the 1 km study area.
- 14.3.160 The junction sits on the boundary of two Nitrate Vulnerable Zones, S320 (River Trent from River Soar to Carlton-on-Trent) and S317 (River Smite).
- 14.3.161 There are no Drinking Water Protected Areas and no Drinking Water Safeguard Zones (surface water or groundwater) in the study area.

Existing Road Drainage

- 14.3.162 Information relating to existing road drainage is not available at this Scoping stage and will be reviewed as part of the assessment for the ES. No information on current assets was available from Via, though there are reports during rainfall events of water flowing northwards within the carriageway which indicated assets which need maintenance.

Water Dependent Designated Ecological Sites and Relevant Protected Species

- 14.3.163 The ecological designated sites within 1km of the Scheme are listed below, with further detail provided in Chapter 9 - Biodiversity, Table 9-10. The reasons for designation are not related to water dependent habitats or associated species.

Hydromorphology

- 14.3.164 Under the WFD, the 'Shelford Brook Catchment (trib of Trent)' (GB104028052501) watercourse is not designated as being artificial or heavily modified, with the hydromorphological supporting elements as 'Supporting Good' potential.
- 14.3.165 Under the WFD, the 'Car Dyke' (GB104028052501) watercourse is not designated as being artificial or heavily modified, with the hydromorphological supporting elements as 'Supporting Good' potential.

Geology and Hydrogeology

- 14.3.166 The current groundwater levels across the Scheme are unknown, however, regionally it is likely to be providing baseflow to both local watercourses.
- 14.3.167 From the Geology and Soils baseline (Chapter 10), there are no superficial deposits mapped within the area of the Scheme.
- 14.3.168 The glacial till, which underlies the south-eastern part of the study area, is classed as a Secondary Aquifer (undifferentiated). The Edwalton Member (mudstone) and Gunthorpe Member are Secondary B Aquifers, while the Edwalton Member (siltstone) and the Cotgrave Sandstone Member are Secondary A Aquifers. The site also lies within an area of high groundwater vulnerability.
- 14.3.169 The Scheme and study area lie within the WFD groundwater body "Trent Lower Erewash – Secondary Combined" (GB40402G990300). This has an overall status of Good (2019). The status is good for quantitative and chemical aspects. The objective is for Good by 2027 which it has met.

14.3.170 The study area is not within a catchment area for groundwater SPZ for abstractions.

Fluvial Flooding

14.3.171 The junction is shown as being within Flood Zone 1 on the Flood Map for Planning (GOV.UK website, accessed January 2021). Land and property in Flood Zone 1 are considered to have a low probability of flooding from rivers or the sea.

Surface Water and Sewer Flooding

14.3.172 The Flood Risk from Surface Water map (GOV.UK, accessed January 2021) indicates that the risk of surface water flooding at Kirk Hill Junction is predominantly 'Low', with small areas of 'Medium' within this.

14.3.173 A 'Low' risk means that each year the area has a chance of flooding from surface water of between 0.1% and 1%. A 'Medium' risk means that each year this area has a chance of flooding of between 1% and 3.3%. The map explains that flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

14.3.174 The map does not indicate the probability of flooding from surface water sewers. However, as the map indicates the risk of flooding from surface water to be predominantly low with small areas at higher risk, it can also be inferred that that risk of flooding from surface water sewers is likely to be low. Furthermore, Via have not reported any known history of sewer flooding to the Schemes. Recent reports during rainfall events of surface water flowing northwards within the carriageway.

Groundwater flooding

14.3.175 The groundwater flooding susceptibility information from the Greater Nottingham strategic flood risk assessment (Nottingham City Council geoserver, accessed April 2021) indicates that the Scheme is located within an area having <25% susceptibility to groundwater flooding.

Artificial sources

14.3.176 The Flooding Risk from Reservoir map (GOV.UK website, accessed January 2021) indicates that the Scheme is not within an area at risk of flooding from reservoirs, and there are no other artificial sources of flooding in the vicinity.

14.4 Value of Environmental and Resource Receptors

14.4.1 Based on the available data, a preliminary importance has been assigned to each identified waterbody, as outlined in Tables 14-7 to Table 14-12 below. These will be reconsidered at the ES assessment stage when further data is available.

Table 14-7: Summary of Receptor Importance for Ollerton Roundabout

Receptor Name	Receptor Type	Importance (provisional)	Justification
River Maun	Water quality	High	The River Maun is a WFD waterbody, classified as being of Moderate potential. A flow gauge downstream has a Q95 of 0.49 m ³ /s (i.e. <1.0 m ³ /s). This is a relatively minor watercourse, whose

Receptor Name	Receptor Type	Importance (provisional)	Justification
			quality will be affected by local industry, road runoff, sewage discharges, and agricultural runoff.
	Morphology	Medium	The River Maun is designated as heavily modified and sections have been altered by culverting under the roads in the area. This includes a drain/ tributary culverted to the south of the roundabout.
	Flood risk	High	Majority of Flood Zone 2/3 is undeveloped and consists of open space (water compatible) and agricultural land (less vulnerable). However, the area of the junction is located within Flood Zone 2/3, and adjacent to the junction there is a public house, a McDonald's and petrol station all located within Flood Zone 3. Construction workers will be considered a very high importance receptor for construction phase impacts.
Local ponds	Water quality	Medium	Various ponds are situated within the study area. It is unknown at the time of writing if GCN reside in any of the ponds.
Idle Torne – PT Sandstone Nottinghamshire & Doncaster WFD groundwater body	Groundwater	Very High	The bedrock is a principal aquifer: which may support water supply and/ or river base flow on a strategic scale. The Poor WFD status should not detract from the resources importance.

Table 14-8: Summary of Receptor Importance for Mickledale Lane Junction (Option 1 and 2)

Receptor Name	Receptor Type	Importance (provisional)	Justification
Rainworth Water	Water quality	High	Rainworth Water is a WFD waterbody, classified as being of Moderate potential. A flow gauge 10 km downstream has been used to estimate a Q95 flow of 0.12 m ³ /s (i.e. <1.0m ³ /s). This watercourse will be affected by sewage discharges, agricultural and urban and transport.
	Morphology	High	Rainworth Water is not designated as artificial or heavily modified, with the morphology of the watercourse supporting good status.

Receptor Name	Receptor Type	Importance (provisional)	Justification
	Flood risk	Medium	There are areas of Flood Zone 2/3 associated with Rainworth Water. These areas are undeveloped and consists of open space (water compatible) and agricultural land (less vulnerable).
Local ponds	Water quality	Medium	Various ponds are situated within the study area. It is unknown at the time of writing if GCN reside in any of the ponds.
Idle Torne – PT Sandstone Nottinghamshire & Doncaster WFD groundwater body	Groundwater	Very High	The bedrock is a principal aquifer: which may support water supply and/ or river base flow on a strategic scale. The Poor WFD status should not detract from the resource’s importance.

Table 14-9: Summary of Receptor Importance for White Post Junction

Receptor Name	Receptor Type	Importance (provisional)	Justification
River Greet	Water quality	High	River Greet is a WFD waterbody, classified as being of Poor status. A flow gauge 9 km downstream has a Q95 of 0.103 m ³ /sec. (i.e. <1.0m ³ /s). This watercourse will be affected by sewage discharges, agricultural and urban and transport.
	Morphology	High	River Greet is not designated as artificial or heavily modified, with the morphology of the watercourse supporting good status.
	Flood risk	Medium	There are areas of Flood Zone 2/3 associated with River Greet downstream on the watercourse. These areas are generally undeveloped and consists of open space (water compatible) and agricultural land (less vulnerable), with some areas of FZ2/3 shown within areas of the town of Southwell.
Local ponds	Water quality	Medium	Various ponds are situated within the study area. It is unknown at the time of writing if GCN reside in any of the ponds.
Lower Trent Erewash – PT Sandstone Wollaton WFD	Groundwater	Very High	The bedrock is a principal aquifer: which may support water supply and/ or river base flow on a strategic scale. The Poor

Receptor Name	Receptor Type	Importance (provisional)	Justification
groundwater body			WFD status should not detract from the resource's importance.

Table 14-10: Summary of Receptor Importance for Warren Hill Junction

Receptor Name	Receptor Type	Importance (provisional)	Justification
Dover Beck	Water quality	High	Dover Beck is a WFD waterbody, classified as being of Moderate potential. A flow gauge 10 km downstream has been used to estimate a Q95 flow of 0.51 m ³ /s (i.e. <1.0m ³ /s). This watercourse will be affected by sewage discharges, agricultural and urban and transport.
	Morphology	High	Dover Beck Water is not designated as artificial or heavily modified, with the morphology of the watercourse supporting good status.
	Flood risk	Medium	There are areas of Flood Zone 2/3 associated with Dover Beck downstream from the junction. These areas are undeveloped and consists of open space (water compatible) and agricultural land (less vulnerable).
Local ponds	Water quality	Medium	Various ponds are situated within the study area. It is unknown at the time of writing if GCN reside in any of the ponds.
Lower Trent Erewash – PT Sandstone Wollaton WFD groundwater body	Groundwater	Very High	The bedrock is a principal aquifer: which may support water supply and/ or river base flow on a strategic scale. The Poor WFD status should not detract from the resource's importance.

Table 14-11: Summary of Receptor Importance for Lowdham Roundabout

Receptor Name	Receptor Type	Importance (provisional)	Justification
Cocker Beck	Water quality	High	Cocker Beck is a WFD waterbody, classified as being of Moderate potential. An estimation of Q95 flow (using a proportional approach of a similar catchment) a Q95 of 0.008 m ³ /s (i.e. <1.0 m ³ /s). This is a watercourse affected by

Receptor Name	Receptor Type	Importance (provisional)	Justification
			sewage treatment, livestock manage and physical modification.
	Morphology	Medium	Cocker Beck is designated as heavily modified and sections have been altered by culverting under the roads in the area.
	Flood risk	Very High	Lowdham Roundabout, and up to 200 m surrounding the roundabout is contained within Flood Zone 2/3. The majority of the village of Lowdham is contained within Flood Zone 2/3. Construction workers will be considered a very high importance receptor for construction phase impacts.
Local ponds	Water quality	Medium	Various ponds are situated within the study area. It is unknown at the time of writing if GCN reside in any of the ponds.
Trent Lower Erewash – Secondary Combined WFD groundwater body	Groundwater	Medium	The bedrock’s Secondary B Aquifer can provide water to agricultural or industrial use, with potentially more limited connection to surface water. The status is Good WFD for quantitative and quality.

Table 14-12: Summary of Receptor Importance for Kirk Hill Junction

Receptor Name	Receptor Type	Importance (provisional)	Justification
Shelford Brook	Water quality	High	Shelford Brook is a WFD waterbody, classified as being of Bad potential. No estimation of Q95 flow has been obtained. However, it is assumed the flow is less than 1 m ³ /sec. This is a watercourse affected by sewage treatment, livestock manage and physical modification.
	Morphology	Medium	Shelford Brook is designated as heavily modified and sections have been altered by culverting under the roads in the area.
	Flood risk	Low - Medium	Kirk Hill Junction is shown as being within Flood Zone 1, with a low probability of fluvial flooding. Areas of FZ2/3 are located downstream.
Local ponds	Water quality	Medium	Various ponds are situated within the study area. It is unknown at the time of

Receptor Name	Receptor Type	Importance (provisional)	Justification
Trent Lower Erewash – Secondary Combined WFD groundwater body	Groundwater	Medium	writing if GCN reside in any of the ponds. The bedrock’s Secondary B Aquifer can provide water to agricultural or industrial use, with potentially more limited connection to surface water. The status is Good WFD for quantitative and quality.

14.5 Potential Effects

14.5.1 The description of the six Schemes are presented in Section 2.4 of this report. The potential effects presented below potentially relate to all six Schemes.

Construction

14.5.2 The potential effects of construction of the Schemes on water receptors could include:

- Impacts on water quality due to deposition or spillage of soils, sediments, oils, fuels, or other construction chemicals, or through mobilisation of contamination following disturbance of contaminated ground or groundwater, or through uncontrolled site run-off;
- Potential increase in volume and rate of surface water runoff from new impervious areas leading to an impact on flood risk;
- Temporary impacts on water levels and sediment dynamics within watercourse;
- Impacts on any water abstractions (if confirmed any present);
- Impacts on any groundwater-dependent terrestrial ecosystems (if confirmed present);
- Loss of floodplain volume due to encroachment on the floodplain;
- Reduced conveyance at watercourse crossings;
- Impacts on groundwater quality from piled foundations; and
- Reduced conveyance at watercourse crossings.

Operation

14.5.3 During operation and maintenance, the following potential effects may occur as a result of the Schemes:

- Impacts on the surface water or groundwater quality from changes in highway run-off (including the use of de-icers) or as a result of accidental spillages;

- Changes in the topography that may have a subsequent impact on surface water drainage patterns and river flows;
- Potential increase in volume and rate of surface water runoff from new impervious areas (all options) leading to an impact on flood risk and scour risk in receiving watercourses upstream and downstream of the Scheme;
- Potential for siltation and blockages within the drainage systems causing failure or improper function, which could impact hydrology through flooding;
- Hydromorphological impacts including changes to physical form (for example scour or culverting) hydraulic processes and sediment dynamics (for example constriction of flows, flood plain disconnection) underpinning habitats in watercourses and their floodplains;
- Potential effects on any groundwater-dependent terrestrial ecosystems (if confirmed present); and
- Impacts on any surface water abstractions (if Environment Agency data indicates a presence).

14.6 Proposed Level and Scope of Assessment

- 14.6.1 Ollerton Roundabout, Mickledale Lane Junction – Option 2 and Lowdham Roundabout will be scoped into the ES and assessed in accordance with guidance presented within DMRB LA 113. Baseline data collated has indicated a number of potential receptors within the study area of the Schemes. As outlined in Section 14.4, preliminary receptor importance for these water bodies has been indicated as ranging between medium and very high. The scope of the works in these areas indicates there may be a potential risk to water resources in the area.
- 14.6.2 The following junctions have only minor works planned within the scope. It is considered there is a negligible risk of potential impacts to water resources from the improvement Schemes listed below. Using Table 14-15 this would not lead to significant effects to water resources:
- Mickledale Lane Option 1: signalisation of the junction with the widening of a small length of road approaching the junction, with a small area of land take outside of the highway boundary to facilitate this;
 - White Post Roundabout: the improvement is a road safety scheme, within the highway boundary, with the addition of anti-skid surfacing and minor maintenance;
 - Warren Hill Junction: The junction will be simplified with the addition of an extended merge lane within the highway boundary; and
 - Kirk Hill Junction: localised widening of the approach roads, and traffic signal improvement. A small area of land take is required outside of the highway boundary.
- 14.6.3 The assessment would be carried out in parallel with the biodiversity and geology and soils assessments, given that there are interrelationships.
- 14.6.4 The potential direct and indirect impacts of each Scheme would be assessed, for both the construction and the operational phases on all water receptors. It would also consider cumulative impacts with other relevant committed developments.

- 14.6.5 The assessment would be undertaken based on a review of published data, including the industry standards, and relevant guidance and policy summarised above, and liaison with the Environment Agency and the local flood authority.

Assessment of Routine Runoff and Spillage Risk

- 14.6.6 The assessment of operational effects on water quality and drainage would have regard to the advice and methodologies set out in DMRB LA 113.
- 14.6.7 The assessment of the potential ecological impacts and effects of routine runoff on surface waters from the operational scheme would determine whether there is an environmental risk, and if pollution mitigation measures are required in specific circumstances. This would be established through the use of the Highways England Water Risk Assessment Tool (HEWRAT), which would identify any potential issues with routine road drainage outfalling into receiving waterbodies. Outfalls would be assessed to highlight any areas where treatment is required, in order to protect the receiving water resources – be it surface watercourses or groundwater in the case of infiltration drainage systems. The groundwater methodology contained in the HEWRAT tool would be used if a decision is made to drain road runoff to ground.
- 14.6.8 The HEWRAT tool input parameters include information on the baseline ambient dissolved copper concentration within the receiving watercourses. Monitoring would be required in order to obtain this baseline information to undertake the assessment. Four monitoring rounds would be undertaken to obtain baseline water quality information. Additionally, the data collection would include parameters required to undertake the Metals Bioavailability Assessment Tool (M-BAT), which is undertaken should the annual average Environmental Quality Standard (EQS) for dissolved metals show a potential failure.
- 14.6.9 The risk of a serious spillage incident occurring during operation of the Scheme would be assessed using the methodology outlined within DMRB LA 113 and which is also undertaken using HEWRAT. This combines various risk factors including traffic volume, percentage of heavy goods vehicles, and the risk attributed to different types of road in order to determine the probability of an accident resulting in a serious pollution incident. Information from this assessment would be used to identify any required spillage containment measures.
- 14.6.10 The assessment would consider environmental design and management measures to minimise flood risk, such as the use of SuDS, water efficiency methods and consideration of best practice guidance. This would include application of the assessment guidance within the DMRB and C753 SuDS Manual (Construction Industry Research and Information Association, 2017), to ensure a suitable SuDS based treatment train of surface water runoff from the improved road junctions.

Hydromorphological Assessment

- 14.6.11 The identified Schemes are located in close proximity to WFD designated waterbodies. As prescribed within the DMRB LA 113, where scoping identifies the potential for a likely significant effect on hydromorphology, a simple assessment would be undertaken to determine whether the degree of hydromorphological change is acceptable. The simple assessment will include a site visit to make observations on the character of the watercourse within the Site and local study area.
- 14.6.12 The simple assessment shall conclude whether the degree of hydromorphological change resulting from the project is compliant with the requirements of the WFD.

Water Framework Directive Assessment

- 14.6.13 Due to the potential for the Project to have significant effects on the water environment without mitigation through good design, the impact assessment would be supported by a Screening WFD Assessment specifically considering the Scheme's compliance with WFD objectives. This would include a review of the latest WFD classification information from the Environment Agencies Catchment Explorer website and water quality and biological quality element data, proposed WFD mitigation measures, and any available investigative reports obtained directly from the Environment Agency. It would consider whether the Schemes might cause deterioration or prevent the failure of waterbodies to improve to their target status. In doing so it would consider adjacent waterbodies and areas protected under other European Directives.

Flood Risk Assessment

- 14.6.14 A detailed Flood Risk Assessment (FRA) would be undertaken in accordance with the requirements of the NPPF (Ministry of Housing, Communities and Local Government, 2019) utilising detailed flood maps and modelled flood extents provided by the Environment Agency and other publicly available information to assess the impact of the proposed Scheme on flood risk. In addition to this, fluvial flood risk modelling would be undertaken to assess the impacts of the Scheme where there is either no existing modelling, or the existing models require upgrades to fully assess the impacts of the Scheme. The FRA report would include appendices detailing hydrological and hydraulic modelling undertaken for the assessment of flood risk.
- 14.6.15 It is envisaged that the FRA would also summarise the proposed surface water drainage strategy. The preparation of the FRA and the surface water drainage strategy being developed by Via would be in accordance with consultation with the Lead Local Flood Authority, Environment Agency and Severn Trent. Results of the assessment would be presented in a standalone FRA as an Appendix to the ES, with summary text included in the ES.

14.7 Proposed Assessment Methodology Including Significance

General Approach

- 14.7.1 The EIA will consider the potential effects of the Scheme on the water environment and flood risk issues. Potential impacts of the Scheme on the water environment will be assessed by:
- Considering the existing (baseline) status of the water environment within the Site and relevant surrounds with respect to flood risk, surface water and ground water;
 - Identifying potential impacts of the Proposed Scheme on the water environment during the operational and construction phases;
 - Proposing suitable mitigation measures to be incorporated into the development design, construction and operation to offset any adverse impacts; and
 - Reviewing any residual impacts and presenting additional mitigation measures to limit their impacts.

Baseline

- 14.7.2 Building on existing desk study and survey information, further data will be collected to prepare a robust baseline for the Site upon which the EIA can be undertaken. This will include a review of national and local planning policy, any relevant published plans, documents and best practice guidance, and a review of the following data sources for any updates:
- Existing scheme information, topographical data, site reports and consultations;
 - Online Ordnance Survey and aerial maps;
 - Envirocheck Report or similar;
 - Online historic maps;
 - Various websites for data on water quality, water resource, hydrological, climate, geological and soils;
 - Existing hydrological and hydraulic modelling. The Environment Agency flood model of the River Maun is available for use in this assessment;
 - Existing river and rain gauge data;
 - Any existing and current RBMP, Catchment Abstraction Management Strategy and Strategic Flood Risk Assessment covering the Site; and
 - Latest water quality, water resource, pollution incident, fisheries and aquatic ecology data from the Environment Agency.
- 14.7.3 Baseline data will be evaluated and constraints to development identified, in accordance with planning policy. This will also inform the emerging options for the development to avoid, minimise and reduce adverse effects on hydraulic processes and sediment dynamics to potentially impacted watercourses, and to ensure compliance with the objectives of the WFD.

Source Pathway Receptor Approach

- 14.7.4 Assessment of the likely significant effects will be based on a source-pathway-receptor approach. For an impact on the water environment to exist, the following is required:
- An impact source (such as a structure over a watercourse, the release of polluting chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or the loss or damage to all or part of a waterbody);
 - A receptor that is sensitive to that impact (i.e. waterbodies and the services they support); and
 - A pathway by which the two are linked.
- 14.7.5 The first stage in applying the source-pathway-receptor approach is to identify the causes or 'sources' of potential impact from a development. The sources will be identified through a review of the details of the Proposed Scheme, including the size and nature of the development, potential construction methodologies and timescales.

- 14.7.6 The next step in the approach is to undertake a review of the potential receptors; that is, the water environment receptors themselves that have the potential to be affected. Waterbodies, including their attributes, will be identified through the desk study described above, and will be surveyed through a site visit at the full impact assessment stage.
- 14.7.7 The last stage of the approach is to determine if there is a viable exposure pathway or a 'mechanism' linking the source to the receptor. This will be undertaken through standard on-site testing (e.g. dye tests) in the context of local conditions relative to water receptors within the Site, such as topography, geology, climatic conditions and the nature of the impact (e.g. the mobility of a liquid pollutant or the proximity to works that may physically impact a waterbody).
- 14.7.8 As the scoping exercise has recorded potential for significant effects relating to road drainage and the water environment, a detailed assessment will be undertaken in accordance with the guidance and methodologies contained within DMRB LA 113 in relation to water quality, resources, hydromorphology, and flood risk.
- 14.7.9 A qualitative assessment of the risk to the water environment during construction works will be undertaken, with mitigation measures developed to avoid, prevent and minimise the risk of pollution. This will also include mitigation measures to manage and control works during construction to avoid, prevent and minimise the risk of pollution. Liaison with the Environment Agency and LLFA will be undertaken to identify any water related licences / consents / permits that may be required for construction and operation of the Proposed Scheme.

Significance Criteria

- 14.7.10 The value, or importance, of the potentially affected water environment features will be established on the basis of a four-point scale, using the criteria presented in Table 14-13 which has been modified from DMRB LA 113 guidance to account for hydromorphology.

Table 14-13: Evaluating the Importance for Surface Water, Groundwater, Flood Risk, and Water Resources**Importance Type of Receptor**

	Ground water	Surface water	Morphology	Flood Risk
Very High	Principal Aquifer providing a regionally important resource or supporting site protected under EC and UK habitat legislation. Groundwater locally supports GWDTE. SPZ 1	Watercourse having a WFD classification shown in a RBMP and $Q95 \geq 1.0$ m ³ /s. Sites protected/designated under an EC or UK legislation (SAC, SPA, SSSI, Ramsar, salmonid water) / Species protected by EC legislation Ecology and Nature Conservation	Unmodified, near to or pristine conditions, with well-developed and diverse geomorphic forms and processes characteristic of river type.	Essential infrastructure or highly vulnerable development
High	Principal Aquifer providing locally important resource or supporting river ecosystem. Groundwater supports a GWDTE. SPZ2	Watercourse having a WFD classification shown in a RBMP and $Q95 < 1.0$ m ³ /s. Species protected under EC or UK legislation. Ecology and Nature Conservation	Conforms closely to natural, unaltered state and would often exhibit well developed and diverse geomorphic forms and processes characteristic of river type, with abundant bank side vegetation. Deviates from natural conditions due to direct and/or indirect channel, floodplain, and/or catchment development pressures	More vulnerable development
Medium	Aquifer providing water for agriculture or industrial use with limited connection to surface water. SPZ3	Watercourses not having a WFD classification shown in a RBMP and $Q95 > 0.001$ m ³ /s	Shows signs of previous alteration and/ or minor flow regulation but still retains some natural features or may be recovering toward conditions indicative of the higher category.	Less vulnerable development
Low	Unproductive strata	Watercourses not having a WFD classification shown in a RBMP and $Q95 < 0.001$ m ³ /s	Substantially modified by past land use, previous engineering works or flow regulation and likely to possess an artificial cross-section (e.g. trapezoidal) and would probably be deficient in bedforms and bankside vegetation. Could be realigned or	Water compatible development

Importance Type of Receptor

Ground water	Surface water	Morphology	Flood Risk
		<p>channelised with hard bank protection, or culverted and enclosed. May be significantly impounded or abstracted for water resources use. Could be impacted by navigation, with associated high degree of flow regulation and bank protection, and probable strategic need for maintenance dredging. Artificial and minor drains and ditches would fall into this category.</p>	

14.7.11 The magnitude of adverse or beneficial impacts will be determined by the seven-point scale presented in Table 14-14 **Error! Reference source not found.**, taking into account DMRB LA 113.

Table 14-14: Evaluating Magnitude for Surface, Groundwater, Flood Risk, and Water Resources

Impact	Criteria	Description and Examples
Major Adverse	Results in the loss of attribute and/ or quality and integrity of the attribute	<p>Surface Water:</p> <ul style="list-style-type: none"> • Failure of both soluble and sediment-bound pollutants in HEWRAT and compliance failure with EQS values (Method B). • Calculated risk of pollution from a spillage >2% annually (Spillage Risk 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, which may result from quality changes, or alterations to the morphology of the watercourse. <p>Groundwater:</p> <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 runoff – risk score >250 (Groundwater quality and runoff assessment). • Calculated risk of pollution from spillages ≥2% annually (Spillage Assessment). • Loss of, or extensive change to GWDTE or baseflow contribution to protected surface waterbodies. • Reduction in water body WFD classification. • Loss or significant damage to major structures through subsidence or similar effects. <p>Flood Risk:</p> <ul style="list-style-type: none"> • Increase in peak flood level (>100mm)¹²
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute	<p>Surface Water:</p> <ul style="list-style-type: none"> • Failure of both soluble and sediment-bound pollutants in HEWRAT but compliance with EQS values. • Calculated risk of pollution from spillages >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.

¹² All references to peak flood level in this table are for a 1% annual probability event, including climate change

Impact	Criteria	Description and Examples
		<ul style="list-style-type: none"> Contribution to reduction in water body WFD classification, which may result from quality changes, or alterations to the morphology of the watercourse. <p>Groundwater:</p> <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 to 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>Flood Risk:</p> <ul style="list-style-type: none"> Increase in peak flood level (> 50 mm).
Minor Adverse	Results in some measurable changes in attributes quality or vulnerability	<p>Surface Water:</p> <ul style="list-style-type: none"> Failure of either soluble or sediment-bound pollutants in HEWRAT. Calculated risk of pollution from spillages $> 0.5\%$ annually and $< 1\%$ annually. Minor effects of water supplies. <p>Groundwater:</p> <ul style="list-style-type: none"> 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 an aquifer, GWDTEs, abstractions and structures. <p>Flood Risk:</p> <ul style="list-style-type: none"> Increase in peak flood level (> 10mm).
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	<p>Surface Water:</p> <ul style="list-style-type: none"> No risk identified by HEWRAT (pass both acute soluble and chronic sediment related pollutants) Risk of pollution from spillages $< 0.5\%$. <p>Groundwater:</p> <ul style="list-style-type: none"> No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages $< 0.5\%$. <p>Flood Risk:</p>

Impact	Criteria	Description and Examples
Minor Beneficial	Results in some beneficial impact on attribute or a reduced risk of negative effect occurring	<ul style="list-style-type: none"> Negligible change in peak flood level ($\leq \pm 10$ mm). <p>Surface Water:</p> <ul style="list-style-type: none"> HEWRAT assessment of either soluble or sediment-bound 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>Groundwater:</p> <ul style="list-style-type: none"> Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk $< 1\%$ annually). Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding. <p>Flood Risk:</p> <ul style="list-style-type: none"> Creation of flood storage and decrease in peak flood level (> 10 mm).
Moderate Beneficial	Results in moderate improvement of attribute quality	<p>Surface Water:</p> <ul style="list-style-type: none"> HEWRAT assessment of both soluble and sediment-bound 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 waterbody WFD classification, from either quality or morphology improvements <p>Groundwater:</p> <ul style="list-style-type: none"> Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is $> 1\%$ annually). Contribution to 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>Flood Risk:</p> <ul style="list-style-type: none"> Creation of flood storage and decrease in peak flood level (> 50 mm).

Impact	Criteria	Description and Examples
Major Beneficial	Results in major improvement of attribute quality	<p>Surface Water:</p> <ul style="list-style-type: none"> Removal of existing polluting discharge or likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification, from either quality or morphology improvements. <p>Groundwater:</p> <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. Improvement in water body WFD classification. <p>Flood Risk:</p> <ul style="list-style-type: none"> Creation of flood storage and decrease in peak flood level (>100 mm).

14.7.12 The significance of effects will be determined using the matrix presented in Table 14-15. Only those effects moderate or greater are considered significant (i.e. shaded cells). Where the matrix allows a range of effect, professional judgement will be used to determine the residual significance.

Table 14-15: Significance of Effect Matrix

		Importance of Attribute				
		Negligible	Low	Medium	High	Very high
Magnitude of Impact	No change	Neutral	Neutral	Neutral	Neutral	Neutral
	Negligible	Neutral	Neutral/Slight	Neutral/Slight	Slight	Slight
	Minor	Neutral/Slight	Neutral/Slight	Slight	Slight/Moderate	Moderate/Large
	Moderate	Neutral/Slight	Slight	Moderate	Moderate/Large	Large/Very Large
	Major	Slight	Slight/Moderate	Moderate/Large	Large/Very Large	Very Large

14.8 Assumptions and Limitations

14.8.1 This scoping exercise has been completed using online data held and maintained by third parties, which for the purpose of the scoping exercise has been assumed to be accurate, up to date and appropriate for use. Additional desk study and site surveys will be carried out and the results of this additional information could alter the baseline and scope of assessments. However, where this is material to the scope presented in this Chapter, the relevant third parties will be consulted.

14.8.2 Details of the proposed drainage strategies for the junctions were not available at the time of writing (June 2021).

15. CLIMATE

15.1 Introduction

15.1.1 This chapter addresses the potential impacts on the climate of the Project and the impacts of future climate change on the resilience of the Project. To align with the requirements of the EIA Regulations and guidance from DMRB LA 114 Climate (Highways England, 2019d), consideration of climate effects is divided into two aspects:

- Greenhouse gas (GHG) impact assessment – considers the impact on the climate of GHG emissions arising from the Project during its lifetime, including how the project will affect the ability of Government to meet its carbon reduction plan targets; and
- Climate change resilience review – considers the resilience of the Project to climate change impacts, including how the Project design will take account of the projected impacts of climate change.

15.2 Study Area

15.2.1 The study area for the GHG assessment includes:

- All direct GHG emissions arising as a result of construction, maintenance and operational activity within the redline boundary;
- Embodied carbon in materials used for construction and maintenance as a result of raw material extraction, processing and manufacture; and
- Road user emissions arising from the 'Affected Road Network'.

15.2.2 The study area for the climate change resilience review will be:

- The area of temporary and completed works within the scoping boundary; and
- Affected receptors identified within other environmental factors 'scoped in' to the assessment.

15.3 Existing and Baseline Conditions

GHG Impact Assessment

15.3.1 The current and future baseline for the lifecycle GHG impact assessment is a 'business as usual' scenario where the Project is not constructed, and the existing road remains (Do Minimum scenario). Included within the baseline will be emissions from the Affected Road Network.

Climate Change Resilience Assessment

15.3.2 The current baseline for the vulnerability assessment is based on historic climate data obtained from the UK Met Office (2020) recorded by the closest meteorological station to the Project (Sutton Bonington) for the period 1981-2010. This data is listed in Table 15-1.

Table 15-1: Historic climate data - UK Met Office (2020)

Climatic Variable	Month	Value
Average annual maximum daily temperature (°C)	-	13.9
Warmest month on average (°C)	July	21.7
Coldest month on average (°C)	February	1.3
Mean annual rainfall levels (mm)	-	620.2
Wettest month on average (mm)	October	61.0
Driest month on average (mm)	February	38.9

15.3.3 The Met Office historic 10-year averages for the 'Midlands' district identify gradual warming between 1970 and 2019, with increased rainfall also. Information on mean maximum annual temperatures (°C) and mean annual rainfall (mm) is summarised in **Error! Reference source not found.**

Table 15-2: Historic Climate Data - Met Office historic 10-year averages for the Midlands district

Climatic Period	Mean maximum annual temperatures (°C)	Mean annual rainfall (mm)
1970-1979	12.78	733.51
1980-1989	12.83	785.16
1990-1999	13.50	762.03
2000-2009	13.93	831.68
2010-2019	13.89	799.96

15.3.4 The future baseline for the vulnerability assessment is based on future UK Climate Projections (UKCP18) data published by the Met Office (2018) detailed in Table 15-3 and Table 15-4.

15.3.5 The review of vulnerability to climate change will consider a scenario that reflects a high level of greenhouse gas emissions at the 10%, 50% and 90% probability levels to assess the impact of climate change over the lifecycle of the Scheme. A 10% probability result indicates that 10% of model results were below this figure. A 50% probability results indicates that 50% of model results were above and below this figure. A 90% result indicated that 90% of model results were below this figure.

15.3.6 For the purpose of the review, UKCP18 probabilistic projections for pre-defined 20-year periods for the following average climate variables have been obtained and will be further analysed:

- Mean annual temperature;
- Mean summer temperature;
- Mean winter temperature;
- Maximum summer temperature;

- Minimum winter temperature;
- Mean annual precipitation;
- Mean summer precipitation; and
- Mean winter precipitation.

15.3.7 Projected temperature and precipitation variables are presented in Table 15-3 and Table 15-4 **Error! Reference source not found.**, respectively. UKCP18 probabilistic projections have been analysed for the two 25km grid squares in which the Project is located. These figures are expressed as temperature/precipitation anomalies in relation to the 1981-2000 baseline.

15.3.8 UKCP18 uses a range of possible scenarios, classified as Representative Concentration Pathways (RCPs), to inform differing future emission trends. These RCPs “... specify the concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to preindustrial levels”. RCP8.5 has been used for the purposes of this assessment as a worst-case scenario.

15.3.9 The Project has varying design life elements, with the pavement surface at 15 years, the pavement at 40 years and the structures at 120 years. The projected climate variables presented in Table 15-3 and Table 15-4 show time periods that intersect these stages. The 2020-2039 time period intersects the construction stage, earliest operations and the end of the design life for pavement surfacing. The 2050-2069 time period intersects the end of design life of the pavement surface and approximately halfway life of the Project. The 2080-2099 intersects the latter part of the Project.

Table 15-3: Projected Changes in Temperature Variables (°C), 50% Probability (10% and 90% Probability in Parenthesis)

Climatic Variable	2020 - 2039	2050 - 2069	2080 - 2099
Mean annual air temperature anomaly at 1.5m (°C)	+1.0 (+0.3 to +1.7)	+2.2 (+1.0 to +3.5)	+4.0 (+2.2 to +6.1)
Mean summer air temperature anomaly at 1.5m (°C)	+1.2 (+0.4 to +2.1)	+2.7 (+1.0 to +4.5)	+5.1 (+2.4 to +8.1)
Mean winter air temperature anomaly at 1.5m (°C)	+0.9 (-0.0 to +1.9)	+2.0 (+0.5 to +3.9)	+3.5 (+1.3 to +5.7)
Maximum summer air temperature anomaly at 1.5m (°C)	+1.3 (+0.2 to +2.5)	+3.1 (+0.9 to +5.4)	+5.7 (+2.2 to +9.6)
Minimum winter air temperature anomaly at 1.5m (°C)	+0.9 (-0.1 to +1.9)	+2.0 (+0.5 to +3.6)	+3.4 (+1.1 to +6.0)

Table 15-4: Projected Changes in Precipitation (%), 50% Probability (10% and 90% Probability in Parenthesis)

Climatic Variable	2020 - 2039	2050 - 2069	2080 - 2099
Annual precipitation rate anomaly (%)	+1.1 (-3.2 to +5.8)	-2.0 (-8.4 to +4.6)	-2.1 (-7.6 to +3.6)
Summer precipitation rate anomaly (%)	-7.1 (-27.5 to +14.4)	-23.4 (-52.5 to +7.2)	-34.2 (-63.2 to -1.6)
Winter precipitation rate anomaly (%)	+4.4 (-5.1 to +14.4)	+9.9 (-6.3 to +27.1)	+17.7 (-0.3 to +38.0)

15.4 Value of Environmental and Resource Receptors

15.4.1 The global climate has been identified as the receptor for the purposes of the GHG emissions impact assessment. All GHG emissions have the potential to be significant, and the global climate is a high value receptor. To enable significance evaluation of the estimated GHG emissions arising from the Project, the UK GHG inventory and the corresponding 5-year UK carbon budget will be used as a proxy for the global climate.

15.4.2 There is no published standard definition for receptor sensitivity to GHG emissions set out in the IEMA guidance (IEMA, 2017) or elsewhere. The sensitivity of the receptor, the UK carbon budget (as a proxy for the global climate), has been defined as high. The rationale for this approach is as follows:

- Any additional GHG impacts could compromise the UK's ability to reduce its GHG emissions and therefore meet its future carbon budgets; and
- The extreme importance of limiting global warming to below 2°C this century, as broadly asserted by the International Paris Agreement (UNFCC, 2015) and the climate science community.

15.5 Potential Effects

15.5.1 Construction and operational activities and materials associated with the Project will result in GHG emissions contributing to an adverse impact on the climate. Residual impacts will arise as it is not currently feasible to fully eliminate emissions resulting from the production of road building materials, construction activities and energy use during the Project operation.

15.5.2 Furthermore, limitations exist in terms of feasible design alternatives for the Project and materials specification(s) due to legal requirements for quality and safety considerations in UK road schemes.

15.5.3 The following measures will be applied to reduce GHG emissions:

- Avoid or prevent: the design will seek to maximise potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required, or explore alternative lower carbon options to deliver the Project objectives;
- Reduce: apply low carbon solutions (including technologies, materials and products) to minimise resource consumption during the construction,

operation, use of the Project, and at end-of-life; and construct efficiently: use techniques that reduce resource consumption over the life cycle of the Project; and

- Remediate: after addressing the above steps, explore options to identify, assess and integrate measures to further reduce carbon through on or off-site offsetting or sequestration.

15.6 Proposed Level and Scope of Assessment

GHG Assessment

- 15.6.1 The key anticipated GHG emission sources are set out in Table 15-5. This approach is consistent with the principles set out in the DMRB LA 114, BS EN 15804 (British Standards Institution, 2012), PAS 2080 (Carbon Trust, 2016) and IEMA guidance (IEMA, 2017).
- 15.6.2 DMRB LA 114 guidance states that during the scoping exercise, consideration should be given to the following questions to understand the need to undertake further GHG assessment.
- Are construction GHG emissions (or GHG-emitting activity), compared to the baseline scenario (i.e. when compared to GHG emissions and energy use associated with existing maintenance activities), increasing by >1%?
 - During operation, will roads meet or exceed any of the following criteria?
 - a change of more than 10% in annual average daily traffic (AADT);
 - a change of more than 10% to the number of heavy-duty vehicles; and
 - a change in daily average speed of more than 20 km/hr.
- 15.6.3 It is considered likely that during construction, GHG emissions will increase by more than 1% compared to baseline of maintaining the existing road network in the area.
- 15.6.4 During operation, the Project is unlikely to result in an increased traffic speed (daily average speed increase of more than 20km/hr). Traffic count is expected to remain comparable.
- 15.6.5 Information presented in Table 15-5 is 'scoped in' to the GHG impact assessment. However, the following activities/ lifecycle stages have been scoped out of the assessment:
- Pre-construction stage: as the Project consists of realignment of existing junctions, it is anticipated there will be limited enabling works and land clearance necessary;
 - Operation stage: it is anticipated the operation of associated road, signalling and maintenance (including resurfacing) will be similar to the baseline scenario. In addition, traffic count and traffic speed are expected to remain comparable; and
 - Decommissioning: it is anticipated the Project will be in use beyond the design life of the road infrastructure. Any future decommissioning would require a separate planning submission.

Table 15-5: Key Anticipated GHG Emissions Sources

Lifecycle stage	Activity	Primary emission sources
Construction	<ul style="list-style-type: none"> On-site construction activity Transport of construction materials (where not included in embodied GHG emissions) Transport of construction workers Disposal of any waste/water generated by the construction processes Raw material extraction and manufacturing of products required for the Project 	<ul style="list-style-type: none"> GHG emissions from vehicle/plant use GHG emissions from disposal of waste/water Embodied GHG emissions

Climate Change Resilience Review

- 15.6.6 The potential impacts for the vulnerability assessment are determined based on the UKCP18 projections. Climatic parameters to be considered include those identified in Table 15-6.
- 15.6.7 On the basis of information in Table 15-6, the climate change vulnerability assessment is scoped into the climate change resilience review.

Table 15-6: Climatic Parameters Scoped for Climate Change Resilience Review

Climate Variable Scope In/ Out Rationale

Extreme weather events	In	The Project may be vulnerable to extreme weather events such as storm damage to structures and assets.
Temperature	In	Increased temperatures may increase cooling requirements of the Project and could impact on structural integrity of roads and materials.
Sea level rise	Out	The Project is not located in an area that is susceptible to sea level rise.
Precipitation	In	The Project may be vulnerable to changes in precipitation, for example, pressure on water supply during periods of reduced rainfall, and damage to structures and drainage systems during periods of heavy precipitation.
Wind	Out	The impacts of wind on receptors in the surrounding environment are likely to be no worse relative to baseline conditions.

- 15.6.8 The Schemes at White Post Roundabout and Warren Hill Junction consist of re-surfacing and other minor carriageway works. This is essentially maintenance work and will not cause GHG emissions to increase by more than 1% compared to baseline of maintaining the existing road network in the area. Therefore, these two Schemes are scoped out the Climate assessment. All remaining Schemes are scoped into the assessment.

15.7 Proposed Assessment Methodology Including Significance

- 15.7.1 The ES will evaluate both the impact of the Project on the climate and the resilience of the Project to cope with future climate change based on available data.
- 15.7.2 GHG emissions arising from construction activities, along with those embedded in materials used to build the Project will be qualitatively considered for their impact against the UK achieving carbon budget targets.
- 15.7.3 The design of the Project will be qualitatively assessed to understand how potential risks arising from future climate change such as an increase in the frequency and severity of precipitation and increased heat may impact the Project's operation.

GHG Impact Assessment

- 15.7.4 It is unlikely that detailed information on construction activity, materials and plant will be available for the assessment in the ES. Therefore, the assessment at this stage will be limited at this time. When details become available, at later stages in the design process, GHG emissions will be assessed using a calculation-based methodology as per the below equation:

$$\text{Activity data} \times \text{GHG emissions factor} = \text{GHG emissions value}$$

- 15.7.5 When relevant activity data is available, Defra (2020) emissions factors and embodied carbon data from the Inventory of Carbon and Energy (ICE) (University of Bath, 2019) will be used as source data for calculating GHG emissions.
- 15.7.6 A set of standard data quality principles will be applied so that the results from the GHG assessment are as accurate and representative as possible:
- Age: Activity data and GHG emissions factors applicable to the study period will be used;
 - Geography: Activity data will reflect the design of the Project. GHG emissions factors will be representative of the UK construction industry and UK transport sector;
 - Technology: The default solution will be to apply data which is representative of the UK construction industry and transport sector. However, technology specific data may be used for the purpose of developing scenarios of the future;
 - Methodology: Activity data will be gathered from the Project's engineering and design teams to enable consistency and completeness of data collection; and
 - Competency: Data gaps will be addressed through, for instance, peer reviewed papers (published in recognised journals) or industry specific literature (e.g. UK construction trade associations). GHG emissions factors from a range of sources will be used: EPDs (adhering to BS EN 15804 standard), Life Cycle Assessment tools (aligned with best practice), and industry specific and UK Government sources.

- 15.7.7 In line with applicable guidelines from the World Business Council for Sustainable Development/ World Resources Institute (2004) Greenhouse Gas Protocol

initiative, the GHG emissions study will be reported as tonnes of carbon dioxide equivalent (tCO₂e) and consider the seven Kyoto Protocol gases:

- Carbon-dioxide (CO₂);
- Methane (CH₄);
- Nitrous oxide (N₂O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs);
- Sulphur hexafluoride (SF₆); and
- Nitrogen Trifluoride (NF₃).

15.7.8 In line with the National Policy Statement for National Networks (DfT, 2014), significance of effects will be assessed by comparing estimated GHG emissions arising from the Project with UK carbon budgets, and associated reduction targets.

15.7.9 Table 15-7 shows the current and future UK carbon budgets, which at present have only been calculated up to 2037 (Committee on Climate Change, 2020). Only the 6th carbon budget, still to be ratified by government, reflects the current target of net zero emissions by 2050. Previous carbon budgets reflect the previous 80% reduction target by 2050.

Table 15-7: UK Carbon Budgets

Carbon Budget	Total Budget (MtCO ₂ e)
3 rd (2018-2022)	2,544
4 th (2023-2027)	1,950
5 th (2028-2032)	1,725
6 th (2033-2037)	965

15.7.10 The assessment of impacts on climate will 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. This would therefore suggest that a development with emissions of <1% of the UK inventory and relevant National Carbon Budget would be minimal in its contribution to the wider national GHG emissions. This has been used to assess the magnitude of the GHG impact and the associated criteria are outlined in Table 15-8 and Table 15-9.

Table 15-8: Magnitude Criteria for GHG Impact Assessment

Magnitude	Magnitude Criteria
High	Estimated GHG emissions equate to equal to or more than 1% of total emissions across the relevant 5-year National Carbon Budget period in which they arise.

Low Estimated GHG emissions equate to less than 1% of total emissions across the relevant 5-year National Carbon Budget period in which they arise.

Table 15-9: Significance of Effects Criteria for GHG Impact Assessment

Magnitude	Sensitivity - High ¹³
Low (less than 1% of carbon budget)	Minor adverse
High (more than or equal to 1% of carbon budget)	Major adverse

Climate Change Resilience Review

- 15.7.11 The vulnerability assessment will follow the method detailed in the DMRB LA 114. This will be completed in liaison with the project design team and the other EIA technical disciplines by considering the UKCP18 projections for the geographical location and timeframe of the Project (from construction through to operation).
- 15.7.12 The DMRB LA 114 guidance details how to assess the relevance of potential impacts during operations, significance criteria, evaluation of significance and when further design and mitigation measures are required. During the construction phase, impacts will be assessed qualitatively. Once climate hazards have been identified the likelihood and consequences will be assessed according to Table 15-10 and Table 15-11.

Table 15-10: Likelihood Categories

Likelihood	Description (probability and frequency)
Very high	The event occurs multiple times during the lifetime of the project (e.g. 120 years) e.g. approximately annually, typically 120 events.
High	The event occurs several times during the lifetime of the project (e.g. 120 years) e.g. approximately once every five years, typically 24 events.
Medium	The event occurs limited times during the lifetime of the project (e.g. 120 years) e.g. approximately once every 15 years, typically 8 events.
Low	The event occurs during the lifetime of the project (e.g. 120 years) e.g. once in 120 years.
Very low	The event can occur once during the lifetime of the project (e.g. 120 years).

Table 15-11: Description of Consequences

Consequence of impact	Description
Very large adverse	Operation - national level (or greater) disruption to strategic route(s) lasting more than 1 week.

¹³ The UK carbon budget (as a proxy for the global climate), has been defined as having high sensitivity, refer to Section 15.4.2 for more information.

Large adverse	Operation - national level disruption to strategic route(s) lasting more than 1 day but less than 1 week or regional level disruption to strategic route(s) lasting more than 1 week.
Moderate adverse	Operation - regional level disruption to strategic route(s) lasting more than 1 day but less than 1 week.
Minor adverse	Operation - regional level disruption to strategic route(s) lasting less than 1 day.
Negligible	Operation - disruption to an isolated section of a strategic route lasting less than 1 day.

15.7.13 The significance of the effect of each impact will then be evaluated through a matrix as detailed in Table 15-12. Any significant conclusions will be based on and incorporate confirmed design and mitigation measures, as described by the DMRB LA 114. Any further design and mitigation measures will then be incorporated, and then residual risks will be reassessed until a non-significant acceptable level is achieved.

Table 15-12: Significance Matrix (S = Significant, NS = Not Significant)

		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
		NS	NS	NS	NS	NS

15.7.14 A statement will be provided within the Climate chapter of the ES to describe how the Project will be designed and monitored to improve its resilience to future climatic conditions.

15.8 Assumptions and Limitations

15.8.1 While the climate projections (as presented in Section 15.3) represent anticipated average weather conditions, they do not capture the full range of possible future severe weather events (i.e. droughts, heatwaves and prolonged heavy rainfall).

15.8.2 Assessments made in relation to the likelihood and severity of potential risks and impacts will rely on professional judgement and evidence gathered through other environmental assessment topics.

15.8.3 Where possible, GHG calculations will be based on the available data. Where specific data is absent, calculations will be transparently based on specified assumptions and proxies. If necessary, a qualitative assessment will be undertaken.

15.8.4 All assumptions, limitations and exclusions (including exclusion criteria applied to input and output data) will be documented as part of the assessment.

16. CUMULATIVE EFFECTS ASSESSMENT

- 16.1.1 The cumulative effects assessment will be undertaken at a Project-wide level, therefore combining and assessing all six Schemes as one whole (the Project).
- 16.1.2 Potential effects from the Project may not be significant in isolation; however, several effects from the Project could combine resulting in an effect which could become significant, or, effects from other committed developments in the area surrounding the Project could occur at the same time as the Project. The potential effects can be negative or positive in nature.
- 16.1.3 The DMRB LA 104 identifies two types of cumulative effect:
- The combined effect of a number of different environmental factors- specific impacts from a single project on a single receptor/resource; and/or
 - The combined effect of a number of different projects within the vicinity (in combination with the environmental impact assessment project, i.e. the Project) on a single receptor/resource.
- 16.1.4 The assessment of cumulative effects will use the guidance provided in DMRB LA 104.

16.2 Multiple Effects on Individual Receptors (In-combination Effects)

- 16.2.1 The in-combination effects assessment will be undertaken once the assessment of all other environmental topics is complete. The temporal limit of the assessment will be the Design Year (i.e. 15 years after opening of the Scheme) and the spatial boundaries of the assessment will be defined by the scope of each individual topic assessment. Where appropriate, receptors will be grouped for the purposes of the in-combination effects assessment.

16.3 Cumulative Effects with Other Developments

- 16.3.1 DMRB LA 104 requires that the following other developments are considered cumulatively:
- Roads projects which have been confirmed for delivery over a similar timeframe;
 - Other development projects with valid planning permissions or consent orders, and for which EIA is a requirement; and
 - Proposals in adopted development plans with a clear identified programme for delivery.
- 16.3.2 Agreement will be sought with NCC Planning as to which other developments are to be considered within the cumulative effects' assessment and as part of the future baseline for each individual topic assessment.
- 16.3.3 The traffic model being developed for the Project will take account of future predicted traffic growth, including traffic generated by new development. Therefore, the assessments that use traffic forecasts will inherently consider vehicle movements associated with both the Project and other planned new development.

- 16.3.4 The cumulative effects with other developments will be reported in each environmental topic assessment chapter to understand whether the environmental topic receptors will also be affected by other nearby planned developments.

Proposed Level and Scope of Assessment

- 16.3.5 Other planned developments and transportation projects will be assessed for their effects on receptors already affected by the Project. This may extend up to several kilometres from the Project and the zone of influence from the topic area, depending on the nature of the planned developments or future transport projects under consideration.

16.4 Proposed Methodology Including Significance

- 16.4.1 The assessment of cumulative effects will use the guidance provided in DMRB LA 104. Planned developments and transport projects that will be considered will be determined in consultation with NCC Planning.
- 16.4.2 The assessment of cumulative effects will be based on professional judgement and will be carried out after the topic assessments within the ES have been completed. This will ensure that all affected receptors can be checked, and all interactions identified.
- 16.4.3 Cumulative effects will be identified as short or long-term. The magnitude of effects will be identified, mitigation measures will be taken into account and the residual significance of the cumulative effects will be assessed using the guidance shown in Table 16-1 (reproduced from Table 2.6 in DMRB LA 104).

Table 16-1: Determining the Significance of Cumulative Effects (In-Combination and Cumulative)

Term	Definition
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised
Major	Effects that may become key decision-making issues
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may need to improve on current performance.
Minor	Effects that are beyond the current forecasting ability or are within the ability of the recourse to absorb such change.
Not significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change

17. SUMMARY

- 17.1.1 This environmental Scoping Report has outlined the approach, methodology, and topics that will be assessed in respect of the Project.
- 17.1.2 During construction, the Schemes which constitute the Project have the potential to give rise to a range of environmental impacts and effects e.g. arising from construction activities, traffic movements, temporary and permanent loss of land. Activities during the operational phase that could give rise to environmental impacts and effects relate to changes in traffic flow and composition, the introduction of additional street lighting and signage.
- 17.1.3 Table 17-1 below outlines the scope of each environmental topic, specifically the aspects of each assessment that have been scoped in and scoped out of the ES for the Project.

Table 17-1: Summary of Assessment Scope for the ES

Environmental topic	Scoped into the ES and level of assessment	Scoped out of the ES
Air Quality	Construction dust, qualitative Operational traffic, quantitative	Construction traffic
Cultural Heritage	Construction and operation	-
Landscape and Visual	Construction and operation	-
Biodiversity	Construction and operation	-
Geology and Soils	Construction and operation	-
Material Assets and Waste	-	Construction materials and waste Operational materials and waste
Noise and Vibration	Construction noise, quantitative Construction vibration, quantitative Operational traffic, quantitative	Operational vibration Construction traffic, quantitative
Population and Health	Impacts of business land, Mickledale Lane Junction Option 1 only.	Land use and accessibility, construction and operation (all Schemes except Mickledale Lane Junction Option 1) Human health, construction and operation (as a stand-alone chapter, the elements would be assessed within other assessments e.g. air quality).

Environmental topic	Scoped into the ES and level of assessment	Scoped out of the ES
Road Drainage and the Water Environment	Construction and operation water quality, (detailed assessment) Operational flood risk, qualitative	-
Climate	Construction phase GHG emissions, including embedded GHG in materials Construction and operation climate change resilience, qualitative	Pre-construction stage, operational stage and decommissioning GHG
Miscellaneous	-	Heat and radiation Transboundary impacts Major accidents and disasters

17.1.4 Table 18-2 displays which environmental topics (scoped in as detailed in Table 18-1) will be undertaken for each Scheme as part of the overarching ES for the Project.

Table 17-2: Scope of the Assessments for Each Scheme to be Included in the ES

Scheme name	Air Quality	Cultural Heritage	Landscape and Visual	Biodiversity	Geology and Soils	Noise and Vibration	Population and Human Health	Road Drainage and the Water	Climate
Ollerton Roundabout	In	In	In	In	In	In	Out	In	In
Mickledale Lane Junction – Option 1*	In	In	In	In	In	In	In	Out	In
Mickledale Lane Junction – Option 2*	In	In	In	In	In	In	Out	In	In
White Post Roundabout	Out	Out	Out	Out	Out	Out	Out	Out	Out
Warren Hill Junction	Out	Out	Out	Out	Out	Out	Out	Out	Out
Lowdham Roundabout	In	In	In	In	In	In	Out	In	In
Kirk Hill Junction	In	In	In	In	In	In	Out	Out	In

17.1.5 Only one option for Mickledale Lane Junction will be taken forward to the next level of assessment and reported in the ES, following further assessment and public consultation.

17.1.6 In addition to the above topic assessments, a Project-wide assessment of cumulative effects will be undertaken, as described in Chapter 16.

17.2 Proposed Structure of the ES

17.2.1 The ES will be structured to provide a stand-alone assessment of each Scheme to accompany individual Scheme planning applications, whilst also providing an assessment of Project-wide impacts and cumulative effects.

17.2.2 Volume 1 of the ES will provide an overview of the Project, the Project-wide impact assessment, the assessment of in-combination effects and cumulative effects in conjunction with other developments.

17.2.3 Volumes 1A-1E would address the environmental assessment of each individual Scheme. The number of volumes required would be dependent upon agreement via the scoping opinion response that White Post Roundabout and Warren Hill Junction would be scoped out of further assessment as proposed here.

17.2.4 Volume 1A-1E will consist of stand-alone chapters to present a complete picture of the assessment and effects for each individual environmental topic. Assessments will be undertaken for the construction and operation/ maintenance phase of each Scheme as relevant to each topic. Although there will be slight variation between environmental topic chapters, in general each topic chapter will include the following headings:

- Regulatory/ policy framework;
- Study area;
- Baseline conditions;
- Value (sensitivity) of resource;
- Design, mitigation and enhancement measures, including monitoring requirements;
- Magnitude of impacts (change);
- Significant effects;
- Indication of any difficulty encountered; and
- Summary and Conclusions.

17.2.5 Supporting Figures and Appendices would be provided within Volumes 2 and 3 of the ES. A non-technical summary would also be provided.

17.2.6 The proposed ES structure is outlined in Table 17-3.

Table 17-3: Proposed ES Contents List/ Structure

Contents	Environmental Assessment	Figures	Technical Appendices
Project Overview and Cumulative Effects	Volume 1	Volume 2	Volume 3
Ollerton Roundabout	Volume 1A	Volume 2A	Volume 3A
Mickledale Lane Junction	Volume 1B	Volume 2B	Volume 3B
White Post Roundabout	Scoped out of further assessment – dependent on agreement via the Scoping Opinion		
Warren Hill Junction	Scoped out of further assessment – dependent on agreement via the Scoping Opinion		
Lowdham Roundabout	Volume 1C	Volume 2C	Volume 3C
Kirk Hill Junction	Volume 1D	Volume 2D	Volume 3D