M60/M62/M66 Simister Island Interchange

PCF STAGE 3

ENVIRONMENTAL SCOPING REPORT

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Registered office Bridge House, 1 Walnut Tree Close, Guildford, GU1 4LZ

Highways England Company Limited registered in England and Wales number 09346363

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1. Introduction

1.1 Overview of the project

1.1.1 The M60/M62/M66 Simister Island Interchange Scheme (the 'Proposed Scheme') comprises improvements to the M60 Junction (J)18 interchange (also known as Simister Island) and also widening to five lanes of the M60 between J17 and J18.

1.1.2 The proposed junction improvement works are located at M60 J18 (Simister Island), north of Manchester (National Grid Reference SD 82825 05937).

1.1.3 The Proposed Scheme would involve improvement of a highway which is wholly in England and where Highways England is the highway authority. The improvement is likely to have a significant effect on the environment. The Proposed Scheme is therefore classed as a Nationally Significant Infrastructure Project (NSIP) under the Planning Act (2008), triggering the need to apply for a Development Consent Order (DCO).

1.1.4 The Proposed Scheme falls under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations'). It falls under Schedule 2, Section 10f, infrastructure projects, construction of roads unless included in Schedule 1. The selection criteria in Schedule 3 of the EIA Regulations have been used to screen the Proposed Scheme and have identified the potential for significant effects. The Proposed Scheme therefore requires a statutory EIA to support the DCO application.

1.2 Purpose of this report

1.2.1 This report is the Environmental Scoping Report for the Proposed Scheme. It is prepared in line with guidance on EIA Scoping provided in the Planning Inspectorate's Advice Note Seven: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping (2020).

1.2.2 The Environmental Scoping Report is a required product for projects likely to seek consent through the Planning Act 2008. The Environmental Scoping Report is produced during Stage 3 (Preliminary Design) of the Major Projects Product Control Framework (PCF). This report was prepared in line with the PCF Environmental Scoping Report guidance.

1.2.3 The Environmental Scoping Report is produced to document the proposed scope of the EIA, including a description of the aspects which will be considered within the Environmental Statement. The Environmental Scoping Report sets out the environmental features and constraints that are identified from a desk-based study and preliminary field surveys and provides a description of the potential impacts that could arise from the Proposed Scheme. The outcomes of the scoping assessment are used to reach a reasoned conclusion on the likely significant effects of constructing and operating the Proposed Scheme on the environment, and provide justification, supported by evidence, for scoping aspects and matters in or out of further EIA.

1.2.4 The environmental aspects covered include those within the EIA Regulations and the Design Manual for Roads and Bridges (DMRB). The structure of the report is set out in Table 1.1. Figures are included in Appendix H (if PDF version is used).This report is prepared in accordance with Section 10 of the EIA Regulations. It is submitted on behalf of Highways England to request a scoping opinion for the Proposed Scheme.

Table 1.1: Structure of the Environmental Scoping Report

Chapter	Contents
1. Introduction	Provides an overview of the Proposed Scheme and the purpose of this report.
2. The project	Provides a statement on the need for the Proposed Scheme, sets out the scheme objectives, and provides a description of the scheme location and design.
3. Assessment of alternatives	Provides a summary of the development of the Proposed Scheme and the various options considered during the design process. Also includes consideration of how the environmental assessment has influenced the option selection process.
4. Consultation	Provides a summary of consultation undertaken to date and consultation strategy going forward.
5. Environmental assessment methodology	Provides an overview of the environmental assessment methodology, including significance criteria and surveys and predictive techniques.
6-15. Aspect chapters	There is a chapter for each environmental aspect. Each sets out the baseline environment including the study area used and the value of existing receptors within the study area. Each chapter also describes the potential impacts, likely significant effects, and proposed assessment methodology.
16. Assessment of cumulative effects	Provides a summary of how the cumulative effects assessment will be undertaken.
17. Summary of assessment scope	Summarises the aspects and matters that will be scoped in and out of the EIA.
Acronyms, glossary, references	Description of acronyms, definitions of technical terms, and a reference list of document sources.
Appendices	Supporting information are provided in the appendices.

2. The project

2.1 Need for the project

2.1.1 The M60 J18 provides the interchange between the M60, M62 and M66 motorways to the north of Manchester, and is identified within the Route Based Strategy (RBS) Evidence Report (Highways Agency, 2014) as a key junction capacity issue on the Strategic Road Network (SRN). Congestion, delays, high usage, and a high accident rate have been identified as issues with the junction and surrounding route.

2.1.2 The M60, M62 and M66 motorways connect important economic areas within Greater Manchester and Lancashire, and also facilitate a connection to Leeds, another important economic area. The M60 J18 links the Greater Manchester orbital motorway with Rossendale and Burnley to the north, and Rochdale and Leeds to the east. There are several significant employment areas accessed from the M60 J18, including Manchester's city centre and central business district, Bury Town Centre, Heaton Park and the Pilsworth Road industrial estate.

2.1.3 In addition, significant developments are proposed in the vicinity of M62 Junction 19 (M62 J19), in South Heywood. These are likely to involve increases in both employment and residential opportunities. As M60 J18 is just a few miles away, it will be important to consider the impact of traffic growth associated with these developments. Further to this, any further traffic growth on the SRN generated as a result of the M60/M62 Smart Motorways project is likely to increase traffic at this interchange. This future increase in traffic has been incorporated into the traffic model.

2.1.4 Significant road developments and improvements are also proposed as part of the Manchester North-West Quadrant (MNWQ) scheme, which covers Junctions 8-18 of the M60. Some of the busiest stretches of road outside the M25 are located between Junctions 8-18 of the M60, and the combination of local and strategic traffic, coupled with the design of the road, further exacerbates congestion and environmental problems.

2.1.5 A shortlist of options for MNWQ is currently being drawn up. However, there is no expected construction date yet, although it is anticipated that it would be after the M60 J18 opening year of 2027. PCF Stage 2 (Option Selection) for MNWQ is due to start in October 2021 and would include public consultation.

2.1.6 The project teams on both M60/M62/M66 Simister Island Interchange and MNWQ schemes are working together to develop a common stakeholder database and to ensure that there is a consistent approach to consulting with stakeholders on potential improvements to the area around M60 J18.

2.1.7 Within the Greater Manchester City Region, it has been predicted there will be over 55,000 additional homes and 50,000 additional jobs by 2031. It is anticipated that these will impact on both the M60 and M62, leading to extra pressure on the M60 J18.

2.2 Project objectives

2.2.1 The Strategic Outline Business Case (SOBC), produced at PCF Stage 0 by Highways England in January 2016, identified the following scheme objectives:

- Contribute to economic growth

- Improve the operation and efficiency of the existing transport network
- Support employment and residential development opportunities
- Deliver capacity enhancements to the SRN whilst supporting the use of sustainable modes of transport and reducing the existing impact of the junction on the wider environment
- Improve connectivity and community cohesion

2.2.2 The Road Investment Strategy's Performance Specification sets eight Key Performance Indicators, including an environmental component, which the Proposed Scheme will aim to contribute towards. These indicators are set out below:

- Delivering better environmental outcomes
- Making the network safer
- Improving user satisfaction
- Supporting the smooth flow of traffic
- Encouraging economic growth
- Helping cyclists, walkers, and other vulnerable users of the network
- Achieving real efficiency
- Keeping the network in good condition

2.3 Project location

2.3.1 The proposed junction improvement works are located at M60 J18 (Simister Island), north of Manchester (National Grid Reference SD 82825 05937). The project location is shown in Figure 1.1. The Proposed Scheme extents fall within the administrative boundary of Bury Metropolitan Borough Council (BMBC) and is close to Rochdale Borough Council (RBC), Salford City Council (SCC) and Manchester City Council (MCC). Local Planning Authority boundaries are shown in Figure 1.1.

2.3.2 It should be noted that the junction is situated on more than one motorway and as a result has two junction numbers: M60 J18 and M66 J4. For the purpose of this project and therefore this report, the junction is referred to as M60 J18.

2.3.3 M60 J18 provides the interchange between the M60, M62 and M66 motorways. The environmental study areas of the Proposed Scheme encompass the following motorways and slip roads:

- M60 between J17 – J18, in both directions
- M60 between J18 – J19, in both directions, partly
- M60 J17, including the eastbound and westbound entry and exit slip roads
- M60 J18, including all entry and exit slip roads to and from the M60, M62 and M66 motorways
- M66 motorway from the M60 J18 (M66 J4) to M66 J3, partly
- M62 motorway between J18 of the M60 and the M62 Birch Services, partly

2.3.4 The Proposed Scheme is situated between several urban areas and settlements including Whitefield, Prestwich, Simister and Middleton. The Proposed Scheme is situated in an urban fringe landscape, with urban settlements to the west, north and south of the scheme and predominantly low-lying Grade 3/4 agricultural land to the east. The majority of the scheme location falls within the Green Belt boundary.

2.3.5 Key environmental constraints figures are included for each environmental aspect in respective aspect chapters.

2.3.6 Key environmental designations and features close to the Proposed Scheme include Philips Park Local Nature Reserve (LNR) and Ancient Woodland Inventory (AWI) site, Hollins Vale LNR, Mere Clough LNR and AWI site, North Wood AWI site, Prestwich Country Park, and Heaton Park Registered Park and Garden. In addition, there are eight Sites of Biological Interest (SBI) located within 1km of the Proposed Scheme.

2.3.7 There are no Main Rivers crossed by the Proposed Scheme. However, there are numerous Main Rivers and surface watercourses within 1km of the Proposed Scheme. All watercourses are within the River Irwell catchment. There are three ponds associated with Egypt Farm, located to the north east of M60 J18; at their nearest, these ponds are approximately 75m from the eastbound carriageway. There are also several ponds within Pike Fold Golf Club (adjacent to the provisional Order Limits).

2.3.8 Haweswater Aqueduct underbridge is located 300m west of M60 J18. This aqueduct supplies most of Greater Manchester's population with their daily water supply.

2.3.9 The Proposed Scheme is located within an Air Quality Management Area (AQMA) and there are several Noise Important Areas (NIAs) covering J17 and J18 and sections of the adjacent motorways.

2.3.10 There are several public rights of way (PRoW) that cross the Proposed Scheme, and several open greenspaces (including community facilities such as playing fields and golf courses) near to the scheme.

2.3.11 There are several development proposals within the study area that have been considered during the project development. A full list of committed development will be produced for the cumulative effects assessment, as set out in Chapter 16.

2.3.12 There are several development land allocations identified in the Greater Manchester Spatial Framework (GMSF). Major housing allocations of between 600 to 2,700 homes at Whitefield, Heywood and Pilsworth and Simister, fall within the footprint of the Proposed Scheme. However, work on the GMSF has ceased, to be replaced by a new joint development plan. The Proposed Scheme does require land that was previously identified for possible residential or commercial development in the GMSF before work on the plan ceased.

2.4 Project description

Highway alignment

2.4.1 The Proposed Scheme consists of the following elements/sections (Figure 2.1):

- M60/M62 Mainline J17-J18 – upgrade existing Smart Motorway to dual 5-lane motorway (D5M) All Lane Running (ALR) cross section – this element would be an

alteration of the existing alignment and would entail the conversion of the hard shoulders to running lanes

- M66/M60 Mainline – provide four lanes southbound through J18 – this element would be an alteration of the existing alignment
- M60 eastbound to M60 southbound free flow link (known as the Northern Loop) – this would be a new element and would be mainly on an embankment
- M66 southbound diverge – this element would be an alteration of the existing alignment and would be on an embankment
- M60 eastbound to M66 northbound free flow link – this element would be an alteration of the existing alignment
- M60 northbound to M60 westbound free flow link – this element would be an alteration of the existing alignment and would consist of cutting (M60 northbound) and embankment (M60 westbound)
- M62 westbound to M60 southbound free flow link – this element would be an alteration of the existing alignment
- M60 J18 circulatory carriageway – this element would be an alteration of the existing alignment

2.4.2 The scheme alignment (Design Fix 1) and provisional Order Limits are shown on Figure 2.1. The provisional Order Limits include permanent land take required for the Proposed Scheme (including environmental mitigation) and temporary land take required for construction, including construction compounds, temporary works, statutory undertaker diversions, local road mitigation, material storage and haul routes. Total areas required for temporary and permanent land take are subject to change with the evolving design and will be confirmed as part of the DCO application. In line with the requirements of the DCO, land take will be kept to a minimum and justified in the Statement of Reasons to accompany the DCO application.

2.4.3 The source of potential material for earthworks has not yet been determined but will be considered further during PCF Stage 3.

Structures

2.4.4 The Proposed Scheme would require two new major structures:

- Bridge 1 will be a high-level 3-span structure to carry a new link over the M66 approximately 70m north of M60 J18
- Bridge 2 will be a standard height, single-span fully integral bridge carrying the M66 southbound off slip road, over the Northern Loop, some 350m north of M60 J18

2.4.5 Two existing overbridge piers in the M60 central reserve would receive pier collars to provide continuity with the adjacent new rigid concrete barrier (RCB) vehicle restraint system (VRS). Headroom and verge piers are assumed to be unaffected within the Scheme extent.

2.4.6 Initial design suggests that six new gantries would be required; these are likely to be steel lattice type to match those installed on the M60 J8 to M62 J20 Scheme. Plate 2.1 shows a typical gantry.

2.4.7 Most of the existing gantries on the Scheme would be retained; Four gantries would need to be demolished. Four gantries would receive new direction signs and electronic message signs. The legs of existing portal gantries in the central reserve would receive encapsulation to strengthen them against vehicular impact and provide continuity with the adjacent new RCB, while the legs in the verge should remain unchanged with VRS running in front of them.

Plate 2.1 – Typical gantry

Walkers, cyclists and horse riders

2.4.8 The Proposed Scheme seeks to improve facilities for walkers, cyclists and horse riders (WCH). The proposals for WCH would be developed further as the design progresses and may include improvements to underpasses and footbridges.

Watercourse crossings

2.4.9 There are two buried drainage pipes located to the west of M60 J18, which would not require modification. Once drainage surveys have been completed the drainage network will be confirmed.

2.4.10 Haweswater Aqueduct, which passes underground between M60 Junctions 17 and 18, would not require modification.

Drainage design

2.4.11 The Proposed Scheme would result in an additional paved area of approximately 1.27ha, which would require additional attenuation storage to reduce the risk of flooding. Balancing ponds, ditches or swales are preferred to provide attenuation on site and these would be located outside of the floodplain to avoid the requirement for additional flood compensation storage, although there may be a need for online storage in pipes at certain constrained locations. Runoff rates would be restricted to existing site condition runoff rates for online road widening, or greenfield runoff rates for new offline road sections. The

drainage design will be based on the principles of the standard DMRB CG 501: Design of Highway Drainage Systems (Highways England, 2020) for the majority of the work. Where the standard cannot be viably applied a departure from Standard will be sought in line with DMRB GG 101: Introduction to the Design Manual for Roads and Bridges (Highways England, 2018). This approach will be discussed with the local lead flood authority before the drainage strategy is finalised.

Lighting

2.4.12 All of the existing Scheme location is lit with high intensity discharge lamps and would remain lit.

2.4.13 Existing lighting is located as follows:

- M60 J17 to J18 in the central reserve and both verges (High Pressure Sodium (SON))
- M62 east of J18 (Light Emitting Diode (LED))
- All slip roads and segregated left turn lanes (mixed SON & LED)
- M60 J18 roundabout circulatory (SON)

2.4.14 The Northern Loop link would have columns fitted with LED luminaires. The Proposed Scheme would introduce new lanes and widening of the existing slip roads, which would affect the existing lighting layout. Replacement lighting columns would be fitted with LED luminaires for better efficiency.

2.4.15 The lighting design is still to be developed; however, it is assumed that efficient full cut-off lighting technology and light emitting diodes would be used.

Technology

2.4.16 Standard technology for an ALR motorway is proposed. This would utilise many of the existing technology and gantries but would increase the number of Advanced Motorway Indicators (AMIs) where necessary to align with the number of lanes. This is likely to include additional signage and gantries, particularly at the junctions where the design changes the junction layouts. This would assist in monitoring traffic flows and identifying incidents and queues.

Utilities

2.4.17 The permanent works of the Proposed Scheme would not significantly affect any statutory undertakers (such as high voltage electricity, gas and mains water suppliers) and would not require major diversion or protection of their services and apparatus. However, existing statutory undertaker information shows a buried BT Telecommunications cable beneath the existing circulatory carriageway, the exit from the circulatory carriageway to M60 westbound and the M60 northbound to M60 westbound link. Similarly, there is a buried low voltage electrical supply to Highways England communications cabinets and street lighting feeder pillar in the verge of the existing M60 northbound to M60 westbound link. Due to works to re-align this part of the junction these supplies might require re-direction or amendment to ensure supply to new features is not affected.

2.4.18 There is a high voltage electricity cable (voltage unknown) mounted on pylons to the south of and running parallel with the M60 between J17 and J18. The overhead cables should

not be affected but construction staff should be aware of proximity for in respect of lifting operations.

2.4.19 Haweswater Aqueduct underbridge is located 300m west of M60 J18. This aqueduct supplies most of Greater Manchester's population with their daily water supply. This supply is provided in a culvert and abridged by the M60 between J17 and J18. No structural work would be needed on the underbridge to accommodate the scheme improvements, however there would be works to the pavement and other highway infrastructure elements on the structure.

Environmental design

2.4.20 The scheme design is an iterative process which considers the key potential significant effects on environmental receptors. Environmental considerations that have influenced the option development and selection process are set out in Chapter 3: Assessment of alternatives. The ongoing design development will continue to be influenced by the EIA process.

2.4.21 Environmental mitigation can be incorporated within the highways design, where appropriate, to mitigate environmental effects from the Proposed Scheme. Examples of this include noise barriers and bunds to mitigate noise level increases from road traffic, drainage features, and landscape planting to screen visual effects. More detail on aspect specific mitigation is provided in Chapters 6-15 of this Environmental Scoping Report. Mitigation measures will continue to be developed throughout the design development, informed by the EIA.

2.5 Construction

Construction programme and phasing

2.5.1 The Proposed Scheme would be managed as a single project with a construction duration of up to 3 years and a projected opening date in 2027.

2.5.2 The Proposed Scheme comprises elements of 'online' works, which require working on and directly adjacent to the existing motorway carriageways, and 'offline' works, which are located remotely from the current road alignments.

2.5.3 The online works would include:

- Works to convert the M60 J17 and J18 four lane Smart Motorway to five lanes by converting the hard shoulders to running lanes and includes central reserve works, gantries, signs, drainage, safety barrier and fencing
- Works to tie the new Northern Loop link and re-aligned M66 southbound diverge into the existing M60 and M66, including creating extra lanes on the southbound M66 through M60 J18 by converting the hard shoulders to running lanes
- Elements of the new bridge structure to carry the Northern Loop over the M66 and its slip roads (e.g. bridge supports that are next to the M66)
- The improved M60 northbound to M60 westbound free flow link
- New drainage, gantries, signs and lighting on the M66 and M60 approaches to Simister Island

- Reconfiguration of lanes, signs and signals within the M60 J18 roundabout

2.5.4 The offline works would include:

- Construction of the majority of the new Northern Loop link from the M60 eastbound to the M66/M60 southbound
- Parts of the re-aligned M66 southbound diverge slip road
- Elements of the new drainage system such as storage ponds

2.5.5 Both online and offline works would likely be carried out concurrently.

2.5.6 The online works would typically start with work in the central reservations, including drainage, surfacing and new safety barriers. To allow this, traffic would be moved away from the central reservations to provide working room, typically by using the hard shoulders as temporary running lanes and installing narrower lanes. Once complete, traffic would be moved back towards the central reservation to provide safe working space for works in the hard shoulders, nearside lanes and verges. Works within M60 J18 roundabout and the improved M60 northbound to M60 westbound free flow link would likely be carried out as the final phase of online works.

2.5.7 The offline works would likely start in all areas concurrently to minimise the overall programme duration. The completion of online central reserve works in the initial phase (as described above) allows the 'tie-in' works for the offline sections to be completed alongside other works in the verges and nearside lanes.

Compounds and haul roads

2.5.8 A scheme of this size requires a main temporary site compound plus some smaller satellite compounds at strategic work locations around the works area. The location for the main site compound is likely to be to the north-east of M60 J18 in land to the south of Pike Fold Golf Club. Satellite compounds are envisaged in land to the north-west and south-west of the junction, with a possible site access and storage area in land adjacent to Prestwich Heys football ground.

Traffic management

2.5.9 The existing motorways would be kept open during construction of the Proposed Scheme to avoid significant disruption to the road user. However, where construction activities prohibit safe road operation, short-term carriageway closures would be required.

2.5.10 Examples of activities which may require closures include:

- Bridge beam and gantry erection
- Bridge deck construction over live carriageways
- Installation of certain signs and signals (e.g. on overhead gantries)
- Cross carriageway drainage and ducting works
- Major surfacing and white lining operations

2.5.11 Closures would include combinations of single carriageways, both carriageways and slip roads. These closures would happen at night-time, and possibly over weekends, to minimise disruption. Suitable diversion routes would be put in place for motorway traffic.

2.5.12 For the online works described above, long-term temporary traffic management measures would be required during construction. These may include narrower lanes, temporary hard shoulder running, hard shoulder and lane closures, contraflow and tidal flow systems. Typically, temporary safety barriers and reduced speed limits are implemented with such measures for the safety of the road user and the construction workforce.

Plant and equipment

2.5.13 Construction activities would involve the use of heavy plant items, for example excavators, dumper trucks, dozers, piling rigs, and demolition and compaction equipment.

Earthworks

2.5.14 Large amounts of imported fill material would be required particularly for the new Northern Loop link. This may be reduced by recycling material generated at site. However, there is still expected to be a significant shortfall of material, estimated at approximately 163,000m^3. Various options will be explored to obtain this material from local sources, including other nearby construction projects which have a surplus of suitable fill, as well as local quarries.

Dewatering

2.5.15 Ground investigation will be undertaken to determine the ground and groundwater conditions within the provisional Order Limits. The information obtained will be used to inform the risk assessment of any identified contaminated land impacting on the groundwater and will be used to determine the requirements for protective measures if deemed necessary. An assessment of the requirement for dewatering activities as part of the construction works will also be undertaken following the ground investigation.

Carbon management

2.5.16 In order to deliver Highways England's aspirations with respect to the minimisation of carbon emissions and the efficient use of resources, the carbon intensity of the Proposed Scheme will be established and monitored throughout the design and construction phases.

Sustainable procurement

2.5.17 In addition to ensuring a carbon efficient design, a sustainable procurement strategy will be implemented to ensure that low carbon materials are, where practicable, specified and that the carbon intensity of materials and sub-contract packages is measured and monitored throughout.

Materials and waste management

2.5.18 The recycling and re-use of site won (including demolition) materials arising from the Proposed Scheme will be implemented and, where practicable, construction materials will be sourced from local sources of supply.

2.6 Rochdale envelope

2.6.1 This Environmental Scoping Report is based on an early preliminary design of the Proposed Scheme. The location and provisional Order Limits of the Proposed Scheme are

shown on Figure 2.1. In accordance with the guidance provided in the Planning Inspectorate's Advice Note Nine: Rochdale Envelope (2018), the provisional Order Limits have been drawn at this stage to allow some flexibility. The project design process is ongoing and as such it is not possible at this point in time to define exactly the footprint of the Proposed Scheme. Figure 2.1 is intended to show the 'worst case' scenario, including temporary working areas that could be required for construction compounds, temporary works, material storage and haul routes, based on current knowledge.

3. Assessment of alternatives

3.1 Introduction

3.1.1 This chapter outlines the alternative design options that have been considered during the development of the Proposed Scheme. The options appraisal process is summarised below within the context of Highways England's project control framework (PCF):

- PCF Stage 0 – strategy, shaping and prioritisation: At this stage initial analysis and appraisal are conducted to assess the viability of transport scheme solutions to the problem, including road network and non-road network solutions.
- PCF Stage 1 – options identification: At this stage traffic modelling and economic and environmental assessment is undertaken on a number of options. The key output is the Technical Appraisal Report (TAR) which documents the decisions made on which options to present during non-statutory public consultation.
- PCF Stage 2 – option selection: At this stage the public are consulted on the recommended options from PCF Stage 1. Refinements are then made to the option designs, traffic modelling and economic and environmental assessments following feedback from the consultation. At the end of the stage a Preferred Route Announcement (PRA) is made to announce the decision on which option to progress.
- PCF Stage 3 – preliminary design: This is the stage the Proposed Scheme is currently in and involves developing a single preferred option to the required level for undertaking an EIA and applying for a Development Consent Order. Alternative ways of delivering the preferred option will be explored throughout PCF Stage 3 (see Section 3.3).

3.2 History of the Proposed Scheme

PCF Stage 0 options appraisal (strategy, shaping and prioritisation)

3.2.1 In PCF Stage 0 a number of potential improvement options were considered to address the congestion at M60 J18 in addition to a do-nothing option. This produced 148 improvement options, formed from different combinations of 30 highway elements.

3.2.2 A sifting process reduced the number of options to be considered at a Value Management Workshop in October 2015 to eleven. At that workshop it was recommended that four options be further considered in PCF Stage 1. A record of the Value Management process is contained in the Value Management Report (Hyder, 2015).

3.2.3 On 28 October 2015, the Project Board agreed in principle to the results of the workshop but decided that a fifth option considered at the workshop should also be taken forward.

3.2.4 A Package Order brief for the scheme was included in the Collaborative Delivery Framework Scheme Specific Scope for PCF Stages 1 and 2 design services. In addition to the five options referred to above, the brief also included changing the M60 between J17 and J18 from a 4-lane controlled motorway with hard shoulder to a 5-lane ALR motorway with no hard shoulder.

Summary of PCF Stage 0 options to be considered at Stage 1

3.2.5 By the end of PCF Stage 0, five options were initially chosen for further assessment at PCF Stage 1. The five initial options were:

- Option 103 (re-named Option A at Stage 1)
- Option 003 (re-named Option B at Stage 1)
- Option 122 (re-named Option C at Stage 1)
- Option 013 (re-named Option D at Stage 1)
- Option 113 (re-named Option E at Stage 1)

3.2.6 Table 3.1 describes the elements that made up the above options.

Table 3.1: PCF Stage 0 options and the elements they comprised

Option	Elements (NB – northbound; EB – eastbound; SB – southbound; WB – westbound)
103 A	Element B9: M60 EB to M60 SB 2 lane loop interchange link. Element G2: M60 NB to M60 WB 2 lane interchange link with improved diverge and merge.
003 B	Element A1: M60 EB to M66 NB 2 lane interchange link with improved diverge and merge. Element B4: new 3 lane signalised link inside roundabout circulatory for M60 EB to M60 SB. Element G2: M60 NB to M60 WB 2 lane interchange link with improved diverge and merge.
122 C	Element A1: M60 EB to M66 NB 2 lane interchange link with improved diverge and merge. Element D3: new 3 lane signalised link inside roundabout circulatory for M66 SB to M60 WB. Element G2: M60 NB to M60 WB 2 lane interchange link with improved diverge and merge.
013 D	Element A1: M60 EB to M66 NB 2 lane interchange link with improved diverge and merge. Element N1: widening of roundabout circulatory on north, east and west parts to 5 lanes.
113 E	Element G2: M60 NB to M60 WB 2 lane interchange link with improved diverge and merge.

3.2.7 After further consideration (see Table 3.2 for justification) two options were taken forward to PCF Stage 1.

Table 3.2: PCF Stage 0 options for consideration at PCF Stage 1

Option	Take Forward	Reasons
A	Yes	• Provides free flow for highest peak hour traffic flows (M60 EB to M60 SB) • Frees up roundabout capacity for other movements • Improves journey times and reliability at the junction • Moves significant traffic flow away from properties close to the roundabout
B	No	• Does not provide free flow for highest peak hour traffic flows (M60 EB to M60 SB) and has very low impact on junction capacity • New route for M60 EB to M60 SB has low radius and limited visibility • Requires 3-way signals which results in reduced green light time and roundabout capacity

Option	Take Forward	Reasons
		• Very little impact on journey times and reliability at the junction
C	Yes	• Separates M60 EB to M60 SB from M66 SB to M60 WB within the roundabout, provides 3 lanes for M66 SB to M60 WB • Frees up capacity for M60 EB to M60 SB within roundabout • Some positive impact on journey times and reliability at the junction • Value for money estimated to be relatively high
D	No	• Does not provide free flow for highest peak hour traffic flows (M60 EB to M60 SB) • 5 lanes at a signal stop line not recommended – safety issue • Widening of roundabout bridges – buildability issue • Widening of circulatory affects viaduct abutment – requires M62/M60 closure • Value for money estimated to be very low
E	No	• Does not provide free flow for highest peak hour traffic flows (M60 EB to M60 SB) • Provides an improvement for only one traffic movement • Very little impact on journey times and reliability at the junction

3.2.8 Following the decision to take Options A and C forward for further consideration, these options were further assessed and developed to remove or mitigate problems. These two options were referenced as A1 and C1. This process was repeated and two further variants were identified, referenced as A2 and C2. Drawings of the four variants are shown in Plates 3.1 to 3.4.

Plate 3.1 – Proposed Option A1 (excluding ALR)

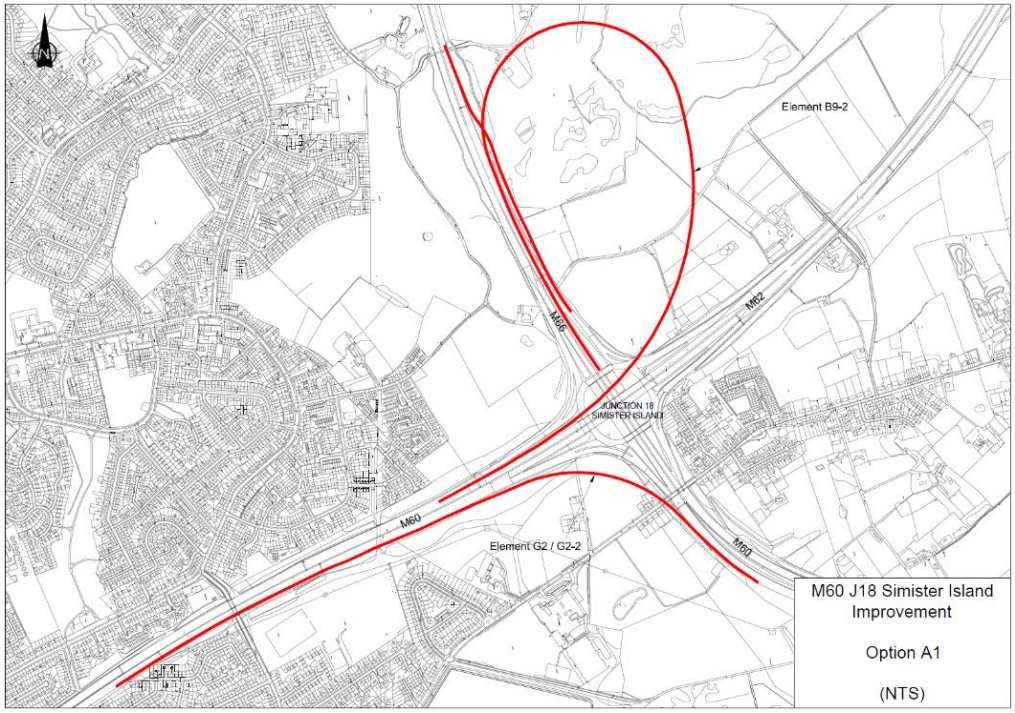


Plate 3.2 – Proposed Option A2 (excluding ALR)

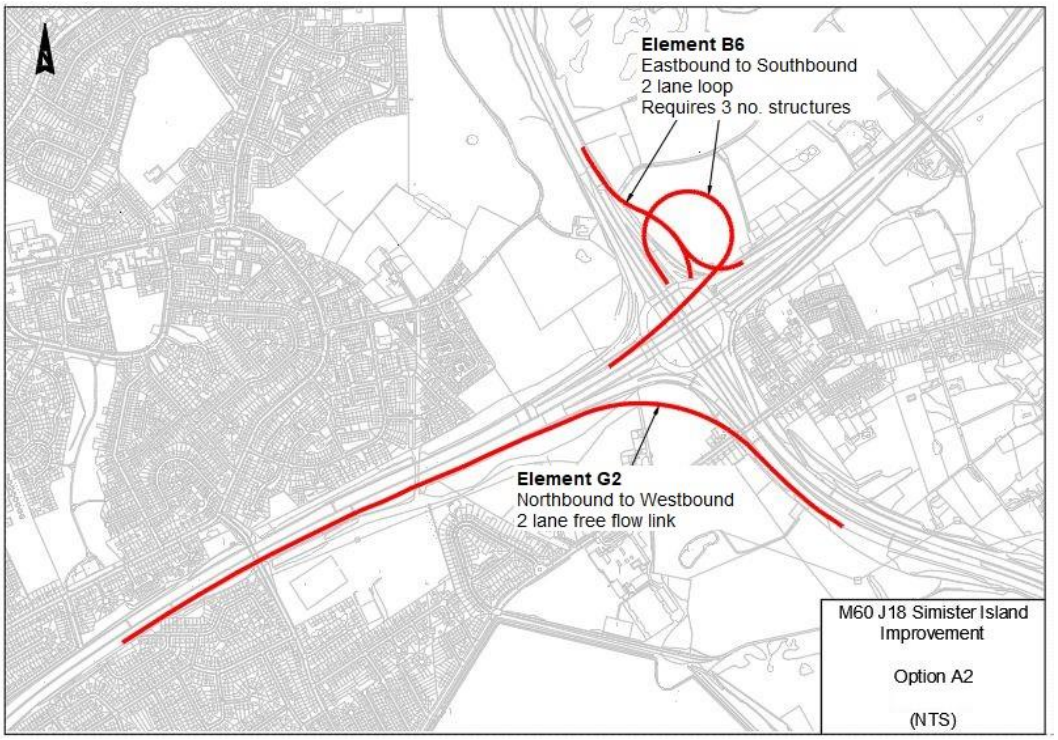


Plate 3.3 – Proposed Option C1 (excluding ALR)

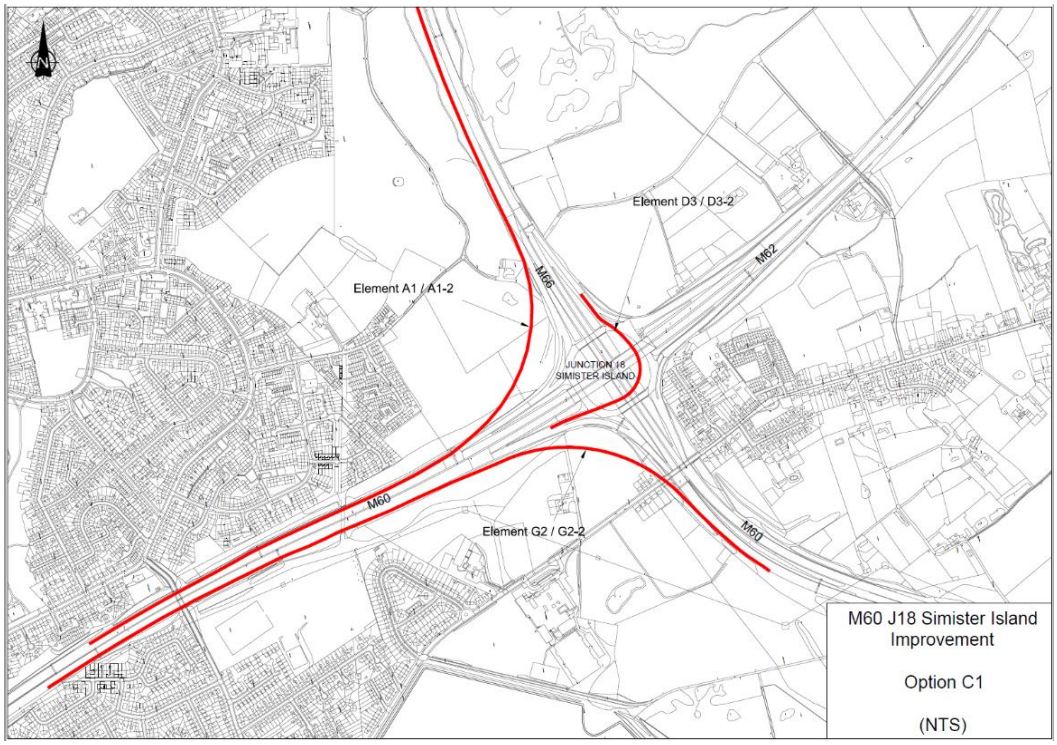
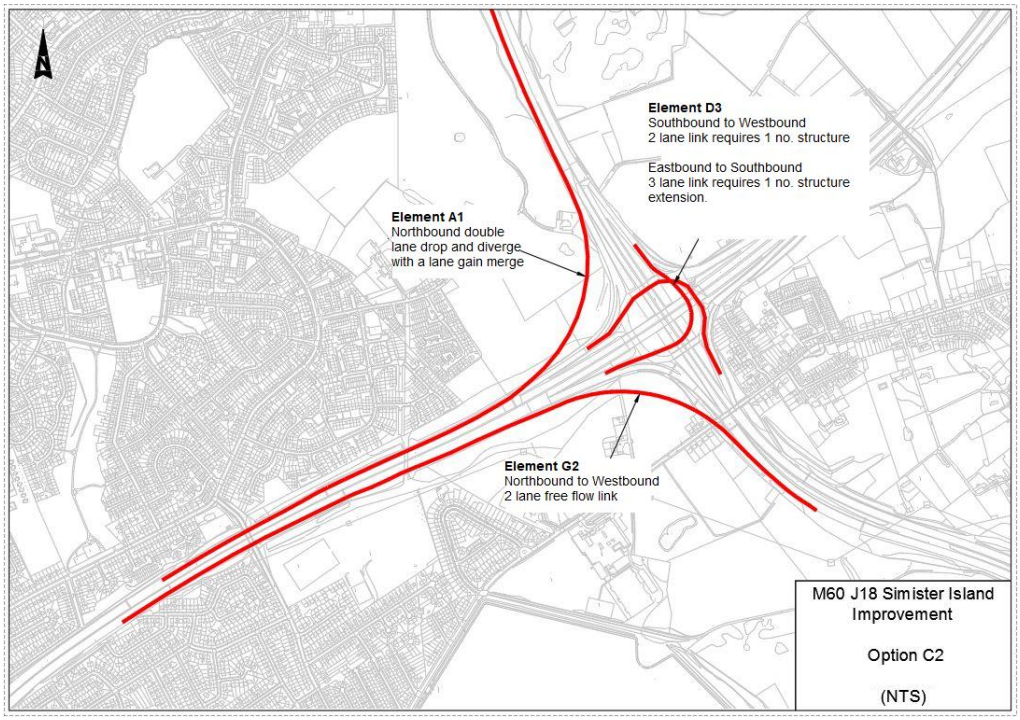


Plate 3.4 - Proposed Option C2 (excluding ALR element)



PCF Stage 1 options (option identification)

3.2.9 Options A and C were subject to a further design review particularly regarding highway layout and geometry, visibility and buildability. Design improvements were made to remove or mitigate problems identified with the Stage 0 proposals. Two variants of Options A and C were identified, and design proposals produced and assessed.

3.2.10 A sub-option of 5-lane ALR between M60 J17 and J18 was introduced for all the improvements (Options A1 and C1) and variants (Options A2 and C2) in-line with the Client Scheme Requirements.

3.2.11 The design of the improvements and variants was based on forecast 2023 opening year traffic flows. The traffic operation of the four options was assessed using a VISSIM micro-simulation traffic model. Impact on land and property, utility equipment, traffic signs and signals requirements, structures, earthworks requirements and environmental impact and effects on maintenance were also considered. The results of this review are in the PCF Stage 1 – Identification of Options Report (CH2M, 2017).

3.2.12 An Options Workshop was held in January 2018 to confirm the problems to be solved and objectives to be met by the scheme, share details of the development of options, assess options against objectives and make recommendations on which options to be considered further. It was confirmed at the Options Workshop held in January 2018 that Options A1, A2, C1 and C2 should be taken forward for further detailed appraisal within PCF Stage 1 (Table 3.3). All of these options included 5-lane ALR between M60 J17 and J18.

Table 3.3: PCF Stage 1 options

Option	Elements
A1	The improvements made to Option A during PCF Stage 1 were: • Increasing the loop size to locate the M66 SB merge upstream of the J18 roundabout north overbridge; • Improving the M60 EB diverge layout; • Improving the M60 NB to M60 WB interchange link; • Improving the M60 WB merge layouts; and • Closure of roundabout entry from M60 EB and exit to M60 SB except for emergency and maintenance vehicles.
A2	This was a new option that was identified at the start of PCF Stage 1. It is similar to Option A1 but has the following differences: • A small loop (radius of 100m) for the M60 EB to M60 SB interchange link; • The M66 SB merge is downstream of the J18 roundabout south overbridge; • The M60 EB to M60 SB interchange link is separated from the M66 SB by the roundabout and viaduct bridge piers; • An overall longer bridge span over the roundabout is required; and • The M66 SB exit slip road roundabout approach and the free flow left turn to the M62 EB require amendment.
C1	The improvements made to Option C during Stage 1 were: • Improving the M60 EB diverge layout; • Improving the M60 EB to M66 NB interchange link and merge with the M66 NB; • Extending the new route within the roundabout to the entry of the M60 NB exit slip road and so increasing signals green time; • Improving the M60 NB to M60 WB interchange link; and • Improving the M60 WB merge layouts.
C2	This was a new option that was identified at the start of PCF Stage 1. It is the same as Option C1 except for the following differences: • Widening of the M60 EB exit slip road to three lanes; • Widening of the roundabout north overbridge to provide two lanes for the M60 NB to M62 EB physically segregated from three lanes for the M60 EB to M60 SB; • Eastern side of the roundabout marked for three lanes for the M60 EB to M60 SB; and • Roundabout exit to the M60 SB entry slip road initially marked as three lanes and then narrowed to two lanes.

3.2.13 At the end of PCF Stage 1, Option A1 and Option C1 were discarded for a number of design, economic, and environmental reasons following their respective assessments. Option A2 and C2 were chosen to be taken forward for further assessment and consideration at PCF Stage 2, which was in part due to their lower environmental impact, particularly when compared to Option A1, which required larger amounts of land-take than the two chosen options.

PCF Stage 2 Options (Option selection)

3.2.14 Early in PCF Stage 2, the two remaining options from PCF Stage 1 (Option A2 (renamed Option A2-1) and C2 (renamed Option C2-1)), were developed further and each split again into two new variants (Option A2-2 and C2-2) (Plates 3.5 and 3.6). Due to improvements in buildability, operational safety and estimated value for money of Options A2-2 and C2-2 over Options A2-1 and C2-1, it was decided that the Options A2-1 and C2-1 would be discarded, and A2-2 and C2-2 would be taken forward for the rest of the stage. Therefore, Option A2-2 and C2-2 were the focus of the PCF Stage 2 Environmental Assessment Report (EAR) (CH2M, 2019).

Plate 3.5 - Proposed Option A2-2 (excluding ALR)

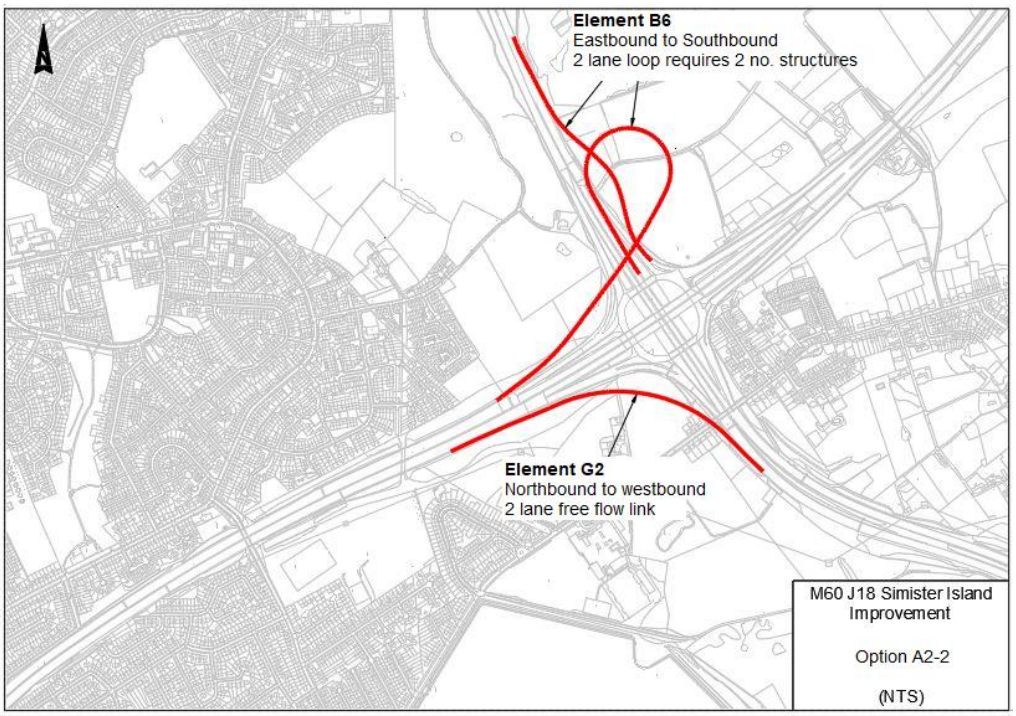
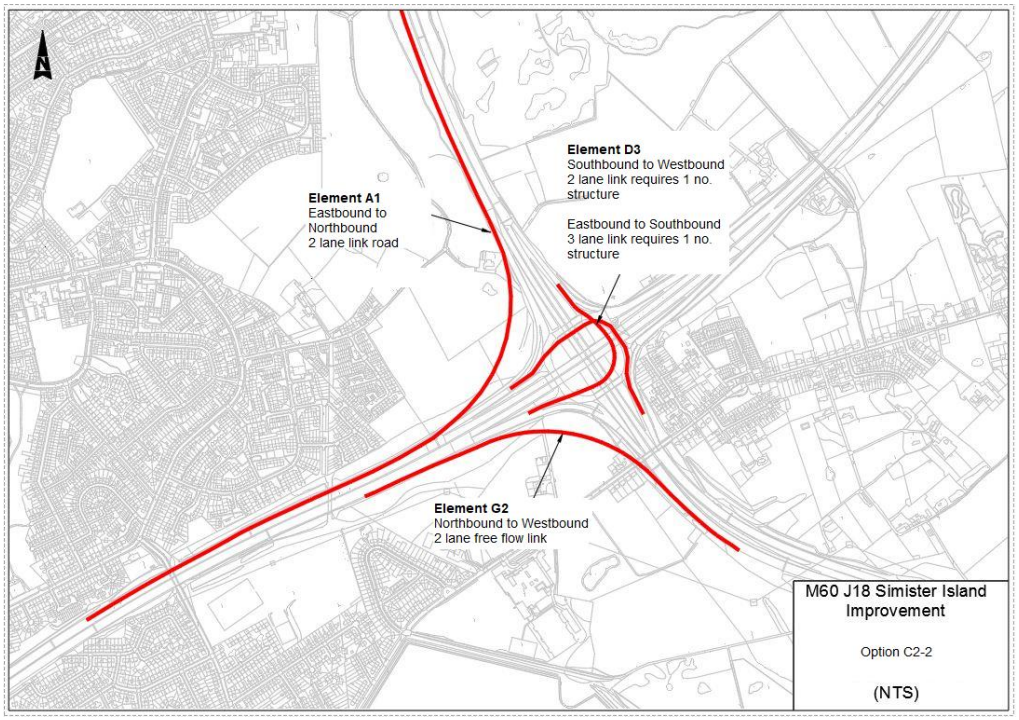


Plate 3.6 – Proposed Option C2-2 (excluding ALR)



3.2.15 During PCF Stage 2 a comparison of the four options was undertaken to identify if there was any difference in Likely Significant Effect (LSE) between the options (taken from PCF Stage 2 EAR (CH2M, 2019)) (see Table 3.4).

Table 3.4: Changes in LSE (Likely Significant effects) between Option A2-1 and A2-2, and C2-1 and C2-2

Subject	Option A2-1	Option A2-2	Option C2-1	Option C2-2	Design changes which altered significance (where applicable)	Comment
Air Quality	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Climate	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Cultural Heritage	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Landscape	**LSE**	**LSE**	**LSE**	**LSE**	N/A	All options would result in LSE on landscape and visual receptors. These effects would be significant on year of opening, generally reducing by year 15, to slight adverse for Option A2-2 and to negligible for C2-2.
Noise & Vibration	No LSE	No LSE	**LSE**	No LSE	Option C2-2 is proposed to reduce the radius of the M60 eastbound to M66 northbound interchange link from 360 m (as proposed in Option C2-1) to 255 m. Since this change will bring this link closer to the M60 J18 roundabout, hence further away from the sensitive receptors to the north-west of this junction, road traffic noise levels are expected to be lower at these receptors than those predicted for Option C2-1. Furthermore, since the options' designs were not yet fully developed in three dimension at PCF Stage 1, the noise model constructed for that stage assumed all road links and receptors to be located on level and flat ground, therefore not considering any noise screening from terrain changes associated with the scheme options. However, since topography data associated with the proposed scheme was made available at PCF Stage 2, the noise levels predicted at this stage accounted for any screening provided by new embankments and other topographic	Impacts could potentially be improved with mitigation. Option C2-2 is the best option based on the number of dwellings in non-compliance with policies identified in the PCF Stage 2 assessment for daytime and night-time periods. With Option C2-1, significant environmental effects are expected at 16 dwellings where increases in road traffic noise levels above 3 dB(A) are predicted. No significant environmental effects are expected with Option C2-2 where the maximum increase in road traffic noise level is predicted to be 2.1 dB(A). However, since topography data associated with the proposed scheme was made available at PCF Stage 2, noise screening from terrain changes associated with the proposed routes under study was not considered at PCF Stage 1.

Subject	Option A2-1	Option A2-2	Option C2-1	Option C2-2	Design changes which altered significance (where applicable)	Comment
					changes between the proposed links and sensitive receptors. This may have been another contributing factor towards a difference in significance between the variants.	
Biodiversity	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Geology & Soils	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Material Assets & Waste	No LSE	No LSE	No LSE	No LSE	N/A	No LSE after mitigation.
Population & Human Health	No LSE	No LSE	**LSE**	No LSE	Reduction in significance of effect between C2-1 and C2-2 due to reduced land take on Cowlgate Farm as a result of design changes to the M60 EB to M66 NB interchange link (Element A1). The radius was reduced from 360m to 255m to reduce land acquisition and the impact on Cowlgate Farm.	No LSE for any of the remaining Stage 2 options (Option A2-2 and C2-2) after mitigation.
Road Drainage & the Water Environment	**LSE**	**LSE**	**LSE**	**LSE**	N/A	LSE before mitigation due to anticipated failures associated with the existing baseline situation, and potentially after mitigation, depending on the type and amount of mitigation required. More information on the extent of failures (and thus effects) will be known at PCF Stage 3 when a HEWRAT assessment is undertaken for routine runoff and its impacts upon water quality. Delivery of improvements to Priority Outfalls Categories A-C is a performance indicator (PI) identified in the Operational Metrics Manual (OMM). It forms a supporting measure as part of "Delivering better Environmental Outcomes" outlined in the RIS performance specification. Where identified and validated Priority outfalls are "coincidental with planned major projects",

Subject	Option A2-1	Option A2-2	Option C2-1	Option C2-2	Design changes which altered significance (where applicable)	Comment
						then the Major Project should address these under scheme delivery as “business as usual.” Based upon this the whole project (and the whole drainage catchment to each outfall) needs to be included within the assessment in accordance with WebTAG, DMRB and in line with this PI.

3.2.16 Prior to Public Consultation and to aid clarity, the options changed names in 2020 as follows:

- Option A2-2 became Northern Loop
- Option C2-2 became Inner Links

3.2.17 Public consultation was then carried out on these two options and this is covered further in Chapter 4.

Preferred Route Announcement (PRA)

3.2.18 Following public consultation in Summer 2020, the Northern Loop option was chosen as the emerging preferred option. When selecting the preferred route, Highways England considered several criteria, including the scheme objectives, safety, benefits, costs, environmental effects, construction and feedback from the public consultation. While both options would meet the scheme objectives, the Northern Loop would provide greater capacity improvements and journey time savings for road users when compared to the Inner Links. These benefits, therefore, will be felt for longer into the future, as predicted traffic levels continue to grow. The option selected was also widely supported during the public consultation, with over 67% of respondents preferring the Northern Loop. Comparison of the options was reported in the PCF Stage 2 - Scheme Assessment Report (CH2M, 2020).

3.2.19 The Preferred Route Announcement (PRA) was for the Northern Loop Option was made on 27 January 2021.

Further scheme development

3.2.20 At the start of PCF Stage 3, the design was further refined. The main changes to the highway design from the PCF Stage 2 PRA design were as follows:

- Northern Loop – M60 westbound to M60 southbound – changed vertical alignment so that M66 southbound diverge link goes onto structure over the Northern Loop link. This results in a significant reduction of earthworks volumes compared to the PRA design and also removes a retaining wall adjacent to the near straight on the M66 southbound merge
- M60 westbound merge and link from M60 northbound – removed offline link that was shown in the PRA design to maintain use of existing M60 northbound to M60 westbound link. Westbound merge arrangement design has been modified so that the merge occurs prior to Haweswater Aqueduct and weaving length to M60 J17 diverge is increased
- M66 / M60 northbound and southbound lane provisions and cross-sections modified – hard shoulders added to design, accommodated by reducing the cross-sectional width of the central reserve to a minimum
- M60 J17 to J18 mainline lane provisions and cross-sections modified – To optimise available verge (which is highly constrained) the central reserve has been designed to be as efficient as possible taking into account the requirement for a concrete barrier

3.3 Assessment methodology

3.3.1 The Environmental Statement will provide a full description of the alternatives considered as well as a justification for why the preferred option was selected.

3.3.2 Now that a preferred route has been announced, the environmental assessment will consider alternative ways of delivering the Proposed Scheme. This will include consideration of:

- The location and type of technology to be included (e.g. traffic signals)
- The design (including size and scale) of the Proposed Scheme and associated structures (e.g. bridges and culverts)
- The construction methodology and programme (including the phasing of construction works and number and location of compounds and haul roads)
- Optimising the cut-fill balance to reduce material requirements and waste
- The location and extent of carriageway widening
- The alignment of new offline elements
- The location and design of proposed WCH diversions
- The location and design of drainage features (such as detention ponds)
- The type, location and extent of environmental mitigation

3.3.3 Reasons for the selection of the chosen options for the design will be defined in the Environmental Statement.

3.3.4 The assessment will fully consider the environmental impact of delivering the Proposed Scheme, including incorporating any mitigation embedded into the scheme design to avoid or reduce environmental effects. This will be documented in the Environmental Statement.

4. Consultation

4.1 Consultation undertaken to date

4.1.1 A public consultation was held for Northern Loop and Inner Links options from 22 June to 17 August 2020. Due to the COVID-19 pandemic this was carried out remotely, which included posting of a consultation brochure and response form to almost 10,000 addresses, provision of on-line information, and providing telephone events to replace face to face engagement.

4.1.2 Highways England received 817 responses to the consultation, which included responses from the local authorities, impacted landowners and local communities. Highways England received responses from a number of local authorities, including Bury Metropolitan Borough Council, Transport for Greater Manchester, Rochdale Borough Council, Salford City Council, Rochdale Development Authority and Lancashire County Council. Each of these stakeholders expressed the need for improvements at M60 J18, with the majority favouring the Northern Loop Option.

4.1.3 625 out of the 817 respondents agreed that there is a need to improve traffic flows through the junction and there was a clear preference for developing the Northern Loop Option over the Inner Links Option as a means of achieving this: 397 strongly supporting the Northern Loop Option compared to 65 strongly supporting the Inner Links Option.

4.1.4 Concerns raised by consultees included the following:

- The need to address congestion (162 responses)
- Air pollution (147 responses)
- Noise pollution (122 responses)
- Negative impacts on residents (115 responses)
- The carbon footprint (73 responses)
- Negative impact on the landscape (61 responses)
- Loss of land (25 responses)
- The impact on nature conservation (20 responses)

4.1.5 Other key concerns were:

- Safety (133 responses)
- Losing the hard shoulder (74 responses)
- Avoiding accidents (28 responses)
- Avoiding confusion for drivers (25 responses)

4.1.6 Another key concern was the construction phase impacts on the area and the duration of works.

4.1.7 Table 4.1 highlights key responses from statutory environmental bodies during the PCF Stage 2 consultation. Further information is available in the M60 Junction 18 Simister Island Interchange Report on Public Consultation (Accent, 2020).

Table 4.1: Statutory consultees - consultation responses

Stakeholder	Consultation response
Environment Agency	The Environment Agency's response focused on flood risk, water quality and environmental permitting. **Flood Risk**: The Environment Agency sees increased risk on watercourses from the works and the scheme may require a flood risk activity permit. There is potential to generate additional amounts of surface water, so Highways England will need to ensure that flood risk is not increased elsewhere. The Lead Local Flood Authority should be consulted on the proposals given their statutory role on surface water flood risk. **Water Quality**: The Water Framework Directive (and the associated statutory River Basin Management Plan) stipulates that there should be no deterioration of any waterbody. Measures to meet the overall objective of 'good' ecological status/potential should be addressed where possible. Surface water from the motorway network ultimately flows into the River Roch and River Irk watercourses which are monitored by the Environment Agency for compliance against the EU Water Framework Directive. Baseline evidence shows that they are currently failing to meet their required objectives with diffuse pollution pressures from 'Urban and Transport' noted as a contributing factor. The public consultation document notes that the two shortlisted options for the scheme are likely to have 'adverse impacts' on the water environment from a water quality perspective. It also states that 'these impacts to be mitigated and options for this will be identified and included in the design for the scheme as it progresses'. Any mitigation should consider opportunities to address current water quality impacts from the existing network to achieve a more sustainable solution to the final design of the scheme and/or avoid the need to retrospectively address current outfall problems in the future. These would ultimately cost more in the longer term. Therefore, as part of the further assessment work for the scheme (including any Environmental Statement) a Water Framework Directive Assessment should be undertaken to inform the scope around this. Opportunities to incorporate environmental best practice in the form of multifunctional and above ground sustainable urban drainage solutions (SUDs) should be adopted where feasible. This would not only address any water quality issues but also provide an opportunity for betterment with regards to biodiversity (net gains). **Environmental Permitting**: This development may require a permit under the Environmental Permitting (England and Wales) Regulations 2016 from the Environment Agency for any proposed works or structures, in, under, over or within eight metres of the bank of Castle Brook and Whitefield 4 Brook which, are designated 'main river'. Some activities are also now excluded or exempt. A permit is separate to and in addition to any planning permission granted.
Natural England	Natural England have no detailed comments to make about the proposal at this stage but want to be consulted in future.

Stakeholder	Consultation response
Public Health England (PHE)	PHE commented on the following implications of the PCF Stage 2 options: • Human health and wellbeing • Environmental hazards • Air quality • Noise • Electric and magnetic fields. The health of an individual or a population is the result of a complex interaction of a wide range of different determinants of health, from an individual's genetic makeup, to lifestyles and behaviours, and the communities, local economy, built and natural environments to global ecosystem trends. All developments will have some effect on the determinants of health, which in turn will influence the health and wellbeing of the general population, vulnerable groups and individual people. Although assessing impacts on health beyond direct effects from, for example, emissions to air or road traffic incidents is complex, there is a need to ensure a proportionate assessment. This should focus on significant effects of the upgrade. From this standpoint PHE made the following observations: **Human Health and Wellbeing**: PHE wants to see the application for a scoping opinion once the public consultation is complete and the preferred option is announced. At that point, PHE recommends the applicants follow the methodology provided by DMRB LA 112 (Population and Human Health), when assessing and reporting the effect of the development on population and human health. **Environmental Hazards**: PHE understands that Highways England will wish to avoid unnecessary duplication and that many issues including air quality, emissions to water, waste, contaminated land etc. will be covered elsewhere in their Environmental Statement (ES). The ES should summarise key information, risk assessments, proposed mitigation measures, conclusions and residual impacts, relating to human health. Compliance with the requirements of National Policy Statements and relevant guidance and standards should also be highlighted. **Air Quality**: PHE's position is that pollutants associated with combustion engine-based road traffic, particularly particulate matter and oxides of nitrogen are non-threshold. This means that an exposed population is likely to be subject to potential harm at any level and that reducing public exposures of non-threshold pollutants below air quality standards will have potential public health benefits. PHE supports minimising or mitigating public exposure to non-threshold air pollutants, addressing inequalities in exposure and maximising co-benefits (such as physical exercise). PHE encourages these to be considered during the development design, environmental and health impact assessment, and the development consent. **Electric and Magnetic Fields**: PHE notes that the current proposals do not appear to consider possible health impacts of Electric and Magnetic Fields (EMF). PHE requests that the ES clarifies this and if necessary, the proposer should confirm either that the proposed development does not impact any receptors from potential sources of EMF or ensure that an adequate assessment of the possible impacts is undertaken and included in the ES.

Stakeholder	Consultation response
Bury Metropolitan Borough Council – Environment Team	**Overall view of scheme**: The Environment Team is neutral about the options for the scheme but is concerned about the potential impacts on air quality and how these can be mitigated. **Current junction problems**: The junction as it is now is likely to be contributing to high nitrogen dioxide levels on A 56 and at the side of M60 between J17 and J18. Monitoring of nitrogen dioxide emissions close to residential housing at the side of the M60 between Junction 17 and 18 indicate that objectives for nitrogen dioxide were not met in 2019. **Views on the proposals**: The Environment Team is neutral about both options for the junction. The prospect of having 10 lanes of running traffic closer to the above residential properties is of great concern, as would be the impact on air quality for residents of Simister. The Environment Team suggests that Highways England must ensure that any improvements at Junction 17 and 18 have a positive impact on air quality and reduce nitrogen dioxide at nearby properties. The Environment Team will need to see the detailed air quality modelling carried out for the schemes and associated reports. It will need assurances that the project will not undermine proposals in the Greater Manchester Clean Air Plan to meet nitrogen dioxide objectives in the shortest time possible.
Rochdale Borough Council - Environment	The Council stated that, while there are issues to be assessed in due course through a statutory planning process, it welcomes the mitigation measures proposed to minimise additional impacts of both options in relation to nature conservation, noise and drainage and the water environment. The Council requests additional future proofing in the design of any proposals at Junction 18 to support a new northerly motorway access into the Northern Gateway site around Birch services together with necessary improvements to M66 Junction 3. However, it does not believe that Highways England has not engaged sufficiently to tackle air quality issues and support the Greater Manchester Clean Air Plan work. The Council stated that it will examine the air quality impacts of the selected improvement during the planning process when greater information is available. This, they stated will help them better understand how any scheme supports collective efforts to reduce nitrogen dioxide levels across Greater Manchester. The Council requests early engagement with Highways England on the design of the selected option to assess the timing of any planned work in terms of the Northern Gateway development as well as the impacts of any diversionary routes during the construction period. They stated that restrictions must be in place on several local roads within the Borough to minimise disturbance to residents. They stated that regular meeting with elected Members and communities will therefore be needed. The Council will also want to ensure we have ongoing dialogue with Highways England to ensure any master planning of the Northern Gateway employment site, and its early phases of its delivery, are integrated into the planning of whichever improvement option is taken forward.

4.2 Proposed consultation

Statutory consultation

4.2.1 This Environmental Scoping Report will be used by the Planning Inspectorate to consult relevant bodies on the proposed scope of the EIA. Stakeholders will be invited to provide feedback to the Planning Inspectorate, and such feedback will be used by the Planning Inspectorate in formulating the scoping opinion for the Proposed Scheme.

4.2.2 Highways England will consult with prescribed consultees as per the requirements of Section 42 of the Planning Act 2008. The consultees will be statutory consultees (Natural

England, the Environment Agency, Historic England, relevant planning authorities, Public Health England (PHE)), statutory undertakers and anyone who has an interest in the scheme (for example landowners and tenants).

4.2.3 The local community and wider public will be consulted on the Proposed Scheme via a statutory consultation programme in line with Section 47 of the Planning Act 2008.

4.2.4 The statutory consultation is expected to be undertaken during Autumn 2021 and last six weeks. A Statement of Community Consultation (SoCC) will be produced and published prior to the formal statutory consultation period. The SoCC will outline how Highways England will formally consult with the local community about the Proposed Scheme.

4.2.5 The purpose of this consultation will be to seek comments from the local community and statutory consultees on the Proposed Scheme. A Preliminary Environmental Information Report (PEIR) will be produced to support the consultation. The PEIR will include environmental information to enable consultees (both specialist and non-specialist) to understand the likely significant environmental effects of the Proposed Scheme, and measures proposed to mitigate such effects, to help inform their consultation responses.

4.2.6 The approach to statutory consultation has not yet been finalised but is likely to include (without being limited to, and depending on the COVID-19 pandemic situation):

- Meetings and workshops with local community groups and other local stakeholders
- Publication of brochures, reports and other information made available in local community facilities and online
- Public exhibitions where members of the community can meet with the project team

4.2.7 In addition, consultation materials will be available online during the consultation period, as well as an online response form enabling people to share their views.

4.2.8 A Consultation Report will be produced and submitted as part of the DCO application. This will summarise the feedback received during the consultation as well as how the project team have considered this feedback in the scheme design and EIA. The Consultation Report will demonstrate how Highways England has complied with the consultation requirements of the Planning Act 2008.

Technical consultation

4.2.9 The following stakeholders have been consulted during the scoping process:

- Local authority environmental health officers (Bury Metropolitan Borough Council)
- Local authority neighbourhood enforcement team (Bury Metropolitan Borough Council)

4.2.10 Stakeholder feedback relevant to the proposed assessment scope and methodology is provided in the individual aspect chapters (Chapters 6-15), where appropriate.

4.2.11 Technical engagement will continue throughout PCF Stage 3 to discuss the scope, potential effects, and proposed mitigation with relevant stakeholders. This engagement will take the form of email exchanges, telephone calls, virtual meetings, and face to face meetings where required.

5. Environmental assessment methodology

5.1 National Networks National Policy Statement

5.1.1 Sections 104 (2) and (9) of the Planning Act 2008 require applications to be decided in accordance with the relevant National Policy Statement. The National Networks National Policy Statement (NNNPS) (DfT, 2014) sets out principles by which applications for road and rail schemes should be assessed. Paragraph 4.3 of the NNNPS states:

'In considering any proposed development and in particular when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State should take into account:

- *Its potential benefits including the facilitation of economic development, including job creation, housing and environmental improvement, and any long-term or wider benefits;*
- *Its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measure to avoid, reduce or compensate for any adverse impacts.'*

5.1.2 The Proposed Scheme will need to meet the policies outlined in the NNNPS. Each aspect chapter in the Environmental Statement will set out the key NNNPS policy relevant to the aspect and highlight how the Proposed Scheme meets these requirements.

5.1.3 In addition to the NNNPS, the EIA will also consider local planning policy. The local planning policy framework is set out in Appendix A. Each aspect will take into account the relevant policies in their assessments.

5.2 Surveys and predictive techniques and methods

Design Manual for Roads and Bridges

5.2.1 The environmental assessment will comply with the general standards set out within DMRB LA 104: Environmental Assessment and Monitoring (Highways England, 2020; hereafter referred to as DMRB LA 104), as well as the aspect-specific DMRB standards (as contained within DMRB LA 105 to 115 and 120). DMRB is the established standard for assessing the environmental impacts of highway schemes and has been developed by Highways England in collaboration with relevant stakeholders. DMRB has recently undergone an extensive update to capture the requirements of the EIA Regulations 2017.

5.2.2 Where relevant, the environmental assessment will draw on relevant topic guidance and best practice. More details on the methods to be used are provided in each of the aspect chapters (Chapters 6 to 15).

Study areas

5.2.3 Various study areas have been used to assess the impact on environmental receptors following DMRB standards and aspect-specific guidance. Specific study areas are outlined in the individual aspect chapters.

Start of works, opening year and design year

5.2.4 For the purpose of the EIA, the construction start of works is 2025, the opening year is 2027, and the design year is 2042 (15 years after opening to traffic).

Surveys and assessment

5.2.5 Several surveys have commenced in 2021 to inform the environmental assessment, including:

- UK habitats survey
- Great crested newt surveys
- Wintering birds survey
- Landscape winter survey
- Air quality monitoring

5.2.6 At the time of writing, most of these surveys are only partially complete. These surveys will mostly be completed in full in 2021 (the wintering bird survey will be completed in January 2022). Additional surveys will also be required to inform the EIA, and these have been identified in the aspect chapters as part of their scope and methodology.

5.2.7 In addition to surveys, other predictive techniques will be used to inform the EIA, such as air quality, noise, and flood risk modelling. Further information on the proposed surveys and assessments to be undertaken is provided in the individual aspect chapters.

Future baseline

5.2.8 The baseline conditions used for assessment purposes are the predicted future conditions that would exist in the absence of the Proposed Scheme either (a) at the time that construction is expected to start, for impacts arising from construction, (b) at the time that the Proposed Scheme is expected to open to traffic, for impacts arising from its operation, or (c) the design year, 15 years after opening. The future baseline is considered in each of the environmental aspect chapters, as relevant to the assessment in question.

Major accidents and disasters

5.2.9 Schedule 4, Part 5 of the EIA Regulations require that risks due to accidents and disasters are considered within the EIA. At this stage, a two-stage qualitative assessment has been undertaken using technical judgement to identify whether the Proposed Scheme is at risk from major accidents and disasters. Firstly, a screening matrix was completed detailing a long list of major accidents and disasters that could occur (see Appendix C). Accidents and disasters requiring further consideration were subject to a second more detailed risk assessment. The more detailed risk assessment considered the following:

- The vulnerability of the project to risks of major accidents and disasters
- Any consequential changes in the predicted effects of the project on environmental aspects from major accidents and disasters

5.2.10 The risk assessment concluded that there are two residual risks remaining that would need to be addressed through the design of the Proposed Scheme. These are inland floods and mass movements and ground hazards.

5.2.11 Inland floods are partly covered under Chapter 15: Climate on climate change adaptation, and partly through Chapter 14: Road Drainage and the Water Environment in terms of reducing future flood risk. Impacts and mitigation associated with these will be covered in the relevant aspect chapters of the Environmental Statement.

5.2.12 Mass movements and ground hazards, including risks of subsidence, are documented within the Preliminary Sources Study Report (CH2M, 2018). This summarises the potential geohazards and risks associated with the ground conditions that need to be factored into the design process and assessed going forward. These risks are being further assessed through a programme of ground investigation surveys. The results and proposed mitigation will be presented within a Ground Investigation Report (GIR) and will be used to inform the designs.

5.2.13 The Preliminary Sources Study Report also contains an initial review of potential land contamination that may be present within the study area. Potential sources of contamination include made ground such as infilled sand and gravel pits and industrial areas. The Proposed Scheme could potentially open up pathways between contaminated sources and environmental receptors. These potential impacts are assessed within the relevant aspect chapters such as Chapter 10: Geology and Soils, Chapter 13: Population and Human Health and Chapter 14: Road Drainage and the Water Environment.

Heat and radiation

5.2.14 Schedule 4, Part 1 of the EIA Regulations introduced a requirement to consider the likely significant effects of the Proposed Scheme on heat and radiation.

5.2.15 The construction and operation of the Proposed Scheme would not introduce any source of radiation and would only generate limited amounts of heat from technology. The assessment of heat and radiation is therefore not considered relevant to the Proposed Scheme and has been scoped out of further assessment.

Transboundary effects

5.2.16 Regulation 32 of the EIA Regulations requires the consideration of any likely significant effects on the environment of another European Economic Area (EEA) State.

5.2.17 Guidance upon the consideration of transboundary effects is provided in the Planning Inspectorate's Advice Note Twelve: Transboundary Impacts and Process (2018).

5.2.18 A screening matrix is included in Appendix D which provides the consideration of transboundary effects for the Proposed Scheme, taking guidance from Planning Inspectorate's Advice Note Twelve (2018).

5.3 General assessment assumptions and limitations

5.3.1 The Proposed Scheme is at an early stage in the scheme development. There are no detailed designs and the construction methodology is not fully defined at this stage. There could therefore be changes to the provisional Order Limits to accommodate changes in temporary working areas, or changes in permanent footprint associated with the design and/or environmental mitigation areas. The provisional Order Limits presented in Figure 2.1 are considered a 'worst-case' estimate of likely land use requirements, which may reduce as the Proposed Scheme is developed towards DCO submission.

5.3.2 A traffic model was built at PCF Stage 2 which was used to understand the likely impacts on the road network (including on air quality and noise) and to inform the options appraisal. A new traffic model is being built for PCF Stage 3, the output of which will feed into the EIA. Updated traffic modelling outputs from the new model were not available at the time of writing this Environmental Scoping Report.

5.3.3 It is assumed that the information provided by third-party public sources is accurate at the time of preparing this report. Data sources will be verified and updated throughout the EIA process. References are included to provide details of relevant sources at this stage.

5.3.4 Aspect specific assumptions and limitations are included within each aspect chapter. This includes information on any data gaps at this stage in the assessment and how these gaps will be filled over the course of the EIA.

5.3.5 This Environmental Scoping Report was prepared during the COVID-19 coronavirus pandemic. At the time of writing this report (March/April 2021), the UK Government was in the process of relaxing the extensive lockdown measures in place in England, however, there is a possibility that restrictions could be re-implemented at a local, regional, or national level in the event that the rate of infection increases. Depending on the development, duration and extent of such future restrictions, some of the site-based/survey work proposed as part of the scope may not be achievable, and traditional methods of public engagement may also be affected. If this is the case, Highways England would seek to identify viable and robust alternatives to the approach set out in this Environmental Scoping Report and would work with relevant consultees to agree a pragmatic way forward.

Mitigation and enhancement

5.3.6 Mitigation measures aim to avoid, reduce and, where possible, remedy significant adverse environmental effects. The purpose of any mitigation measure is to eliminate the effect or, if not possible, to reduce its significance. Mitigation measures for the Proposed Scheme will be developed in accordance with the mitigation hierarchy of avoidance, reduction, restoration and compensation, as described in DMRB LA 104, paragraph 3.23.

5.3.1 For the purposes of the environmental assessment, two types of mitigation will be used, in accordance with DMRB LA 104 (paragraph 3.24):

- Embedded mitigation: project design principles adopted to avoid or prevent adverse environmental effects. This will form part of the project description in the Environmental Statement.
- Essential mitigation: measures required to reduce and if possible offset likely significant adverse environmental effects, in support of the reported significance of effects in the environmental assessment.

5.3.2 The 1st Iteration of the Environmental Management Plan (EMP) will be produced following DMRB LA 120: Environmental Management Plans (Highways England, 2020), which will contain all measures, including the Register of Environmental Actions and Commitments (REAC), to manage environmental effects in construction and operation. This EMP will provide the equivalent to a Code of Construction Practice (CoCP) and therefore the framework for the future production of the more detailed 2nd Iteration of the EMP.

5.3.3 If effects cannot be mitigated, compensatory measures would be considered, for example, to provide replacement habitat.

5.3.4 Mitigation and enhancement measures will be developed further in PCF Stage 3 and will be outlined in the Environmental Statement. Mitigation and enhancement proposals will be developed in consultation with statutory consultees, where appropriate.

5.4 Significance criteria

5.4.1 Appendix B contains a table summarising the criteria used to assess the magnitude of impact (amount of change), which follows the standards within DMRB or aspect-specific guidance (as specified in each aspect chapter). These criteria have been used to identify the potential impacts that might occur due to the construction and operation of the Proposed Scheme. Impacts may be adverse or beneficial, direct, indirect, secondary or cumulative, temporary or permanent, short, medium or long term. Impacts can affect the environment in a variety of ways.

5.4.2 Significance of effect is derived through a combination of the sensitivity of a receptor affected (value) and the magnitude of the impact. A typical matrix for these two variables is provided in DMRB LA 104 and replicated in Table 5.1. Appendix B shows how the baseline has been assessed in terms of its value.

Table 5.1: Significance matrix (taken from DMRB LA 104)

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

5.4.3 Certain disciplines do not use a matrix-based approach, because they use calculations to assess effects in numerical terms. These are noise and air quality aspects and flood risk matter.

5.4.4 In all cases, professional judgement is applied to the assessment to underpin the outcomes identified through the matrix or calculation assessments. Where professional judgement is used, this is accompanied by text to explain the reasons and justification.

5.4.5 Significance categories are described in Table 5.2. This describes effects with a very large or a large significance as being ‘material’ and ‘likely to be material’ in the decision-making process respectively. Therefore, large and very large effects are considered ‘significant’ for the purposes of the EIA Regulations. Moderate effects are described as potentially

being material in the decision-making process. Moderate residual effects are therefore also typically considered as 'significant'.

Table 5.2: Descriptors of the significance of effect categories (taken from DMRB LA 104)

Significance category	Typical descriptors of effect
Very large	Effects at this level are material in the decision-making process.
Large	Effects at this level are likely to be material in the decision-making process.
Moderate	Effects at this level can be considered to be material decision-making factors.
Slight	Effects at this level are not material in the decision-making process.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

5.5 Duplication of assessment

5.5.1 The ES will be prepared taking into account other relevant environmental assessments with a view to avoiding duplication of assessment. The other assessments are described below.

Habitats Regulations Assessment

5.5.2 A Habitats Regulations Assessment (HRA) stage 1 screening exercise was undertaken at PCF Stage 2 (CH2M, 2018). The HRA identified no possible source-receptor pathways to designated sites. It concluded that no likely significant effects on any European sites are anticipated, when considered alone or in combination with other plans and projects.

5.5.3 Natural England will be consulted on the conclusions of the screening exercise to confirm that an Appropriate Assessment is not required.

Water Environment Regulations

5.5.4 The impact of the Proposed Scheme on the Water Framework Directive (WFD) is now being assessed under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WER). The impacts to the WER objectives are being assessed in line with the Planning Inspectorate's Advice Note Eighteen: The Water Framework Directive (2017). A standalone WFD compliance assessment will be prepared as an appendix to the Environmental Statement and the conclusions summarised in the Road Drainage and the Water Environment chapter of the Environmental Statement.

Flood Risk Assessment

5.5.5 A Flood Risk Assessment will be undertaken and reported within a standalone report which will form an appendix to the Environmental Statement. To avoid duplication, the Road Drainage and the Water Environment chapter of the Environmental Statement will cross refer to this report and summarise where appropriate.

Health Impact Assessment

5.5.6 The impact of the Proposed Scheme on health will be assessed in the Population and Human Health chapter of the Environmental Statement. This in turn will be supported by technical appendices as required. A standalone Health Impact Assessment (separate from the EIA) will not be undertaken.

5.6 Environmental Statement

5.6.1 The results of the EIA will be reported within an Environmental Statement. An outline structure of the Environmental Statement is provided in Table 5.3.

Table 5.3: Outline structure of the Environmental Statement

Subject	Description
Non-technical summary (NTS)	A summary of the EIA using non-technical language. The NTS will summarise the scheme description, alternatives considered, the likely significant effects, and the proposed mitigation, monitoring and enhancement requirements.
Chapter 1. Introduction	A brief introduction to the scheme, legislative and policy framework, competent expertise used to undertake the EIA, and the purpose and structure of the Environmental Statement.
Chapter 2. The project	Description of the scheme location, the need for the scheme, scheme objectives, and baseline scenario. A scheme description will be provided comprising information on the site, design, and physical characteristics of the development. The scheme description will describe both the construction and operation of the scheme, as well as long term management and a statement of whether the EIA is to consider decommissioning.
Chapter 3. Assessment of alternatives	Description of the main alternatives considered during the design and development of the scheme, and the justification for the choice of the preferred option, including a comparison of environmental effects.
Chapter 4. Environmental assessment methodology	This chapter will set out the scope of the EIA, including a summary of how this has been influenced by statutory consultation. The general assessment approach will be detailed including the guidance and methodologies to be used, general assessment criteria and terminology to be used, and the approach to mitigation, enhancement, and monitoring.
Chapter 5. Air quality	Chapters 5-14 will assess the potential significant effects from the Proposed Scheme. Each of the specialist chapters will include the following: • competent expert evidence • legislative and policy framework • assessment methodology • assessment assumptions and limitations • study area • baseline conditions • potential impacts • design, mitigation and enhancement measures • assessment of likely significant effects
Chapter 6. Cultural heritage	
Chapter 7. Landscape	
Chapter 8. Biodiversity	
Chapter 9. Geology and soils	
Chapter 10. Material assets and waste	
Chapter 11. Noise and vibration	
Chapter 12. Population and human health	

Subject	Description
Chapter 13. Road drainage and the water environment	• monitoring requirements
Chapter 14. Climate	
Chapter 15. Assessment of cumulative effects	This chapter will assess the cumulative effects of other major developments which could overlap with the Proposed Scheme.
Chapter 16. Summary	Summary of the residual effects (highlighting where significant residual effects are predicted), and a summary of mitigation measures and monitoring requirements. This will form the basis of a commitments schedule to be included within the EMP.
Technical appendices and figures (including location, design, and constraints plans).	

6. Air quality

6.1 NNNPS requirements

6.1.1 The National Networks National Policy Statement (NNNPS) (Department for Transport, 2014) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

6.1.2 Key policy from the NNNPS relevant to air quality is set out below:

- Paragraphs 5.3-5.4 of the NNNPS outline the potential impacts of construction or operation of national network projects (i.e. changes in pollutant emissions) on human health as well as on protected species and habitats. These paragraphs also outline UK legislation such as local air quality objectives (AQO) as well as EU legislation, such as limit values (LV) for the main pollutants in the Ambient Air Quality Directive (2008/50/EU), which Member States are required to meet by various dates.
- National AQOs are defined in the Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002. The EU Ambient Air Quality Directive (2008/50/EU) forms the basis for UK air quality legislation. EU LVs are transposed into UK law by the Air Quality Standards (England) Regulations 2010. The AQOs for nitrogen oxides (NO_x), nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter less than 10 µm (PM_{10}) are shown in Table 6.1. Pollutant $PM_{2.5}$ is also listed as the finer fraction of PM_{10} to include much of the combustion-based particulate, responsible for serious respiratory illnesses.
- Paragraphs 5.6-5.9 state that where the impacts of any project may have a significant effect on air quality, then an assessment must be undertaken as part of the environmental statement. These paragraphs then go on to describe that the environmental statement must include existing air quality levels, forecasts of air quality at the time of project opening and significant effects on air quality, using the Department for Environment, Food and Rural Affairs' (Defra) future national projections of air quality during the modelling process. A judgement on the risks as to whether the project would affect the UK's ability to comply with the Air Quality Directive must also be included.
- Paragraph 5.12 states that the SoS must give air quality considerations substantial weight where, after taking into account mitigation, a project would lead to a significant air quality impact in relation to EIA and/or where they lead to a deterioration in air quality in a zone/agglomeration.
- Paragraph 5.13 states that the SoS should refuse consent where, after taking into account mitigation, the air quality impacts of the scheme will result in a zone/agglomeration currently reported as being compliant with the Air Quality Directive becoming non-compliant; or affect the ability of a non-compliant area to achieve compliance within the most recent timescales reported to the European Commission at the time of the decision.
- Paragraphs 5.14-5.15 state that mitigation measures should be included in order to reduce any negative impacts caused by the proposed project. The SoS should then consider whether the mitigation measures put forward by the applicant are sufficient.

6.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

Table 6.1: AQOs for NO_x, NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Concentration	Averaging period
Nitrogen Oxides (NO_x)	30 µg/m^3	Annual mean
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-Hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-Hour mean
	40 µg/m^3	Annual mean
Particulate Matter ($PM_{2.5}$)	25 µg/m^3	Annual mean

6.2 Study area

6.2.1 For the construction phase, in line with Design Manual for Roads and Bridges (DMRB) LA 105: Air quality (Highways England, 2019; hereafter referred to as DMRB LA 105), potential air quality impacts from construction dust will be considered within 200m of all construction activities, as discussed further in sections 6.4.1 and 6.4.2. If necessary a study area for changes in road traffic during construction will also be defined as discussed below for the operational assessment, however, for the purposes of scoping and based on professional judgement from previous similar projects it is assumed that road traffic assessment of changes in road traffic during construction is scoped out.

6.2.2 The study area for the operational local air quality assessment will be defined following the traffic screening process outlined within DMRB LA 105, which identifies the Affected Road Network (ARN) based on predicted changes in traffic between the Opening Year Do-Minimum (DM) and Do-Something (DS) scenarios. Roads will be included in the ARN where any of the following criteria are met between the Opening Year DM and DS:

- Daily traffic flows change by more than 1,000 by annual average daily traffic (AADT)
- Heavy duty vehicle (HDV) flows change by more than 200 AADT
- Daily average or peak hour speed bands change
- Horizonal road alignment changes by 5m or more

6.2.3 The traffic screening process will be applied only to the Traffic Reliability Area (TRA), which is the area covered by the traffic model that the competent expert for traffic has identified as reliable for inclusion in an environmental assessment. If the ARN extends to the extent of the TRA then the traffic modelled roads beyond the TRA will also be screened using the above criteria and the traffic modelling team will be consulted where these instances arise as to the appropriateness of the underlying traffic data and whether the TRA can be expanded to include these additional links.

6.2.4 Sensitive receptors within 200m of the ARN will be identified and the study area will then be defined as the ARN plus all other roads within 200m of any of these sensitive receptors.

6.2.5 This PCF Stage 3 assessment will apply a different traffic model from that applied at the previous PCF Stage 2. PCF Stage 3 traffic data are not yet available and therefore an ARN cannot be determined until later in this stage. The PCF Stage 3 ARN will be defined based on the criteria in section 6.2.2. Prior to modelled traffic data being available, the baseline conditions in this scoping report and potential receiving environment sensitivity have been assessed based on the PCF Stage 2 ARN. It should be noted that the PCF Stage 2 ARN was created using different criteria for speeds, based on older DMRB guidance available at the time.

6.2.6 Figure 6.1 shows the extent of the PCF Stage 2 ARN. The roads that were considered likely to be 'affected' at PCF Stage 2 were predominantly located along the M60 between J15 and J19 as well as between the M66 J3 and J4 and the M62 J18 and J20, as well as other major roads near to the junctions. It is noted that the ARN determined at PCF Stage 3 could vary from the PCF Stage 2 ARN; however, in the absence of any other data the PCF Stage 2 ARN has been used to define the area for this scoping report. As and when PCF Stage 3 traffic data are available, an ARN will be determined and baseline conditions and receiving environment sensitivity reviewed.

6.3 Baseline conditions

Baseline sources

6.3.1 A review of the baseline air quality conditions in the area around the Proposed Scheme has been undertaken based on information from the following sources:

- Greater Manchester Combined Authority 2019 Air Quality Annual Status Report (ASR; GMCA, 2020)
- Transport for Greater Manchester (TfGM) and Highways England monitoring data (2020)
- Defra background maps (Defra, 2020a)
- Defra PCM Census ID projections (Defra, 2020b)
- Ordnance Survey Address Base+ (AB+) data
- Ecological open data (Data.gov.uk, 2020a to 2020d)
- Ordnance Survey maps of the surrounding area

6.3.2 All data used in the baseline assessment are publicly available, with the exception of the Ordnance Survey AB+ data, which was purchased to conduct the PCF Stage 2 assessment, and the Highways England and TfGM monitoring data.

Baseline information

6.3.3 The Proposed Scheme is predominantly located within the administrative boundary of Bury Metropolitan Borough Council, though it extends into the boundaries of Rochdale Borough Council and Manchester City Council. The extent of the ARN determined in the Stage 2 PCF assessment remains within the boundaries of these three local authorities.

Monitoring

6.3.4 All reported monitoring data has either over 75% data capture (i.e. has 9 or more months' worth of data for the represented year) or where this is not stated in the source (i.e. some of the older local authority data), data capture is assumed to be greater than 75%.

6.3.5 Local authorities regularly review, assess and report air quality measured within their areas; the Greater Manchester Combined Authority undertakes air quality monitoring as part of their Local Air Quality Management (LAQM) duties across the entirety of Greater Manchester. This is carried out using a combination of both continuous monitoring stations and passive (diffusion tube) analysers. The annual mean NO_2 data collected between 2015 and 2019 at the monitoring locations within 200m of the ARN defined at PCF Stage 2 are shown in Figure 6.2 (all values are in $\mu g/m^3$).

6.3.6 The five-year monitoring data measured at locations within the study area do not show a definitive decreasing trend in annual mean NO_2 concentrations, and there are exceedances (as well as concentrations close to exceeding) of the AQO of $40\mu g/m^3$ measured in 2019. However, future NO_x emissions are projected to decline, due to cleaner road vehicles penetrating the vehicle fleet, and the majority of monitoring locations are at the roadside (i.e. close to the source) instead of at relevant exposure locations.

6.3.7 The continuous monitoring stations also measure particulate matter (PM_{10}). All of the annual mean concentrations were below the AQO of $40\mu g/m^3$ at both of the monitoring locations between 2015 and 2019 (see Figure 6.2).

6.3.8 Highways England NO_2 diffusion tube monitoring was previously undertaken in the vicinity of the Proposed Scheme; however, this is now discontinued, with the latest monitoring survey having taken place in 2016. Those monitoring results indicated a limited number of sites exceeding the AQO. Some of these sites were used to verify the modelling predictions of NO_2 in the PCF Stage 2 assessment.

6.3.9 Longer-term monitoring is also undertaken by Highways England across England at key locations. None of these locations are close enough to the Stage 2 ARN to be considered further; however, this decision will be reviewed when the Stage 3 ARN is defined.

6.3.10 In addition to local authorities, TfGM also currently undertake NO_2 monitoring at the sites in close proximity to the Proposed Scheme, as seen in Figure 6.2. Many of these sites will be suitable for verification purposes of the PCF Stage 3 assessment.

6.3.11 Spatially, there are gaps where additional monitoring would result in a more comprehensive baseline and be used to verify modelling results at PCF Stage 3. An additional six-month monitoring survey to support the assessment at PCF Stage 3 will therefore be undertaken by members of the Project team from April 2021, at locations described below.

6.3.12 New monitoring locations along the PCF Stage 2 ARN were identified (including around the vicinity of the Proposed Scheme and along the M60, M62 and M66 motorway corridors) to support the necessary verification of the air quality modelling results carried out at PCF Stage 3. Other sites that are not appropriate for verification (e.g. because they are behind a noise barrier or shielded from the road and therefore cannot be accurately modelled) were chosen in discussion with Highways England, typically at locations close

to the proposed scheme, in order to assess the risk of exceedances such as near residential properties within close proximity of the M60.

6.3.13 Figure 6.2 shows the 21 new NO_2 diffusion tube monitoring locations (including the recommissioned monitoring locations from the previous Highways England survey), which have been discussed with Bury MBC, including co-location with one Bury MBC site and two TfGM sites, required for the PCF Stage 3 assessment. Figure 6.2 also includes the TfGM sites which will be used to support model verification, in addition to the local authority locations previously mentioned. The TfGM monitoring data will be published and available in advance of the PCF Stage 3 assessment, whereas the local authority data is currently publicly available.

Air quality management areas (AQMAs)

6.3.14 Local authorities review current and future air quality to assess whether or not air quality objectives (AQOs) are being achieved or are likely to be achieved. Where it is anticipated that an AQO will not be met, it is a requirement that an AQMA is declared. Where an AQMA is declared, the local authority is obliged to produce an Action Plan in pursuit of the achievement of the AQOs. The scheme is located almost entirely in the Greater Manchester AQMA (as seen in Figure 6.3), which was declared for exceedances of the NO_2 AQO in 2016.

Backgrounds

6.3.15 Defra provides background maps for a range of pollutants for all years from 2018 to 2030, which show predicted background pollutant concentrations for 1km x 1km grid squares across the UK.

6.3.16 The range of Base Year (2018) and Opening Year (2027) background concentrations for the grid squares that cover the PCF Stage 2 ARN (see Table 6.2) are all within the AQOs for annual mean NO_2, NO_x and PM_{10} in the Opening Year, although there are exceedances of NO_x concentrations in the Base Year.

Table 6.2: Background concentration data around PCF Stage 2 ARN

Pollutant	AQO (µg/m^3)	2018 Base Year (µg/m^3)	2027 Opening Year (µg/m^3)
NO_x	30	19.5-49.4	13.7-27.7
NO_2	40	14.3-31.8	10.7-19.5
PM_{10}	40	11.2-14.8	10.3-13.4

Pollution Climate Mapping Census IDs

6.3.17 The Pollution Climate Mapping (PCM) model is a collection of models provided by Defra (Defra, 2020b). This was developed to report on compliance with the European Air Quality Directive (EU Directive (2008/50/EC)) Limit Values and is run by Ricardo Energy & Environment (on behalf of Defra).

6.3.18 The PCM model has been reviewed to assess whether any PCM links correspond with the Stage 2 ARN and if the identified links are likely to comply with the EU Limit Values. Figure 6.4 (all values are in µg/m^3) identifies the corresponding PCM links, where 2018 Base Year roadside annual mean NO_2 concentrations are predicted to be between

28.3µg/m^3 and 40.1µg/m^3. Based on Defra's PCM forecasts, concentrations are predicted to be between 17.8µg/m^3 and 24.1µg/m^3 in the 2027 Opening Year, and therefore compliant with the EU Directive Limit Values. There are no exceedances of the Limit Values predicted in 2027.

6.3.19 During PCF Stage 3, a compliance risk assessment will be undertaken, as per DMRB LA 105, whereby any qualifying features (i.e. public access (e.g. footpaths) and sensitive receptors (e.g. residential properties) within 15m of the running lane or kerbside and 25m away from any junctions) along PCM links that coincide with the ARN defined at this stage will be considered.

Human health receptors

6.3.20 Locations that are sensitive to air quality include residential properties and buildings used by the young, elderly and other susceptible populations, such as schools and hospitals (as defined in DMRB LA 105). There are numerous receptors (residential properties and schools) in Simister, Whitefield and Prestwich located within 200m of the PCF Stage 2 ARN.

6.3.21 The 2023 Opening Year (used at PCF Stage 2) NO_2 concentrations at the worst-case receptors (as defined in DMRB LA 105) were modelled during PCF Stage 2. A number of the sensitive receptors were initially predicted to exceed the AQO in 2023 using a simple modelling approach, although, further, more detailed ADMS-Roads (Atmospheric Dispersion Modelling System) modelling found that there were no exceedances. However, while PCF Stage 2 found no significant effects, the possibility of exceedances owing to the Proposed Scheme cannot be ruled out.

6.3.22 There may be other sensitive receptors identified when the ARN is re-defined in the PCF Stage 3 assessment, as the traffic model will be updated prior to the assessment taking place and additional links may be included in the ARN. Sensitive receptors will be included in the local air quality assessment should they be deemed to be at risk of exceedance, or to represent relevant ARN links.

Ecological receptors

6.3.23 DMRB LA 105 states that designated habitats are 'internationally, nationally and locally designated sites of ecological conservation importance for protected species and for habitats and other species identified as being of principal importance for the conservation of biodiversity'.

6.3.24 At PCF Stage 2, no ecological sites met the DMRB assessment criteria at that time. However, the DMRB standard was updated in 2019, after the PCF Stage 2 assessment took place, and now indicates that designated sites within 200m of the ARN need to be considered during air quality assessments.

6.3.25 A preliminary desk study has identified one Site of Special Scientific Interest (SSSI), one Special Area of Conservation (SAC), six Ancient Woodland (AW) sites, three Local Nature Reserves (LNRs) and seven Sites of Biological Importance (SBIs) within 200m of the PCF Stage 2 ARN. These can be seen in Figure 6.3.

6.3.26 As the ARN for PCF Stage 3 is yet to be defined, this list is not exhaustive and may change. Once the PCF Stage 3 ARN is defined, a comprehensive list of designated sites

that meet the DMRB LA 105 criteria will be established, in discussion with the scheme ecologists, and the air quality effects on the identified sites will be assessed.

Future baseline

6.3.27 The Opening Year (2027) baseline conditions will be established by following the methodology outlined in Section 6.7, based on a Do-Minimum (DM) traffic scenario. The DM traffic scenario will be representative of the predicted growth in traffic, accounting for local and regional development. Opening Year vehicle emission estimates will use fleet proportions for 2027 as per the latest Highways England (HE) speed banded emission calculation tool (to be provided by HE).

Value of receptors

6.3.28 All sensitive receptors will be considered of equal (high) value.

Receiving environment sensitivity

6.3.29 The baseline conditions described above have been used to define the receiving environment sensitivity with reference to the criteria in Table 2.11a/b of DMRB LA 105. The sensitivity of the receiving environment is considered to be medium, for the following reasons:

- 2019 monitored exceedances of the AQO for NO_2 within the study area
- The Proposed Scheme being situated almost entirely within the Greater Manchester AQMA and near the TfGM Clean Air Zone
- Concentrations modelled at sensitive receptors using the DMRB screening model assessment at PCF Stage 2, which were exceeding and close to exceeding the AQO in the Opening Year
- The potential exceedance of lower critical load thresholds through nitrogen deposition at the designated ecological sites identified within 200m of the ARN

6.4 Potential impacts

Construction

6.4.1 Construction activities can give rise to emissions of dust, which could cause damage to vegetation or annoyance associated with the soiling of surfaces. Construction dust emissions can also elevate airborne particulate matter concentrations at off-site locations, which may affect human health if mitigation measures are not implemented. There is potential for adverse impacts to arise from the deposition of construction dust at sensitive receptors. Therefore, a construction dust assessment will be undertaken to determine the construction dust risk potential, as per DMRB LA 105.

6.4.2 Increases in heavy duty vehicle (HDV) movements on roads, associated with construction activities, can lead to elevated NO_x and PM_{10} emissions on affected roads. There is potential for adverse impacts to occur at sensitive human health receptors, designated ecological sites and PCM receptors if pollutant concentrations are increased as a result of construction traffic, both in terms of changes in traffic flows and speeds. DMRB LA 105 states that a construction traffic assessment should be completed if the construction duration is longer than 2 years. The construction duration for the Proposed Scheme is

currently planned for 2023 to 2027, so would meet this criterion. Therefore, construction traffic screening will be undertaken for the worst-case construction year as per DMRB LA 105, however, based on professional judgement, it is unlikely that any road will meet the screening criteria and therefore further assessment is likely to be scoped out during traffic screening. In the event that any roads meet the screening criteria then the methodology will follow that outlined for the operational assessment of road traffic.

Operation

6.4.3 There is potential for the Proposed Scheme to adversely influence (i.e. increase) pollutant concentrations at sensitive human health receptors and designated ecological sites. These will be assessed in the PCF Stage 3 local air quality assessment following a detailed methodology. As per DMRB LA 105, a local air quality assessment is required where any of the traffic scoping criteria in Section 6.2.2 are triggered on roads within 200m of sensitive receptors.

6.4.4 In accordance with DMRB LA 105, PCM receptors will be modelled for the EU compliance assessment where any ARN road is located on a PCM Census ID road with qualifying features (as outlined in paragraph 6.3.19).

Summary of scope

6.4.5 Table 6.3 summarises the proposed scope for air quality. These matters have been scoped in based on the presence of sensitive receptors and PCM Census IDs in the vicinity of the Proposed Scheme.

Table 6.3: Summary of air quality scope

Matter	Scoped in - construction	Scoped in - operation
Construction dust receptors (human and ecological)	✓	×
Human health receptors	✓	✓
Designated ecological sites	✓	✓
PCM compliance risk	✓	✓

6.5 Design, mitigation and enhancement measures

Construction

6.5.1 The Environmental Management Plan (EMP) will adopt best practice measures to control fugitive dust (and hence avoid or reduce potential impacts) in compliance with DMRB LA 105. The construction partner will enter into pre-works discussions with affected local authorities and Highways England representatives to agree the method of works and appropriate dust mitigation measures outlined within the EMP. Mitigation measures will include the dampening down of surfaces, planning the site layout so that machinery and dust-causing activities occur as far from receptors as possible, erecting screens or barriers around the dust-causing activities or the site boundary, covering stockpiles to prevent entrainment by wind and undertaking regular monitoring. With best practice construction mitigation measures, there are unlikely to be significant air quality effects resulting from construction dust.

6.5.2 It is unlikely there will be any mitigation measures needed for construction traffic.

Operational

6.5.3 DMRB LA 105 states that "*where the air quality assessment concluded that the project triggered a significant air quality effect and/or affect the UK's reported ability to comply with the Air Quality Directive in the shortest timescales possible, a project air quality action plan (PAQAP) shall be included in the air quality assessment*".

6.5.4 If required, mitigation measures set out in a PAQAP (such as a vertical barrier of at least 9m in height or speed limits adjusted for air quality or later opening year) and should be both viable and provided with a quantification of the change in concentrations associated with the measure.

6.6 Description of the likely significant effects

6.6.1 In order to determine whether the Proposed Scheme could result in any significant effects, professional judgement has been informed by the following sources of information:

- Information presented in Section 6.3 regarding baseline conditions
- Knowledge gained at PCF Stage 2
- DMRB LA 105 standard, where appropriate

6.6.2 Exceedance of AQOs at relevant human and ecological receptors with respect to construction dust is unlikely to occur if appropriate mitigation is put in place during the construction phase.

6.6.3 There is a risk that compliance with the EU LVs in the worst-case construction year at PCM Census IDs may be affected. Whilst construction traffic movements are unknown at this stage, there are many PCM links within the vicinity of the Proposed Scheme which are likely to be used during the construction phase. Localised modelling will be undertaken for roadside reportable receptors as well as relevant receptors if the traffic screening criteria are met.

6.6.4 During operation, a range of effects are likely to occur with respect to human, PCM and ecological receptors.

6.6.5 Furthermore, the five-year local authority annual mean concentrations within the study area do not show a definitive decreasing trend in annual mean NO_2 concentrations and there is an exceedance (as well as concentrations close to exceeding) of the AQO in 2019. Whilst the scheme itself is considered unlikely to cause exceedances of the annual mean NO_2 AQO, future trends are uncertain and traffic impacts may be different than assessed previously. Considering the scheme in the context of DMRB LA 105 and Table 2.11a, this project is deemed high risk, and given the existing baseline data a detailed assessment is appropriate at PCF Stage 3.

6.6.6 The risk of affecting compliance with the EU LVs in the Opening Year at PCM Census IDs in the shortest possible timeframe is considered low based on current PCM compliance reporting for the Opening Year. At this stage, the PCM Census IDs that will be on the PCF Stage 3 ARN are unknown pending receipt of the new traffic data. At PCF Stage 3, and as advised by DMRB LA 105, the results of local modelling will be used to assess the risk of

compliance as opposed to PCM model outputs. In places, local modelling results have the potential to differ from PCM model projections.

6.6.7 At PCF Stage 2, a DMRB screening model assessment was undertaken. A number of the sensitive receptors were initially predicted to exceed the AQO in 2023 using a simple modelling approach, although, further, more detailed ADMS-Roads (Atmospheric Dispersion Modelling System) modelling found that there were no exceedances. This, in combination with expected reductions in vehicle emissions by 2027, suggests that risk to compliance with AQOs as a result of the Proposed Scheme is low.

6.6.8 The Proposed Scheme has the potential to adversely affect designated ecological habitats. As the ARN for PCF Stage 3 is unknown at this stage, the exact number of ecological habitats is not known but will exceed those assessed at PCF Stage 2. However, traffic associated with the construction and operation of the Proposed Scheme have the potential to change the nitrogen deposition by more than 0.4kg N/ha/yr, or cause an exceedance of lower critical load thresholds, or for nitrogen deposition rates to exceed 1% of the lower critical load, at some sites, which would trigger the need for further assessment. There is, therefore, a risk that the Proposed Scheme could have significant effects at designated ecological receptors.

6.6.9 Accounting for considerations stated in paragraphs 5.12 and 5.13 of the NNNPS, the air quality risk from the Proposed Scheme in the opening year is considered on balance to be low with respect to meeting AQO's and EU LV's.

6.7 Assessment methodology

6.7.1 The proposed approach for air quality assessment meets the NNNPS policy requirements outlined in Section 6.1.

Construction dust

6.7.2 A construction dust assessment will be undertaken in accordance with DMRB LA 105. The dust assessment will consider all sensitive receptors within 200m of all construction activity in order to determine the construction dust risk potential of the project to the receiving environment. The risk potential will be used to inform proposed mitigation measures. In combination with best practice mitigation measures, to be outlined in the EMP, it is unlikely that there would be significant effects associated with the air quality impacts of construction dust.

Local air quality operational traffic (and construction traffic, where applicable)

6.7.3 The potential impacts of the Proposed Scheme will be assessed in accordance with DMRB LA 105. It is proposed that a detailed level of air quality assessment be undertaken in order to assess the potential for air quality effects associated with the Proposed Scheme. In line with DMRB LA 105, a detailed assessment is normally undertaken where there is potential for exceedances of the AQOs.

6.7.4 The main steps in the operational air quality assessment methodology will be:

- **Study area:** The study area will be defined from the TRA based on changes in modelled traffic between the Opening Year DM and DS, as described in Section 6.2.2. As per DMRB LA 105, it is not necessary to select all receptors within 200m of the ARN, however, a representative number of sensitive human health receptors will be

selected, which will include all receptors with a likelihood of exceeding the air quality threshold. Ecological transect locations and PCM compliance receptors will be confirmed.

- **Emissions calculations for peak and interpeak/off peak periods:** Emission rates for NO_x and PM_{10} will be calculated from speed-banded traffic data inputs using the latest speed banded Highways England emission calculation tool (to be provided). It is not proposed to model $PM_{2.5}$ as per DMRB LA 105 paragraph 2.21.4 (i.e. no risk of exceedance).
- **Dispersion modelling:** Annual mean concentrations of NO_x and PM_{10} at receptors will be modelled using latest version of ADMS-Roads (Cambridge Environmental Research Consultants, 2020).
- **Backgrounds:** Sector-removed Defra background concentrations will be added to the dispersion modelling to generate total concentrations.
- **Verification:** Base year modelled road NO_x concentrations will be compared to monitored road NOx to account for any systematic bias in the air quality dispersion modelling approach, following the methodology described in LAQM TG(16) (Defra, 2018). The verification process will identify whether adjustment(s) to the raw modelled road NOx concentrations will be required.
- **Post-processing/adjustment:** Verification-based adjustment will be applied to the modelled Opening Year concentrations. The latest version of the LAQM NO_x to NO_2 conversion tool will be applied to calculate annual mean NO_2 concentrations at sensitive human health and compliance receptors. Long-term trend adjustment factors will be applied to annual mean NO_2 and NO_x concentrations at human health and ecological receptors (but not PCM receptors) in accordance with the gap analysis methodology described in DMRB LA 105.
- **Assessment of significance:** The significance of the environmental impact for individual matters (ecological/human health) will be determined following the DMRB LA 105 criteria outlined in paragraphs 6.7.5 and 6.7.6.
- **PCM:** PCM compliance risk assessment will be conducted separately for those Census IDs coinciding with the PCF Stage 3 ARN. The qualifying risk assessment flow chart illustrated in Figure 2.79 of DMRB LA 105 will be used to determine the significance of the operational effects of the Proposed Scheme at qualifying PCM receptors, outlined in Section 6.7.7 and 6.7.8. Mitigation measures will be proposed if there is a risk to the UK's reported ability to comply with the Air Quality Directive as a result of the Proposed Scheme.

6.7.5 The significance of an environmental effect is a function of the sensitivity of the receptor and the scale or magnitude of the impact (change). The sensitivity of all receptors, such as dwellings, hospitals or schools, is assumed to be equal (high). The magnitude of change is determined for each receptor based on the difference in pollutant concentration between the Opening Year DM and DS scenarios. The magnitude of change criteria for the assessment are shown in Table 6.4 (see also Appendix B).

Table 6.4: Air quality magnitude of change criteria

Magnitude of change	DM to DS change in annual mean NO_2 and PM_{10} ($\mu g/m^3$)
Imperceptible (< 1 % +/- of AQO)	< 0.4$\mu g/m^3$

Magnitude of change	DM to DS change in annual mean NO_2 and PM_{10} ($\mu g/m^3$)
Small (1-5 % +/- of AQO)	0.4 – 2$\mu g/m^3$
Medium (5-10 % +/- of AQO)	2 – 4$\mu g/m^3$
Large (>10 % +/- of AQO)	> 4$\mu g/m^3$

6.7.6 The number of receptors showing a small, medium or large magnitude of change will be counted where they are above (i.e. exceed) the UK air quality thresholds. DMRB LA 105 provides guidance on the number of receptors in each magnitude of change category that could constitute a significant effect. The significance categories and guideline receptor numbers are summarised below in Table 6.5. These are guideline values, based on the considered opinion of Highways England, are intended to help provide consistency across road scheme assessments. The number of receptors in each guideline band will be used to inform professional judgement on the significant effects of the Proposed Scheme.

Table 6.5: Guideline to the number of receptors constituting a significant effect

Magnitude of change in pollutant concentration	Number of receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large	1 to 10	1 to 10
Medium	10 to 30	10 to 30
Small	30 to 60	30 to 60

PCM compliance risk assessment

6.7.7 Highways England's PCM compliance risk assessment test (DMRB LA 105) has been developed to enable decision makers to judge a scheme's likelihood of delaying or preventing compliance with the EU Directive. The desk-based baseline conditions survey (section 6.3) did not identify PCM links of material concern for the Opening year 2027. However, the compliance risk assessment will be undertaken, as per Figure 2.79 of DMRB LA 105, to establish whether the PCF Stage 3 air quality modelling confirms the results of the PCM modelling. A risk to compliance would be identified where:

- There is a modelled Opening Year exceedance of the air quality thresholds for any PCM link and the change in annual mean NO_2 concentration between the DM and DS is greater than +/- 0.4$\mu g/m^3$; and/or
- The project materially impacts on measures within local air quality or national plans for the achievement of compliance.

6.7.8 If a risk to compliance between DM to DS is identified (change in annual mean NO_2 concentration of > 0.4 µg/m^3), then mitigation would need to be proposed in a PAQAP. If the proposed measures in the PAQAP do not reduce the impact of the Proposed Scheme to within 0.4 µg/m^3 on any exceeding PCM links, professional judgement will be applied to determine whether the effects are significant. In determining significance, the following will be considered:

- The qualifying feature being affected (e.g. little used or heavily used footpaths, residential properties, schools etc)
- The level of change in concentration as a result of the Proposed Scheme and whether there is an overall worsening or improvement
- The number of features being affected, such as the number of PCM links resulting in a deterioration in air quality as a result of the Proposed Scheme

6.8 Assessment assumptions and limitations

6.8.1 The air quality impact assessment will be based on a series of computer models of future conditions. The process will begin with the modelling of future traffic flows, which is subject to its own inherent degree of uncertainty.

6.8.2 These traffic data are used in an emissions model. The emissions data are then fed into a dispersion model, and a total concentration derived to compare future air quality conditions both with and without the Proposed Scheme. The air quality models will draw on a number of other trends and parameters that must be projected into the future. The modelling process will include atmospheric dispersion modelling, which provides an estimate of concentrations arising from input emissions and historical meteorological data.

6.8.3 As with any computer model that seeks to predict future conditions, there is uncertainty in the predictions made. Elements of impact prediction such as the specific concentration of a given pollutant at a given property, or whether an exceedance of AQOs or EU LVs would or would not occur at a specific location, are not precise and are always subject to a margin of error. However, the assessment process is considered to be based on the most reasonable, robust and representative methodologies, taking advice from published guidance.

6.8.4 Sensitive receptors will be determined using Ordnance Survey AB+ dataset and available information on future committed developments. There may in some cases be properties, such as those recently built, which are not yet present within these data sources.

7. Cultural heritage

7.1 NNNPS requirements

7.1.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

7.1.2 Key policy from the NNNPS relevant to this aspect includes:

- Paragraph 5.120 states that the construction and operation of national networks infrastructure has the potential to result in adverse impacts on the historic environment.
- Paragraph 5.122 defines heritage assets as those elements of the historic environment that hold value to this and future generations because of their historic, archaeological, architectural or artistic interest. The sum of the heritage interests that a heritage asset holds is referred to as its significance (heritage value). Significance derives not only from a heritage asset's physical presence, but also from its setting.
- Paragraph 5.124 requires that non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments should be considered subject to the policies for designated heritage assets.
- Paragraph 5.127 states that the applicant should describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum, the relevant Historic Environment Record should have been consulted and the heritage assets assessed using appropriate expertise. Where a site on which development is proposed includes or has the potential to include heritage assets with archaeological interest, the applicant should include an appropriate desk-based assessment and, where necessary, a field evaluation.
- Paragraph 5.129 requires that in considering the impact of a proposed development on any heritage asset, the SoS should take into account the particular nature of the significance of the heritage asset.
- Paragraph 5.130 states that the SoS should take into account the desirability of sustaining and, where appropriate, enhancing the significance of heritage assets, the contribution of their settings and the positive contribution that their conservation can make to sustainable communities, including their economic vitality.
- Paragraph 5.131 states that substantial harm to or loss of grade II listed buildings and grade II registered parks and gardens should be exceptional and that substantial harm to, or loss of, scheduled monuments, grade I and II* listed buildings and grade I and II* registered parks and gardens should be wholly exceptional.
- Paragraph 5.132 states that any harmful impact on the significance of a designated heritage asset should be weighed against the public benefit of development, recognising that the greater the harm to the significance of the heritage asset, the greater the justification that will be needed for any loss.

7.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

7.2 Study area

7.2.1 The Design Manual for Roads and Bridges (DMRB) LA 106: Cultural Heritage Assessment (Highways England, 2019; hereafter referred to as DMRB LA 106) section 3.6 states that a study area for new roads "*shall include the footprint of the scheme plus any land outside that footprint which includes any heritage assets which could be physically affected*" and that should include "*the settings of any designated or other cultural heritage resource in the footprint of the scheme or within the zone of visual influence or potentially affected by noise*".

7.2.2 For the purposes of this scoping report, a study area extending 300m from the provisional Order Limits in all directions has been used to develop the initial baseline and identify designated and non-designated assets that may be physically affected by the Proposed Scheme or where their settings may be affected. This study area is also used to characterise the potential for unknown archaeological remains within the footprint of the Proposed Scheme which would also have the potential to be physically affected. The size of the study area is informed by guidance on scoping given within DMRB, and with accepted best practice, is considered appropriate due to the nature of the proposed works and sensitivity of the receiving environment.

7.2.3 Designated heritage assets data within a study area extending up to 1km from the provisional Order Limits in all directions have been collated and considered to ensure that designated assets have been identified to a sufficient distance to anticipate or identify any potential effects arising from changes within an asset's setting. It is recognised that significant effects on the value of heritage assets arising from changes to setting are unlikely beyond 1km. This is due to the nature of the Proposed Scheme, which primarily comprises an area of existing motorway infrastructure, and the anticipated sensitivity of the receiving environment. The presence of intervening urban areas and buildings which will also preclude any likely intervisibility with the Proposed Scheme by designated heritage assets beyond 1km.

7.2.4 The study area for the cultural heritage assessment is shown on Figures 7.1 and 7.2.

7.3 Baseline conditions

Baseline sources

7.3.1 For the purposes of this report, cultural heritage comprises three matters, defined as:

- Archaeological remains: the material remains of human activity from the earliest periods of human evolution to the present. These could be buried traces of human activities, sites visible above ground, or moveable artefacts.
- Historic buildings: architectural, designed or other structures with a significant historical value. These could include structures that have no aesthetic appeal or structures not usually thought of as buildings, such as milestones or bridges. Conservation areas are considered within the historic building matter.

- Historic landscapes: the current landscape, whose character is the consequence of the action and interaction of natural and human factors.

7.3.2 To inform the baseline for the study area the following sources of information were consulted:

- The National Heritage List for England (NHLE) for information on designated heritage assets (scheduled monuments, listed buildings, registered parks and gardens, registered battlefields, World Heritage Sites, and protected wrecks).
- Information on designated conservation areas from the Bury Council website.
- The Greater Manchester Historic Environment Record (HER) for information on non-designated heritage assets and previous archaeological investigations.
- The Greater Manchester Urban Historic Landscape Characterisation (HLC) Project for information on the historic landscape character of the 300m study area.

7.3.3 In the baseline below, assets are identified by their unique NHLE, HER or HLC reference numbers.

7.3.4 The locations of the designated and non-designated assets discussed below are shown on Figures 7.1 and 7.2.

Baseline: Archaeological remains

7.3.5 There are no designated archaeological assets (scheduled monuments) recorded within 1km of the Proposed Scheme.

7.3.6 Within the footprint of the Proposed Scheme, six non-designated archaeological assets are recorded comprising:

- The projected alignment of the Roman road from Manchester to Ribchester (HER 14.1.1). There are no surviving above-ground remains of this asset which crosses the western limit of the Proposed Scheme on an approximate north-west to south-east alignment.
- The site of a possible oven (HER 3921.1.0) identified from a historic field name ‘Owen Hill’. A watching brief conducted within Pike Fold Golf Club to the east of the Proposed Scheme did not identify any evidence of this asset.
- The site of structures south of Mode Hill Lane (HER 3919.1.0) identified from 19th century historic mapping. Two structures are shown on the historic mapping to the north-west of Simister Island. No trace of the buildings was identified during archaeological assessments undertaken in 1993.
- The site of structures off Corday Lane (HER 3915.1.0) identified from 19th century historic mapping to the north-west of Simister Island.
- The site of Gravel Hill House (HER 3914.1.0) identified from 19th century historic mapping. An irregularly shaped building is shown on the historic mapping to the north-west of Simister Island. No trace of the building was identified during archaeological assessments undertaken in 1993.
- The site of Grundy Fold (HER 10097.1.0) identified from 19th century historic mapping. An L-shaped building with two associated smaller rectangular buildings are shown on the historic mapping. The site is recorded to lie beneath the M66 at the northern extent of the Proposed Scheme and is assumed to have been destroyed.

7.3.7 Within the 300m study area, a further 52 non-designated archaeological assets are recorded including: a possible Bronze Age settlement at Castle Brook Farm (HER 2894.2.0) to the north-east of the Proposed Scheme; the findspot of a Roman bow Brooch (HER MGM17742) identified approximately 150m to the south of the Proposed Scheme; and a mill race (HER 11098.1.0) located approximately 300m to the north-east of the northern limit of the Proposed Scheme. However, the majority of the non-designated assets recorded within the 300m study area by the HER comprise the sites of post-medieval buildings or places identified from 19th century historic mapping.

7.3.8 Due to the likely significant impacts during groundworks for the construction of the motorway and associated junctions, the potential for previously unknown archaeological assets within the footprint of the majority of the Proposed Scheme is considered to be negligible/nil. However, for works in previously undeveloped areas, there is a low potential for previously unknown archaeological assets to be present.

Baseline: Historic buildings

7.3.9 There are 42 listed buildings recorded within 1km of the Proposed Scheme comprising:

- Two Grade I listed buildings (Heaton Hall (NHLE 1200809, National grid reference (NGR) SD 83334 04424) and Church of St Mary (NHLE 1067252, NGR SD 81102 03683)), both of which are located approximately 1km to the south of the Proposed Scheme.
- Three Grade II* listed buildings (Temple to north-east of Heaton Hall (NHLE 1200813, NGR SD 83493 04559), Smithy Lodge to east of Heaton Hall (NHLE 1282994, NGR SD 84005 04491), and Monument to John Brooks to west of Church of St Mary (NHLE 1067254, NGR SD 81043 03665)) all also located towards the southern limit of the 1km study area.
- 37 Grade II listed buildings. Only one of which, Unsworth War Memorial (NHLE 1440257), falls within 300m of the footprint of the Proposed Scheme.

7.3.10 There are three designated conservation areas recorded within 1km of the Proposed Scheme comprising:

- Poppythorn Conservation Area (NGR SD 81382 04467) located approximately 350m to the south of the Proposed Scheme. The asset encompasses a fine and well-preserved example of mainly residential development in the south of the Borough (Bury), which grew after the construction of the new turnpike roads and the coming of the railway during the 19th century.
- All Saints, Whitefield, Conservation Area (NGR SD 80310 06008) located approximately 760m to the north of the Proposed Scheme at its nearest. The asset encompasses a fine and well-preserved example of mainly residential development in the south of the Borough (Bury), which grew after the construction of the new turnpike roads and the coming of the railway during the 19th century.
- St Mary's, Prestwich, Conservation Area (NGR SD 81102 03683) located approximately 850m to the south of the Proposed Scheme. The asset encompasses part of a pleasant wooded landscape. The area is dominated by St Mary's Church (NHLE 1067252) which dates back to the 15th century, and the mature treescape within Prestwich Clough. The residential parts of the Conservation Area are typified by tree lined streets with substantial properties in large grounds mostly dating from

the mid-19th century. The combination of large private grounds and public open spaces results in a lush and heavily tree-lined appearance.

7.3.11 There are no non-designated historic buildings recorded within the footprint of the Proposed Scheme.

7.3.12 Within the 300m study area, 13 non-designated historic buildings are recorded comprising:

- Cold Gate Farm (HER 3918.1.0), also referred to as Cowlgate Farm, is a 19th century two-storey house, with slate roof, ridge stack and rendered exterior located to the immediate west of the Proposed Scheme. The asset is shown on historic mapping dating from the early 19th century and is recorded as a homestead. There is a modern extension on the west side of the asset. The asset is bounded to the north, south and west by undulating pasture fields and to the east by the M60 motorway from which it is screened by a bank of mature trees and vegetation.
- Droughts Farm (HER 3934.1.0) is a 19th century farm complex located to the immediate south-east of Simister Island. The farmhouse is built of brick in the English garden wall bond. The threshing barn is also made of brick. This asset is shown on the historic mapping dating from the mid-19th century and is recorded as 'site of buildings and fold'. The asset is bounded to the north and west by Simister Island, to the east by an area of undeveloped land, and to the south by residential dwellings.
- Egypt Farm (formerly Higher Egypt) (HER 3931.1.0) is a 19th century farmstead located to the north of the M60 at the eastern limit of the Proposed Scheme.
- Hills Nook (HER 10101.1.0) comprises two 18th or 19th century buildings located on Pole Lane approximately 70m to the west of the Proposed Scheme. The asset is a two-storey, rectangular plan building, with a slate roof. The asset is surrounded by undulating pasture fields. The M66 motorway is located within a cut to the east of the asset and is not visible.
- Coach and Horses Public House (HER 9961.1.0) is a 19th century inn located on Bury Old Road approximately 70m to the south of the Proposed Scheme. The asset comprises three-storey brick-built rectangular plan building with a blue slate roof. The asset is bounded by residential and commercial properties. The M60 motorway is located within a cut to the north of this asset.
- The Hills (HER 3926.1.0) is an 18th century farmstead located approximately 120m to the east of the Proposed Scheme off Hills Lane. The asset is surrounded by the Pike Fold Golf Club. The M66 motorway is located within a cut to the west of the asset and is not visible.
- St George's Church (HER 2931.1.0) is an 18th century church located approximately 130m to the west of the Proposed Scheme. The church comprises a rectangular brick-built building with stone-capped buttresses to the northern and southern elevations. The fenestration is placed centrally between the buttresses. The windows are brick-built lancets with keystones to the lancet window heads. The western gable has a five-sided porch which is brick built with stone upper band and a stone parapet. The entranceway has a brick moulded doorway surround.
- 122 Hollins Lane (HER 2927.1.0) is a two storey 19th century townhouse located approximately 220m to the west of the Proposed Scheme.
- Pike Fold Golf Club (HER 3925.1.0), previously known as Back o'th' Moss Farm, is an 18th century farm complex located 260m to the east of the Proposed Scheme.

The asset has been subject to extensive redevelopment and is currently the club house of the Pike Fold Golf Club. The asset is surrounded by the landscaped golf course. The M66 motorway is located within a cut to the west of the asset and is not visible.

- Former General Store at Hollins Lane (HER 2926.1.0) is a possibly early 18th century shop building located approximately 260m to the west of the Proposed Scheme.
- Beehive Dyeworks (HER 3889.1.0) is a former 19th century cotton mill located approximately 300m to the west of the Proposed Scheme.
- Pumping Station (HER 11008.1.0) is a two-storey mid-20th century building located on the north bank of the Hollins Brook approximately 300m to the north-east of the Proposed Scheme. The building is now used to house a generator.
- Cuckoo Nest (HER 9963.1.0) is a modern building on the site of former buildings recorded to be named as Cuckoo's Nest. It is clear from the HER that the original 19th century building has been replaced. This asset is located approximately 250m to the south of the Proposed Scheme.

Baseline: Historic landscapes

7.3.13 There is one designated historic landscape asset recorded within 1km of the Proposed Scheme, comprising the Grade II Heaton Park Registered Park and Garden (NHLE 1000854, NGR SD 82745 04249). The asset forms the park and pleasure gardens of the Heaton Estate and was probably designed by William Emes and John Webb in the late 18th century. The park covers an area of approximately 240ha and is situated on land which rises from the south and west, and there is a valley running through the northern and north-eastern part of the site. The setting is urban in character but there are views over partially open country to the east and south-east and to the Pennines to the north and north-west.

7.3.14 Within the footprint of the Proposed Scheme, there following HLC broad types are recorded:

- Commercial - public houses, retail centres, and industrial areas dating to the 19th and 20th centuries.
- Communications - predominantly relating to the modern road network including the M60 and M66.
- Enclosed Land - areas of piecemeal enclosure and agglomerated fields dating from the post medieval period.
- Institutional - schools, nursing homes, religious complexes and medical facilities dating to the 19th and 20th centuries.
- Ornamental, Parkland and Recreation - golf courses, public parks, urban green spaces and sports fields.
- Residential - areas of 19th and 20th century residential expansion.
- Woodland.

Future baseline

7.3.15 The future baseline for cultural heritage is very much dependent on the actions of others to conserve and manage heritage assets (both designated and non-designated). Current policies and laws are likely to continue to require the conservation and enhancement of heritage assets. However, in the absence of action to maintain them or keep them in active use, the condition of such assets will likely deteriorate.

Value of receptors

7.3.16 A preliminary assessment of the value of the heritage assets within the study areas (1km for designated assets and 300m for non-designated assets) has been undertaken. This has used professional judgement and the standard contained within DMRB LA 104: Environmental Assessment and Monitoring (Highways England, 2019; hereafter referred to as DMRB LA 104) on a scale of negligible, low, medium, high and very high.

7.3.17 Heritage assets within the baseline have been assigned a value following the criteria in DMRB LA 104 and using professional judgement. Table 7.1 summarises the values of the heritage assets within the study areas.

7.3.18 In this report, the term value is used when describing the significance of heritage assets as set-out in the requirements of the NNNPS. This is to avoid any confusion when describing effects that are significant later on in the assessment process.

Table 7.1: Value of receptors in the study area for cultural heritage

Value/ sensitivity	Description	Identified receptors within the study areas
Very high	Assets of very high importance and rarity, international scale and very limited potential for substitution.	None
High	Assets of high importance and rarity, national scale, and limited potential for substitution.	• Listed Buildings (all grades)
Medium	Assets of medium or high importance and rarity, regional scale, limited potential for substitution.	• Grade II Heaton Park Registered Park and Garden • Conservation Areas (Poppythorn, All Saints, St Mary's)
Low	Assets of low or medium importance and rarity, local scale.	• Non-designated archaeological remains with potential for contributing to local research agendas • Non-designated historic buildings • HLC areas with potential for contributing to local research agendas
Negligible	Assets of very low importance and rarity, local scale.	• Non-designated archaeological remains such as field boundaries, undated cropmark features • Sites of non-designated archaeological assets that have now been removed or identified from historic mapping • Findspots • HLC areas of modern origin

7.4 Potential impacts

Construction

7.4.1 Potential impacts on heritage assets during construction can be divided into physical impacts and impacts arising from changes in an asset's setting (if the setting is relevant to understanding and appreciating the heritage value of the asset).

7.4.2 Potential physical impacts on heritage assets which may occur during construction of the Proposed Scheme comprise:

- Partial or complete removal of archaeological remains or historic landscape elements (such as hedgerows) within the footprint of the Proposed Scheme through groundworks associated with construction. This could include widening of the existing highway boundary or the creation of new offline sections, in addition to any service trenches and drainage features, topsoil stripping for compounds, the excavation of borrow pits and attenuation ponds and landscaping features.
- Impacts on archaeological remains within the footprint of the Proposed Scheme through their compression during construction, through the movement of machinery or within site compound or spoil storage areas.
- Impacts on archaeological remains through changes to groundwater levels caused by engineering activities associated with the Proposed Scheme.
- Impacts to historic buildings through subsidence due to groundwater dewatering.

7.4.3 Potential impacts where the Proposed Scheme may affect the contribution made by setting to an assets value (if the setting is relevant to understanding and appreciating the heritage value of the asset) which may occur during construction comprise:

- The physical removal of, damage to, or severance of associated archaeological remains which form the setting of a heritage asset.
- The alteration to the setting of archaeological remains and historic buildings through the removal of vegetation or associated above-ground elements during construction.
- Temporary changes in the way in which sound and noise currently contribute to the heritage value of assets and changes to the setting of archaeological remains, historic buildings, where that setting is relevant to understanding and appreciating its heritage value, during construction activities such as groundworks, placement of site compounds, and from increased construction traffic.

7.4.4 In line with the scoping assessment questions presented in DMRB LA 106 Section 3.2, an initial assessment of potential impacts indicates that:

- No physical impacts are predicted on any designated heritage assets.
- There is the potential for construction activities to have a temporary impact on the value of historic buildings, both designated and non-designated, (where the setting is relevant to understanding and appreciating the heritage value of the asset) due to increases in the way in which sound and noise currently contribute to the heritage value of assets, and from dust.
- There is a low potential for previously unknown archaeological assets to be present within the footprint of the Proposed Scheme that may be physically affected/removed during construction activities.

- There are non-designated HLC areas within the footprint of the Proposed Scheme that may be physically affected.

7.4.5 Based on the above, impacts on archaeological remains, historic buildings, and historic landscapes during construction are scoped in for further assessment.

Operation

7.4.6 Potential impacts on heritage assets during operation can be divided into physical impacts and where the Proposed Scheme may affect the contribution made by setting to an assets value (if the setting is relevant to understanding and appreciating its' heritage value).

7.4.7 Potential physical impacts on heritage assets which may occur during operation of the Proposed Scheme comprise:

- removal of, or damage to, archaeological remains during maintenance works
- damage to archaeological remains, historic buildings, or HLC areas through pollutants

7.4.8 Potential impacts on the value of heritage assets, where the Proposed Scheme would alter the setting and its contribution to an asset's value (if the setting is relevant to understanding and appreciating its heritage value) during operation, comprise:

- Alterations to the setting of historic buildings where new infrastructure is present in key views towards, through and across an asset.
- Alterations to an asset's setting due to increases in the way in which sound and noise currently contribute to the heritage value of assets and light currently contribute to the heritage value of assets caused by the Proposed Scheme.
- Severance of identifiable interrelationships due to a new length of road causing physical divisions between previously related heritage assets.

7.4.9 In line with the scoping assessment questions presented in DMRB LA 106 Section 3.2, an initial assessment of potential impacts indicates that:

- There is limited potential for significant physical impacts on historic buildings and archaeological remains during operation.
- The value of historic buildings (where setting is relevant to the appreciation and understanding of that heritage value) and designated historic landscapes (Grade II Heaton Park) has the potential to be impacted due to alteration to setting through increases in the way sound, noise and light currently contribute to the heritage value of assets during operation.
- While archaeological remains have the potential for their settings to be impacted, the initial assessment of the archaeological remains within the study area is that their value is primarily derived from their physical remains and any intrusion on their setting during operation would have limited to no impact on our understanding and appreciation of these heritage assets.

7.4.10 Based on the above, impacts to historic buildings and historic landscapes (designated assets only) during operation are scoped in for further assessment. Archaeological remains would be sensitive only to the potential for changes in the way in which sound and noise currently contribute to their heritage value.

Summary of scope

7.4.11 Table 7.2 summarises the proposed scope for cultural heritage. As mentioned in Section 7.4, there are interrelationships between cultural heritage and other environmental aspects, particularly noise and vibration (Chapter 12), and landscape (Chapter 8). The combined effect on the setting of heritage assets from these aspects will be assessed within the cultural heritage assessment.

Table 7.2: Summary of cultural heritage scope

Matter	Scoped in - construction	Scoped in - operation
Archaeological remains	✓	×
Historic buildings	✓	✓
Historic landscape	✓	✓

7.5 Design, mitigation and enhancement measures

7.5.1 Design mitigation would include landscape design to screen or take account of sensitive assets and viewpoints. For example, providing banks or screening planting between the road and a historic asset to soften the visual intrusion.

7.5.2 Additional mitigation is likely to include a programme of archaeological investigation and recording, prior to commencement of construction.

7.5.3 Enhancement measures could include provision of interpretation boards at key sites.

7.6 Description of the likely significant effects

7.6.1 Potential types of impacts to heritage assets are described in Section 7.4 above.

7.6.2 DMRB LA 106 (Section 3.2) confirms that four scoping questions should be answered in order to gain an understanding of the need to undertake further assessment for the Cultural heritage aspect. Where the response to one or more of these questions is 'yes', then further assessment should be undertaken.

7.6.3 The responses to the scoping assessment questions for the Proposed Scheme are provided in Table 7.3, based on the application of professional engineering judgement to the current design information.

Table 7.3: DMRB LA 106 Scoping questions and responses

Scoping questions	Response	Scoped in/out
1) is any designated or other cultural heritage resource in the footprint of the scheme or outside that footprint but still potentially physically affected by it?	no	Scoped in
2) is the setting of any designated or other cultural heritage resource in the footprint of the scheme, within the zone of	yes	Scoped in

Scoping questions	Response	Scoped in/out
visual influence or potentially affected by noise (see LA 111 [Ref 13.I])?		
3) is there new land take associated with the project?	yes	Scoped out
4) could potential archaeological remains be concealed?	uncertain	Scoped in

7.6.4 Having answered 'yes' or 'uncertain' to one or more of the DMRB LA 106 scoping questions for the Cultural heritage aspect, it is recommended that this is scoped into the EIA.

Construction

7.6.5 Archaeological remains, historic buildings and historic landscapes have been considered using the methodology outlined in Section 7.7. Preliminary evaluation indicates that there would be no significant effects on any designated heritage assets within the footprint of the Proposed Scheme arising from direct physical impacts.

7.6.6 Preliminary evaluation indicates that there would be no significant effects arising from temporary impacts on the setting of heritage assets, both designated and non-designated, within the wider study areas.

Operation

7.6.7 Historic buildings and historic landscapes have been considered using the methodology outlined in Section 7.7. No potential impacts likely to be on a scale that may result in significant effects have been predicted during the operation of the Proposed Scheme.

7.7 Assessment methodology

7.7.1 All further assessment will be undertaken in accordance with the relevant sections of DMRB LA 106 with consideration of guidance such as the NPPF and The Setting of Heritage Assets (Historic England, 2017). The assessment of value (sensitivity) of assets and the magnitude of impact will be undertaken based on the assessment criteria in Appendix B. The significance of effects will be assessed in accordance with DMRB LA 104 (see Chapter 5: Environmental assessment methodology).

7.7.2 A cultural heritage desk-based assessment will be prepared in accordance with NNNPS paragraph 5.127. The desk-based assessment will be compiled in accordance with the Standard and Guidance provided by the Chartered Institute for Archaeologists (2020).

7.7.3 The study areas used in further detailed assessment may be amended through consideration of a final Zone of Theoretical Visibility (ZTV), once available, to allow the full extent of potential impacts on the setting of heritage assets to be assessed. Further information on the ZTV is included in Chapter 8: Landscape.

7.7.4 The above methodology meets the NNNPS policy requirements outlined in Section 7.1.

7.7.5 Further archaeological investigation of previously undeveloped areas of the Proposed Scheme will also be undertaken. The scope of the surveys will be informed by the cultural-heritage desk-based assessment. If required, it is anticipated that the surveys will include a non-invasive geophysical survey followed by targeted trial trenching.

7.8 Assessment assumptions and limitations

7.8.1 This scoping assessment has undertaken a preliminary evaluation of value and potential for impacts commensurate for this stage of work. The assessed value and potential for impact on heritage assets may change through fieldwork activities such as walkover surveys, site inspections, archaeological geophysical survey and trial trench evaluation.

7.8.2 Any changes to the design of the Proposed Scheme and the introduction of construction elements beyond the footprint of the Proposed Scheme (such as construction compounds, borrow pits, etc.) have the potential to change both the cultural heritage baseline and the assessment of potential impacts.

7.8.3 No site visits have been undertaken for the production of this scoping report. A site walkover survey will be undertaken as part of the assessment to inform the cultural heritage chapter of the Environmental Statement.

8. Landscape and visual

8.1 NNNPS requirements

8.1.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

8.1.2 Key policy from the NNNPS relevant to this aspect includes:

- Paragraph 5.144 of the NNNPS states that, '*where the development is subject to EIA, the applicant should undertake an assessment of any likely significant landscape and visual impacts in the environmental impact assessment and describe these in the environmental assessment. A number of guides have been produced to assist in addressing landscape issues. The landscape and visual assessment should include reference to any landscape character assessment and associated studies, as a means of assessing landscape impacts relevant to the proposed project. The applicant's assessment should also take account of any relevant policies based on these assessments in local development documents in England*'.
- Paragraph 5.145 states that, '*the applicant's assessment should include any significant effects during construction of the project and/or the significant effects of the completed development and its operation on landscape components and landscape character (including historic landscape characterisation)*'.
- Paragraph 5.146 states that, '*the assessment should include the visibility and conspicuousness of the project during construction and of the presence and operation of the project and potential impacts on views and visual amenity. This should include any noise and light pollution effects, including effects on local amenity, tranquillity and nature conservation'*.
- Paragraph 5.149 states that, '*landscape effects depend on the nature of the existing landscape likely to be affected and the nature of the effect likely to occur. Both of these factors need to be considered in judging the impact of a project on landscape. Projects need to be designed carefully, taking account of the potential impact on the landscape. Having regard to siting, operational and other relevant constraints, the aim should be to avoid or minimise harm to the landscape, providing reasonable mitigation where possible and appropriate'*.

8.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

8.2 Study area

Landscape and Visual

8.2.1 DMRB LA 104 Environmental assessment and monitoring, paragraph 3.13.1, states that, '*the study area for an assessment should reflect the project and the surrounding*

environment over which effects are reasonably be thought to occur, taking into account cumulative effects'.

8.2.2 DMRB LA 107, Assessment of landscape effects, Study Area, paragraph 3.11 states that the study area for the Landscape aspect should be '*proportionate*' in terms of the '*project boundary'*, '*wider landscape setting'*, '*extent of the area visible'* and '*the full extent of adjacent or affected landscape receptors of special value'*.

8.2.3 DMRB LA 107, Assessment of visual effects, Study Area, paragraph 3.31 states that the study area for the Visual aspect should be '*proportionate'* in terms of the 'project/construction visual footprint, '*the wider visual envelope'*, *'the extent of representative viewpoints visible'*, and '*the extent of adjacent or affected visual receptors and the visual amenity of the area'*.

8.2.4 Guidance on the study area is also provided in the Guidelines for Landscape and Visual Impact Assessment 3rd Edition (GLVIA3) (Landscape Institute and Institute of Environmental Management and Assessment, 2013). Paragraph 5.2 of GLVIA3 states that '*the assessment area should include the site itself and the full extent of the wider landscape around it which the proposed development may influence in a significant manner. This will usually be based on the extent of Landscape Character Areas likely to be significantly affected either directly or indirectly. However, it may also be based on the extent of the area from which the development is potentially visible, defined as the Zone of Theoretical Visibility, or a combination of the two.*'

8.2.5 Both LA 107 and GLVIA3 advocate a proportionate approach to the LVIA process, with emphasis placed on the potential for significant effects.

8.2.6 An initial Zone of Theoretical Visibility (ZTV) map has been generated for the Proposed Scheme and is shown on Figure 8.1. The ZTV is based on a 'bare earth' scenario to illustrate the worst-case theoretical extent of possible visibility and does not take account of potential screening by vegetation or buildings. The presence of screening features is initially best judged by field surveys to record location, size and extent, and their effect in screening visibility at selected viewpoints.

8.2.7 Once the Proposed Scheme has been 'fixed', a further ZTV map will be developed as part of the LVIA, incorporating buildings and significant woodland blocks. This follows requirements in LA 107 and will be based on buildings from OS MasterMap and woodland blocks from the National Forest Inventory Woodland Map. However, in reality there would be additional screening features present in the landscape such as new buildings, hedgerows and individual trees that will not have been modelled. The ZTVs will therefore not always be precise and are an indication only of the area within which visual effects may occur. The ZTV map will be modelled using the same methodology as used for the initial ZTV map. The detailed scope of the LVIA will be adjusted accordingly in further consultation with relevant stakeholders.

8.2.8 The ZTV has been prepared using digital terrain modelling (OS Terrain 5) and Geographical Information System (ArcGIS 10.6) base mapping to display the areas from which the Proposed Scheme would be theoretically visible.

8.2.9 The ZTV modelling has been based on the 3D scheme with a series of points at 50m intervals along the centreline. In order to represent the maximum extent of visibility, a 4.5m high Heavy Goods Vehicle travelling along the Proposed Scheme was modelled at

each point. GLVIA3 states that ZTV mapping should '*assume that the observer height is between 1.5 and 1.7m above ground level*'. A height of 1.7m above ground level was therefore used to represent the eye level of a viewer.

8.2.10 It was proposed that the study area for the Proposed Scheme in the LVIA will initially cover a radius of up to 5km from the provisional Order Limits and the ZTV map has been developed accordingly. This study area is described as the overarching study area. The ZTV demonstrates that theoretical visibility extends beyond this distance. However, with reference to the ZTV and initial site survey, it is considered unlikely that the Proposed Scheme will result in significant adverse effects on landscape and visual receptors due to the nature of the Proposed Scheme.

8.2.11 Therefore, the LVIA will focus on potentially significant effects within a 2km radius. Significant effects are not anticipated beyond 2km due to the lack of tall structures, the context of similar developments and the nature of intervening vegetation, topography and built form. This has been determined through desk-based study, including a review of the ZTV, interrogation of topographic mapping, determining the extents of urban areas and significant woodland, and including highway planting belts, and site-survey work. Desk-based study and site-survey work has also informed the LVIA scope, such as the indicative viewpoint list. Where applicable, longer distance views will also be considered at notable locations where these may be subject to significant effects. This approach is considered to be reasonable and proportionate.

8.2.12 Site visits were carried out by a Chartered Landscape Architect in March and April 2021. The objectives of the site visits were to become familiar with the study area and to undertake a baseline survey during winter for the visual impact assessment. Views towards the Proposed Scheme from residential properties, communities, footpaths and other recreational routes, the road network, and public green spaces within the study area will form the focus of the visual impact assessment. Survey notes and photographs taken on site recorded the existing landscape and visual baseline and will be used to inform the baseline and assessment in the LVIA.

8.2.13 The locations of the viewpoints selected following desk-based study and site-survey work are described below and will be agreed with local authority officers and other key stakeholders as part of an agreed consultation process.

8.2.14 Subsequent to adoption of the scoping direction, Bury Metropolitan Borough Council will be consulted further on the detailed approach to the assessment of effects on landscape and visual amenity, in particular the selection of viewpoints for the visual assessment and information regarding developments to be included in the cumulative assessment. The methodology will be finalised following this consultation process.

8.3 Baseline conditions

Baseline sources

8.3.1 The baseline conditions have been established through a review of existing desktop studies. The following sources have been used to inform the baseline:

- National Character Area Profiles (Natural England, 2014)
- Bury Landscape Character Assessment (Bury Metropolitan Borough Council, 2009)

- Rochdale MBC's Local Development Framework (LDF): Biodiversity and Development Supplementary Planning Document (SPD 2017)
- Rochdale Unitary Development Plan (UDP 2006)
- Greater Manchester Landscape Character and Sensitivity Assessment (Greater Manchester Combined Authority/LUC, 2018)
- England's Light Pollution and Dark Skies (CPRE The Countryside Charity, 2019)
- Tranquillity Map England (CPRE The Countryside Charity, 2007)
- MAGIC Map application (Defra, 2020)

Baseline information

8.3.2 Key designations and features relevant to landscape and visual effects are illustrated on Figure 8.2. There are no nationally designated National Parks or Areas of Outstanding Natural Beauty within the study area.

Policy designations

Special Landscape Area

8.3.3 A local landscape designation is identified within the Bury Unitary Development Plan 1997 as Special Landscape Areas under Policy EN9/1. UDP states that '*any development which is permitted will be strictly controlled and required to be sympathetic to its surroundings in terms of its visual impact. High standards of design, siting and landscaping will be expected. Unduly obtrusive development will not be permitted in such areas'*. It explains that this is in order to protect and enhance the character of areas where the landscape is of high quality and help safeguard the pleasant environment of the area.

8.3.4 A large proportion of the study area is located within the Green Belt as defined by the relevant local planning authorities. The purpose of Green Belt is to safeguard open land from urban sprawl, including the maintenance of open character seeking '*to assist in safeguarding the countryside from encroachment'*.

Designations

Conservation Areas

8.3.5 Conservation Areas are areas of special architectural or historic interest, the character or appearance of which is desirable to preserve or enhance. There are three Conservation Areas within the study area, located between 400m and 900m from the M60. Site surveys have determined that built form and vegetation belts considerably limit the influence of the motorway corridor beyond 200m within the urban areas to the west of M60 J18. The location of the Conservation Areas are beyond the influence of the Proposed Scheme and have therefore been scoped out of the LVIA. Refer also to Chapter 7 Cultural Heritage.

Registered Parks and Gardens

8.3.6 Heaton Park, a Grade II listed Registered Park and Garden (NGR SD 82745 04249), is located in the south of the study area adjacent to the M60 between J18 and J19.

Statutory listed buildings

8.3.7 There are a number of statutory listed buildings and features located within the landscape study area including several at Heaton Park and the Grade II Listed Church of St George (NGR SD 83450 05863) at Simister and the Grade II Listed Brick Farmhouse (NGR SD 82836 07497) at Unsworth.

Tree Preservation Orders

8.3.8 There are a number of Tree Preservation Orders (TPOs) just beyond the Provisional Order Limits, and none of these will be affected by the Proposed Scheme.

Landscape character

8.3.9 National and local landscape character assessments are illustrated on Figure 8.3. The existing landscape character of the study area is summarised below. The National Character Areas (NCA) cover the whole study area and describe the broad landscape context.

8.3.10 The greater part of the study area lies within the eastern part of NCA 54, Manchester Pennine Fringe. This is described as a transitional zone between the densely populated urban areas of the Manchester conurbation and the wild open moorland of the Pennines to the east. The study area extends into NCA 55, Manchester Conurbation within Heaton Park.

8.3.11 Due to their broad geographical coverage the effects on character of the NCAs will not be considered as part of the LVIA. The regional-level Greater Manchester Landscape Character and Sensitivity Assessment described below is more related to the scale and extent of the landscape character in the assessment area.

Local landscape character assessments (LCA)

8.3.12 The study area extends over three local authority areas, Bury Metropolitan Borough Council (BMBC), Rochdale Borough Council (RBC), and Manchester City Council (MCC). The majority of the study area is within the administration of BMBC. National and local landscape character areas illustrated on Figure 8.3.

8.3.13 BMBC's Landscape Character Assessment comprises a framework of Landscape Character Types (LCT) and their component LCAs. There are four LCAs within the study area:

- LCT Manchester Pennine Fringe, Fringe Settled Valley Pasture 54/2, Castle, Whittle & Brightley Character Area
- LCT Manchester Pennine Fringe, Fringe Industrial Brook, 54 / 1c Hollins & Parr
- LCT Manchester Pennine Fringe, Post Industrial Man Made Hill, 54/7 Pilsworth
- LCT Manchester Conurbation, Woodland Cloughs, 55/2 Prestwich

8.3.14 RBC UDP identifies a single LCA within the study area. This is Settled Farmlands Landscape Character Area. Also, RBC's Biodiversity and Development SPD briefly describes the landscape character of the Council's administration area, including the eastern part of the study area which is identified as '*predominantly low lying open farmscape'* urban fringe landscape.

8.3.15 The Greater Manchester Landscape Character and Sensitivity Assessment covers the whole of the Greater Manchester Combined Authority. It consolidates previously published Landscape Character Assessments into a single assessment with continuity across district boundaries which provides a baseline to inform the analysis of landscape. The Greater Manchester Landscape Character and Sensitivity Assessment comprises a framework of LCTs and their component LCAs.

8.3.16 There are five LCAs within the study area:

- LCT Incised Urban Fringe Valleys, LCA 16: River Irwell (south Bury) and River Croal
- LCT Historic Parks and Wooded Estate Farmland, LCA 19: Heaton, Prestwich, Whitefield and Stand Parklands
- LCT Incised Urban Fringe Valleys, LCA 25: River Roch
- LCT Mosslands and Lowland Farmland and LCT Reclaimed Land/Wetlands, LCA 26: Prettywood, Pilsworth and Unsworth Moss (LCA 26 falls within two LCTs)
- LCT Urban Fringe Farmland, LCA 27: Simister, Slattocks and Healds Green.

8.3.17 Given that the Greater Manchester Landscape Character and Sensitivity Assessment provides a consistent baseline to inform the analysis of landscape across the study area, the effects on landscape character will be assessed against this character assessment. As part of the LVIA, further follow up surveys will be undertaken to verify the characteristics described in the Greater Manchester Landscape Character and Sensitivity Assessment.

Local townscape character assessments (TCA)

8.3.18 Townscape Character Areas (TCAs) are areas where the built environment is dominant. There are no published townscape character assessments for the study area; therefore, a desk-based townscape character assessment will be undertaken for the parts of the study area not covered by the published landscape character assessments. The townscape character assessment will be informed by GLVIA3, An Approach to Landscape Character Assessment and Townscape Character Assessment Technical Information Note 05/2017.

8.3.19 In line with paragraph 3.17 of LA 107, the effect on the constituent landscape/townscape features and elements/components of the LCAs and TCAs, such as trees, woods, hedgerows, hedgerow trees, landform and landscape/townscape pattern, will be considered in combination as part of the effects on landscape/townscape character rather than as individual receptors.

Perceptual qualities

8.3.20 The CPRE has undertaken a study of tranquillity in England and has mapped and published the results. CPRE highlights new roads as one of the greatest threats to remaining levels of tranquillity. The Tranquillity Map for England (CPRE, 2007) identifies tranquillity zones based on sources of noise and visual intrusion and the zones over which intrusion may be felt. Within the study area, Bury and north Manchester urban area are indicated to be among the least tranquil areas, whilst the rural parts of the study area are indicated to be more tranquil, although even here tranquillity levels are influenced by noise and visual intrusion.

8.3.21 The CPRE mapping of England's light pollution and dark skies illustrates the influence of light pollution on the night skies within the study area. The study area is affected by night-

time light pollution, especially associated with the urban areas of Bury, Rochdale and Prestwich, as well as the M60 corridor and J18. The night skies within the more rural part of the study area to the north-east of J18 are darker. However, there are no dark skies located within the study area, with the darkest skies are located over the Pennines, approximately 20 km to the north-east.

Visibility and potential visual receptors

8.3.22 The landscape within the study area to the west, north and east is generally low-lying and relatively flat, with very gentle undulations. To the south, including within Heaton Park and the settlement of Simister, the topography becomes more undulating allowing opportunities for longer distance views to the north.

8.3.23 To the west of the study area around Whitefield/Prestwich, adjacent to the M60 corridor, there is a high density of residential areas. However, a combination of environmental barriers and woodland belts within the highway boundary reduces the visibility of the nearby motorway corridor. Visibility reduces further with distance from the highway boundary due to the density of residential development enclosing the corridor. As such, the range of available views is generally near-distance.

8.3.24 The woodland belts within the highway boundary, and occasional environmental barriers, continue to the east and south of M60 J18 along the M62 and M60 respectively. Woodland belts are also in place approximately 750m to north of M60 J18 on the M66. These provide some screening of the M60, M62 and M66 for surrounding residential areas within Prestwich, Simister Island, Whitefield and Unsworth.

8.3.25 At M60 J18, the motorway becomes more visually prominent with near and middle-distance views from the eastern fringes of Whitefield and Prestwich. To the north-east of M60 J18, where the M62 and M66 are predominantly at grade or on low embankment, the landscape is more open, comprising pastoral land with fewer tree belts. While there are open views within these areas towards the motorway network, intervening hedgerows, tree belts and woodlands limit some near and middle-distance views from rural properties.

8.3.26 The study area includes several Public Rights of Way (PRoW) on overbridges crossing the M60/M62/M66 north, west and east of the M60 J18. West of M60 J17, footpaths crossing Whitefield Golf Course and Prestwich Country Park afford views to the M60, although visibility quickly reduces with distance due to intervening topography and vegetation. Elevated areas within Heaton Park allow views to the M60, although woodland within Heaton Park and along the highway boundary provides a high level of screening. Footpaths within open areas to the north-west and north-east of M60 J18, including within Pike Fold Golf Course, provide more open views to the motorway network.

8.3.27 The proximity of the parks and footpaths to urban areas suggests that their levels of use would be high.

8.3.28 Motorway lighting is visually prominent due to the open character of the surrounding area and wide views.

8.3.29 Potential visual receptors within the study area include:

- Residents within settlements of Prestwich, Simister, Whitefield and Unsworth
- Residents within the rural area to the north-east of the M60

- Users of the PRoW network
- Visitors to Heaton Park Registered Park and Garden, Prestwich Country Park (including Prestwich Forest Park)
- Visitors to Public Open Spaces -Thatch Leach Lane Playground, Fusilier's Meadow, Boz Park, Hollins Vale Local Nature Reserve
- Visitors to private open space including allotments, playing fields, Heaton Park Golf Course, Whitefield Golf Course, Pike Fold Golf Course, Unsworth Cricket Club
- People at their places of work, such as within nearby school and businesses on the peripheries of the motorway corridor
- Travellers on the road network, including the M60, M62, M66. The A56 Bury New Road, the A665 Bury Old Road, and the surrounding local road network. (Vehicle travellers on local residential streets are not included in LA 107 Table 3.41 and therefore, will not be included in the LVIA).

Future baseline

8.3.30 Future development, such as areas of housing on land at Hollins Mount Farm, areas of infill housing and retail in Whitefield and Prestwich, and other proposed development may lead to changes to the baseline environment.

8.3.31 Proposed developments will be included in the consideration of cumulative effects.

Methodology

8.3.32 The documents below provide an outline of the methodology that will be used to assess the landscape and visual effects of the proposed development. The methodology used will be agreed through consultation with the Landscape Officers from BMBC, RBC and MCC and is developed in accordance with the following documents:

- Design Manual for Roads and Bridges (DMRB) LA 107 Landscape and Visual Effects (Highways England, February 2020)
- DMRB LA 104 Environmental Assessment and Monitoring (Highways England, August 2020)
- Guidelines for Landscape and Visual Impact Assessment 3rd Edition (GLVIA3) (Landscape Institute and Institute of Environmental Management and Assessment, 2013)
- Technical Information Note 05/2012 on Townscape Character Assessment (Landscape Institute, April 2018)
- An Approach to Landscape Character Assessment (Natural England, October 2014).

8.3.33 The NPPF gives ancient and veteran trees the same status as Ancient Woodland (i.e. loss of irreplaceable habitat). For this reason an Arboriculture Impact Assessment will be undertaken following BS5837:2012 to determine if trees would meet the criteria to be included within the Ancient Tree Inventory (Woodland Trust's web-based database). With respect to local planning policy, Policy EN8 – Woodland and Trees (Bury UDP) states that it '*will support the retention of trees, woodland, copses and hedgerows'*.

8.3.34 The proposed approach to surveying arboricultural resources – individual trees, tree groups, woodlands and hedgerows is described in Appendix G.

8.4 Potential impacts

Construction

8.4.1 The principal elements which would result in landscape and visual effects at the construction stage include:

- Widening of the existing M60/M62 Mainline J17-J18 to dual 5-lane motorway resulting in changes to landform and loss of vegetation, and opening up people's views to the motorway
- Construction of the Northern Loop resulting in changes to landform from excavation, soil stripping and earthworks across a wide area
- Construction of the M66 southbound diverge resulting in changes to landform and loss of vegetation, and opening up people's views to the motorway
- Construction of the M60 northbound to M60 westbound free flow link resulting in changes to landform and loss of vegetation, and opening up people's views to the motorway

8.4.2 Other construction activities which would result in landscape and visual effects include:

- Temporary soil stockpiles
- Temporary contractors' compounds
- Movement of vehicles on temporary haul routes
- Construction activity and operation of plant such as excavators, cranes and site vehicles with beacons visible to nearby receptors
- Upgrading works on the existing motorway network
- Night-time closures including temporary lighting and traffic management operations.

8.4.3 During the construction period, the disruption to the field pattern across three fields; loss of highway trees belts, notably along the M66 southbound verge north east of M60 J18; and loss of agricultural land and changes to land uses would alter landscape character locally.

8.4.4 Similar changes would occur to the Special Landscape Area EN Policy EN9/1, resulting in the loss of part of the high-quality landscape and erosion of the pleasant environment of the area due to the obtrusive nature of the Proposed Scheme.

8.4.5 Local landscape character areas from where there would be limited or no intervisibility with the Proposed Scheme and which would be unlikely to be affected, such as small fragments of landscape character areas that lie on the outer edges of the overarching study area are scoped out of the assessment during construction and operation.

8.4.6 Surrounding visual receptors would experience adverse visual effects. Many of these visual effects are likely to be significant, particularly from the residential edges of surrounding settlements, individual residential properties within the rural area to the east, and PRoW that run close to, or cross, the Proposed Scheme.

8.4.7 Landscape and visual effects during construction could be significant and are therefore scoped in for further assessment.

Operation

8.4.8 The principal elements which would result in landscape and visual effects at the operational stage include:

- Operation of the existing M60/M62 Mainline J17-J18 to dual 5-lane motorway, bringing moving traffic nearer to residential properties
- Extending the M60 J18 and the Northern Loop into the local landscape, eroding the rural character, and increasing the prominence of M60 J18 in people's views
- Operation of the M66 southbound diverge, eroding the rural character, and increasing the prominence of M60 J18 in people's views from the rural area to the north-east
- Operation of the M60 northbound to M60 westbound diverge, increasing the prominence of M60 J18 in people's views.

8.4.9 Other elements associated with the operational stage which would result in landscape and visual effects include:

- New lighting columns, gantries, road signals and signage
- Residual effects from vegetation clearance to accommodate construction of new structures

8.4.10 The Proposed Scheme would increase the prominence of major highway infrastructure within the landscape. This would occur where established woodland belts that help to integrate the existing M60 online sections into the landscape and townscape would be removed during construction. The scale of the infrastructure, including the new and upgraded junctions, and the elevated position of the Northern Loop would be at variance with the scale and character of the rural landscape. The offline bypasses and major junctions are likely to have an adverse effect on landscape character and quality, with a loss of vegetation, disruption to field pattern and some reduction in tranquillity.

8.4.11 The proposed widening of the existing M60/M62 Mainline J17-J18 to dual 5-lane motorway (D5M) would, in places, result in the loss of mature vegetation that currently screens views of the motorway. There are a number of properties that front the M60 that would face substantial changes as the road widening would both bring traffic closer and also require removal of highways woodland belts. Individual rural properties are also likely to experience substantial changes following removal of highways woodland belts for the M66 southbound diverge and the M60 northbound to M60 westbound diverge.

8.4.12 The Northern Loop would increase the prominence of M60 J18 in people's views. In particular for residents on the edges of surrounding settlements, within rural properties and users of footpaths within the rural area to the north-east.

8.4.13 Lighting proposals are likely to create adverse visual effects, due to visibility of the vertical lighting columns during daytime, and from night-time lighting. New gantries and highways signage would also further increase the visual prominence of the highway infrastructure, particularly in open landscapes and where the road is at grade or on embankment.

8.4.14 Landscape and visual effects during operation would potentially be significant and are therefore scoped in for further assessment.

Summary of scope

8.4.15 Table 8.1 summarises the proposed scope for landscape and visual.

Table 8.1: Summary of landscape and visual scope

Matter	Scoped in - construction	Scoped in - operation
Effects on local landscape character that would potentially be directly or indirectly affected	✓	✓
Visual effects	✓	✓

8.5 Design, mitigation and enhancement measures

8.5.1 DMRB LA 104, Design and Mitigation, paragraph 3.23 describes a hierarchical approach to environmental assessment and design. Firstly, through avoidance and prevention to prevent the effect, then reduction (and mitigation) where avoidance is not possible. Where it is not possible to avoid or reduce a significant adverse effect, remediation measures are used to offset the effect.

8.5.2 DMRB LA 107 states that the hierarchical approach outlined in DMRB LA 104 shall be applied to avoid, reduce or remediate (offset) potential effects on the landscape, views and visual amenity.

8.5.3 Where effects cannot be avoided through alignment/design choices, a mitigation strategy should be developed to reduce the potential effects. DMRB LA 104 sets out the categories of mitigation:

- Embedded mitigation: project design principles adopted to avoid or prevent adverse environmental effects
- Essential mitigation: measures required to reduce and if possible offset likely significant adverse environmental effects, in support of the reported significance of effects in the environmental assessment.

8.5.4 The preliminary landscape design would be developed to integrate the road into the local context, avoiding the need for additional mitigation and seeking enhancement opportunities where possible, in line with DMRB LD 117 Landscape Design (Highways England, 2020).

8.5.5 Embedded mitigation is likely to include, but would not be limited to:

- Junction design to reduce the effects on landform; retain vegetation, field pattern, and landscape features; and reduce the effects on people's views
- Careful design of major structures, signage and gantries to limit visual intrusion
- Refinement of the design of earthworks to create natural gradients and slopes that achieve better integration with the surrounding landform, where space and material are available
- Use of sensitive lighting design such as the use of horizontally mounted, flat-glass lanterns
- Native tree and shrub planting on and adjacent to highway earthworks to create woodlands, copses and shelterbelts in order to break up the scale of the road, help

screen structures, traffic and lighting and help integrate the Proposed Scheme into the existing landscape pattern

- Use of planting to link into existing field boundary vegetation to provide screening and integration into the local pattern and character, as well as connection of existing wildlife corridors
- Use of native species as appropriate to reflect the distinctive local character, such as increasing hedgerow and hedgerow trees
- Retention of views to local landmarks through breaks in the planting to help create a sense of place for vehicle travellers, where possible.

8.6 Description of the likely significant effects

8.6.1 Landscape and visual effects during construction would be caused by construction activity, including movement of plant and equipment, and the loss of vegetation. Landscape and visual effects during operation would result from the increased extent of highway infrastructure, lighting, signage and gantries. Significant landscape and visual effects during construction and during operation, particularly in the short term before mitigation planting becomes established, are likely.

8.6.2 Some residual landscape and visual effects during operation are likely to remain significant in the long term despite mitigation. For example, the rural character of the landscape would be permanently affected by the Proposed Scheme, and views from some highly sensitive receptors, such as nearby residents and users of footpaths, are likely to be permanently affected.

Scoping - Landscape aspect

8.6.3 DMRB LA 107 (paragraph 3.9) confirms that five scoping questions should be answered in order to gain an understanding of the need to undertake further assessment for the Landscape aspect. Where the response to one or more of these questions is 'yes', then further assessment should be undertaken.

8.6.4 The responses to the scoping assessment questions for the Proposed Scheme are provided in Table 8.2, based on the application of professional engineering judgement to the current design information.

Table 8.2: DMRB LA 107 Scoping questions and responses – Landscape aspect

Scoping questions	Response	Scoped in/out
1) is the project likely to affect designated landscapes (statutory or local designation)?	Yes	Scoped in
2) is the project likely to affect the distinctiveness of a landscape character area or type?	Yes	Scoped in
3) is the project likely to affect national, regional or local characteristics or distinctive features?	Yes	Scoped in
4) is the project likely to affect the condition or quality of a landscape?	Yes	Scoped in
5) is the project likely to affect the intrinsic character, qualities and local identity of the urban environment (sense of place)?	Yes	Scoped in

8.6.5 Having answered 'yes' to one or more of the DMRB LA 107 scoping questions for Landscape, it is recommended that this matter is scoped into the EIA.

Scoping - Visual aspect

8.6.6 DMRB LA 107 (paragraph 3.29) confirms that four scoping questions should be answered in order to gain an understanding of the need to undertake further assessment for the Visual aspect. Where the response to one or more of these questions is 'yes', then further assessment should be undertaken.

8.6.7 The responses to the scoping assessment questions for the Proposed Scheme are provided in Table 8.3, based on the application of professional engineering judgement to the current design information.

Table 8.3: DMRB LA 107 Scoping questions and responses – Visual aspect

Scoping questions	Response	Scoped in/out
1) is the project likely to affect receptors (individuals or range of people) views and the visual amenity of the area?	Yes	Scoped in
2) is the project likely to affect the sensitivity of views to and from designated and/or valued landscapes, or from public rights of ways, public open spaces or from national trails?	Yes	Scoped in
3) is the project likely to affect a range of viewpoints and nature of views from which the project is visible?	Yes	Scoped in
4) is the project likely to generate significant visual effects (daytime and night-time)?	Yes	Scoped in

8.6.8 Having answered 'yes' to one or more of the DMRB LA 107 scoping questions for Visual, it is recommended that this matter is scoped into the EIA.

8.7 LVIA Assessment methodology

8.7.1 This section describes the approach to the LVIA.

8.7.2 The proposed assessment will be proportionate, focusing on significant adverse effects within the 2km study area. Effects on receptors that are not considered likely to be significant will be summarised concisely but will not be set out in detail.

8.7.3 The assessment methodology for the LVIA will follow DMRB LA 107, which sets out the requirements for assessing and reporting the landscape and visual effects for highway projects. The methodology is also in accordance with the requirements of the DMRB, LA 104 Environmental Assessment and Monitoring (Highways England, 2019). The assessment criteria for sensitivity and magnitude of effects is described in Appendix B. Note that DMRB LA 107 considers landscape 'sensitivity' which incorporates judgements on 'value' and 'susceptibility' (Table 3.22) which differs from LA 104 (Table 3.2N). LA 107 sensitivity criteria described in Appendix B will be followed. Photography and photomontages will be in accordance with the Visual Representation of Development Proposals Technical Guidance Note 06/19 (Landscape Institute, 2019).

8.7.4 It is proposed to base the assessment of landscape effects within the 2km study area on the Greater Manchester Landscape Character and Sensitivity Assessment described above. The assessment of impacts on landscape components, such as trees and

woodland, and perceptual and aesthetic aspects will be considered within the assessment of impacts on landscape character. The assessment of impacts on historic environment features in the study area, such as Heaton Park Registered Park and Garden and conservation areas, will be addressed in the cultural heritage aspect (see Chapter 7, Cultural Heritage). Historic landscape characterisation will also be considered within the cultural heritage aspect.

8.7.5 It is proposed to base the assessment of visual effects on a selection of representative viewpoints representing different receptor groups within the study area. Representative viewpoints have been selected through study of aerial photography, topographical mapping and Winter and early Spring site surveys. Photomontage locations that have been selected would represent the likely visual change from a range of receptor types and view locations. The selection of potential representative viewpoints and photomontage locations will be agreed through consultation with local planning authorities. Table 8.4 summarises the selected representative viewpoints and photomontage locations.

8.7.6 Proposed representative viewpoint and photomontage locations are illustrated on Figure 8.4.

Table 8.4: Summary of Representative viewpoints and photomontage location

Reference - Representative viewpoint (VP), Photomontage location (PM)	Representative viewpoints and location	Receptor type
VP1	Footpath 4WHI	Recreational
VP2	Castlebrook Farm, Whitegate Bungalow on Castle Road, Restricted Byway 85BUR	Residential, recreational
VP3	Brickhouse Farm, four residential properties on Killy Lane, Footpath 6WHI, Footpath 8WHI, Pike Fold Golf Course	Residential, recreational
VP4	Residential properties on Parr Lane, Bury	Residential
VP4a	Hollins Mews, Unsworth	Residential
VP5 and PM2	Unsworth Moss Farm, Unsworth Moss Bungalow, Moss Top Farm, Footpath WHI8, Footpath WHI10	Residential, recreational
VP6	Footpath 9WHI on Hills Lane	Recreational
VP7 and PM1	Footpath 9WHI, Footpath 46WHI	Recreational,
VP8	Footpath 50PRE	Recreational
VP9	Simister Green residential properties, Simister Green Play Area	Residential, recreational
VP10	Simister Green residential properties	Residential
VP11	Droughts Lane residential properties	Residential
VP12	Farm Lane, Simister, Footpath 28bPRE	Residential
PM3	Heywood Road, M60 overbridge	Transient
VP13	Footpath 12WHI	Recreational
VP14	Roch Crescent, Douglas Walk	Residential
VP15 and PM8	Roch Crescent, Boz Park Public Open Space	Residential, recreational
VP16 and PM9	Boz Park Public Open Space	Recreational
VP17	Mersey Drive, Oak Lane residential properties, Boz Park Public Open Space	Residential, recreational
VP18 and PM7	Cowl Gate Farm, Footpath 12WHI	Residential, recreational
VP19	Residential properties on Mode Hill Lane, Footpath 12 WHI	Residential, recreational
VP20	Residential properties on Marston Close	Residential
VP21	Residential properties on Rothay Close, Brathay Close,	Residential
VP22	Residential properties on Heybrook Close	Residential
VP23 and PM6	Residential properties on Corday Lane	Residential
PM5	Heywood Road	Transient
VP24 and PM4	Parrenthorn High School, Heywood Road	Community
VP25	Bridle Way 27aPRE	Recreational

Reference - Representative viewpoint (VP), Photomontage location (PM)	Representative viewpoints and location	Receptor type
VP26	Heaton Park Registered Park and Garden	Recreational
VP27	Residential properties on Parrenthorn Road, St. Mary's Church of England Primary School	Residential, community
VP28	Residential properties on Sandgate Road, St. Joseph's Avenue, Prestwich Heys FC, Footpath 12 WHI	Residential, recreational
VP29	Residential properties on Warwick Avenue	Residential
VP30	Footpath 12 WHI, Sandgate Road	Recreational
VP31	Residential properties on Thatch Leach Lane, Fusiliers Memorial Meadow, Thatch Leach Lane Play Area	Recreational, residential
VP32	Residential properties on Balmoral Avenue	Residential
VP33	Residential properties on North Circle	Residential
VP34	Whitefield Interchange roundabout footpath	Recreational
VP35	Residential properties on Beech Avenue	Residential
VP36	Footpaths 32WHI, Whitefield Golf Course	Recreational
VP37	Footpath 33WHI (view east)	Recreational
VP38	Footpath 33WHi (View west)	Recreational
VP39	Footpath 24PRE	Recreational
VP40	Heywood Farm to east of southern extent of M60 order limits, Footpath 29bPRE	Residential

8.7.7 The criteria that will be used for the assessment of landscape and visual effects will be those from DMRB LA 107.

8.7.8 As defined in LA 107 Terms and Definitions, and in accordance with GLVIA3, the magnitude of effects *'combines judgements about size and scale of effect, extent of area it occurs over, whether reversible or irreversible and whether short or long term in duration'.*

8.7.9 The assessment of magnitude of landscape and visual effects will consider impacts at the following timeframes, in accordance with DMRB LA 107 (paragraph 3.19):

- Construction Phase: Considers construction activities, temporary works (including compounds) and construction traffic during the construction period. Assessments for each landscape and representative visual receptor will be made at a time during construction when impacts are likely to be most significant for the individual receptor.

8.7.10 In accordance with DMRB LA 107, magnitude of effects shall be reported in year 1 (opening year) and year 15 (design year) including summer and winter for landscape effects (Section 3.19) and visual effects (Section 3.42).

- Operation Year 1: Considers impacts on a winter's day during year 1 following completion of all construction, when planted mitigation would not yet have taken effect. Both the completed project and the traffic using it would be considered.

- Operation Year 15: Considers the impacts on a summer's day in the fifteenth year after opening. Both the completed project and the traffic using it would be considered.

8.7.11 Day and night-time changes for landscape and visual receptors will be considered against the baseline situation, that is the situation if the Proposed Scheme did not proceed. However, it is not considered that assessment of effects on the night skies in their own right is required due to the surrounding night-time landscape context, as no dark skies have been identified by CPRE within the study area.

8.7.12 The significance of effects will be determined by combining judgements on the sensitivity of landscape receptors (LA 107 Table 3.22) and visual receptors (LA 107 Table 3.41) with the magnitude of landscape effects (LA 107 Table 3.24) and visual effects (LA 107 Table 3.43). In accordance with DMRB LA 107, the matrix in Chapter 5 (Table 5.1), which is consistent with the matrix within DMRB LA 104, will be used to assist professional judgement when determining the significance of landscape and visual effects. An overall statement of landscape and visual significance will be included in accordance with DMRB LA 107.

8.7.13 In accordance with DMRB LA 107, the magnitude of effect and significance of effect will be assessed taking into consideration the proposed mitigation.

8.7.14 The data sources identified under 'baseline sources' (Section 8.3) will be used to inform the assessment.

8.7.15 The proposed methodology for assessing landscape and visual effects set out in DMRB LA 107 meets the NNNPS policy requirements outlined in Section 8.1.

8.8 Assessment assumptions and limitations

8.8.1 For simplicity, the term 'landscape' will be used throughout the LVIA to describe areas of landscape and townscape, in line with DMRB LA 107 which states that the "*LVIA process does not differentiate between 'landscape' and 'townscape', as it is applicable to any landscape - urban, rural or a combination of both...".* Therefore, the assessment methodology for impacts on landscape and townscape does not differ.

8.8.2 Access to receptors and viewpoints to be assessed will be restricted to publicly accessible areas. Descriptions of baseline views and the assessment of changes to views from private and inaccessible viewpoints, including upper storey views from properties, will therefore be made using the professional judgement of Chartered Landscape Architects, based on an assessment from a nearby representative viewpoint (e.g. adjoining PRoW or highway).

8.8.3 Visual effects tend to diminish with distance. Where a receptor, such as the user of a PRoW, could view the Proposed Scheme from a range of distances, the assessment of visual effects likely to be experienced is generally based on the worst-case situation. In most cases, subject to other factors such as the presence of screening elements, this is likely to be when the receptor is at the nearest point to the Proposed Scheme.

8.8.4 Future development, as described under future baseline (Section 8.3), may lead to changes to the baseline environment.

8.8.5 Proposed developments will be included in the consideration of cumulative effects. The future baseline of the LVIA will not include proposed developments. This is because proposed developments are not guaranteed to be built and the date at which potential future development would be completed is often unknown. Details are often in outline so that the design, form and layout of future development is unknown, making it impractical to incorporate them accurately within the assessment of landscape and visual effects. Committed development with full planning consent or where construction is underway at the time of assessment will, however, be considered within the LVIA for assessment during the construction, Year 1 and Year 15 time periods.

8.8.6 The screening or filtering effect of existing vegetation outside the Proposed Scheme boundary will be taken into account within the assessment in its current condition. Growth or other changes to this vegetation would potentially affect impacts caused by the Proposed Scheme, but the management and retention of such vegetation is outside the control of Highways England.

9. Biodiversity

9.1 NNNPS requirements

9.1.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

9.1.2 Key policy from the NNNPS relevant to this aspect, taking into account the ecology constraints described in Section 9.3, includes:

- Paragraph 5.22 of the NNNPS states that the applicant's assessment should describe any likely significant effects on internationally, nationally and locally designated sites of ecological conservation importance; protected species; habitats (including irreplaceable habitats such as ancient woodland and veteran trees); and other species identified as being of principal importance for the conservation of biodiversity
- Paragraph 5.23 states that the applicant should describe how the project plans to conserve and enhance biodiversity conservation interests
- Paragraph 5.25 states that development should avoid significant harm to biodiversity conservation interests, including through appropriate mitigation and consideration of alternatives
- Paragraph 5.32 states that development should not result in the loss or deterioration of irreplaceable habitats including ancient woodland and veteran trees
- Paragraph 5.35 states that other habitats and species identified as being of principal importance should be protected from adverse effects of development
- Paragraph 5.36 states that appropriate mitigation measures are considered an integral part of a proposed development and the applicant should include these in their assessment, including identifying how these measures will be secured. The applicant should demonstrate that:
  - they will seek to ensure that activities will be confined to the minimum areas required for works during construction
  - best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised during construction and operation
  - developments and landscaping will be designed to provide green corridors and minimise habitat fragmentation
  - opportunities will be taken to enhance existing habitats and create new habitats within the site landscaping proposals
- Changes in air quality, light pollution, noise, and the water environment due to project construction or operation should be assessed for their potentially adverse impacts on wildlife, biodiversity and nature conservation

9.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

9.2 Study area

9.2.1 The study area for biodiversity relates to the main areas of construction activity, including the Proposed Scheme, construction compounds, storage areas, haul roads and outfalls. These areas are included in the provisional Order Limits.

9.2.2 The survey areas for individual biodiversity resources are provided in Appendix E with the zone of influence of each detailed in Section 9.4.

9.2.3 Any receptors that are hydrologically connected to the Proposed Scheme through rivers or other watercourses within 500m of the Order Limits will also be considered.

Designated sites and habitats

9.2.4 The study area for Ramsar and European designated sites for nature conservation follows that of the Design Manual for Roads and Bridges (DMRB) LA 115: Habitats Regulations Assessment (Highways England, 2020; hereafter referred to as DMRB LA 115). This includes where the Proposed Scheme:

- Is within 2km of a Ramsar or European site or functionally linked land
- Is within 30km of a Special Area for Conservation (SAC), where bats are noted as one of the qualifying interests
- Crosses or lies adjacent to, upstream of, or downstream of, a watercourse which is designated in part or wholly as a Ramsar or European site
- Has a potential hydrological or hydrogeological linkage to a Ramsar or European site containing a groundwater dependent terrestrial ecosystem
- Has an affected road network (ARN) within 200m of a Ramsar or European site

9.2.5 Consideration is also given where there is a greater distance between the Proposed Scheme and Ramsar/European sites, but a pathway to effect exists. For example, flight paths or feeding or roosting areas of birds that may be found using habitats outside the boundaries of a Special Protection Area (SPA). The sites under consideration were limited to those within 20km where wildfowl and waders are a qualifying feature. Gull species typically range further than this and are considered at greater distances.

9.2.6 The study area for national statutory designated sites (Sites of Special Scientific Interest (SSSI) and National Nature Reserves (NNR)) and non-statutory designated sites (Local Nature Reserves (LNR)) is defined as 2km from the Proposed Scheme. Local, non-statutory, designated sites (Sites of Biological Interest (SBI)) have a 1km study area from the Proposed Scheme.

9.2.7 A desk-based study of a 1km wide study area centred on the Proposed Scheme was used to identify ancient woodland and habitats of principal importance in England, referred to as ‘priority habitats’ in this report.

Other habitats

9.2.8 Aerial photography and Ordnance Survey (OS) maps have been viewed within a 1km study area around the Proposed Scheme. Highly urbanised areas were excluded from the study area, due to the absence of habitats of conservation interest.

Air quality impact assessment

9.2.9 Assessment of the potential air quality impacts on sensitive designated sites and habitats within 200m of the ARN will be undertaken in accordance with DMRB LA 105: Air Quality (Highways England, 2019) (see Chapter 6: Air Quality).

Protected and notable species

9.2.10 The desk-based study area for protected and notable species comprises an area within 2km of the Proposed Scheme. Field survey areas for species-specific surveys vary depending on the sensitivities and legal protection of the receptor, using best practice species-specific guidance wherever possible. Field surveys were undertaken in 2018 and are also being carried out in 2021, with some surveys ongoing at the time of writing. Appendix E provides detail on the survey methodology and programme.

9.3 Baseline conditions

Baseline sources

9.3.1 The following baseline sources have been used during the data gathering:

- Greater Manchester Local Records Centre (GMLRC) provided data records in 2017 which were updated in 2021 for protected and designated species, invasive species, non-statutory Local Wildlife Sites (LWS) and special road verges (updated data were not received at the time of writing)
- The Ancient Woodland Inventory (Natural England, 2021) was reviewed to identify ancient woodland habitats
- Aerial photography and OS maps were reviewed between 2018 and the present day
- International and national statutory designated sites, priority habitats and granted European Protected Species Licences were identified on the Multi-Agency Geographic Information for the Countryside (MAGIC) website (Defra, 2021)

Designated sites and habitats

9.3.2 There are no confirmed or potential Special Protection Areas (SPA), Special Areas of Conservation (SAC) or Ramsar sites located within the 2km study area (Figure 9.1) and no SAC designated for bats within 30km of the Proposed Scheme. There is one internationally designated site within 10km of the Proposed Scheme. Rochdale Canal SAC and SSSI is located 5.5km east of M60 J18 and is primarily designated for its assemblage of aquatic flora. The Rochdale Canal SAC and SSSI (NGR SD 89300 03800) lies within 200m of the PCF Stage 2 Affected Road Network (ARN). While the ARN has yet to be defined at PCF Stage 3, this site will be scoped into the assessment under DMRB 105 Air Quality criteria.

9.3.3 There are no National Nature Reserves (NNRs) within 2km of the Proposed Scheme. There are eight Local Nature Reserves (LNRs) located within 2km of the Proposed Scheme or within 200m of the PCF Stage 2 ARN (see Table 9.1 and Figure 9.1). The Proposed Scheme directly borders Philips Park LNR and is in close proximity to Mere Clough LNR.

Table 9.1: Local Nature Reserves within 2km of the Proposed Scheme or within 200m of the PCF Stage 2 ARN

Site	Interest/designated features	Approximate distance and direction from the Proposed Scheme
Philips Park LNR (NGR SD 79745 03852)	Mixed woodland, grassland, streams, ponds and lodges.	0m south
Hollins Vale LNR (NGR SD 81502 08603)	Species-rich grassland, hedgerows.	35m west
Mere Clough LNR (NGR SD 80135 03923)	Woodland and watercourse.	50m south
Blackley Forest LNR (NGR SD 84125 04092)	Broadleaved and plantation woodland, grassland, lake, marsh and a river.	1.6 km south-east
Chapelfield LNR (NGR SD 78972 06155)	Woodland, reservoirs, aquatic plants	1.9km north
Clifton Country Park LNR (NGR SD 77191 04304)	Woodland, meadow, lakes	2.6km west
Alkrington Woods LNR (NGR SD 86140 05478)	Woodland, meadow, lake, fishing lodges	2.2km south-east
Hopwood Woodlands LNR (NGR SD 87923 07955)	Woodland	4.2km east

9.3.4 There are 22 Sites of Biological Importance (SBIs) within 1km of the Proposed Scheme or within 200m of the PCF Stage 2 ARN (Table 9.2 and Figure 9.1). The closest of these is Philips Park and North Wood which is immediately adjacent to (i.e. within 10m of) the Proposed Scheme (this site is also designated as an LNR and which also has an area of ancient woodland within it).

9.3.5 As the ARN for PCF Stage 3 is yet to be defined, this list is not exhaustive and may change. Once the PCF Stage 3 ARN is defined, a comprehensive list of designated sites that meet the DMRB LA 105 criteria will be established, and the air quality effects on the identified sites will be assessed.

Table 9.2: Sites of Biological Interest within 1km of the Proposed Scheme or within 200m of the PCF Stage 2 ARN

Site	Reason for designation													Distance (m) and direction from Proposed Scheme
	Large standing water (Fw3)	Small lodges[1] (Fw2)	Other broadleaved woodland (Ws1)	Plantation woodland (Wd2)	Grassland (Gr2)	Reedbed, swamp, and fen (Fw1)	Aquatic invertebrates (A11)	Birds (Br6)	Ancient Woodland (Wd1)	Scrub (Wd3)	Heath (HB1)	Bees and wasps (GSG1)	Habitat Mosaic (HM1)	
Philips Park and North Wood		X			X				X					0m south
Hollins Plantation			X											30m north-west
Hazlitt Wood		X	X				X							70m south-east
Hollins Vale		X			X									260m north-west
Heaton Park Reservoir								X						280m south
Pilsworth	X	X												420m north-east
Parr Brook					X									580m west
Prestwich Clough									X					900m south
Clifton Lodge (North & South)	X	X							X	X				3.4km south-west
Unity Brook									X					3.3km south-west

[1] Lodges are man-made waterbodies, with most examples originating from the industrial revolution. These were created to hold water for industrial processes - notably in Greater Manchester for the textile industry.

Site	Reason for designation													Distance (m) and direction from Proposed Scheme
	Large standing water (Fw3)	Small lodges[1] (Fw2)	Other broadleaved woodland (Ws1)	Plantation woodland (Wd2)	Grassland (Gr2)	Reedbed, swamp, and fen (Fw1)	Aquatic invertebrates (AI1)	Birds (Br6)	Ancient Woodland (Wd1)	Scrub (Wd3)	Heath (HB1)	Bees and wasps (GSG1)	Habitat Mosaic (HM1)	
Rhodes Farm Sewage Works	X					X		X						1.3km west
Clifton Country Park		X						X	X					2.2km west
Ringley Woods					X				X					1km west
Grassland & Heath off Clively Avenue											X	X		2km south-east
Manchester, Bolton & Bury Canal at Agecroft	X													2.8km south-west
Reservoirs at Chapelfield		X												1.9km north
Sailor's Brow & Springwater Park		X					X						X	1.9km north
Lakeside Woodland in Heaton Park					X				X					1.4km south
Bowker Vale Reservoirs	X		X	X			X							2.2 km south
Streams and Flushes near Bradley Hall Farm					X									1.3km east

Site	Reason for designation													Distance (m) and direction from Proposed Scheme
	Large standing water (Fw3)	Small lodges[1] (Fw2)	Other broadleaved woodland (Ws1)	Plantation woodland (Wd2)	Grassland (Gr2)	Reedbed, swamp, and fen (Fw1)	Aquatic invertebrates (AI1)	Birds (Br6)	Ancient Woodland (Wd1)	Scrub (Wd3)	Heath (HB1)	Bees and wasps (GSG1)	Habitat Mosaic (HM1)	
Blackley Forest & Heaton Vale Reservoirs		X												1.7km south-east
Alkrington Woods and Rhodes Lodges													X	2.1km east

9.3.6 There are six Ancient Woodland Inventory sites located within the 1km study area or within 200m of an PCF Stage 2 ARN (Figure 9.2). These are ancient semi-natural woodland habitats. The closest Ancient Woodland Inventory site is Philips Park Wood, part of which lies within the provisional Order Limits. Two of these are also designated as LNR.

9.3.7 The desk-based study identified a number priority habitats within 1km of the Proposed Scheme. However, the confidence in these classifications as detailed on the MAGIC website is 'low', likely indicating that they have been identified remotely through aerial imagery or remote sensing and have not been ground-truthed (Defra, 2021). The following priority habitats were identified as being present within 1km of the Proposed Scheme:

- Good quality semi-improved grassland
- Lowland mixed deciduous woodland
- Purple moor grass and rush pastures wet woodland
- Lowland dry acid grassland
- Lowland fens
- Traditional orchards
- Wood pasture and park
- Open mosaic on previously developed land

9.3.8 Several areas identified as deciduous woodland located along the existing motorway verges are located within the provisional Order Limits.

Other habitats

9.3.9 A UK Habitat Classification system survey was underway at the time of writing. A Phase 1 habitat survey was also undertaken in 2018. The 2018 Phase 1 survey results found the survey area to be an approximate equal mixture of amenity grassland, improved grassland, and semi-improved grassland areas. Areas of dry heath/acid grassland, marshy grassland, and small areas of calcareous grassland were also present. Broadleaved semi-natural woodland was present along the verges of the motorways. A number of ponds were present in the landscape, with a large concentration of ponds within Pike Fold Golf Course to the north-east of the Proposed Scheme. Other habitats recorded included tall ruderal vegetation, bare ground, scrub, marginal and inundation vegetation, running water and hedgerows. Built up residential areas are present but were not surveyed.

Protected and notable species

9.3.10 Updated desk study records have not yet been received. Findings from the 2018 Phase 1 habitat survey were that a range of habitat features that would be suitable for the following protected and notable species or groups of species:

- Amphibians including great crested newt (*Triturus cristatus*)
- Badger (*Meles meles*)
- Bats (*Chiroptera*) species

- Breeding and wintering birds
- Fish
- Freshwater invertebrates
- Otter (*Lutra lutra*)
- Reptiles
- Terrestrial invertebrates
- Water vole (*Arvicola amphibius*)
- Notable vascular plants

9.3.11 Other notable species such as brown hare (*Lepus europaeus*), hedgehog (*Erinaceus europaeus*), or other amphibian species may also be present, with a record of brown hare being present in the 2018 desk study data.

9.3.12 At the time of writing, 2021 surveys are ongoing and data sets are not sufficiently complete to contribute to this scoping report. However, notable results to date include the presence of great crested newt and badger setts.

9.3.13 Appendix E details the survey methodology used for each species group. Where there is deviation from published survey guidance, this is detailed. No deviations have been reported to date.

Invasive species

9.3.14 Japanese knotweed (*Reynoutria japonica*), giant hogweed (*Heracleum mantegazzianum*), and Himalayan balsam (*Impatiens glandulifera*) were recorded within the study area during the 2018 Phase 1 Habitat survey.

Future baseline

9.3.15 It would be expected that as the landscape is a mixture of amenity and agricultural grassland it would continue to be managed in this way. Increasing development and housing in the area is likely to put more pressure on the remaining natural habitats which may affect the local population and distribution of species. Any effect from climate change would be unlikely to significantly alter the land use, and therefore the habitats, prior to construction of the Proposed Scheme. Long term impacts from climate change could alter the species composition and types of habitats in and around the site, and therefore types and diversity of fauna. However, it is not anticipated that the combined impact of the Proposed Scheme and climate change would be any different to the impact of climate change in isolation (i.e. without the Proposed Scheme) as the habitats that would be created as part of mitigation proposals will be the same types as those found in the local area at the current time.

Value of receptors

9.3.16 The value of each receptor was determined based on a geographical scale, following the ‘resource importance’ approach described in DMRB LA 108: Biodiversity (Highways England, 2020; hereafter referred to as DMRB LA 108), which is replicated in Appendix B. The list of receptors and the respective importance

provided in Table 9.3 should be treated as provisional and may change based on the outcome of detailed surveys, assessments, and consultation during development of the Proposed Scheme.

9.3.17 Invasive non-native animal and plant species do not have an intrinsic value and are considered of negligible value in this assessment of value/importance.

Table 9.3: Value of receptors in the study area for biodiversity

Value/ sensitivity	Examples within the study area	Justification
Designated sites and habitats		
International or European	Rochdale Canal SAC	European site within 200m of PCF Stage 2 ARN
UK or National	Rochdale Canal SSSI Six Ancient Woodland Inventory sites:	• SSSI sites are considered to be of UK or national importance • Irreplaceable habitat. • Has been selected as nationally important through expert consensus according to national criteria.
Regional	No features present within the study area at this level of importance.	N/a
County	8 LNRs (Table 9.1) and 22 SBIs (Table 9.2)	Wildlife / nature conservation sites designated at a county (or equivalent) level.
County	Priority habitat: hedgerows; lowland mixed deciduous woodland; ponds; dry heath/acid grassland.	Areas of habitats identified in county or equivalent authority plans or strategies
Local	Non-priority habitats: other broadleaved woodland, semi-improved neutral grassland, calcareous grassland; amenity grassland, marshy grassland, poor semi-improved grassland, and tall ruderal vegetation	Not priority habitats or not high-quality examples of their types, but provide benefits to wildlife and have intrinsic biodiversity value
Species		
International or European	No features present within the study area at this level of importance.	N/a
UK or National	No features present within the study area at this level of importance.	N/a
Regional	Breeding bird assemblage and wintering bird assemblage.	A locally designated site for its bird population is present in the area. Habitats around the Proposed Scheme could support a population of species that could be important at a UK level at a critical phase in its life cycle (breeding or over-wintering)

Value/ sensitivity	Examples within the study area	Justification
Regional	Great crested newts	Numerous ponds present within the landscape could support a population of breeding great crested newts, a European Protected species at a critical phase in its life cycle
Regional	Bat species	Potential for a presence of a breeding roost of a regionally importance bat species to be present.
County	Otter	A population of otter may be present within the area that could form a critical part of a wider county or equivalent authority area population.
County	Water vole	A population of water vole may be present. The local authority has a biodiversity action plan for the species.
County	Common *lizard* (*Zootoca vivipara*)	A population of common lizard may be present within the area that could form part of a wider county or equivalent authority area population.
County	Grass snake (*Natrix helvetica*)	A population of grass snake may be present within the area that could form part of a wider county or equivalent authority area population.
County	Terrestrial invertebrates	A species of national importance may be present within the area and may be at a critical phase of its life cycle.
County	Notable vascular plants	Notable vascular plants may be present and the loss of these could adversely affect the conservation status or distribution of the species at a county or unitary scale.
Local	Badger	Widespread and relatively abundant in this region. A species considered to appreciably enrich the habitat resource within the local context.
Local	Brown hare	A species considered to appreciably enrich the habitat resource within the local context.
Local	Hedgehog	A species considered to appreciably enrich the habitat resource within the local context.

9.4 Potential impacts

9.4.1 The potential impacts from the Proposed Scheme, and the zone of influence (ZOI) within which receptors might experience effects, are listed in Table 9.4.

9.4.2 Table 9.4 shows the typical pathways to an effect and the ZOI over which the effect is felt (based on standard guidance where available) and the ecological features identified in the baseline that are present within a ZOI. ZOI is the area over which biodiversity resources can be affected by changes as a result of a proposed project.

Impact pathways - construction

9.4.3 The Proposed Scheme would require the temporary and permanent loss of terrestrial habitats, including priority habitats, and habitats likely to be used by or to support protected and notable species. Habitat fragmentation would potentially result from the severance of linear habitat features such as hedgerows and lines of trees. This could potentially affect protected or notable species that rely upon such habitats for foraging, commuting, or dispersing.

9.4.4 During the construction phase, the following activities could potentially result in mortality and injury of species receptors: site clearance, earthworks, works affecting watercourses, and other temporary works e.g. entrapment in excavations. Significant effects could arise if protected or notable species are present within the footprint of the Proposed Scheme, especially if they could not avoid the works.

9.4.5 Disturbance to important receptors could result from changes in noise, light, vibration, or visual stimuli. During construction, disturbance could arise from the following activities: fencing, earthworks, compound set up, construction, and reinstatement.

9.4.6 Air quality changes could occur through dust and changes in pollutant levels caused by emissions from construction plant and machinery, with resulting effects on sensitive habitats. Chapter 6: Air Quality provides additional detail on air quality. Modelling assessment is required to assess the impact of nitrogen oxide (NO_x) deposition on sensitive habitats; this is described in Chapter 6. See Chapter 16: Assessment of cumulative effects for the ZOI for air quality impacts.

9.4.7 There is potential for hydrological change to cause significant effects during construction where works would directly or indirectly affect watercourses. Hydrological changes are detailed in Chapter 14: Road Drainage and the Water Environment; and include changes to both water quality and quantity within nearby watercourses. Changes in hydrology, fluvial geomorphology and hydrogeology are important to terrestrial and freshwater ecology due to the following factors:

- Water quantity has an important role in structuring the flora and fauna communities in watercourses, ponds and wetlands
- Sediment and other pollutant releases have the potential to adversely affect sensitive ecological receptors
- Ecological receptors can be sensitive to alterations of runoff regimes changing the quality of surface and groundwater

9.4.8 Any introduction or spread of invasive non-native species (INNS) would potentially cause significant adverse effects to sensitive habitats. This is because of the dominance that these species can have over native species. During the construction works, topsoil and subsoil potentially containing plant INNS would be disturbed. Such soil or seed and ‘propagules’ could be spread during construction activities, including

excavation and machinery movements. Works within water can also introduce and spread animal INNS.

Impact pathways - operation

9.4.9 Mortality in the operation phase relates to the fact that animals may be attempting to cross a wide road, used by fast traffic, which bisects the landscape. Unlike the risk of construction direct mortality, which is of a temporary nature, the risk of direct morality through operation of the Proposed Scheme is effectively permanent.

9.4.10 Sources of disturbance in the operational phase relate to road noise and lighting. Noise has the potential to impact upon receptors, potentially reducing the suitability of habitat close to the road, and therefore reducing the habitat available to receptors in the vicinity of the site.

9.4.11 Impacts from operational road lighting may occur. The effects of road lighting are complex but include disturbance and roost abandonment; habitat severance, loss of foraging habitats for light-shy species due to light-spill; a decline in prey availability, and potential to increase traffic collisions by altering foraging behaviour. Habitats where the impact of lighting can be particularly severe include along river corridors, woodland edge, and hedgerows.

9.4.12 The key receptors that may be sensitive to changes in vehicle emissions are sensitive priority habitats and ancient woodland habitats, and any species that depend on this. Chapter 6: Air Quality provides additional detail on air quality. Modelling assessment is required to assess the impact of nitrogen oxide (NOx) deposition on sensitive habitats. The DMRB standard was updated in 2019 and now requires that designated sites within 200m of the ARN need to be considered during air quality assessments. The air quality assessment currently includes one Site of Special Scientific Interest (SSSI), one Special Area of Conservation (SAC), six Ancient Woodland (AW) sites, three Local Nature Reserves (LNRs) and seven Sites of Biological Importance (SBIs) within 200m of the PCF Stage 2 ARN. These can be seen in Figure 6.3. This is described in Chapter 6: Air Quality.

9.4.13 Operational effects to watercourses are possible in relation to surface water road drainage and unexpected pollution events. The Water Framework Directive (WFD) assessment will aim to determine the effects of the Proposed Scheme on ecological quality, identifying any potential impacts that could cause deterioration in the assigned status of a water body or prevent a water body from meeting its WFD objectives. WFD assessment is covered in Chapter 14: Road Drainage and the Water Environment.

Table 9.4: Summary of impact pathways, zones of influence and relevant ecological receptors

Impact pathway	Zone of influence and rationale	Receptor potentially sensitive to the impact pathway
Construction phase		
Habitat loss/gain, fragmentation or modification	Habitat loss/gain would be restricted to areas cleared to make way for highways construction, temporary compounds or temporary access roads. Temporary/permanent loss and fragmentation of watercourses may occur with installation/modifications to outfalls	• Philips Park LNR/SBI/Ancient woodland • Priority habitats: woodland, and hedgerow • Habitats supporting protected / notable species: bats; badger; breeding and wintering birds; great crested newt; otter; reptiles; terrestrial invertebrates; water vole; priority species (brown hare, hedgehog, notable vascular plants
Mortality and injury of species	Physical interaction between species and project infrastructure, machinery or activities would be limited to areas within the footprint of the Proposed Scheme and areas immediately outside the scheme footprint due to construction traffic approaching or leaving the site.	• Bats; badger; breeding and wintering birds; great crested newt; otter; reptiles; terrestrial invertebrates; water vole; and priority species
Species disturbance (from changes to noise, vibration, visual and light stimuli)	The area subject to noise disturbance varies based on the activity being undertaken and the sensitivity of the individual receptor. All potentially sensitive receptors within the area likely to be exposed to noise level changes will be considered. Consideration will be given to the effects of visual disturbance for all potentially sensitive receptors. The zone of influence for visual disturbance is extremely difficult to quantify and varies with each receptor and type of stimuli. This assessment will be informed using professional judgement in consultation with statutory advisors; however, the baseline study area fully encompasses all likely zones of influence.	• Bats (within roosts only [noise and vibration] and/or in foraging/commuting areas [light]); badger (within setts only); breeding and wintering birds; otter; and water vole

Impact pathway	Zone of influence and rationale	Receptor potentially sensitive to the impact pathway
Air quality changes (resulting in habitat loss/modification)	The effect of air emissions including dust from construction traffic and plant are considered within 200m as per DMRB standard (LA 105 - Air Quality).	• LNR – see Table 9.1 • SBI – see Table 9.2 • Ancient Woodland Inventory sites and other ancient woodland habitats • Priority habitats: woodland, dry heath/acid grassland • Notable vascular plants
Hydrological changes to surface and groundwater (resulting in mortality/injury of species and/or habitat loss/modification and/or impacts to prey species)	All sensitive receptors within 250m or with hydrological connection to an affected waterbody.	• LNR – see Table 9.1 • SBI – see Table 9.2 • Ancient Woodland Inventory sites and other ancient woodland habitats • Priority habitats • Fish; freshwater invertebrates; fresh water macrophytes; great crested newt; otter; water vole; notable vascular plants, and priority species
Introduction and spread of invasive non-native species (INNS) (resulting in habitat loss/modification)	Effects associated with INNS would only likely be experienced within the immediate vicinity of areas where machinery movements, soil stripping, storage and habitat reinstatement would be undertaken. However, there is potential for wider effects to occur where works would be within and in the vicinity of flowing watercourses and from accidental spillage while transporting materials.	• LNR – see Table 9.1 • SBI – see Table 9.2 • Ancient Woodland Inventory sites and other ancient woodland habitats • Priority habitats - Good quality semi-improved grassland - Lowland mixed deciduous woodland - Purple moor grass and rush pastures wet woodland - Lowland dry acid grassland - Lowland fens - Traditional orchards - Wood pasture and park - Open mosaic on previously developed land
Operational phase		
Mortality and injury of species	Within an active highway.	• Bats; badger; great crested newt and other species; barn owl (*Tyto alba*)
Species disturbance (from changes to noise and light stimuli)	The area subject to operational road noise and lighting disturbance is dependent on the sensitivity of the individual receptor.	• Bats (within roosts only [noise] and and/or in foraging/commuting areas [light]); badger (within setts only); breeding and wintering birds; fish; otter; water vole; and priority species

Impact pathway	Zone of influence and rationale	Receptor potentially sensitive to the impact pathway
Air quality changes (resulting in habitat loss/modification)	The effect of air emissions from operational traffic are considered within 200m of the ARN.	• LNR • SBI • Ancient Woodland Inventory sites and other ancient woodland habitats • Priority habitats • Notable vascular plants
Hydrological changes (resulting in mortality/injury of species and/or habitat loss/modification)	All sensitive receptors with hydrological connection to an affected waterbody.	• LNR – see Table 9.1 • SBI – see Table 9.2 • Ancient Woodland Inventory sites and other ancient woodland habitats • Priority habitats • Fish; freshwater invertebrates including white-clawed crayfish (*Austropotamobius pallipes*); fresh water macrophytes; great crested newt; otter; water vole; notable vascular plants

Impact pathways – receptors

9.4.14 Rochdale Canal SAC and SSSI is located within 200m of the PCF Stage 2 ARN. It is therefore scoped in due to the potential for air quality impacts upon the watercourse.

9.4.15 Direct habitat loss may occur at Philips Park SBI/LNR/Ancient Woodland. The other LNRs, SBIs, ancient woodland sites and priority habitats within the ARN will also undergo specialist assessment for potential NO_x deposition impacts. The ARN has yet to be defined for Stage 3 and therefore all sites are scoped in until the ARN for Stage 3 is determined. Significant impacts are possible and are scoped into further assessment.

9.4.16 Impact pathways of relevance have been identified for badger which are present within the survey area. There is potential for significant effects to badger setts (destruction and disturbance), and to the foraging habitat of this species, and a risk of increased mortality during operation of the scheme. This receptor is therefore scoped in for further assessment.

9.4.17 There is potential for significant effects to bat roosts and commuting and foraging habitats across the Proposed Scheme to be lost disturbed, and / or fragmented, therefore, bats are scoped in for further assessment.

9.4.18 There is potential for significant effects on the populations of breeding and wintering birds (including schedule 1 species such as barn owl). Potential effects include loss of nesting and foraging habitat, disturbance during operation and construction and increased mortality during operation of the Proposed Scheme. Therefore, breeding and wintering birds are scoped in for further assessment.

9.4.19 Impact pathways of relevance to freshwater fauna (including fish, and macroinvertebrates), otter and water vole have been identified in relation to outfall construction, run-off, noise and vibration in the construction phase, and changes to the hydrological regime. As the outline construction methodology and design details for outfalls are not yet available, these ecological features are precautionarily scoped in for further assessment of the construction phase.

9.4.20 Great crested newts are known to be present within the survey area and impact pathways relating to habitat loss/fragmentation, mortality and injury of individuals, and hydrological change of habitats have been identified. Great crested newts are therefore scoped into the assessment.

9.4.21 Common reptile species have potential to be present within the survey area. Until the field surveys have been completed it is not possible to accurately assess the value of the site for reptiles, nor the scale of potential impacts, however potential impacts include mortality and injury of individuals, habitat loss and disturbance. Therefore, reptiles are scoped into the assessment.

9.4.22 There is potential for terrestrial invertebrates to be impacted by the Proposed Scheme. Until the field surveys have been completed it is not possible to accurately assess the value of the site for invertebrates, nor the scale of potential impacts, however potential impacts include mortality and injury of individuals, habitat loss and disturbance. Therefore, terrestrial invertebrates are scoped into the assessment.

9.4.23 The desk-study confirmed presence or likely presence of brown hare, a Species of Principal Importance. This, and other species of principal importance or notable species, such as hedgehog and amphibian species, may also be present within the landscape. The majority of habitats recorded within the footprint of the Proposed Scheme are abundant within the local landscape and any priority species present would also benefit from the mitigation strategies which would be implemented for the protected and notable species scoped in for further assessment. However, until the designs of this mitigation are developed, priority species are scoped into the assessment.

9.4.24 Although of negligible value, INNS will be considered during construction in relation to legislative compliance.

9.4.25 Species scoped in for further assessment at this stage may be scoped out in future if the value assigned to them is reduced following additional surveys and data collection. Receptors will only be scoped out following consultation and agreement with statutory bodies.

Summary of scope

9.4.26 Table 9.5 summarises the proposed scope for biodiversity. As mentioned in Section 9.4, there are interrelationships between biodiversity and other environmental aspects, particularly noise and vibration (Chapter 12), and light pollution (Chapter 8), and the water environment (Chapter 14). The combined effect on biodiversity receptors from these aspects will be assessed within the biodiversity assessment.

Table 9.5: Summary of biodiversity scope

Matter	Scoped in - construction	Scoped in - operation
European designated sites (SAC, SPA and Ramsar)	×	✓
SSSI	×	✓
NNR	×	×
LNR	✓	✓
SBI	✓	✓
Ancient Woodland Inventory sites and ancient woodland habitat	✓	✓
Priority habitats	✓	✓
Notable vascular plants	✓	✓
Badger	✓	✓
Bats	✓	✓
Birds – breeding, wintering and schedule 1 species (including barn owl)	✓	✓
Freshwater fauna (fish and macro-invertebrates)	✓	✓
Great crested newt	✓	✓
Otter	✓	✓
Reptiles	✓	✓

Matter	Scoped in - construction	Scoped in - operation
Terrestrial invertebrates	✓	✓
Water vole	✓	✓
Priority species	✓	✓
INNS – plants and animals	✓	×

9.5 Design, mitigation and enhancement measures

9.5.1 Mitigation is likely to include:

- Vegetation clearance method statements in accordance with legislative and licencing conditions, if required (protected species licences from Natural England are likely to be required for great crested newt, and licence of closure and destruction of badger setts)
- General protective and control measures to be detalied in Environmental Management Plans, risk assessments and method statements during the construction phase
- Species translocation may be required where impact avoidance is not possible
- Implementation of an Invasive Species Management Plan for plant and animal species in the terrestrial and aquatic environment
- Landscape planting to reduce noise and lighting impacts and to provide guide planting to route species away from new Sections of road, and further planting to provide a range of habitats to benefit local fauna
- The design of linear habitats such as hedgerows and lines of trees should aim to increase connectivity along the scheme, linking with retained woodland and hedgerows where possible
- Placement of bat and bird boxes

9.5.2 The Proposed Scheme, as part of the wider Highways England Delivery Plan, would aim to maximise biodiversity delivery to contribute to a target of no net loss across all its activities commencing within Road Investment Strategy 2 (RIS 2).

9.5.3 A Protected Species Compliance Report will be provided with the assessment to document the mitigation that would be put in place to comply with legal requirements for protected species that may be impacted but that would not be significantly affected in EIA terms.

9.6 Description of the likely significant effects

9.6.1 There is potential for loss of priority habitat at a significant level. Without survey data to confirm the habitats present at this stage it is not possible to be precise about the habitats that will be lost, but it is considered likely that there will be loss of broadleaved woodland, grassland and hedgerow habitats.

9.6.2 It is likely that there will be loss of terrestrial habitat used by great crested newts. Until presence / absence and population size class assessments are completed the size of the population present and proximity of the population to the Proposed Scheme is not known but it could be a significant effect.

9.6.3 Loss of badger setts, bat roosts, and breeding and over-wintering bird habitat may also occur on a significant level. There is potential for reptile habitat loss on a significant level.

9.6.4 The Proposed Scheme has the potential to adversely affect designated ecological habitats. As the ARN for PCF Stage 3 is unknown at this stage, the exact number of ecological habitats is not known but will exceed those assessed at PCF Stage 2. It is unlikely that significant effects associated with construction dust would occur at designated sites if appropriate mitigation is put in place. However, traffic associated with the construction and operation of the Proposed Scheme have the potential to change the nitrogen deposition by more than 0.4kg N/ha/yr, or cause an exceedance of lower critical load thresholds, or for nitrogen deposition rates to exceed 1% of the lower critical load, at some sites. There is, therefore, a risk that the Proposed Scheme could have significant effects at designated ecological receptors.

9.6.5 DMRB LA 108 (paragraph 3.2) confirms that five scoping questions should be answered in order to gain an understanding of the need to undertake further assessment for the Biodiversity aspect. Where the response to one or more of these questions is 'yes', then further assessment should be undertaken.

9.6.6 The responses to the scoping assessment questions for the Proposed Scheme are provided in Table 9.6, based on the application of professional engineering judgement to the current design information.

Table 9.6: DMRB LA 108 Scoping questions and responses

Scoping questions	Response	Scoped in/out
1) is the project likely to impact designated sites (statutory or non-statutory)?	Yes	Scoped in
2) is the project likely to impact protected or priority habitats?	Yes	Scoped in
3) is the project likely to impact protected or priority species?	Yes	Scoped in
4) is the project likely to impact the function or quality of habitats?	Yes	Scoped in
5) is the project likely to impact the conservation status of habitats and species?	Uncertain	Scoped in

9.6.7 Having answered ‘yes’ or ‘uncertain’ to one or more of the DMRB LA 108 scoping questions for Biodiversity, it is recommended that this aspect is scoped into the EIA.

9.7 Assessment methodology

Biodiversity

9.7.1 It is anticipated that, due to the potential for significant effects on biodiversity receptors, a detailed assessment is required to identify the necessary mitigation to avoid any significant effects. The biodiversity assessment will be undertaken in accordance with the DMRB methodology, specifically DMRB LA 104: Environmental Assessment and Monitoring (Highways England, 2019) and DMRB LA 108: Biodiversity (Highways England, 2020) which meets the NNNPS policy requirements set out in Section 9.1. The assessment will be based on the information collated from desk-based resources detailed in Section 9.3 and the ongoing field surveys, detailed in Appendix E. Assessment criteria for determining value (in terms of sensitivity/geographical importance) and magnitude of

impact are provided in Appendix B. Habitats and species will be assigned a level of geographic importance:

- International or European importance e.g. Ramsar sites
- UK or National importance e.g. SSSIs
- Regional importance e.g. non-statutory designated sites
- County or equivalent authority importance e.g. LNRs
- Local importance e.g. SBIs

9.7.2 Level of impact shall be determined by assessing the following:

- If the impact is positive or negative e.g. adverse/beneficial
- Duration of the impact e.g. permanent or temporary
- Reversibility of impact e.g. irreversible/reversible
- Extent/ magnitude of impact
- Frequency and timing of impact.

9.7.3 The geographic level of importance and level of impact are then used to determine the significance of the impact. The significance matrix to be used to determine the level of impact in the assessment is shown in Table 9.7.

Table 9.7: Significance matrix – Biodiversity (taken from DMRB LA 108)

Resource value (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
Regional Importance	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
County Importance	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
Local Importance	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

9.7.4 The impact assessment work to be undertaken for the Proposed Scheme and reported in the Environmental Statement will detail impacts affecting the integrity of biodiversity resources, including those where the impact is considered to be negligible / minor within the ZOI.

9.7.5 The requirements of protected and controlled species legislation will be detailed in a separate report, to be an appendix to the EIA, to allow the Environmental Statement chapter to focus on potential significant effects, in terms of EIA only, and keep the document concise. To obtain a protected species licence it will be necessary to demonstrate favourable conservation status. It is anticipated that protected species licences are likely to be required for great crested newt and potentially bats. Draft licences and all associated information will be prepared and agreed with Natural England as required, alongside the EIA as an appendix. Full submission of licences to Natural England would be required following the granting of the DCO.

9.7.6 Assessment of the potential air quality impacts on sensitive designated sites and habitats within 200m of the ARN will be undertaken in accordance with DMRB LA 105: Air Quality (Highways England, 2019).

Habitats Regulations Assessment (HRA)

9.7.7 HRA is a recognised step-by-step process to determine the likely significant effects and (where appropriate) assess adverse impacts on the integrity of European (Natura 2000) sites. Where likely significant effects are identified, the assessment examines alternative solutions and provides justification for imperative reasons of over-riding public interest (IROPI).

9.7.8 HRA Stage 1 (Screening) identifies the likely significant effects of a project upon the integrity of a European Site, either alone or in combination with other plans and projects and considers whether the impacts are likely to be significant. Currently there is one SAC and SSSI within 200m of the ARN. The Stage 3 ARN is yet to be defined. Any relevant sites present within 200m of the ARN will be subject to an HRA.

9.8 Assessment assumptions and limitations

9.8.1 Where possible, nationally recognised standard survey methodologies will be used to reduce limitations for ecological evaluation and impact assessment. It is assumed that the scheme design, and construction footprint will not deviate significantly from what has been used for this scoping report.

9.8.2 Specific limitations relevant to each survey, such as land access constraints, will be detailed in the relevant survey result factual reports. The survey specific constraints are unlikely to represent a limitation that would compromise the ecological impact assessment, especially when taking account of the Proposed Scheme's embedded mitigation in design and best practice measures.

10. Geology and soils

10.1 NNNPS requirements

10.1.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

10.1.2 Key policy from the NNNPS relevant to this aspect includes:

- Paragraph 5.168 of the NNNPS states that applicants should take into account the economic and other benefits of the best and most versatile (BMV) agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification (ALC) system). Where significant development of agricultural land is demonstrated to be necessary, applicants should seek to use areas of poorer quality land in preference to that of a higher quality. Applicants should also identify any effects, and seek to minimise impacts, on soil quality, taking into account any mitigation measures proposed. Where possible, developments should be on previously developed (brownfield) sites provided that it is not of high environmental value.
- Paragraph 5.176 states that the decision-maker should take into account the economic and other benefits of the best and most versatile agricultural land. The decision-maker should give little weight to the loss of agricultural land in grades 3b, 4 and 5, (as defined in the ALC system) except in areas (such as uplands) where particular agricultural practices may themselves contribute to the quality and character of the environment or the local economy.
- Paragraph 5.168 states that for developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this. The policy makes reference to the Model Procedures for Management of Land Contamination (CLR11), however this guidance was superseded in October 2020 by Environment Agency guidance Land Contamination Risk Management (LCRM).
- Paragraph 5.22 states that where the project is subject to EIA the applicant should ensure that the Environmental Statement clearly sets out any likely significant effects on internationally, nationally and locally designated sites of ecological or geological conservation importance (including those outside England).
- Paragraph 5.23 states that the applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.
- Paragraph 5.25 states that as a general principle, and subject to the specific policies, development should avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives.

10.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

10.2 Study area

10.2.1 This chapter assesses the potential effects which may be realised during the construction and operational phases of the Proposed Scheme on the baseline geology and soil environment. This chapter considers:

- Effects on bedrock geology and superficial deposits, including geological designations and sensitive / valuable non-designated features
- Effects on soil resources
- Effects from contamination on human health, surface water and groundwater

10.2.2 For surface water and groundwater quality, this chapter only considers the effects from land contamination. Detailed assessment of potential effects of the Proposed Scheme on water quality is given in Chapter 14: Road Drainage and the Water Environment.

10.2.3 A buffer of 250m around the provisional Order Limits has been used to establish baseline conditions and identify potential impacts on receptors. This is as per Section 3.5 in the Design Manual for Roads and Bridges (DMRB) LA 109: Geology and soils (Highways England, 2019; hereafter referred to as DMRB LA 109). This is also based on Guidance for the Safe Development of Housing on Land Affected by Contamination (National House Building Council et al. 2008) and is a conservative but sensible approach in the context of the proposed development, considering the distance over which contamination can migrate. The study area and key geological information are shown in Figure 10.1 and Figure 10.2.

10.3 Baseline conditions

Baseline sources

10.3.1 The following sources have been used to establish baseline conditions:

- British Geological Survey (BGS) Interactive Map Viewer – GeoIndex. Accessed April 2021
- British Geological Survey (BGS) Lexicon of Named Rock Units. Accessed April 2021
- CH2M, Preliminary Sources Study Report (PSSR) M60 Junction 18 Simister Island, Version P01, HA GDMS number 30640, October 2018
- Coal Authority Coal Mining Report (reference: HMD-252-4559913), 2017
- Cranfield University LandIS Soilscapes Map. Accessed April 2021)
- Groundsure EnviroInsight report (reference: HMD-252-4559910), 2017
- Groundsure GeoInsight report reference: HMD-252-4559911, 2017
- Groundsure MapInsight report (reference: HMD-252-4559912), 2017

- Highways England, Geotechnical Data Management System (HAGDMS). Accessed April 2021
- MAGIC Map Application. Accessed April 2021
- Natural England ALC Grades – Post 1988 Survey. Accessed April 2021
- Natural England Provisional Agricultural Land Classification (ALC) Survey. Accessed April 2021

Baseline information

Solid geology

10.3.2 British Geological Survey (BGS) mapping (BGS, 2021) indicates that the study area is cross-cut by several faults. The throw (vertical separation of the fault) of these faults has often resulted in bedrock of the Triassic Chester Formation, which includes the Manchester Marls unit, being downthrown (sinking of rocks on one side of a fault) against the older Upper Carboniferous Pennine Middle Coal Measures (PMCM).

10.3.3 The BGS Lexicon of Named Rock Units (BGS, 2021) describes the Chester Formation as being part of the Triassic Sherwood Sandstone Group. The Manchester Marls Formation, part of the Cumbrian coast group, conformably underlie the Chester Formation. It is locally recorded to underlie the study area between 150m to 330m west of the centre of M60 J18.

10.3.4 The PMCM occur towards the western end of the study area where the Worsley Four Feet Coal seam is recorded to sub-crop beneath the M60 mainline, approximately 100m to 150m east of the centre of M60 J17, 3.5km west of M60 J18. The Worsley Four Foot Coal seam dips to the west, underlying the western end of the study area.

10.3.5 The PMCM underlie the M66 north of M60 J18, increasing in age towards the north and transitioning into the Pennine Lower Coal Measures (PLCM) around 1.25km south of M66 J3. The PLCM underlie the PMCM. The Arley Coal seam is shown to subcrop beneath the M66 J3. The subcrop is broadly orientated northwest/southeast, with the seam dipping towards the west. It is therefore present beneath the M66 carriageway from the junction until being displaced by faulting. Although not shown to subcrop, other coal seams may underlie the M66 carriageway, south of the faulting.

10.3.6 The PMCM underlie the M62 carriageway east of M60 J18, increasing in age towards the east and transitioning into the PLCM around 210m north-east of Egypt Lane bridge. Although not shown to subcrop, coal seams may be present at shallow depth beneath this section of the M62. The M60 J18 to J19 is underlain by bedrock of the Chester Formation. Figure 10.1 shows the location of the BGS information considered pertinent to this review.

Superficial geology

10.3.7 BGS mapping (BGS, 2021) shows Glacial Till underlying the majority of M60 J18, and the M62 and M66 to the east and north, respectively. The north-west quadrant of the junction is shown to be underlain by Glaciofluvial Ice Contact Deposits. These also extend for approximately 400m north of the centre of J18, beneath the M66. Elsewhere these deposits are recorded parallel to the north of the M60 mainline, from Sandgate Road bridge and continuing for around 150m west of the structure. Information on Glacial deposits as a mineral resource are covered in Chapter 11: Material Assets and Waste.

10.3.8 Glacial Till is also recorded beneath the M60 mainline west of J18, with peat recorded between 550m west of J18 and 40m east of Sandgate Road bridge. Glaciolacustrine deposits are recorded adjacent to the north-east of the peat, extending out towards the north-east. Glacial Till is also recorded to the west of the peat, extending to around 300m east of Bury Old Road bridge. Continuing west, Glaciofluvial Deposits and Glacial Till are shown beneath and adjacent to the M60 mainline.

10.3.9 Between J18 and J19, hummocky Glacial Deposits are shown beneath the M60. These are shown to continue as a large east-west swath, running parallel to the south of the M60 mainline, between J18 and J17. Consequently, pockets may be encountered beneath the M60 mainline, east of Sandgate Road Bridge and Bury Old Road Bridge. These deposits are also recorded to underlie the M66 north of Roe Bank subway. Within these hummocky deposits are bands of Head Deposits, one of which underlies Hollins Vale Bridge on the M66. Head Deposits are recorded on both sides, but not beneath the M60 carriageway between J18 and J19. Descriptions typically classify the material as sand 1.5m to 4m thick, with some clay, silt and occasionally gravel and clayey peat. Information on Glacial deposits as a mineral resource are covered in Chapter 11: Material Assets and Waste.

10.3.10 BGS borehole SD80NW270 (NGR: 382060, 405500), located 220m east of Sandgate Road overbridge, recorded peat between 2.9 and 3.1m below ground level (bgl) (97 to 96.8 m above ordnance datum (AOD)). The underlying sand is very peaty in parts with an organic smell, and was proven to 3.4mbgl (96.5 mAOD). Elsewhere within the study area, occasional reference is made to organic material or organic clay, suggesting that localised Peat Deposits may be present elsewhere within the study area. Information on Peat deposits as a mineral resource are covered in Chapter 11: Material Assets and Waste.

Made ground

10.3.11 Highways England Geotechnical Data Management System (HAGDMS) (Highways England, 2021) records a number of embankments along the M60 carriageway. This indicates that made ground, comprising engineered fill, is present within the study area. Many of the historical boreholes sunk along the M60 carriageway and around M60 J18 recorded made ground. Often the base of the deposits has not been proven, with most exploratory holes having been sunk to depths of between 2 and 4mbgl.

10.3.12 Made ground deposits are predominantly granular, comprising sand or gravel with varying proportions of silt, cobbles and boulders, although Pulverised Fuel Ash (PFA) may be present in earthworks in the vicinity of Sandgate Road Overbridge.

10.3.13 During the site walkover undertaken by Jacobs after issue of the Preliminary Sources Study Report (PSSR) (CH2M, 2018) an area of raised ground was noted in the north east quadrant of J18. This is not noted on any maps but is suspected to comprise of made ground. The nature of this made ground is currently unknown.

Soils

10.3.14 The economic resource value of soil is primarily measured by its ability to support agricultural uses. This is quantified by its Agricultural Land Classification (ALC) grade, with six grades defined within the ALC for England and Wales as follows:

- Grade 1 (excellent quality)
- Grade 2 (very good quality)

- Subgrade 3a (good quality)
- Subgrade 3b (moderate quality)
- Grade 4 (poor quality)
- Grade 5 (very poor quality)

10.3.15 The Best and Most Versatile (BMV) agricultural land equates to grades 1, 2 and subgrade 3a of the ALC system and is the most flexible land in terms of the range of crops that can be grown, the level and consistency of yield and the cost of obtaining yield.

10.3.16 Provisional ALC data for the study area (Natural England, 2021) show the majority of land within the provisional Order Limits between M60 J17 and J18 is classified as urban. M60 J18 is dominated by grade 3. Where grade 3 land is mapped by the provisional ALC data, it is assumed at this stage that subgrade 3a land is likely to be present. A small area west of M60 J17 is classified as grade 4.

10.3.17 Soils may also be of importance in supporting sites of ecological importance; thus, a high-level review of soil types has been undertaken. The LandIS Soilscapes Map (Cranfield University, 2021) identifies the majority of the area is marked as Soilscape 10, freely draining slightly acid sandy soils. There is a small area of Soilscape 17, slowly permeable seasonally wet acid loamy clayey soils, intersecting the study area towards the western end of the provisional Order Limits but it should be noted that this area is outside of the 250m buffer for the study area.

10.3.18 Neither of these soil types is inherently particularly sensitive, but soils supporting sites of ecological importance identified within Chapter 9: Biodiversity, will be considered within the Environmental Statement in line with LA 109. Baseline information for these sites will not be repeated in this chapter.

Mining, quarrying and mineral resources

10.3.19 The Coal Authority Mining Report (Coal Authority, 2017) at PCF Stage 1 states that the study area is within an area that could be affected by underground mining in one seam of coal at 430 to 460m depth, which was last worked in 1970. Consequently, any associated ground movements should have ceased. The study area is not within an area where there are active or proposed underground mining, or within the boundary of a former, active or proposed opencast site. There are no recorded mine entries on or within 20m of the study area.

10.3.20 HAGDMS (Highways England, 2021) identifies the western and northern extents of the study area as being Grade C: Medium Hazard in terms of Coal Mining, which broadly correlates with the Coal Authority's designation that parts of the study area are within a Development High Risk area. East of Sandgate Road overbridge, and from 1.3km south of M66 J3; the rest of the study area is classified Grade B: Low, although it is predominantly within the coal field and, as such, the potential for underground coal mining, unrecorded mine workings or shafts and adits cannot be discounted.

Historical mineral extraction sites (potentially infilled)

10.3.21 The Groundsure Geo Insight report (Groundsure, 2017) identifies several ground workings within the study area, including unspecified ground workings and brick pits which have ceased operation. The two main ground workings within the provisional order limits are:

- A sand pit, located at Cold Gate adjacent to the north-western quadrant of M60 J18 Interchange
- A gravel pit, located on Hills Lane, to the east of Hills Lane Accommodation overbridge on the M66

Landfills

10.3.22 There are two historical landfills within the study area, located directly west and east of the M60, south-west of J18. These are:

- Landfill directly east of the M60. Land to the south of Whitehouse farm. Inert waste deposited between 1993 – 1994
- Landfill directly west of the M60, Bridle road. Inert waste deposited in 1994

Potential sources of contamination

10.3.23 The study area is predominantly in a rural setting (Groundsure, 2017; CH2M, 2018) consisting of mostly agricultural land use. In addition to the landfill sites, and potentially infilled ground noted above, there are further potentially significant land uses within the study area, including:

- Railway infrastructure, including the Manchester Whitefield and Radcliffe branch lines shown on the late 19th century maps, crossing the M60 around 250m east of J17
- Current and former industrial areas, including a historical brick works
- Fuel station, immediately adjacent to the M60 and the A665
- Pulverised Fuel Ash (PFA) and made ground within the existing highway embankments
- Coal tar associated with the original carriageway construction, pre-dating the mid-1980s
- Possible PFA and/or made ground within the area of raised ground immediately north of M60 Simister Island
- Ground gases (methane and carbon dioxide) associated with peat deposits
- Potential sources of land contamination listed above are shown in Figure 10.4

Surface water and groundwater

10.3.24 There is the potential that contaminants from contaminated land and landfills could impact groundwater and surface water as noted in the PSSR (CH2M, 2018). Information on surface water and groundwater receptors are covered in Chapter 14: Road Drainage and the Water Environment. To avoid duplication, this section does not describe the water environment baseline as Chapter 14 provides a full description of the baseline conditions.

10.3.25 Many of the historical exploratory holes reviewed do not include groundwater information or are recorded as dry. Seepages are generally reported within made ground, suggesting localised pockets of perched groundwater, particularly where more cohesive materials underlie granular deposits (ref. SD80NW271, 275 and 276). As many exploratory holes do not extend into the superficial deposits, there is limited information regarding groundwater within them. However, where groundwater has been recorded within the superficial deposits it comprises a mix of seepages and strikes of medium flow, particularly within the

glaciofluvial materials (ref. SD80SW284 and SD80SW1022). Occasional seepages have been recorded within the Glacial Till, associated with sand bands and pockets (ref. SD80SW1020).

Future baseline

Geology

10.3.26 Based on the likely evolution of the baseline environment without the implementation of the development the bedrock geology would not change.

Surface water and groundwater

10.3.27 Surface water and groundwater baseline conditions would not change if the development did not proceed given the existing use of the area is for a motorway with associated infrastructure.

Value of receptors

10.3.28 An overview of the criteria used to determine the value (sensitivity) of geology and soil receptors will conform to the criteria set out in Table 3.11 of DMRB LA 109 and provided in Appendix B. The value / sensitivity of surface water and groundwater receptors will conform to the criteria set out in DMRB LA 113: Road drainage and the water environment (Highways England, 2020; hereafter referred to as DMRB LA 113) (see Chapter 14: Road Drainage and the Water Environment). The description of the sensitivity criteria in Table 10.1 below is an edited version of the tables found in LA 109 and LA 113 for brevity. The table summarises the value of the receptors identified within the study area.

Table 10.1: Value (sensitivity) of receptors in the study area for geology and soils

Value / sensitivity	Aspect	Description	Examples within the study area
Very high	Geology	International designated sites of geological value (e.g. UNESCO World Heritage Sites).	None identified within the study area.
	Human health	Very sensitive land use such as residential or allotments.	Residential properties are located immediately adjacent to the M60 between J17 and J18
	Soil	ALC grades 1 and 2 or LCA grade 1 & 2. Soils directly supporting an EU designated site (e.g. Special Area of Conservation or Special Protection Area).	None within the study area.
	Groundwater quality	Groundwater that locally supports a groundwater dependent terrestrial ecosystem (GWDTE). Inner source protection zone (SPZ1). Principal aquifer.	Chester Formation is a Principal Aquifer

Value / sensitivity	Aspect	Description	Examples within the study area
	Surface water quality	Watercourse having a Water Framework Directive (WFD) classification shown in a River Basin Management Plan (RBMP) with a Q95≥1.0m^3/s. Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water)/Species protected by EC legislation LA 108.	Q95, none within the study area. Surface water quality information pending from surveys by water / ecology team, to be confirmed.
High	Geology	Rare and of national importance with little potential for replacement (e.g. geological SSSI).	None within the study area.
	Human health	High sensitivity land use such as public open space.	Heaton Park, Prestwich Forest Park and Pike Fold Golf Club are located within the study area.
	Soil	ALC subgrade 3a or LCA grade 3.1 Soils directly supporting a UK designated site (e.g. SSSI).	ALC subgrade 3a was identified within the study area within the limited post-1988 data and undifferentiated grade 3 land is mapped for much of the study area.
	Groundwater quality	Principal or secondary A aquifer providing locally important resource or supporting a river ecosystem. SPZ2.	The PMCM, PLCM and superficial deposits (Glaciofluvial, Glaciofluvial Ice Contact, Glaciolacustrine and Hummocky Glacial Deposits) are Secondary A Aquifers. The Chester Sand Formation is classified as a Principal Aquifer. The Manchester Marls are a Secondary B Aquifer.
	Surface water quality	Watercourse having a WFD classification shown in RBMP with a Q95<1.0m^3/s. Species protected under EC or UK legislation LA 108.	River Irk has Q95 of 0.24. Surface water quality information pending from surveys by water / ecology team, to be confirmed.
Medium	Geology	Regionally Important Geological Sites with limited potential for replacement (e.g. RIGS).	None within the study area.
	Human health	Medium sensitivity land use such as commercial or industrial.	Commercial and industrial properties are located throughout the study area.

Value / sensitivity	Aspect	Description	Examples within the study area
	Soil	ALC subgrade 3b or LCA grade 3.2 Soils supporting non-statutory designated sites (e.g. LNR).	ALC undifferentiated grade 3 soils are mapped across much of the study area, therefore subgrade 3b soils may be present.
	Groundwater quality	Aquifer providing water for agricultural or industrial use with limited connection to surface water. Unlicensed private water supply. SPZ3.	There are no licensed abstractions within the site boundary
	Surface water quality	Watercourse not having a WFD classification shown in RBMP and a Q95>0.001m^3/s.	Water courses with Q95>0.001m^3/s, Un-named tributary of Castle Brook, Un-named tributary of Whittle Brook and Bradley Brook. Surface water quality information pending from surveys by water / ecology team, to be confirmed.
Low	Geology	Geology of local importance / interest with potential for replacement (e.g. non designated geological exposures, former quarries / mining sites).	None within the study area.
	Human health	Low sensitivity land use such as highways and rail.	Railway line crosses the M60 east of J17. Numerous highways are located throughout the study area.
	Soil	ALC grades 4 and 5 or LCA grade 4.1 to 7. Soils supporting non-designated notable or priority habitats.	ALC grade 4 soils are mapped at the western end of the study area.
	Groundwater quality	Unproductive strata.	None within the study area.
	Surface water quality	Watercourses not having a WFD classification shown in a RBMP and Q9 5 ≤0.001m^3/s.	Surface water quality information pending from surveys by water / ecology team, to be confirmed.
Negligible	Geology	No geological exposures, little / no local interest.	None within the study area.
	Human health	Undeveloped surplus land / no sensitive land use proposed.	None within the study area.
	Soil	Previously developed land formerly in ‘hard uses’ with little potential return to agriculture.	A number of areas within the study area have been previously developed.

Value / sensitivity	Aspect	Description	Examples within the study area
	Groundwater quality	Not applicable.	Not applicable.
	Surface water quality	Not applicable.	Not applicable.

10.4 Potential impacts

Construction

Geology

10.4.1 No geology receptors have been identified within the study area.

Soils

10.4.2 Soils would be affected in two ways during construction, via:

- Physical removal or permanent sealing of agricultural land
- Degradation during stripping, handling and storage, through mechanisms such as compaction and smearing

10.4.3 It is assumed for the purposes of assessment at this stage that all soils identified within the Proposed Scheme footprint would be affected, therefore soils of very high to low quality are likely to be impacted.

10.4.4 Peat deposits are recorded within the Proposed Scheme footprint at two locations; beneath the M60 west of J18; and, north of J18 immediately west of the M66. Due to its compressible nature, it is likely that peat deposits will need to be excavated and disposed of off-site as part of the works. BGS mapping suggests that the peat is localised and therefore could be considered to be a rarity at a local level. The resource value and sensitivity of this material will need to be assessed further.

10.4.5 It is anticipated that agricultural land would be sealed by development, or otherwise lost to agricultural production by, for instance, the creation of borrow pits.

10.4.6 However, the permanent sealing or wastage of topsoil would be avoided as far as practicable via stripping and sustainable reuse elsewhere, as per embedded mitigation measures. In addition, by following best practice soil management measures, degradation during stripping, handling and storage would either be avoided, or would only be temporary in nature.

10.4.7 Soils will be scoped in for the construction phase of the project.

Human health

10.4.8 Made ground, engineered fill and natural soils underlying the scheme may have been potentially contaminated by the historical and current land use activities identified along the Proposed Scheme, including historical landfill sites, infilled mineral extraction pits, petrol stations and industrial areas. Disturbance of potentially contaminated soils may cause an increase in dust and leaching of soils, mobilising contaminants along new or

existing surface or sub-surface pollution pathways. These could create new pathways to construction workers and adjacent land users around the Proposed Scheme.

10.4.9 There is potential for ground gases associated with historical landfills to migrate to residential properties in close proximity to the Proposed Scheme. However, as the Proposed Scheme has not been fully designed, it is not known at this stage if it would encroach on the landfill boundaries or the potential for gas migration from peat deposits. Whilst peat deposits are present within the scheme, the potential for the generation and migration of ground gases toward residential properties is assessed to be low. Ground gas monitoring will be undertaken after completion of the ground investigation to assess ground gas risks.

10.4.10 No ground investigation soil chemical data were available at the time of writing this report, therefore, screening of soil chemical analysis data against acceptable soil guideline values for human health risk assessment has not been undertaken. There is a short-term risk to the health of construction workers exposed to potentially harmful contaminants close to the landfill sites.

10.4.11 Risks during construction are typically mitigated by applying good working practice set out in the 2nd Iteration of the Environmental Management Plan (EMP) or Health and Safety Plan (HASP) as appropriate. If the Proposed Scheme were to encroach on the identified historical landfill boundary, or there was a risk of ground gas migration to residential properties, then the significance of effects would likely be moderate. Therefore, human health has been scoped in for the construction phase.

Groundwater and surface water

10.4.12 Disturbance of potentially contaminated soils or landfill materials along the Proposed Scheme may cause an increase in the leaching of soils and mobilisation of contaminants along new or existing surface or sub-surface pollution pathways. This may lead to the quality of surface waters and groundwater aquifers being impacted through runoff, infiltration and sub-surface movement. In the absence of site-specific ground investigation data and baseline groundwater monitoring data, the predicted significance of effects on controlled waters is likely to be moderate.

10.4.13 Risks during construction are typically mitigated by applying good working practice set out in a 2nd Iteration of the EMP or HASP and can help to reduce the likelihood of pollution incidents occurring. Assuming appropriate good working practices are undertaken during construction, the predicted significance of effects is likely to be slight. Therefore, groundwater and surface water likely to be affected by contaminated land has been scoped in for the construction phase.

Operation

Geology

10.4.14 No geology receptors have been identified within the study area.

Soils

10.4.15 No additional impacts are predicted on soils during the operational phase. The permanent loss of agricultural land occurring during construction would persist during operation but is not considered as an additional effect. Temporary effects arising during construction on

soil quality in relation to degradation during handling may extend into operation but should not be persistent assuming that the best practice mitigation measures in Section 10.5 are applied. Operational effects on soils are therefore scoped out of further assessment.

Human health

10.4.16 It is understood that on completion of the construction phase, the Proposed Scheme would predominantly comprise hardstanding.

10.4.17 Contamination within the Proposed Scheme extents would have been removed during construction, reducing the potential for contact with contaminated soil. Furthermore, implementing appropriate site-specific risk assessments and method statements would reduce exposure. Therefore, human health for site users has been scoped out, but scoped in for maintenance workers and residential properties located in close proximity of the Proposed Scheme due to the possibility of them being affected by ground gas during the operational phase.

Groundwater and surface water

10.4.18 During the operational stage, potential contaminated land linkages would have been broken due to the construction of the carriageway, therefore no additional impacts are predicted in relation to water receptors. Operational effects on surface water and groundwater from contaminated land are therefore scoped out of further assessment.

10.4.19 There is the potential for pollution incidents resulting from fuel and chemical leaks or spills on the new highway by road users. These are covered in Chapter 14: Road Drainage and the Water Environment and are not addressed further in the geology and soils chapter.

Summary of scope

10.4.20 Table 10.2 summarises the proposed scope for geology and soils.

Table 10.2: Summary of geology and soils scope

Matter		Scoped in - construction	Scoped in - operation
Geology	Not applicable	×	×
Soils		✓	×
Human health	Site users/general public	✓	×
	Construction/maintenance workers	✓	✓
	Residential properties	✓	✓
Groundwater and surface water from contaminated land		✓	×

10.5 Design, mitigation and enhancement measures

10.5.1 The following mitigation measures would be put in place for the receptors that have been identified as being potentially impacted by the Proposed Scheme or would potentially impact the scheme. Mitigation measures would include both embedded mitigation and additional mitigation measures.

10.5.2 Embedded mitigation would include design measures which may include the use of:

- Consolidated development footprints to reduce the loss of agricultural land
- Stripping of topsoil as a minimum from the footprints of all permanent development (hardstanding and materials placement), followed by sustainable reuse within the Proposed Scheme or elsewhere wherever practicable
- 2nd Iteration of EMP to be developed prior to the start of construction works
- Materials Management Plan (MMP) for reuse of materials under the CL:AIRE Code of Practice to be developed prior to the start of construction works
- Completion of a soil resource survey and development and implementation of a soil resource plan prior to construction start of works, consistent with Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009)
- Ground investigation - to be completed 2021
- Risk assessments and method statements to be completed as part of the construction process

10.5.3 A 1st Iteration of the EMP will be prepared for the EIA and DCO submission (see Chapter 5: Environmental Assessment Methodology).

10.5.4 Additional mitigation measures may also be developed to address specific identified impacts. At this stage, the requirement for specific mitigation measures in respect of geology and soils cannot be meaningfully identified, particularly in relation to impacts from ground contamination. Measures could include, for example:

- Remedial treatment (in-situ and/or ex-situ) of targeted areas, for example where the route is aligned or located adjacent to landfill sites
- Working methods incorporated during the works to mitigate against gas build up in voids, and to mitigate the negative effect of land contamination on potential receptors. Remediation is usually informed by ground investigations and detailed risk assessment. Remediation costs and risk mitigation solutions would be more complex if the route is aligned through the existing landfill boundaries. The design will avoid these areas if possible

10.5.5 The waste hierarchy principle will be used at every stage of the project, as appropriate and proportionate, to identify enhancement opportunities with respect to the reuse of suitable excavated soils and materials on the scheme development.

10.5.6 It is anticipated that in order to promote sustainable reuse of soil and other geological arisings within the Proposed Scheme, a MMP would be prepared prior to construction, which would detail the proposed use of the arisings. It is anticipated that this will follow the protocols within the CL:AIRE Definition of Waste (2011) guidance so that excavated materials are reused appropriately and sustainably. This is covered in Chapter 11: Material Assets and Waste.

10.6 Description of the likely significant effects

10.6.1 At this stage, it is not practicable to meaningfully describe the likely nature of any significant or residual effects in respect to geology and soils, particularly in relation to impacts from ground contamination due to lack of site-specific ground investigation data

and environmental monitoring data. However, it is anticipated that, with mitigation measures of the type discussed in Section 10.5, the residual effects are unlikely to be significant, with the exception of the loss of agricultural land.

Scoping questions

10.6.2 DMRB LA 109 (paragraph 3.2) confirms that five scoping questions should be answered in order to gain an understanding of the need to undertake further assessment for the Geology and soils aspect. Where the response to one or more of these questions is 'yes', then further assessment should be undertaken.

10.6.3 The responses to the scoping assessment questions for the Proposed Scheme are provided in Table 10.3, based on the application of professional engineering judgement to the current design information.

Table 10.3: DMRB LA 109 Scoping questions and responses

Scoping questions	Response	Scoped in/out
1) is the project likely to affect designated geological sites (statutory or non-statutory)?	No	Scoped out
2) is the project likely to affect the function or quality of soil as a resource?	Yes	Scoped in
3) is the project likely to affect agricultural land classified as best and most versatile (BMV) or prime land?	Yes	Scoped in
4) is the project likely to disturb historical contamination?	Uncertain	Scoped in
5) is the project likely to introduce significant sources of contamination	No	Scoped out

10.6.4 Having answered ‘yes’ or ‘uncertain’ to one or more of the DMRB LA 109 scoping questions for Geology and soils, it is recommended that this aspect is scoped into the EIA.

10.7 Assessment methodology

10.7.1 The assessment of the potential effects on the geology and soil characteristics, including land quality, will consider the following legislation, regulations, planning policies and guidance:

- Environmental Protection Act 1990, Part IIA
- Environmental Permitting (England and Wales) Regulations 2016
- Water Framework Directive (Council Directive 2000/60/EC); implemented in England by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
- Wildlife and Countryside Act 1981, as amended
- National Planning Policy Framework (NPPF)
- National Policy Statement (NPS National Networks) (Department for Transport, 2014)
- DMRB LA 104: Environmental Assessment and Monitoring (Highways England, 2019)
- DMRB LA 109: Geology and Soils (Highways England, 2019)
- DMRB LA 113: Road Drainage and the Water Environment (Highways England, 2020)

10.7.2 The criteria that will be used to assess the value (sensitivity) of receptors and magnitude of impacts will conform to DMRB LA 109 and are set out in Appendix B.

10.7.3 The significance of effects will be determined by combining judgements on the sensitivity of geology and soils receptors, with the magnitude of impacts. In accordance with DMRB LA 109, Table 5.1 (see Chapter 5: Environmental Assessment Methodology), which is consistent with the matrix within DMRB LA 104, will be used to assist professional judgement when determining the significance of effects.

10.7.4 A desk study has been completed for the Proposed Scheme. It is proposed that information gained from an intrusive ground investigation and period of environmental monitoring will be used in the assessment for geology and soils. Data will be gathered on the chemical quality of soil and groundwater which will be used to inform further stages of assessment.

10.7.5 A land contamination risk assessment will be undertaken in accordance with Land Contamination Risk Management (LCRM) guidance (Environment Agency, 2020). LCRM sets out the procedure for the investigation and assessment of potentially contaminated land. A Conceptual Model (CM) supports the identification and assessment of pollutant linkages using the source-pathway-receptor model. Development of the CM forms the main part of preliminary risk assessment and the model is subsequently refined or revised as more information becomes available (for example ground investigation data).

10.7.6 Data gathered from the ground investigation and environmental monitoring will be analysed and the CM and preliminary risk assessment presented in the desk study will be updated. Potential risks to human health will be assessed by screening soil contaminant concentrations against relevant soil screening criteria (e.g. category 4 screening levels) recommended in DMRB LA 109 for the assessment of risk to human health from land contamination. Similarly, potential risks to controlled waters will be assessed by screening monitoring data against relevant guideline screening values. Where exceedances of screening levels are established, further risk assessment and/or additional mitigation works will be recommended and incorporated into the design.

10.7.7 Additional technical consultation with various statutory and non-statutory bodies and external sources will be undertaken to obtain the latest information on baseline conditions, particularly landfills, private water supplies (PWS) and licensed water abstractions.

10.7.8 Additional monitoring of watercourses likely to be impacted by the Proposed Scheme (see Chapter 14: Road Drainage and Water Environment for details of watercourses) may be undertaken prior to the start of construction works to supplement any baseline surface water monitoring data. This will be detailed in the Environmental Statement and 2nd Iteration of the EMP. The purpose of the monitoring would be to provide data under differing flow conditions which would be used to assess the impact, if any, of the Proposed Scheme development on surface water quality during and post construction works.

10.7.9 An ALC survey will be undertaken to inform further stages of assessment, in accordance with the Revised Criteria for Grading the Quality of Agricultural Land (Ministry of Agriculture, Fisheries and Food, 1988).

10.7.10 The proposed assessment methodology is compliant with the NNNPS policy for geology and soils outlined in Section 10.1.

10.8 Assessment assumptions and limitations

10.8.1 The proposed assessment methodology will largely be dependent of the quality of information obtained from third party sources which have not been fully verified.

10.8.2 The following limitations have been encountered:

- Only provisional ALC data were available for the majority of the study area. An ALC survey will be undertaken to inform further stages of assessment
- Ground investigation will be undertaken in 2021. In the absence of ground investigation data for the Proposed Scheme, potential impacts to current land users, groundwater and surface water from contaminated land cannot be fully assessed at this stage
- The ground investigation is programmed to be completed and data made available in time to inform the assessment. However, if some of the ground investigation data are unavailable at the time of drafting the Environmental Statement (due to unforeseen circumstances), a qualitative land contamination risk assessment will be carried out, applying a 'matrix approach' to account for the probability and consequence associated with contaminant linkages
- It is proposed to undertake additional technical consultation with various statutory and non-statutory bodies, and external sources, to obtain the latest information on baseline conditions. However, the information held by these sources may in some cases be limited and may be delayed. Where there is a lack of third-party data, professional judgement will be used in interpreting available desk study information

11. Material assets and waste

11.1 NNNPS requirements

11.1.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

11.1.2 Key policy from the NNNPS relevant to this aspect includes:

- Paragraphs 4.28 to 4.29 of the NNNPS state that applicants should include design as an integral consideration from the outset of a proposal; and *inter alia* produce sustainable infrastructure efficient in the use of natural resources.
- Paragraph 5.169 of the NNNPS states that applicants should safeguard any mineral resources on the proposed site as far as possible.
- Paragraph 5.182 of the NNNPS states that where a proposed development has an impact on a Mineral Safeguarding Area, the SoS should ensure that the applicant has put forward appropriate mitigation measures to safeguard mineral resources.
- Paragraph 5.42 of the NNNPS states the applicant should set out the arrangements that are proposed for managing any waste produced. The arrangements described should include information on the proposed waste recovery and disposal system for all waste generated by the development. The applicant should seek to reduce the volume of waste produced and the volume of waste sent for disposal unless it can be demonstrated that the alternative is the best overall environmental outcome.

11.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

11.2 Study area

11.2.1 This scoping assessment has been prepared in accordance with Design Manual for Roads and Bridges (DMRB) LA 110: Material Assets and Waste (Highways England, 2019; hereafter referred to as DMRB LA 110) which is the published environmental assessment standard for assessing the impacts and effects associated with the material assets and waste aspect.

11.2.2 The scoping assessment for material assets and waste considers the following matters:

- The consumption of 'material assets' [Article 3.1 (d) of the Directive 2011/92/EU] – this includes materials and products from primary, secondary, recycled, sustainable, and renewable sources, and the use of excavated and other arisings that fall within the scope of waste exemption criteria.

- The production and disposal of 'waste' [Annex IV of Directive 2011/92/EU] – this includes surplus materials which can become waste, as well as other substances which the holder discards or intends or is required to discard.

11.2.3 Material assets and waste can affect the full range of environmental media and assessment aspects. Where materials are consumed, and waste is generated, it is acknowledged that, depending on how they are managed, attendant indirect adverse effects may arise (from greenhouse gas emissions; water consumption; visual impacts, dust, noise, vibration, vehicle emissions, disruption to traffic and other potential causes of nuisance; and water pollution, amongst others). Such effects do not form part of the material assets and waste assessment and are considered as part of the other aspect chapters in this scoping report.

11.2.4 In accordance with DMRB LA 110 (paragraph 3.5 to 3.7), the assessment of material assets and waste utilises two geographically different study areas to examine the use of material assets, sterilisation of mineral sites and the production and management of waste:

- The first study area (Proposed Scheme) – based on the construction footprint of the proposed works which is delineated by the contiguous provisional Order Limits boundary (Figure 2.1). Within these areas construction materials would be consumed and waste would be generated.
- The second study area is based on the likely provenance of construction materials required to construct the Proposed Scheme and waste infrastructure that is likely to be suitable (permitted for waste volume and type) to accept arisings and/or waste generated by the Proposed Scheme. These include:
  - The North West Aggregate Working Party area and the North West Crown Estate Dredging area which are likely to be the first source of material assets (primary, secondary and recycled aggregates) used to construct the Proposed Scheme.
  - The former North West Regional Planning area where the waste management infrastructure, likely to be used in managing the majority of waste generated by the Proposed Scheme, is located.

11.2.5 In accordance with DMRB LA 110 (paragraph 3.7.1), professional judgement, with consideration for a balance of the proximity principle and value for money, has been applied in establishing the second study area at the regional level (north-west).

11.2.6 In contrast to other environmental aspects, impacts from the use of material assets and the production and management of waste, such as resource depletion and use of waste disposal capacity, are largely dispersed or generalised, rather than affecting specific geographically-bounded receptors. DMRB LA 110 significance criteria also requires that the impacts and effects from this aspect be contextualised within the context of the UK legislative and policy targets for material assets and waste (as per Table 3.13 and 3.14 in DMRB LA 110).

11.2.7 Setting the study area at the regional level takes account of the need for the inter-regional movement of construction materials and waste within England, and echoes the broader approach to minerals and waste planning and management that has traditionally been undertaken on a county and regional-level basis. This reflects the

fact that minerals and waste planning authorities have a statutory duty to plan for an appropriate amount of minerals and waste capacity to be available over a defined period, and take account of minerals and waste that are transferred across minerals and waste planning authority boundaries.

11.2.8 It would be up to the appointed Contractor to source materials and manage waste during the construction of the Proposed Scheme, and typically they would look to use local (sub-regional) material sources/waste infrastructure wherever feasible to reduce the environmental impact and cost of transport, and support the economic well-being of the local communities.

11.2.9 Procurement rules mean that it is not possible to prescribe specific material suppliers and waste management facilities to be used during construction of the Proposed Scheme, and these rules prevent setting a precedent that would potentially tie the appointed Contractor to exclusive arrangements with specific material suppliers and/or waste management facilities.

11.2.10 The ability to utilise materials suppliers and waste management infrastructure from a wide range of locations would allow existing material resources and waste management capacity to be used effectively and efficiently, without resulting in local overcapacity to the detriment of the local economy.

11.3 Baseline conditions

Baseline sources

11.3.1 A desk-based assessment has been undertaken in order to establish, for the two study areas, the current and likely future baseline conditions for material assets and waste during the anticipated construction period (2025 to 2027) in the absence of the Proposed Scheme.

11.3.2 Baseline data has been collected at both the regional (north-west) and sub-regional (Greater Manchester) level, including availability of primary, secondary and recycled aggregate materials; presence of mineral safeguarding sites and peat resources; as well as information on waste management capacity, including remaining landfill void space and annual throughputs of waste transfer, waste treatment, metal recycling and waste incineration facilities.

11.3.3 The baseline assessment has been prepared with reference to the latest minerals and waste planning information published by the:

- North West Aggregate Working Party
- Association of Greater Manchester Authorities
- British Geological Survey
- Crown Estate
- Environment Agency

Baseline information

Material assets

11.3.4 For the purposes of this assessment, material assets are considered to be the physical resources in the environment required for constructing the Proposed Scheme, which may be of human or natural origin.

11.3.5 Primary, secondary and recycled aggregates have been chosen to act as a proxy indicator of regional and sub-regional material assets given that large quantities of aggregates are typically required for motorway and all-purpose trunk road projects. This was also considered appropriate due to the prominence given to aggregates in the DMRB LA 110 Environmental Assessment standard.

11.3.6 This is also supported by the 'Sustainable Development Strategy and Action Plan' (Highways England, 2017) which confirms that its key ambition covering manufactured capital is to: push towards a 'circular' approach to the management of its resources; minimising its demand for primary resources extracted from the ground; and maximising the reuse of the resources already in use on the network.

Aggregates consumption associated with the existing highways network

11.3.7 The operational maintenance of the first study area is likely to consume both unbound aggregates (used as sub-base and drainage applications) and bound aggregates (used in ready mixed concrete, asphalt and pre-cast concrete products).

11.3.8 At the time of writing, there were no figures available regarding the baseline quantities of operational/maintenance aggregates consumption generated across the first study area. Based on recent experience on other road schemes, this information is unlikely to be available at sufficient granularity to be useful in reporting the baseline conditions associated with the first study area.

11.3.9 Notwithstanding, it is proposed that operational effects be scoped out of the assessment for the reasons outlined in Section 11.4.

Regional primary, secondary and recycled aggregates

11.3.10 Mineral Planning Authorities (MPAs) are required to maintain a minimum landbank of seven years for sand and gravel and a minimum landbank of 10 years for crushed rock. This is used to determine whether there is a shortage or surplus of supply in a given minerals planning area. The North West Aggregate Working Party is the body charged with data collection to facilitate planning by MPAs, national government agencies and the aggregate industry.

11.3.11 The latest North West Aggregates Working Party 'Annual Monitoring Report' (North West Aggregates Working Party, 2017) provides sales and reserves data from January to December 2017. This confirms that sand and gravel and crushed rock landbanks for the north-west were 7.2 years and 29.3 years respectively at the end of 2017, and therefore above their respective minimum requirements. Sales of sand and gravel and crushed rock in 2017 in the north-west were 2.40Mt and 6.43Mt respectively, with reserves of 23.54Mt and 282.24Mt and a capacity margin of 49%

and 60% respectively. In addition to the land won aggregates, the Crown Estates (2020) 'Marine Aggregates Capability and Portfolio Document 2020' reports that there were an additional 10.33Mt of marine aggregate reserves in the north-west as of July 2020, which equates to an additional reserve life of 34.43 years.

11.3.12 The 'Greater Manchester Joint Minerals Development Plan Authority Monitoring Report 2019-20' (Capita, 2020) confirms that the sand and gravel landbank in Greater Manchester (at 4.0 years) is below the seven year minimum requirement and will be fully depleted during the Minerals Local Plan period (2012 to 2027) unless additional proposals for minerals extraction come forward and planning permissions are granted for the release of additional reserves. The 3-year average sales figure for 2016, 2017 and 2018 confirms that sales averaged out at 0.26Mt, slightly above the ten-year average of 0.25Mt.

11.3.13 Capita (2020) reports that whilst reserves of crushed rock are depleting year on year and additional permissions for its extraction will be required in the medium to long term, the landbank in Greater Manchester (at 29.2 years) is currently above the 10 year minimum requirement. Sales of crushed rock in 2018 were 0.65Mt, above the ten-year average of 0.6Mt but below the three-year average of 0.77Mt. Capita (2020) suggests that Greater Manchester is heavily reliant on imported high quality crushed rock as the material extracted within the sub-region is generally of a poor quality.

11.3.14 Whilst Capita (2020) reports that sand and gravel reserves in Greater Manchester have tended to fall and are currently below the required seven year landbank and are likely to remain that way, it suggests that the general fall in sales and reserves of crushed rock may indicate an increased use of secondary and recycled aggregate in the sub-region in place of local primary aggregates.

11.3.15 Secondary and recycled aggregate production in the north-west were 6.96Mt in 2017, based on a handling rate of 8.58Mt of construction and demolition (C&D) materials (Capita, 2020). Capita (2020) reports that in Greater Manchester the amount of C&D waste received in the area decreased from 3.23Mt in 2018 to 2.69Mt in 2019. By comparison, the amount of C&D waste removed from Greater Manchester in 2019 was 1.1Mt which indicates that Greater Manchester generally processes more C&D waste than in produces.

Mineral safeguarding sites

11.3.16 DMRB LA 110 (terms and definitions) defines mineral safeguarding sites as *"Operational sites or sites identified within strategic planning documents for the extraction of minerals"*.

11.3.17 MPAs are required to define Mineral Safeguarding Areas (MSAs) and adopt appropriate policies in order that known locations of specific minerals resources of local and national importance are not needlessly sterilised by non-mineral surface development. The NNNPS requires that, where a proposed development has an impact on an MSA, there is appropriate mitigation put forward to safeguard mineral resources.

11.3.18 A review of the BRITPITS database (British Geological Survey (BGS), 2020) has not identified any operational mineral sites within or in close proximity to the first study

area. However, a review of the 'Adopted Greater Manchester Joint Minerals Plan' and 'Bury Council Online Proposals Map' suggests that the Proposed Scheme is located within an area designated as MSAs for sand and gravel, and brick clay/surface coal (as shown on Figure 11.1).

11.3.19 This is supported by the 'Greater Manchester Mineral Resources Map in Support of National, Regional and Local Planning' (BGS, 2005) which identifies that first study area is predominately underlain by mineral resources consisting of superficial glaciofluvial sand and gravel deposits; and brick clay and fireclay deposits, coincident with shallow coal bearing strata of the Pennine Coal Measures.

11.3.20 Consultation with the Greater Manchester Minerals and Waste Planning Unit, undertaken for the Proposed Scheme at PCF Stage 2 (option selection), also confirmed the presence of two Areas of Search (AoS) for sand within, or in close proximity to, the study area (as shown on Figure 11.1):

- The first: located within land immediately to the south of the existing northbound to westbound M60 J18 offslip at Parrenthorn Farm and Clarke's Cross.
- The second: located at the northern extents of the study area, immediately east of the Hills Lane overbridge, within land occupied by the Hills private property and Pike Fold Golf Club.

11.3.21 AoS are areas where knowledge of mineral resources may be less certain than specific mineral extraction site allocations, but within which planning permissions for particular sites could be granted to meet any shortfall in supply if suitable applications were made. AoS are located within the much larger MSA designations, which are based on the extent of the mineral resource excluding the urban area.

11.3.22 It should be noted that both MSAs and AoS are not considered to meet the definition of mineral safeguarding sites, as defined in DMRB LA 110, as Government guidance makes it clear that there is no presumption that resources defined in MSA or AoS would be worked/extracted.

Peat resources

11.3.23 DMRB LA 110 (terms and definitions) defines peat resources as "*existing or potential peat extraction sites*". National planning policy means that MPAs do not identify peat as a mineral resource of local and national importance, and specifies that LPAs do not identify new sites or extensions to existing sites for peat extraction.

11.3.24 A review of the 'Greater Manchester Joint Minerals Plan April 2013' (Association of Greater Manchester Authorities, 2013) confirms that there are sufficient peat workings with planning permission until 2042 to meet existing and future demand and no new planning permissions need be granted for new peat workings in Greater Manchester. In line with the requirements of the National Planning Policy Framework (NPPF) the Minerals Local Plan does not include an MSA for peat resources.

11.3.25 Peat extraction is focused in the Salford and Wigan areas of Greater Manchester. In the recent past peat has been worked at three sites: Little Woolden Moss with a planning permission running to 2042; Chat Moss where permission expired in 2010; and Astley Moss which finished in 2015.

11.3.26 None of these peat workings are located in proximity to the first study area, and there is limited potential for further peat extraction in Greater Manchester as the area has already been extensively worked. The current policy drive in England is towards carbon sequestration and as a consequence peat harvesting is generally not encouraged.

11.3.27 The 'Minerals Information Online Tool' (BGS, n.d.) confirms the presence of two areas of superficial peat deposits within the first study area (as shown on Figure 11.1):

- The first: located to the north of M60 J18 from approximately 250 m north of M60 J18 southbound to eastbound off slip to the Pike Fold Golf Club ponds.
- The second: located to the west of M60 J18 underlying the M60 carriageway from approximately 550 m west of M60 J18 to approximately 40 m east of Sandgate Road bridge.

11.3.28 Furthermore, occasional reference to organic material or organic clay in historic borehole logs would suggest that localised peat deposits may also be present elsewhere within the study area. Notwithstanding, these peat deposits are not considered to meet the definition of peat resources provided in DMRB LA 110 as they are neither existing nor potential commercial peat extraction sites.

Waste management

11.3.29 Constructing the Proposed Scheme would potentially produce a range of waste types including inert, non-hazardous and small amounts of miscellaneous hazardous wastes. The majority of wastes assumed to be produced would be C&D type wastes.

11.3.30 There would also be a small amount of municipal-type waste associated with construction workers such as food waste, packing, sewerage etc. A large proportion of this waste is likely to be suitable for reuse, recycling or other recovery, although a small proportion may also require disposal to landfill.

Waste generation associated with the existing highways network

11.3.31 The operational maintenance of the first study area is likely to generate a range of C&D wastes including, but not limited to asphalt planings, soft-estate vegetative arisings, road sweepings, gully arisings, oil separator waste, animal by-products, litter etc.

11.3.32 At the time of writing, there were no figures available regarding the baseline quantities of operational / maintenance waste generated across the first study area. Based on recent experience on other road schemes, this information is unlikely to be available at sufficient granularity to be useful in reporting the baseline conditions associated with the first study area.

11.3.33 Notwithstanding, it is proposed that operational effects be scoped out of the assessment for the reasons outlined in Section 11.4.

National and regional construction and demolition waste generation

11.3.34 UK statistics on Waste – March 2020 (Defra, 2020) provides an update on the generation and management of UK waste, including the contributions made by various sectors.

11.3.35 This confirms that the construction sector in England generated a total of 59.6 Mt of non-hazardous C&D waste in 2016, and that 92% of this was recovered/diverted from landfill. Defra (2020) also confirms that the rate has remained at similar levels from 2010 to 2016 and has at all times been well above the Waste Framework Directive 2020 target of 70%. This excludes hazardous waste and excavation and dredging waste which are outside the scope of the target.

11.3.36 The Waste Data Interrogator 2019 (Environment Agency, 2020) confirms that approximately 8.49Mt of C&D waste was received at waste management facilities in the north-west in 2019, with 2.61Mt of this received at waste management facilities in Greater Manchester.

Waste transfer, treatment, recycling and recovery baseline

11.3.37 The availability of waste transfer, treatment, recycling and recovery infrastructure able to accept waste generated during construction of the Proposed Scheme has been considered through a review of the 'Waste Management in the North West: Data Tables 2019' (Environment Agency, 2020).

11.3.38 Whilst annual capacity data is published by the Environment Agency for both landfill and incineration facilities at the national, regional and sub-regional level, no annual capacity data is published by the Environment Agency for waste transfer, treatment or recycling sites. Only annual permitted throughput is published for these facilities.

11.3.39 The total annual permitted throughput or capacity reported by the Environment Agency (2020) for the north-west region and Greater Manchester sub-region is detailed in Table 11.1.

Table 11.1: Total permitted throughput or capacity of transfer, treatment, metal recycling and incineration in the north-west and Greater Manchester, 2019

Site type	North-west region (000s tonnes)	Greater Manchester sub-region (000s tonnes)
Transfer (annual throughput)		
Hazardous waste transfer stations	707	351
Household, industrial, commercial waste transfer stations	4,645	1,518
Non-biodegradable waste transfer stations	128	127
Treatment and metal recycling (annual throughput)		
Material recovery	1,612	632
Physical treatment	5,474	1,783
Physico-chemical treatment	1,872	427
Chemical treatment	159	-
Composting	713	136

Site type	North-west region (000s tonnes)	Greater Manchester sub-region (000s tonnes)
Biological treatment	7,683	4,232
Metal recycling	2,532	632
Incineration (annual capacity)		
Co-incineration of hazardous waste	175	-
Hazardous waste incineration	100	-
Municipal and/or industrial & commercial incineration	1,227	127
Biomass/waste wood incineration	324	-

11.3.40 The Waste Data Interrogator 2019 (Environment Agency, 2020) reports that, as of 2019, there were 1,155 No. permitted transfer, treatment, metal recovery, incineration and use of waste sites in the north-west, with 790 No. of these having accepted waste in 2018.

11.3.41 Based on these data, it can be assumed that there would be opportunities for waste arisings during the construction of the Proposed Scheme to be transferred, treated, recycled or recovered as appropriate in the second study area, if they cannot be reused, recycled or otherwise recovered on-site (i.e. within the first study area).

Inert, non-hazardous and hazardous landfill capacity baseline

11.3.42 For wastes which cannot be reused, recycled or otherwise recovered, disposal to landfill would be required. The Environment Agency (2020) details the total remaining landfill capacity in the north-west region and Greater Manchester sub-region in 2019 as presented in Table 11.2.

Table 11.2: Total landfill capacity available in the north-west and Greater Manchester, 2019

Landfill type	North-west region (000s tonnes[1])	Greater Manchester sub-region (000s tonnes[1])
Hazardous merchant landfill	9,000	-
Hazardous restricted landfill	225	-
Non-hazardous landfill with SNRHW cell[2]	6,022	3,687
Non-hazardous landfill	10,542	1,109
Non-hazardous restricted landfill	3,900	-
Inert landfill	8,246	2,088
Total	**37,935**	**6,884**

[1] Converted from cubic metres through adoption of the following conversion factors: inert landfills 1.5 tonnes/m^3, non-hazardous landfills 0.83 tonnes/m^3 and hazardous landfills 1.5 tonnes/m^3.
[2] Some non-hazardous sites can accept some Stable Non-Reactive Hazardous Wastes (SNRHW) into a dedicated cell, but this is usually a small part of the overall capacity of the site.

11.3.43 The Environment Agency (2020) reports that, at the end of 2019 there were 50 No. operational landfills (with 35 No. of these having remaining capacity) and 9 No. (with 4 No. of these having remaining capacity) in the north-west region and Greater Manchester sub-region respectively. Those landfills within Greater Manchester, with remaining capacity at the end of 2019, are shown on Figure 11.1.

11.3.44 On the basis of these data, it can be assumed that there would be opportunities for waste arisings during the construction of the Proposed Scheme to be disposed of to landfills in the second study area, if they cannot be reused, recycled or otherwise recovered within the first or second study area (i.e. on or off site).

Future baseline

Future primary, secondary and recycled aggregates baseline

11.3.45 For the purpose of this assessment, it has been assumed that the future material assets baseline (size of the primary aggregate landbanks, marine aggregate reserves and the market for primary, secondary and recycled aggregates) would be largely the same during construction (2025 to 2027) as for the current baseline year.

11.3.46 Whilst it is expected that existing landbanks and marine dredging sites would continue to be depleted, other sites and extensions to existing sites are likely to be granted to offset any potential shortfall in capacity, ensuring that sufficient availability is provided in line with future policy requirements and market demands.

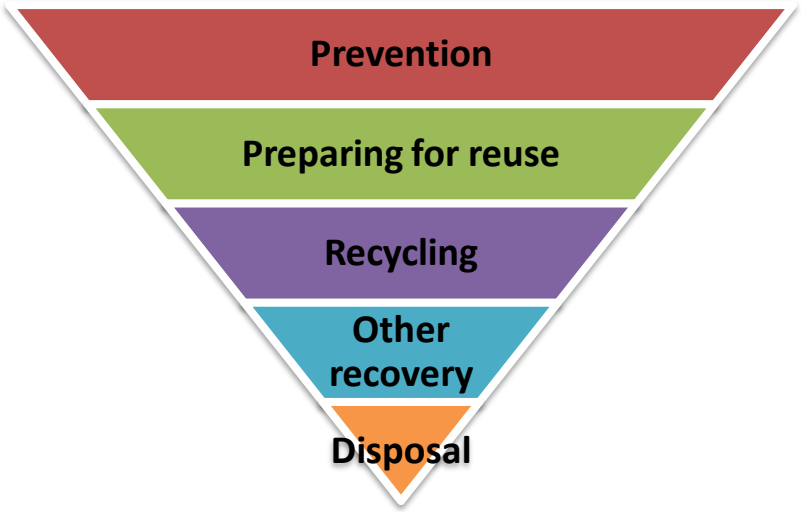
Future minerals safeguarding sites and peat resources baseline

11.3.47 It has been assumed that the size and location of mineral safeguarding sites would remain unchanged from the current baseline year. The locations of MSAs are considered to be relatively constant given that they are largely defined on the basis of geological mapping. Future allocated mineral sites would typically be located within MSAs. It has also been assumed that the size and location of peat deposits would remain unchanged from the current baseline year.

Future waste treatment, recycling and recovery capacity baseline

11.3.48 Waste treatment, recycling and recovery infrastructure facilities are considered to be a beneficiary of incoming materials through driving the management of the waste hierarchy, and by creating conditions that facilitate a circular approach to the management of materials (see Plate 11.1).

Plate 11.1: Waste hierarchy



11.3.49 These facilities are therefore not considered to be sensitive receptors for the purpose of assessment in the same way as landfill sites are, given that they are part of a recovery system that has the potential to reduce the environmental effects associated with waste generation, management and disposal. These facilities are also different to landfills, in that landfills are a finite resource.

11.3.50 Waste treatment, recycling and recovery facilities are typically characterised by large annual throughputs; consequently, large step changes in capacity (as single facilities are commissioned) have an exaggerated impact on the historical trend. Waste treatment, recycling and recovery infrastructure capacity cannot therefore be realistically projected forward to the construction phase of the Proposed Scheme.

11.3.51 Professional experience has shown that waste markets are flexible and adapt to changing markets within a region; and that historical trends show that waste treatment, recycling and recovery is added or removed, not least to cope with changes in waste generation. It is expected that whilst the actual waste facilities available may change over the course of constructing the Proposed Scheme, the overall capacity is likely to remain similar as the market responds.

11.3.52 The future waste treatment and recovery infrastructure capacity for use in the assessment would, therefore, be based on the most recent available Environment Agency annual capacity/input data for 2019. This suggests that there is likely to be adequate opportunity for wastes arising during the construction of the Proposed Scheme to be treated, recycled or otherwise recovered via appropriate means within the second study area.

Future inert, non-hazardous and hazardous landfill capacity baseline

11.3.53 Projected future inert, non-hazardous and hazardous landfill capacity has been estimated in Table 11.3 and illustrated in Plate 11.2 and Plate 11.3.

11.3.54 This is based on the average annual percentage change in remaining landfill capacity for the years for which consistent data is available from the Environment Agency (i.e. 2005 to 2019). The predicted changes in inert, non-hazardous and hazardous landfill capacity are derived from the existing Environment Agency (2020) time-based data (i.e. remaining landfill capacity at the end of each calendar year).

11.3.55 These data have been projected forward to 2027 (targeted opening year), using the calculated average annual capacity change in landfill capacity from 2005 to 2019[2], in order to provide an estimate of the remaining landfill capacity that may be available during the construction of the Proposed Scheme (expected between 2025 and 2027).

11.3.56 The estimates, provided in Table 11.3, assume continuation of a similar trend, in the subtraction and addition of landfill capacity, as that reported by the Environment Agency for 2005 to 2019.

[2] North West: inert landfill (-1.77%), non-hazardous landfill (-7.40%) and hazardous landfill (+0.70%); Greater Manchester: inert landfill (-48%), non-hazardous landfill (-68%) and hazardous landfill (n/a).

Table 11.3: Forecast future baseline landfill capacity in the north-west and Greater Manchester, 2020-27

Timeline	North-west forecast future landfill capacity (000s tonnes)			Greater Manchester forecast future landfill capacity (000s tonnes)		
	Inert	Non-hazardous	Hazardous	Inert	Non-hazardous	Hazardous
2020	8,101	18,950	9,289	1,085	2,492	-
2021	7,958	17,548	9,354	564	1,295	-
2022	7,817	16,249	9,419	293	673	-
2023	7,679	15,047	9,485	152	349	-
2024	7,543	13,933	9,551	79	182	-
2025	7,409	12,902	9,617	41	94	-
2026	7,278	11,947	9,684	21	49	-
2027	7,149	11,063	9,751	11	25	-
Average (000s tpa) during construction phase (2025-27)	**7,279**	**11,971**	**9,684**	**25**	**56**	**-**

Plate 11.2: Forecast future landfill capacity in the north-west (2020-27) (000s tonnes)

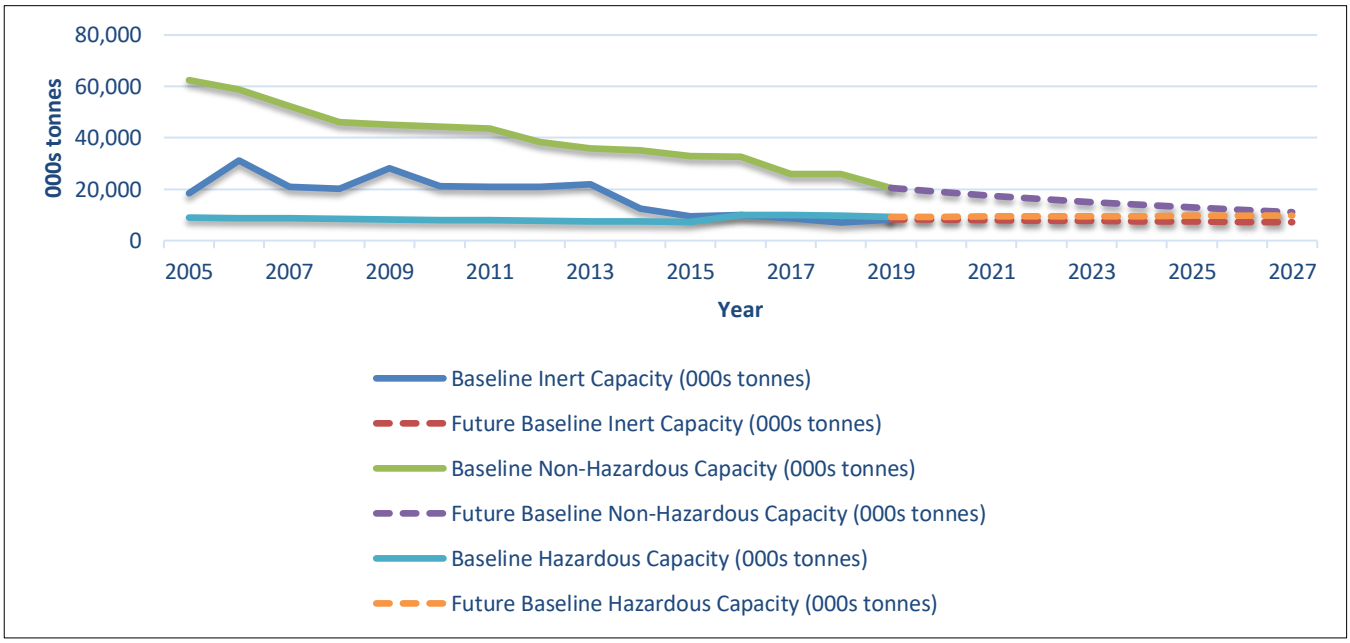
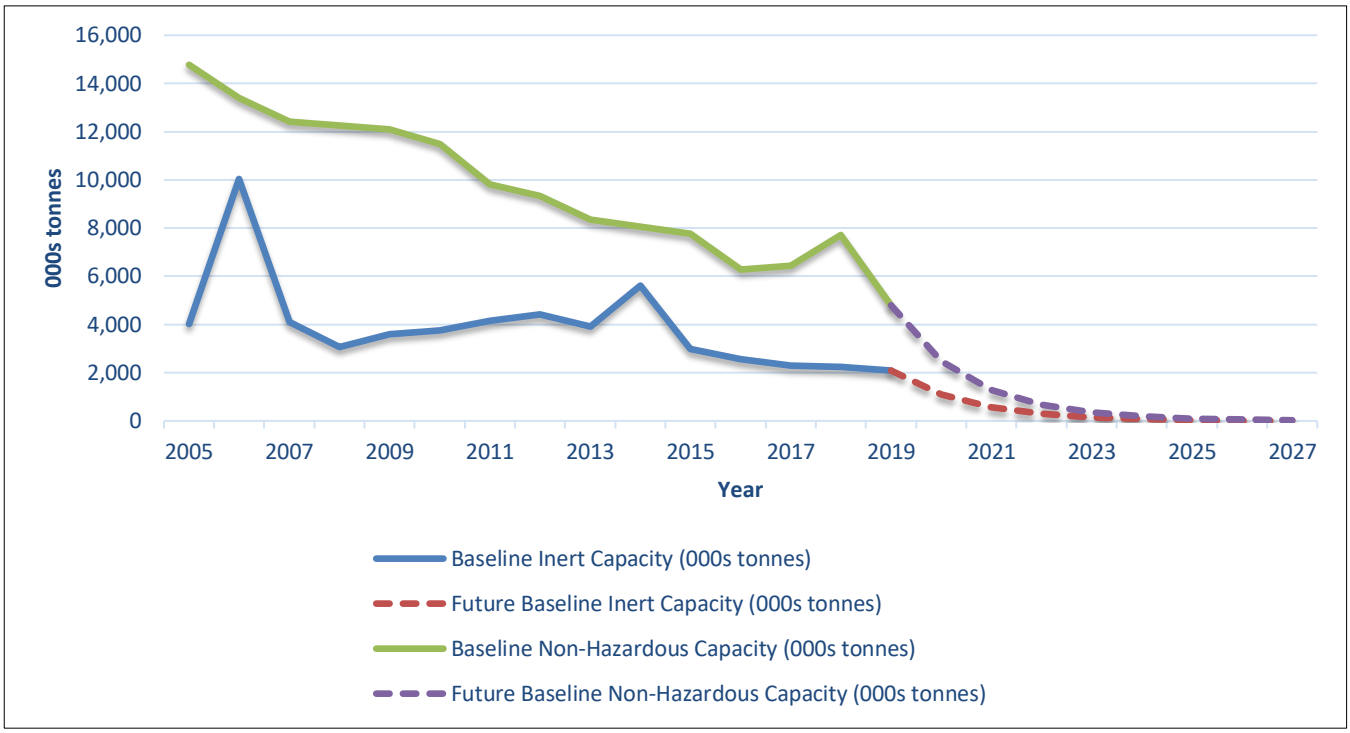


Plate 11.3: Forecast future landfill capacity in Greater Manchester (2020-27) (000s tonnes)



11.3.57 Although there is generally a reducing trend for landfill disposal in England, the forecast future baseline landfill capacity suggests that there is likely to be available inert, non-hazardous and hazardous landfill in the north-west region to support the construction of the Proposed Scheme between 2025 and 2027. However, there is likely to be very limited capacity at the sub-regional level unless additional capacity is provided in the intervening period by the Grater Manchester Authorities.

11.3.58 This means that any inert, non-hazardous, SNRHW and hazardous waste that is destined for landfill would most likely find available regional capacity in the study area. Waste Planning Authorities have a statutory responsibility to make provision for sufficient landfill capacity; future local plans should include provision for landfill sites and/or to identify other suitable placement locations to enable continued capacity to be available as landfill void space is occupied.

11.3.59 Notwithstanding, it is envisaged that the vast majority of waste arising from construction of the Proposed Scheme would be re-used, recycled or otherwise recovered within the first or second study area in accordance with legislative and policy requirements. This assumption is validated by the available English statistics, with Defra (2020) confirming that 92% of non-hazardous C&D waste is currently being diverted from landfill. This would also be required in order to demonstrate the Proposed Scheme's contribution to achieving the following targets in DMRB LA 110:

- At least 70% (by weight) of non-hazardous C&D waste "shall" be subjected to material recovery/diverted from landfill (constitutes a requirement of Highways England) (paragraph 3.17 of DMRB LA 110).
- At least 90% (by weight) of non-hazardous C&D waste "should" be subjected to material recovery/diverted from landfill (constitutes advice expressed as a recommendation by Highways England) (paragraph E/2.1.1 of DMRB LA 110).

11.3.60 It is also of note that even where wastes are accepted at landfill some may, subject to their properties, be used within landfill cover or other backfilling/engineering uses rather than subject to and accounted as disposal. Any landfills that have ceased infilling at the time of construction and are no longer accepting waste may also still require inert and non-hazardous materials for capping and restoration purposes, and therefore may be amenable to accepting any suitable surplus materials arising from construction.

Value of receptors

11.3.61 The baseline environment is comprised of receptors which have been defined geographically based on the likely impacts and effects associated with the use and consumption of material assets and the production and management of waste, as set out in DMRB LA 110.

11.3.62 Whilst these receptors and an indication of their baseline sensitivity are summarised in Table 11.4, it should be noted that the DMRB LA 110 simplified assessment framework precludes the need to assign a sensitivity rating to the identified receptors for the purposes of assessment (see Section 11.7).

11.3.63 The sensitivity of all receptors within the baseline are intrinsically considered within the significance category descriptions provided in DMRB LA 110 and, as such, the methodology for this aspect is not based on the more traditional method of combining the sensitivity of the receptor and the magnitude of impact to determine the significance of effect (as detailed in Chapter 5: Environmental assessment methodology).

Table 11.4: Sensitivity of receptors in the study area for material assets and waste

Sensitivity	Description	Summary of baseline conditions
N/A	Primary, secondary and recycled aggregates	Primary aggregates are, in their own right, considered as sensitive receptors. Notwithstanding, there is likely to be a good supply of both primary, secondary and recycled aggregates within the second study area to support the construct the Proposed Scheme.
N/A	Mineral safeguarding sites and peat resources	A proportion of the first study area intersects with MSAs for sand and gravel and surface coal/brick clay, and an Area of Search for sand. Two areas of superficial peat deposits are also recorded within the first study area. These MSAs, AoS and peat deposits are not considered to meet the definition of mineral safeguarding sites and peat resources provided in DMRB LA 110.
N/A	Inert, non-hazardous and hazardous landfill capacity	There is likely to be available landfill capacity within the second study area to accommodate the majority of wastes arising from the construction of the Proposed Scheme, and there are unlikely to be any specific constraints with regards to disposing of inert, non-hazardous, stable non-reactive hazardous or hazardous waste streams. However, very limited landfill capacity is forecast to be available within the Greater Manchester sub-region to support the construction of the Proposed Scheme between 2025-28.

11.3.64 DMRB LA 110 (paragraph 3.12.2) requires that sensitive receptors (designated sites identified in other environmental aspects) should also be considered in order to minimise the effects from material assets and waste. In addition to the generalised

receptors identified in Table 11.4 for material assets and waste, additional environmental receptors and designated sites are considered as part of the other aspect chapters in this scoping report and are not reproduced in this chapter.

11.4 Potential impacts

Construction

11.4.1 Constructing the Proposed Scheme would unavoidably require the consumption of material assets (including both site-won and imported materials) and the production and management of waste.

11.4.2 The use of primary materials (new materials rather than secondary or recycled) impacts upon their immediate and - in the case of primary aggregates - long-term availability, resulting in direct impacts on the environment through the depletion of finite natural resources. Whereas the generation and management of waste would result in direct impacts on the environment through the permanent use of landfill capacity.

11.4.3 This loss of resources to landfill would require the extraction and/or production of new materials which, in turn, would accelerate the depletion of resources resulting in indirect environmental impacts (from greenhouse gas emissions, water consumption, visual impacts, dust, noise, vibration, vehicle emissions, pollution, disruption to traffic and other potential causes of nuisance, amongst others). Though such impacts do not form part of the environmental assessment for this scheme they are an important factor in driving the appropriate application of the waste hierarchy and the circular economy principles described in Section 11.3 and 11.5 respectively.

11.4.4 The Proposed Scheme would also require structural works (including earthworks and concrete and steel structures) as well as imported aggregates and asphalt for road construction. Constructing the Proposed Scheme would require land to be acquired and used outwith the existing highway boundary for both temporary (e.g. construction compounds, laydown areas, haul roads etc) and permanent (for new highways, access roads, structures, embankments, drainage etc.) construction purposes.

11.4.5 Any land to be permanently acquired and used inside MSAs and AoS may therefore result in potential partial sterilisation impacts to mineral resources. Sterilisation may occur through constructing the Proposed Scheme directly overlying these MSAs and AoS which may restrict their future workability through immediate land take, or through construction on or close to the boundary of these areas which can indirectly sterilise the mineral resource. Indirect sterilisation can occur through closing off the access to a resource in circumstances where access to the resource is limited.

11.4.6 The potential exists for partial sterilisation impacts to occur to the MSA for sand and gravel and brick clay/surface coal within the study area, and AoS for sand and gravel located at Parrenthorn Farm and Clarke's Cross, where the proposed M60 northbound to M60 westbound free flow link would be constructed.

11.4.7 Based on geological mapping, peat deposits may be encountered during the construction of the proposed M60 northbound to M60 westbound free flow link and the proposed interchange link. Due to its compressible nature, any peat that is

encountered within the footprint of the Proposed Scheme may need to be excavated and managed as waste if deemed unsuitable for conventional construction methods.

11.4.8 Peat resources hold large stocks of poorly protected carbon, and any excavation of peat is likely to result in carbon losses from the excavated peat and also any areas affected by drainage. Any impacts on climate from the potential release of sequestered carbon would be considered as part of the Chapter 15: Climate assessment for the Proposed Scheme.

11.4.9 MSAs and AoS are not considered to meet the definition of mineral safeguarding sites, provided in DMRB LA 110, as Government guidance makes it clear that there is no presumption that resources defined in MSA or AoS would be worked/extracted. The peat deposits present within the study area are also not considered to meet the definition of peat resources provided in DMRB LA 110 as they are neither existing nor potential peat extraction sites.

11.4.10 It is therefore proposed that both mineral safeguarding sites and peat resources be scoped out of the assessment. This determination is supported by the following consultation responses, from the Greater Manchester Minerals and Waste Planning Unit and Coal Authority, that were received for the Proposed Scheme at PCF Stage 2 (option selection). These responses have been used to determine whether the Proposed Scheme has the potential to realise likely significant effects on safeguarded mineral resources and peat resources within the study area:

- The Greater Manchester Minerals and Waste Planning Unit (Williams.C, 2018/19) has confirmed that the extent of the Proposed Scheme is unlikely to impact on the potential future extraction of sand and gravel within the study area, as such it is content that the resource would not be sterilised and no minerals resource assessment is therefore necessary. No sterilisation of the brick clay resource is also likely to occur given that the Williams.C (2018/19) confirmed that they would not expect the clay associated with the coal to be exploited as the Coal Authority has confirmed that the coal would not need to be extracted.
- The Greater Manchester Minerals and Waste Planning Unit (Williams.C, 2018/19) has confirmed that no sterilisation (by definition) of peat resources is likely to occur given that the current policy drive is towards carbon sequestration, and subsequently planning authorities do not identify new sites or extensions to existing sites for peat extraction. Whilst the approach of the Greater Manchester Minerals Plan is not to extract peat, should peat extraction be necessary the local environmental impacts of the loss of this resource should be dealt with through any scheme proposals put forward but would not be a minerals planning issue.
- The Coal Authority (MacArthur, 2019) has confirmed that the sterilisation of the surface coal resource is unlikely to occur given that there are no known coal seams/outcrops near the surface. Consequently, in considering the limited extent of the area where the development is proposed, the fact that the shallowest coal seam is in excess of 30 metres below ground level, together with both the suggested regional benefits and the impracticalities of extracting any surface coal so close to an operating highway, the Coal Authority considers that the removal of the coal would be unreasonable and that a sustainable objection could not be justified. This is further reinforced when considering the key developments in the

UK energy system and the ways in which energy is expected to be produced in the longer term.

Operation

11.4.11 DMRB LA 110 (paragraph 3.21) specifies that the assessment should only report on the first year of operational activities (opening year).

11.4.12 It has been assumed that no significant maintenance activities would occur during the first year of operational activities (target opening year 2027), and thus no significant materials consumption or waste generation is likely to be realised. It has also been assumed that any sterilisation impacts to mineral safeguarding sites would have been mitigated as far as practicable during the design and construction phase.

11.4.13 It is therefore proposed that operational impacts be scoped out of the assessment on the basis that no likely significant effects would be realised. Although the opening year is a time period not necessarily confined to operational effects, any construction phase effects overlapping within this period will be captured within the construction phase assessment.

11.4.14 Notwithstanding this, the design process would inherently seek to reduce the consumption of material assets, unnecessary sterilisation of mineral and waste sites, and the generation of waste throughout the lifecycle of the Proposed Scheme. Design choices and the choice of materials would make a significant contribution to reducing the environmental impacts associated with material assets and waste during operation, by influencing the required method and frequency of maintenance, and facilitating opportunities to recover and regenerate materials and products at the end of first life to support a circular economy (as defined in Section 11.5).

11.4.15 It is also assumed that the assessment of any environmental impacts and effects associated with material assets and waste during any large scale future maintenance, renewal, or improvement works beyond the opening year, would be undertaken by Highways England's North West Asset Delivery Contractor(s) (or equivalent) in accordance with the requirements of DMRB LA 110 (or any future environmental assessment standard specified by Highways England).

Summary of scope

11.4.16 Table 11.5 summarises the proposed scope for material assets and waste.

Table 11.5: Summary of material assets and waste scope

Matter	Scoped in – construction	Scoped in – operation
Material assets	✓	×
Waste	✓	×

11.5 Design, mitigation and enhancement measures

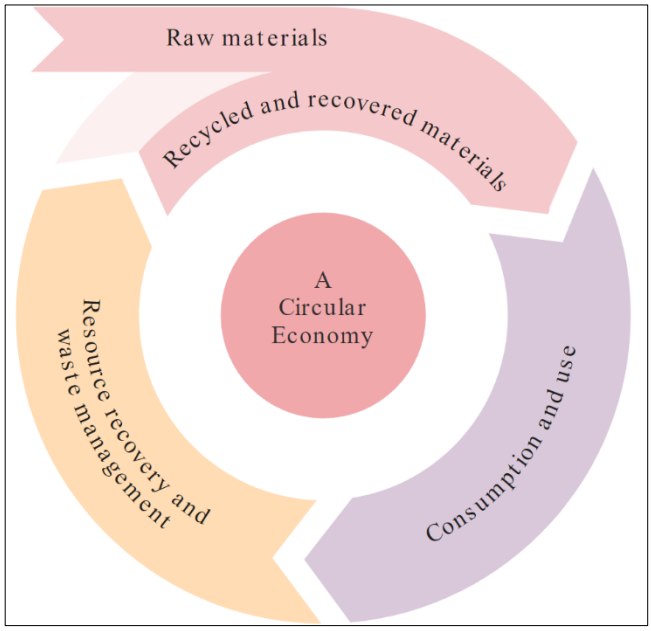
11.5.1 Measures would be implemented to reduce the potential impacts associated with both the consumption of material assets and the production and management of waste during the construction of the Proposed Scheme. There is significant synergy

between material assets and waste, thus there is overlap between the mitigation measures.

11.5.2 Where practicable, those surplus materials and wastes that would arise during the construction of the Proposed Scheme would be re-used, recycled or otherwise recovered on or off-site, which would prevent the need for off-site disposal to landfill. Maximising the use of reused, recycled and responsibly sourced materials in the build, and diverting materials from landfill would reduce the attendant indirect environmental impacts and effects associated with materials production (as discussed in Section 11.2), thereby supporting a circular economy.

11.5.3 A circular economy is an alternative to a traditional linear economy (of make, use, dispose) in which resources are kept in use for as long as possible; maximum value is extracted from these resources while in use; products and materials are recovered and regenerated at end of life; and products, components and materials are kept at their highest utility and value at all times (see Plate 11.4).

Plate 11.4: A Circular Economy (reproduced from Defra 2018)



11.5.4 The design of the Proposed Scheme has not been sufficiently developed to allow mitigation measures to be defined in detail. This section, therefore, identifies established and reliable design, mitigation and enhancement measures considering relevant legislation, policy and best practice. These measures would be implemented during the design and construction of the Proposed Scheme. Embedded mitigation would be developed as the design progresses.

11.5.5 All percentage targets identified below in Section 11.5.7 are taken from the DMRB LA 110 National Application Annex. This annex sets out Highways England's specific recycled aggregate targets and mandatory C&D waste recovery targets for use with LA 110.

Embedded mitigation

11.5.6 Design measures (embedded mitigation) should include, but not be limited to, the following:

- Implementing Design for Resource Efficient (DfRE) construction principles in a systematic manner to suit the scale of the Proposed Scheme, to identify, prioritise and select appropriate opportunities to improve project resource efficiency and design out waste:
  - Designing for reuse and recovery: identifying, securing and using materials that already exist on site, or can be sourced from other projects.
  - Designing for materials optimisation: simplifying layout and form to reduce material use, using standard design parameters, balancing cut and fill, maximising the use of renewable materials and materials with recycled content; and using engineering plan configurations and layouts that show how the most effective use of materials and arisings can be achieved.
  - Designing for off-site construction: maximising the use of pre-fabricated structure and components, encouraging a process of assembly rather than construction.
  - Designing for the future (deconstruction and flexibility): identify how materials can be designed to be more easily adapted over an asset's lifetime and how deconstructability and demountability can be increased at end of first life.
  - Designing for waste efficient procurement: identifying and specifying materials that can be acquired responsibility, in accordance with recognised industry standards.

Essential mitigation

11.5.7 Essential mitigation measures should include, but not be limited to, the following:

- Producing a Responsible Sourcing Plan to increase the responsible sourcing of construction materials and products with proven sustainability credentials that reduce adverse impacts on people and the environment. The plan shall specify, the:
  - Use of key material elements (asphalt, concrete, aggregate, steel, aluminium and plastics) responsibly sourced from suppliers with industry recognised responsible sourcing certification for that material (e.g. BRE (2014) BES 6001, or membership of a sector specific scheme that complies to BSI BS 8902:2009).
  - Use of timber and wood-derived products that are sustainably sourced from independently verifiable legal and sustainable sources or from a licensed Forest Law Enforcement Governance and Trade partner.
  - Use of alternatives to primary materials, where available and permitted by the Specification for Highway Works. This could include materials that already exist on site or can be sourced from other projects/suppliers.
  - Ensuring that any imported aggregates comprise re-used, secondary or recycled content at levels at least in line with the 'North-west regional

guideline for aggregates provision 2005-2020' (Ministry of Housing, Communities & Local Government, 2009) target of 30% where available.

- Minimal use of hazardous materials that have the potential to harm human health or the environment; and that might cause problems for future reuse, recycling and recovery.

- Reducing any permanent land taken within or close to the boundary of MSAs and AoS to reduce any unnecessary sterilisation of minerals resources where feasible:
  - Any sand and gravel arisings (a safeguarded mineral resource) that are incidentally extracted during site preparations would be processed and used on site where practicable, and/or exported to nearby minerals operators for processing so as to supply aggregates to other development projects for high value applications.
- Ensuring that any peat deposits encountered during construction of the Proposed Scheme are managed in accordance with the following hierarchy where practicable:
  - Prevention: avoiding generating excess peat during construction (e.g. by avoiding areas of peat or by using construction methods that do not require excavation, such as floating roads etc).
  - Re-use: use peat produced on site in designated areas in an environmentally beneficial and suitable way, in the restoration of temporary works areas or as part of landscaping strategy.
  - Recycling/recovery/treatment: modification of peat produced on site for use as a fuel, or as a compost/soil conditioner, or dewater peat to improve its mechanical properties in support of re-use.
  - Storage: temporarily store peat on-site (for example, during short periods in the construction period) and then re-use.
- Implementing a Site Waste Management Plan (SWMP) to evidence how the design and construction of the Proposed Scheme has adopted the waste hierarchy of prevention, reuse, recycling other recovery and disposal. The SWMP shall also demonstrate how the Proposed Scheme supports the DMRB LA 110 stretch target of ensuring that at least 90% of non-hazardous C&D waste is subject to material recovery/diverted from landfill in line with the Greening Government Commitments; and through:
  - Complying with waste 'Duty of Care' requirements and taking all reasonable steps to ensure that waste is managed safely without endangering human health or harming the environment.
  - Engaging early with contractors during design to identify possible mitigation and enhancement measures, and to identify opportunities to reduce waste.
  - Obtaining all necessary waste carrier registrations; environmental permits, mobile plant deployments and/or waste exemptions in relation to the storage, sorting, treatment, use, disposal and transportation of waste.
  - Preparing any documentation required of statutory and industry regulated codes of practice or end of waste quality protocols (e.g. CL:AIRE Code of

Practice and Environment Agency Quality Protocol for the Production of Aggregates from Inert Waste).

- Ensuring waste arisings generated are handled, stored, managed and re-used or recycled as close as practicable to the point of origin, with consideration of the proximity principle and value for money principle.
- Identifying areas for stockpiling and storing arisings that would reduce degradation, damage and loss, and ensuring that site compounds and on-site storage, stockpiling and processing areas are located/designed to reduce impacts to those designated environmental sites and sensitive environmental receptors identified by other aspects.

- Contributing to developing the 1st iteration of the Environmental Management Plan (EMP), to be produced to accompany the DCO application, through the identification of additional high-level control measures to reduce the impacts associated with material assets and waste. These measures shall be based on established and reliable standard construction measures considering relevant legislation, policy and best practice; and shall reference any specific materials management plans to be developed, under relevant statutory and industry regulated codes of practice, by the appointed Contractor as part of the 2nd iteration of EMP to be prepared in advance of construction.

Enhancement

11.5.8 No enhancement measures have been identified at this stage with regards to the material assets and waste aspect. Enhancement measures would be explored throughout the design and construction of the Proposed Scheme, and as an intrinsic part of developing the Responsible Sourcing Plan and Site Waste Management Plan.

11.5.9 Example enhancement opportunities for this aspect could include, but not be limited to, the following:

- Undertaking an assessment of local operator interest for any sand and gravel material, that may be incidentally extracted during the construction of the Proposed Scheme, for sale to support other development projects in the area.
- Using surplus recycled or recovered materials in community projects, for example utilising recycled mulch from tree felling on adjacent community facilities.
- Recycling suitable material for construction of noise and landscape bunding outside of the highway boundary where the need for enhancement has previously been identified (where land availability allows).

11.6 Description of the likely significant effects

11.6.1 Given the scale of the Proposed Scheme the potential exists for significant effects on material assets and waste to occur from the depletion of natural resources and the use of landfill capacity, as well as deviation from the relevant legislative and policy targets outlined in DMRB LA 110.

11.6.2 DMRB LA 110 (paragraph 3.2) confirms that five scoping questions should be answered in order to gain an understanding of the need to undertake further

assessment for the material assets and waste aspect. Where the response to one or more of these questions is 'yes', then further assessment should be undertaken.

11.6.3 The responses to the scoping assessment questions for the Proposed Scheme are provided in Table 11.6, based on the application of professional engineering judgement to the current design information.

Table 11.6: DMRB LA 110 Scoping questions and responses

Scoping questions	Response	Scoped in/out
Material assets		
1. Is the project likely to recover / reuse little on site material thereby requiring materials to be imported to site?	Yes	Scoped in
2. Is the project likely to use little / no recycled / secondary materials thereby requiring the majority of materials used on the project to comprise primary materials?	Uncertain	Scoped in
3. The project is likely to sterilise (substantially constrain / prevent existing and potential future use of) mineral sites or peat resources?	No	Scoped out
Waste		
4. Would the project generate large quantities of waste relative to regional landfill capacity?	Uncertain	Scoped in
5. Will the project have an effect on the ability of waste infrastructure within the region to continue to accommodate waste from other sources?	Uncertain	Scoped in

11.6.4 Having answered ‘yes’ or ‘uncertain’ to one or more of the DMRB LA 110 scoping questions for the material assets and waste matters, it is recommended that this aspect and both of its matters be scoped into the EIA.

11.7 Assessment methodology

11.7.1 A quantitative material assets and waste assessment will be undertaken, with professional judgement applied to the DMRB LA 110 simplified assessment framework as required (see Table 11.7, Table 11.8 and Appendix B).

11.7.2 The collection, interpretation and use of the following information on material assets and waste will be targeted during the environmental assessment in order to generate a meaningful assessment:

- For material assets:
  - types and quantities of materials assets required to construct the scheme
  - information on materials that contain secondary / recycled content
  - information on any known sustainability credentials of materials to be consumed
  - the type and volume of materials that would be recovered from on-site or off-site sources for use on the scheme
  - the cut and fill balance

- details of on-site storage and stockpiling arrangements, and any supporting logistical details

- For waste management:
  - types and quantities of wastes generated during the construction of the scheme
  - amount of waste (by type and weight) that would be recovered and diverted from landfill either on-site or off-site (i.e. for use on other projects)
  - types and quantities of waste arising from the scheme (demolition, excavation arisings and remediation) requiring disposal to landfill
  - details of on-site storage and segregation arrangements for waste and any supporting logistical arrangements
  - potential for generation of hazardous waste (type and quantity)

11.7.3 The following published resource efficiency statistics, benchmarks and key performance indicators would be used to populate any data gaps that may exist in relation to assessing the effects of constructing the Proposed Scheme in accordance with both NNNPS and DMRB LA 110 requirements:

- Resource Efficiency Benchmarks for Construction Projects (Waste and Resources Action Programme (WRAP), 2013)
- Profile of the UK Mineral Products Industry Workbook (Mineral Products Association, 2020)
- Construction Procurement Guidance: Delivering Higher Recycled Content in Construction Projects (WRAP, 2009)
- Net Waste Tool – Dataset (WRAP, 2008)
- ENV23 - UK Statistics on Waste dataset (Defra, 2020)

11.7.4 These data sources are likely to be required in order to populate the following data gaps which may exist for the assessment:

- Information on indicative levels of recycled content in imported aggregate and aggregate containing construction materials
- The amount of waste that could be recovered and diverted from landfill within the first or second study area
- Quantities of waste arising from the project requiring disposal to landfill

11.7.5 No surveys or modelling will be undertaken for this aspect. A desk based assessment is considered to be appropriate and proportionate following DMRB LA 110 for the material assets and waste assessment.

Simplified assessment framework (significance categories and criteria)

11.7.6 DMRB LA 110 sets out how effects associated with the material assets and waste aspect should be assessed through the use of a ‘simplified assessment framework’. Consequently, this precludes the application of a methodology to derive a measure of

the significance of effect based on the more traditional approach of combining the sensitivity of the receptor and the magnitude of impact.

11.7.7 The assessment of effects on material assets and waste will adopt the significance categories in Table 11.7. The significance of effects on material assets and waste will be reported in accordance with the significance criteria in Table 11.8. These significance category descriptions and significance criteria are replicated from Tables 3.13 and 3.14 in DMRB LA 110. Where required, professional judgement will be used to determine which significant effect categories the Proposed Scheme is likely to fall within, with regards to the material assets and waste matters of this aspect.

Table 11.7: DMRB LA 110 significance category descriptions

Significance category	Description[1]
Very large	Material assets: 1) no criteria: use criteria for large categories. Waste: 1) >1% reduction or alteration in national capacity of landfill, as a result of accommodating waste from a project; or 2) construction of new (permanent) waste infrastructure is required to accommodate waste from a project.
Large	Material assets: • project achieves <70% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste to substitute use of primary materials; and • aggregates required to be imported to site comprise <1% re-used / recycled content; and/or[2] • project sterilises ≥1 mineral safeguarding site and/or peat resource[3]. Waste: • >1% reduction in the regional capacity of landfill as a result of accommodating waste from a project; and • >50% of project waste for disposal outside of the region.
Moderate	Material assets: • project achieves less than 70% overall material recovery / recycling (by weight) of non-hazardous construction and Demolition Waste to substitute use of primary materials; and • aggregates required to be imported to site comprise re-used/recycled content below the relevant regional percentage target[4]. Waste: • >1% reduction or alteration in the regional capacity of landfill as a result of accommodating waste from a project; and • 1-50% of project waste for disposal outside of the region.
Slight	Material assets: • project achieves 70-99% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste to substitute use of primary materials; and • aggregates required to be imported to site comprise re-used/recycled content in line with the relevant regional percentage target[4]. Waste: • ≤1% reduction or alteration in the regional capacity of landfill; and

Significance category	Description[1]
	• waste infrastructure has sufficient capacity to accommodate waste from a project, without compromising integrity of the receiving infrastructure (design life or capacity) within the region.
Neutral	Material assets: • project achieves >99% overall material recovery / recycling (by weight) of non-hazardous Construction Demolition Waste to substitute use of primary materials; and • aggregates required to be imported to site comprise >99% re-used / recycled content. Waste: • no reduction or alteration in the capacity of waste infrastructure within the region.

[1] This table, reproduced from DMRB LA 110, uses very precise and deliberate language, specifically "OR", "AND" and "AND/OR" after each descriptor of effect to denote which significance category should be applied. The descriptors for the material assets matter are generally summative (large, moderate, slight and neutral effects), and all descriptors need to be met in full in order to assign a relevant significance category (i.e. with the notable exception of a large effect which can be assigned when a project sterilises ≥1 mineral safeguarding site and/or peat resource). The descriptors of effect for the waste matter are either standalone (very large and neutral effects) or summative (large, moderate and slight effects).

[2] The published version of DMRB LA 110 includes "AND" instead of "AND/OR". This has been changed to correct an editorial error in the original standard that was confirmed in an email from Wilson. S (2020) at Highways England.

[3] Sterilisation is defined by DMRB LA 110 to mean "substantially constrain / prevent existing and potential future use and extraction of materials". In the absence of further information, this has been interpreted to mean that the Proposed Scheme would need to substantially sterilise one or more mineral safeguarding sites (in their entirety), placing their future use at risk or rendering them inaccessible for current or future use.

[4] The recycled aggregate target for the north-west region is 30%. This target is given in Table E/1.2 of DMRB LA 110, and is sourced from National and Regional Guidelines for Aggregates Provision in England 2005 to 2020 (Ministry of Housing, Communities & Local Government, 2009).

Table 11.8: DMRB LA 110 significance criteria

Significance	Description
Significant (one or more criteria met)	Material assets • category description met for moderate or large effect. Waste • category description met for moderate, large or very large effect.
Not significant	Material assets • category description met for neutral or slight effect. Waste • category description met for neutral or slight effect.

11.7.8 With reference to DMRB LA 104: Environmental Assessment and Monitoring (Highways England, 2020) (paragraph 3.7), effects of moderate significance can be considered to be material decision-making factors, large effects are likely to be material in the decision-making process and very large effects are material in the decision-making process. Whereas, effects at the slight level are not material in the decision-making process.

11.8 Assessment assumptions and limitations

11.8.1 There is little information available at this stage regarding the precise materials and waste requirements associated with constructing the Proposed Scheme and therefore, there is insufficient information available at this stage to definitively answer all of the DMRB LA 110 scoping questions.

11.8.2 These limitations are not untypical of scoping level assessments, and the information presented in this chapter is considered to represent an appropriate level of detail in line with the scoping assessment methodology outlined in DMRB LA 110.

11.8.3 Should detailed scheme-specific information not be available to support the Preliminary Environmental Information Report and/or Environmental Statement for this aspect, it is assumed that these uncertainties/limitations would be addressed by means of those resource efficiency statistics, benchmarks and key performance indicators identified in Section 11.7.

11.8.4 Whilst the baseline data sources used in this assessment represent the most recently available stakeholder information, there is a general lag (in years) for materials, waste processing and landfill capacity data in the UK and conditions may change since publication of this data. The annual reporting cycle is also likely to have been impacted to some degree by the COVID-19 pandemic.

11.8.5 Although checks are made by stakeholders for anomalies or errors in their data prior to publication, it cannot be guaranteed that these data sets are error free, or whether any commercial decisions have been taken by site operators that may have affected these data.

12. Noise and vibration

12.1 NNNPS requirements

12.1.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

12.1.2 Key policy from the NNNPS relevant to this aspect includes:

- Paragraph 5.190 states that the potential noise impact elsewhere directly associated with the development, such as changes in road traffic movements elsewhere on the road network should be considered as appropriate.
- Paragraph 5.191 of the NNNPS states that operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. The prediction of road traffic noise should be based on the method described in Calculation of Road Traffic Noise (CRTN) (Department of Transport and Welsh Office, 1988). For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies.
- Paragraph 5.193 states that developments must be undertaken in accordance with statutory requirements for noise. Due regard must have been given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government's associated planning guidance on noise.
- Paragraph 5.194 states that the project should demonstrate good design through optimisation of scheme layout to minimise noise emissions and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission. The project should also consider the need for the mitigation of impacts elsewhere on the road and rail networks that have been identified as arising from the development, according to Government policy.
- Paragraph 5.195 states that the SoS should not grant development consent unless satisfied that the proposals will meet the following aims, within the context of Government policy on sustainable development:
  - avoid significant adverse impacts on health and quality of life from noise as a result of the new development
  - mitigate and minimise other adverse impacts on health and quality of life from noise from the new development
  - contribute to improvements to health and quality of life through the effective management and control of noise, where possible
- Paragraph 5.200 states that applicants should consider opportunities to address the noise issues associated with the Important Areas as identified through the noise action planning process.

12.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

12.2 Study area

12.2.1 The Design Manual for Roads and Bridges (DMRB) document LA 111: Noise and Vibration (Highways England, 2020; hereafter referred to as DMRB LA 111) provides instructions on how to define the study area for an assessment of noise and vibration. For construction and operation, defining the study area is based on professional judgement of likely changes in noise and vibration. For a project proceeding to further assessment, a method is provided within DRMB LA 111 to set the study areas for noise and vibration. These methods allow for the study areas to be reduced or extended to ensure they are proportionate to the risk of likely significant effects. An example of this would be where the study area is extended to cover concerned communities that might otherwise be excluded from the assessment.

12.2.2 When further assessment is identified for construction noise, DMRB LA 111 suggests that a study area of 300m from the closest construction activity is normally enough to cover potential adverse effects at sensitive receptors. A study area of 100m from the closest construction activity with the potential to generate vibration is normally enough to define the study area for vibration from construction. For this scoping exercise, these distances from the Proposed Scheme are used when examining the potential impacts from construction.

12.2.3 The study area for operational road traffic is defined by the extent of the Proposed Scheme and the extent of other road links away from this area with a potential to experience a short-term change in noise of more than 1 dB(A). DMRB LA 111 suggests that for most projects an operational study area is defined as the area within 600m of new road links or road links physically changed or bypassed by the project, with the addition of the area within 50m of other road links with a potential to experience a short term road traffic noise change of more than 1 dB as a result of the project. .

12.2.4 These three study areas, illustrated in Figure 12.1, are generally sufficient for most projects and have initially been used when examining the potential impacts from the Proposed Scheme. However, the assessment will not be limited to these distances if it is considered there is a risk of likely significant effects beyond 100m for construction vibration, 300m for construction noise, or 600m for operational noise.

12.3 Baseline conditions

Baseline sources

12.3.1 The following baseline sources have been used during the scoping stage:

- Defra Noise Action Plan: Roads (Defra, 2019)
- OS Mastermap digital mapping
- Aerial photography (Google Maps)

Baseline information

12.3.2 The existing noise climate in the vicinity of the Proposed Scheme is dominated by road traffic noise, predominantly from the M60, M62 and M66, as well as traffic using local roads. There is also a combined railway line and Metrolink tram-line that passes over the M60 at the western end of the Proposed Scheme, about 240m east of M60 J17. Railway noise would therefore contribute to the local noise climate in some locations.

12.3.3 As part of the Manchester Smart Motorway (MSM) Scheme, a baseline noise survey was undertaken in May 2012. While this measured noise data was used during PCF Stage 2, the data is considered to now be out of date, and therefore not reported here. Additional baseline noise measurements are to be undertaken in 2021 involving a series of daytime and night-time baseline noise measurements, which are scheduled to be completed prior to the next stage of assessment. These surveys are described in Section 12.7.

12.3.4 The Department for Environment, Food & Rural Affairs (Defra) has identified Noise Important Areas (NIAs)[3,4] as part of the production of strategic noise maps and action plans, which are legal requirements set out in the Environmental Noise (England) (Amendment) Regulations 2018. The NIAs are locations where the highest 1% of noise levels at residential locations can be found. In accordance with the noise action plans, the IAs provide a framework for further investigation.

12.3.5 There are seven NIAs within 600m of the Proposed Scheme. Three of them are directly adjacent to the Proposed Scheme, and the remaining four are located adjacent to the local road network. They are listed in Table 12.1 and shown on Figure 12.1.

Table 12.1: Defra Noise Important Areas (NIAs) for road traffic within 600m from the Proposed Scheme

NIA ID	Description	Location	Asset owner
1671	On M62 extending from J17 to J18	Adjacent to the Proposed Scheme and road network	Highways England and Bury Metropolitan Borough Council
8188	On M60 J18	Adjacent to the Proposed Scheme and road network	Highways England
10718	On M62 north east of M60 J18	Adjacent road network	Highways England
1406	On M66 between Castle Road and Haweswater Crescent	Adjacent to the Proposed Scheme and road network	Highways England
1670	On A56 Bury New Road to the north west of the Proposed Scheme	Adjacent road network	Bury Council

[3] Defra (2019), Noise Action Plan: Agglomerations (Urban Areas).

[4] Defra (2019), Noise Action Plan: Roads.

NIA ID	Description	Location	Asset owner
1743	On A56 Bury New Road to the south west of the Proposed Scheme	Adjacent road network	Bury Council
10719	On A665 Higher Lane to the west of the Proposed Scheme	Adjacent road network	Bury Council

12.3.6 The wider area around the Proposed Scheme is mostly urban, with the exception of the area to the north-east of M60 J18, which is more rural. The settlement of Simister is located to the south-east of M60 J18, with more open space immediately adjacent to the other three quadrants. Sensitive receptors for humans include multiple residential properties located either side of the M60 in Prestwich to the south and Besses O'Th'Barn to the north. The settlement areas also contain other noise sensitive receptors, including several schools in close proximity to the Proposed Scheme. There are no hospitals within the study area. The closest residential property is approximately 12m from the south-eastern part of the roundabout in Simister, and the closest school is St Margaret's Church of England Primary School at approximately 125m south of the M60 near J18. There are also isolated semi-rural properties in the area of the Proposed Scheme.

12.3.7 Figure 12.1 also indicates those designated sites and cultural heritage assets that have been identified within the study area. There are no quiet areas designated by Bury Metropolitan Borough Council in the surroundings.

12.3.8 Existing noise mitigation along some sections of the M60 and M66 is in the form of noise barriers. There are existing noise barriers in six locations adjacent to the existing route of the Proposed Scheme which have been identified from a desktop review during the PCF Stage 2 Environmental Assessment Report (EAR) (CH2M, 2019) as:

- M60 J18 there is a noise barrier at a relative height of 1.5m above the concrete wall bounding the dedicated left turn from the westbound M62 to the M60
- There is a 1.5m barrier adjacent to the slip road from the eastbound M60 onto the M60 J18 roundabout
- There are two 1.5m barriers either side of the M60 between M60 J18 and J17, running approximately 470m east of the Sandgate Road overbridge
- There are a further two noise barriers either side of the M60 between J18 and J17 and running approximately 600m eastwards from where the A665 passes over the M60

12.3.9 The location, length and height of these barriers will be established prior to the assessment. A desk-based exercise will also be undertaken to determine whether any of these barriers have noise reducing properties.

12.3.10 It is Highways England policy to deploy Low Noise Surfacing (LNS) on all new and resurfaced roads, which provides a -2.5 dB(A) and -3.5 dB(A) reduction on existing and new roads with speed levels above 75 kph. The latest HAMPs Construction Records indicates that the following road surface types are laid on the M60, M62 and M66 carriageways and associated slip roads within the proposed Scheme corridor:

- LNS on both M60 mainline carriageways between J17 and J18 and between J18 and J19

- LNS on the M60 J17 eastbound on-slip road, and all slip roads associated with J18, with some high friction surface on the lane of the M60 J18 eastbound off-slip road to the J18 roundabout and retexturing bituminous on the M62 J18 eastbound on-slip road from the J18 roundabout
- LNS on the M62 eastbound and westbound mainline carriageways between J18 and J19
- LNS on the M66 northbound and southbound mainline carriageways between J3 and J4 as well as on the M66 J4 northbound on-slip and southbound off-slip roads

12.3.11 All other roads within the Study Area are considered to be surfaced with a Hot-Rolled Asphalt.

Future baseline

12.3.12 The Do-Minimum traffic scenario will be representative of the predicted growth in traffic, accounting for local and regional development. Cumulative impacts are implicit in the future Do-Minimum and Do-Something scenarios because committed developments will be included in the traffic model.

12.3.13 Traffic growth aside, the future noise baseline around the Proposed Scheme is likely to be similar to the existing baseline.

12.3.14 Future committed developments (i.e. those where planning permission has been granted) that would introduce noise sensitive receptors within the study area will be considered within the assessment.

Value of receptors

12.3.15 DMRB LA 111 does not provide a scale of value or sensitivity for receptors. A receptor is either sensitive or not sensitive to noise and/or vibration. DMRB LA 111 defines a noise sensitive receptor as *'dwellings, hospitals, healthcare facilities, education facilities, community facilities, international and national designated sites, public rights of way and cultural heritage assets'*.

12.3.16 With no scale of value, the noise and vibration assessment does not use the matrix-based approach to determine potentially significant effects. The approach to determining potential significant effects is described in Section 12.7.

12.4 Potential impacts

Construction

12.4.1 Impacts from construction can be defined as those that occur between the start of enabling works and the end of the Proposed Scheme construction period. Although temporary, construction-related impacts may nevertheless require mitigation. Typical construction impacts might include a localised increase in noise and/or vibration and a loss of amenity due to the presence of construction traffic.

12.4.2 The following are generally applicable to temporary construction related impacts:

- The area where construction disruption occurs tends to be more localised than the impacts of the road scheme once it has opened to traffic

- It has been shown that disturbance arising from construction diminishes rapidly with distance
- The duration of the effects is important when considering the potential for disturbance

12.4.3 For construction noise, the following two situations are considered to determine the need for further assessment:

1. Does construction noise generated by the project have the potential to adversely affect any noise sensitive receptors?
2. Are there any noise sensitive receptors where there would be a reasonable stakeholder expectation that a construction noise assessment would be undertaken?

12.4.4 If the answer to either of these scoping situations is 'yes' then DMRB LA 111 advises that further assessment shall be undertaken. For the Proposed Scheme it is very likely that the construction work associated with the project would adversely affect the noise climate in the area. Activities, such as breaking up of existing structures and piling for foundations, are some of the noisiest activities associated with a project of this kind. Any works being undertaken at night which may require a full motorway closure have the potential to cause adverse impacts.

12.4.5 At various locations along the Proposed Scheme route there are sensitive receptors sufficiently close that these and other construction activities could increase the noise level and cause adverse impacts. Given the size and scale of the Proposed Scheme it is likely that stakeholders would expect that the noise from construction is assessed and controlled. Noise from construction should therefore be scoped in for further assessment.

12.4.6 For construction vibration, the following two situations are considered to determine the need for further assessment:

1. Does vibration from construction have the potential to adversely affect any vibration sensitive receptors?
2. Does the scale of the development or type of construction mean that there will be a reasonable stakeholder expectation that a construction vibration assessment would be undertaken at any vibration sensitive receptors?

12.4.7 If the answer to either of these scoping situations is 'yes' then DMRB LA 111 advises that further assessment shall be undertaken. For the Proposed Scheme, there is likely to be activities that generate vibration, such as piling or compaction works. These activities would at times be close enough to sensitive receptors that vibration could be felt. However, it is unlikely that sufficiently high levels of vibration to cause structural damage would be generated. Given the nature of the construction and the close proximity to receptors it is likely that stakeholders would expect that the vibration from construction is assessed and controlled. Vibration from construction should therefore be scoped in for further assessment.

Operation

12.4.8 The level of road traffic noise affecting any receptor is dependent on several variables, all of which are accounted for within the road traffic noise prediction methodology. In summary these are:

- Traffic related factors: volume, speed and composition of vehicles

- Road related factors: surface (e.g. concrete or bituminous) and gradient
- Propagation factors: distance, the presence of screening and type of ground cover intervening between the road and any receptor
- Receptor specific factors: view of the road and reflections

12.4.9 Should any of these factors alter, whether through changes on or to an existing road, or with the introduction of a new section of road, then noise levels are also likely to change. Individually, these variables might cause noise levels to increase or decrease for any receptor. DMRB LA 111 provides four situations to consider when determining whether further assessment is required. These are:

1. Is the project likely to cause a change in the basic noise level (BNL) calculations of 1dB $L_{A10,18hr}$ in the do-minimum opening year (DMOY) compared to the do-something opening year (DSOY)?
2. Is the project likely to cause a change in the BNL calculations of 3dB $L_{A10,18hr}$ in the do-something future year (DSFY) compared to the DMOY?
3. Does the project involve the construction of new road links within 600m of noise sensitive receptors?
4. Would there be a reasonable stakeholder expectation that an assessment would be undertaken?

12.4.10 Given the proximity of sensitive receptors to the Proposed Scheme, it is likely that some sensitive receptors would experience adverse impacts. Operational noise should therefore be scoped in for further assessment.

12.4.11 DMRB LA 111 states that operational vibration should be scoped out of the assessment methodology as a maintained road surface will be free of irregularities so operational vibration will not have the potential to lead to significant adverse effects. It is considered that there is nothing within the initial design of the Proposed Scheme that would change this assumption.

Summary of scope

12.4.12 Table 12.2 summarises the proposed scope for noise and vibration.

Table 12.2: Summary of noise and vibration scope

Matter	Scoped in - construction	Scoped in - operation
Construction noise	✓	n/a
Construction vibration	✓	n/a
Operational traffic noise	n/a	✓
Operational traffic vibration	n/a	×

12.4.13 The operational impact from traffic on vibration is the only matter to be scoped out from further assessment. This decision has been based on the instructions set out in DMRB LA 111 as there is no potential for disturbance to be caused.

12.5 Design, mitigation and enhancement measures

12.5.1 Mitigation measures for noise and vibration include measures embedded into a project design to reduce the overall environmental impact (e.g. new road alignment) and measures used solely to mitigate noise (e.g. noise barriers, restrictions on plant or activities during the construction phase, quieter road surfaces).

12.5.2 Given the proximity of sensitive receptors to the construction activities, consideration of temporary construction noise mitigation measures and on-site noise management strategies will need to be highlighted as part of the Environmental Statement, and determined for implementation at later PCF stages.

12.5.3 Prior to construction, the 2nd Iteration of the Environmental Management Plan (EMP) would be prepared and implemented. The 2nd Iteration of the EMP would include the relevant construction noise criteria and any proposed monitoring during construction. It would also contain details of best practice measures associated with mitigating potential noise and vibration impacts. Appropriate mechanisms to communicate with local residents would be developed to highlight potential periods of disruption. These mechanisms could include web-based updates or articles, newsletters and radio announcements.

12.5.4 A complaint management system would be in place, in line with systems used by Highways England on other large infrastructure projects. Any noise and vibration complaints would be investigated and appropriate action taken as required. The complainant would be provided with a response outlining the results of the investigation and any action taken.

12.5.5 When considering noise mitigation from operational noise, the principle of source – path – receptor will be applied. This is a principle where noise mitigation is first considered at source as this is often the most practical and cost-effective solution, and it would also provide a reduction in noise to all the surrounding receptors. Examples of mitigation at source are:

- Changes to the vertical or horizontal alignment of the road
- Low noise road surfacing
- Speed limits
- Restrictions on noisy vehicle types

12.5.6 DMRB LA 111 notes that speed limits or restrictions on noisy vehicle types are not normally practical for use on motorways and all-purpose trunk roads, as they can encourage drivers to take alternative routes which can be less safe and result in higher noise levels for populations along the alternative routes.

12.5.7 It is Highways England's policy to deploy LNS on all new and resurfaced roads. The application of LNS on the new slip roads and areas of carriageway to be widened and/or realigned will provide a long-term reduction in noise. At traffic speeds below 75 kph the DMRB LA 111 methodology assumes no benefit from LNS is included in calculations.

12.5.8 The reduction of noise between the source and receptor is considered next as, after controlling noise at source, a reduction in the path would benefit the greatest number of receptors. A reduction in noise in the path is most likely to be achieved by placing a solid structure between the source and receptor, such as a purposely built noise barrier.

However, the use of a solid barrier would only protect receptors within approximately 200m of the barrier. Examples of mitigation in the path are:

- Purpose built noise barriers
- Bunds or earth embankments

12.5.9 The mitigation of noise at the receptor in the form of sound insulation of buildings is the last resort that should be provided when minimising noise exposure. This is because it would only be of benefit to the individual receptor inside the treated buildings but not to outdoor areas. In addition, providing insulation in terms of improved glazing would be ineffective if the windows of a property are open or if the individuals are outside.

12.5.10 The suitability of each potential noise mitigation measure for use within the Proposed Scheme area will be based on the benefit of a measure in terms of elimination of likely significant effects, any engineering constraints, and the potential impact across other environmental factors. In addition, when considering mitigation for residential noise receptors only, a comparison of the monetised noise benefit of a mitigation measure against the cost of the measure over the anticipated design life of the Proposed Scheme shall be undertaken.

12.5.11 Enhancement measures in the form of noise barriers will be considered for residential receptors across the Proposed Scheme. The receptors will include, not only NIA, but also other locations where a reduction in noise could be achieved. An initial assessment of likely areas to benefit from enhancement will be based on professional judgement using knowledge gained from other large road projects. Any chosen locations will then be subject to detailed calculations where the cost of the barrier is compared against the benefit from the reduction in noise it would provide. DMRB LA 111 will be followed for this process.

12.6 Description of the likely significant effects

12.6.1 Given the very close proximity of some receptors to parts of the Proposed Scheme there is the potential for significant adverse construction noise effects at these receptors. These are generally likely to be in the areas of online widening or where large infrastructure is constructed as part of the proposed new link roads. Night working is likely to be required for some activities and this has the potential to generate further significant effects.

12.6.2 There are not expected to be any significant adverse effects in relation to building damage from construction induced vibration. This is because it is unlikely that the required construction activities would generate vibration levels of the magnitude to cause building damage. However, there is the potential for significant construction vibration effects on human receptors in buildings.

12.6.3 It is likely that these potential significant effects from construction can be controlled through mitigation, although it is acknowledged that some residual significant effects may remain.

12.6.4 The Proposed Scheme has the potential to cause significant adverse operational effects in two ways. The first is from the sections of online widening, where receptors that are already close to the road would have the traffic stream moved closer. With a forecast increase in traffic flow along the M60, these changes have the potential to increase the noise levels at receptors that are already subject to a high level of noise, especially those

within NIAs. The second possible cause of significant effects would be from the new link roads of the Proposed Scheme moving the traffic closer to some new receptors.

Scoping questions

12.6.5 DMRB LA 111 (paragraph 3.26 and 3.41) confirms that six scoping questions should be answered in order to gain an understanding of the need to undertake further assessment for the Noise and vibration aspect. Where the response to one or more of these questions is 'yes', then further assessment should be undertaken or the scoping assessment shall make a recommendation on the scope of further assessment.

12.6.6 The responses to the scoping assessment questions for the Proposed Scheme are provided in Table 12.3, based on the application of professional engineering judgement to the current design information.

Table 12.3: DMRB LA 111 Scoping questions and responses

Scoping questions	Response	Scoped in/out
Construction noise		
1) does construction noise generated by the project have the potential to adversely affect any noise sensitive receptors?	Yes	Scoped in
2) are there any noise receptors where there would be a reasonable stakeholder expectation that a construction noise assessment would be undertaken?	Yes	Scoped in
Construction vibration		
1) does vibration from construction have the potential to adversely affect any vibration sensitive receptors?	Yes	Scoped in
2) does the scale of the development or type of construction mean that there will be a reasonable stakeholder expectation that a construction vibration assessment would be undertaken at any vibration sensitive receptors?	Yes	Scoped in
Operational noise assessment		
1) is the project likely to cause a change in the BNL of 1dB $_{LA10,18hr}$ in the do-minimum opening year (DMOY) compared to the do-something opening year (DSOY)?	Yes	Scoped in
2) is the project likely to cause a change in the BNL of 3dB $_{LA10,18hr}$ in the do-something future year (DSFY) compared to the DMOY?	Yes	Scoped in

12.6.7 Having answered ‘yes’ or ‘uncertain’ to one or more of the DMRB LA 111 scoping questions for Noise and vibration, it is recommended that this aspect is scoped into the EIA.

12.7 Assessment methodology

12.7.1 The assessment of impacts from noise and vibration will be undertaken in accordance with the instructions set out in DMRB LA 111. By following these instructions within DMRB LA 111 the Proposed Scheme can be measured against the NNNPS policy requirements.

12.7.2 DMRB LA 111 incorporates the noise effect levels that have been introduced to English noise policy by the Noise Policy Statement for England (NPSE) (Defra, 2010). These effect levels are defined as:

- LOAEL - Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL - Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.

12.7.3 The NPSE does not assign decibel values to these effect levels as they will vary depending upon the type of assessment being undertaken. However, suggested effect levels for construction and operational noise and vibration are contained within DMRB LA 111 and these will be used for the Environmental Statement of the Proposed Scheme. These suggested levels are replicated in Appendix B.

Data requirements

12.7.4 The following data sources will be used to undertake the assessment:

- Baseline noise survey and site walkover
- Horizontal and vertical alignments of the Proposed Scheme
- Land use OS Mastermap (including building heights), OS AddressBase and building use, and data.gov.uk datasets of designated sites
- Topographical information within the Study Area
- Traffic data from the traffic modelling of the Proposed Scheme; the core scenario from the traffic model will be used for the operational noise assessment
- Highways England Pavement Management System (HAPMS) and Environmental Information System (ENVIS) databases of road surfacing information and existing noise barriers
- Consultation with Local Authority as to the scope of noise surveys and assessment, and in respect of local area knowledge
- Information from the planning applications of recently completed developments within the area to inform on locations of non-Highways England noise barriers and any reliable data from noise surveys
- Information from planning applications within the area to inform on committed developments that may not be included within the OS AddressBase dataset
- Likely construction plant and programme

Baseline noise and vibration levels

12.7.5 DMRB LA 111 states that '*noise monitoring should be used to inform baseline noise modelling results and to provide data for public consultation purposes*'. Noise data collected in May 2012 at two locations close to the Proposed Scheme as part of the baseline noise survey for the MSM Scheme were referenced at the previous PCF stages.

12.7.6 A series of daytime and night-time noise measurements will be undertaken prior to the Environmental Statement at a selection of locations representative of individual or groups of sensitive receptors in order to gather more extensive and up-to-date noise data of the surrounding area. A selection of these locations will be compared against the predicted noise levels for validation purposes (DMRB LA 111, paragraph 3.45). All noise monitoring will follow the procedures within BS 7445-1:2003 Description and measurement of environmental noise – Part 1: Guide to quantities and procedures (British Standards Institution, 2003) (DMRB LA 111, paragraph 3.46).

12.7.7 It is proposed to undertake noise surveys at a minimum of five locations, shown in Figure 12.2, all of which are representative of sensitive receptors closest to the Proposed Scheme. Unattended long-term (i.e. one week) measurements will be completed in at least one of these locations. Short-term attended daytime and night-time measurements may also be undertaken at some of the locations. A justification for the selection of each monitoring location and the areas these are meant to represent will be reported in the Environmental Statement.

12.7.8 Bury Metropolitan Borough Council's Environmental Health Officer (EHO) assigned for this Proposed Scheme was consulted in March 2021 with regards to the proposed scope of baseline noise surveys described above. A written approval was then received from the appointed EHO in May 2021.

12.7.9 No baseline vibration surveys will be undertaken as the standard within DMRB LA 111 states '*the construction vibration baseline shall be assumed to be zero due to the absence of construction work prior to project commencement*'.

Construction noise and vibration approach

12.7.10 The assessment of noise from construction will be undertaken quantitatively based on the standard within DMRB LA 111, which in turn references the guidance and calculation methodology within BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise (British Standards Institution, 2014).

12.7.11 Noise predictions from construction are undertaken using known noise levels from the various items of plant that would be used during the different activities associated with the construction of the Proposed Scheme. Factors such as the amount of time that each item of plant is operating over a working day are also included within the calculations. Until construction physically starts some of the information required to inform these predictions will be based on professional judgement and in collaboration with the principal contractor. Likewise, if available, the areas where night-time construction works and piling works will be shown on a figure within the Environmental Statement.

12.7.12 The noise levels from construction will be calculated at selected locations which are representative of all noise sensitive receptors in the study area. These selected locations

may be individual sensitive receptors or groups of sensitive receptors. These calculations will be undertaken by using either spreadsheets or the noise model produced for the assessment of the operational noise. The items of plant and corresponding noise levels will be added to the noise model in order to undertake the calculations.

12.7.13 To determine significance of effect from construction noise, the method involves a comparison between the predicted noise level arising from construction operations and the pre-construction ambient noise level. Table 3.16 of DMRB LA 111 includes a scale of magnitude that will be used to determine the impact, and this table is shown in Appendix B. Construction noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact would occur for a duration exceeding (DMRB LA 111, paragraph 3.19):

- 10 or more days or nights in any 15 consecutive days or nights
- A total number of days exceeding 40 in any six consecutive months

12.7.14 If significant effects are identified, then specific noise mitigation measures to reduce the noise impact from activities will be considered.

12.7.15 The impact from additional construction traffic on the road network and that from diversion routes will be assessed in accordance with the standard from paragraphs 3.15 to 3.19 within DMRB LA 111. This method compares the existing level of traffic against that predicted during construction. Table 3.17 of DMRB LA 111 includes a scale of magnitude that will be used to determine the impact, and this table is shown in Appendix B. The potential impact from the construction and use of borrow pits, construction compounds and haul roads will also be included within the assessment for the Environmental Statement.

12.7.16 Predicted noise levels from the construction of the Proposed Scheme will also be provided to inform the assessment of other aspects including Chapter 7: Cultural Heritage, Chapter 9: Biodiversity, and Chapter 13: Population and Human Health.

12.7.17 The assessment of vibration from construction will, where possible, be undertaken quantitatively based on the standard within DMRB LA 111, which in turn references the guidance and calculation methodology within BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration (British Standards Institution, 2014).

12.7.18 For some activities of construction (e.g. piling, compaction) equations are available within BS 5228-2:2009+A1:2014 to calculate the level of vibration at a distance from the construction activity. Certain input parameters are required for these calculations and until construction physically starts some of the information required will be based on professional judgement. Where a construction activity is not covered by the calculation methodology, the level of vibration from the activity will be based on professional judgement or empirical data contained within BS 5228-2:2009+A1:2014.

12.7.19 The level of vibration will be calculated at selected locations which are representative of all vibration sensitive receptors in the study area. These may be individual sensitive receptors or groups of sensitive receptors.

12.7.20 To determine significance of effect from construction vibration, the magnitude of the predicted level is compared against a scale shown in Table 3.33 of DMRB LA 111, and

this table is included in Appendix B. Construction vibration shall constitute a significant effect where it is determined that a major or moderate magnitude of impact would occur for a duration exceeding (DMRB LA 111, paragraph 3.34):

- 10 or more days or nights in any 15 consecutive days or nights
- A total number of days exceeding 40 in any six consecutive months

12.7.21 If significant effects are identified, then specific vibration mitigation measures to reduce the vibration impact from activities will be considered.

Operational road traffic noise approach

12.7.22 The assessment of noise from the operation of the Proposed Scheme will be undertaken quantitatively following the standard within DMRB LA 111. The approach within DMRB LA 111 is to compare the predicted noise level with and without the Proposed Scheme at individual or groups of sensitive receptors. Noise levels will be calculated using the methodology contained within the CRTN (Department of Transport and Welsh Office, 1988) and 'Converting the UK noise index $L_{A10,18h}$ to EU noise indices for noise mapping' (TRL, 2002).

12.7.23 To determine the significance of effect, the predicted change in noise in the short-term (i.e. on opening) will be compared against the scale of magnitude shown in Table 12.4 (DMRB LA 111, Tables 3.54a and 3.54b). Where the magnitude of change in the short-term is negligible, this will be deemed as not giving rise to a likely significant effect.

Table 12.4: Classification of magnitude of noise impacts

Magnitude of impact	Noise change, dB	
	Short term noise change (dB $L_{A10, 18h}$ or L_{night})	Long term noise change (dB $L_{A10, 18h}$ or L_{night})
Major	Greater than or equal to 5.0	Greater than or equal to 10.0
Moderate	3 - 4.9	5 – 9.9
Minor	1 - 2.9	3 - 4.9
Negligible	less than 1.0	less than 3.0

12.7.24 For noise sensitive receptors where the magnitude of change in the short-term is minor, moderate or major, the final significance of the impact should be determined by considering a series of factors described in Table 3.60 of DMRB LA 111 and summarised as follows:

- The actual short-term change, i.e. a change of 2.9 dB or less (in the short-term) may still be considered a significant environmental effect
- The predicted long-term (i.e. 15 years after opening) change in noise, i.e. comparison of the Do Minimum scenario in baseline year against Do Something in the future assessment year
- Absolute noise level with reference to the LOAEL and SOAEL values
- Circumstances of the receptor or receptor group, e.g. location of windows, outdoor spaces, use of receptor
- The existing acoustic character of the area

- Changes to the landscape or setting of the receptor or receptor group

12.7.25 If significant effects are identified, then mitigation measures described in Section 12.5 will be considered.

12.7.26 Predicted noise levels from the operation of the Proposed Scheme will also be provided to inform the assessment of other aspects including Chapter 7: Cultural Heritage, Chapter 8: Landscape and Visual, Chapter 9: Biodiversity, and Chapter 13: Population and Human Health.

12.7.27 An initial assessment of likely eligibility for sound insulation measures under the Noise Insulation Regulations 1975 (as amended 1988) will be undertaken to identify residential dwellings that may potentially qualify under the Regulations.

Consideration against noise policy

12.7.28 Consideration of the Proposed Scheme with respect to national policy on noise will also be undertaken. The Environmental Statement will report against the three aims within the NNNPS and describe the actions taken to support delivery of each aim. These three aims, together with the actions required by DMRB LA 111, are shown in Table 12.5.

Table 12.5: NNNPS aims and associated actions

NNNPS aim	Action required during assessment
Aim 1: Avoid significant adverse impacts on health and quality of life from noise as a result of the new development. NOTE: Significant adverse noise effects occur when noise levels are above SOAEL.	• For each receptor or group of receptors, set out the mitigation measures used to reduce noise exposure to below SOAEL. • Where project noise levels are not predicted to be below the SOAEL, report the reasons why noise levels could not be reduced below the SOAEL, in terms of Government policy on sustainable development.
Aim 2: Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development. NOTE: Other adverse impacts occur when noise levels are between LOAEL and SOAEL.	• Set out measures used to mitigate and minimise other adverse impacts for all receptors or groups of receptors where project noise levels are above LOAEL. • Where project noise levels are not predicted to be below the LOAEL, report the reasons why noise levels could not be reduced below the LOAEL, in terms of Government policy on sustainable development.
Aim 3: Contribute to improvements to health and quality of life through the effective management and control of noise, where possible. NOTE: Applies to all noise levels.	• Set out mitigation measures used to improve the noise environment. • Where it has not been possible to contribute to improvements to health and quality of life through management of project noise levels, report the reasons why it is not possible in terms of Government policy on sustainable development.

12.8 Assessment assumptions and limitations

12.8.1 The information available at this stage is considered sufficient to define the scope of the noise and vibration assessment for the Environmental Statement. The study area for the Environmental Statement cannot be finally determined until detailed traffic data are received allowing for affected road links to be identified. However, it is unlikely that this will change significantly from the study area indicated in Figure 12.1.

12.8.2 The noise modelling incorporates many different data sources. Therefore, the outcome of the modelling is reliant on the quality of these data. For instance, it is understood that the core traffic forecast will not account for any unplanned lockdowns or other national restrictions due to COVID-19. In the event that the Department for Transport releases any COVID-19 impacted traffic forecast scenarios later in 2021, a sensitivity test may be done to check for any significant changes. However, it is possible that this information will not be available prior to the Environmental Statement submission. Any limitations of these data sources will be reported in the Environmental Statement, along with any associated implications.

12.8.3 The construction noise calculation methods enable the level of noise during various construction activities to be determined. However, the precision of any such prediction is dependent on assumptions and predictions that have to be made regarding the number and type of plant to be utilised, their location and detailed operating arrangements. Some of this information will be clarified as the scheme design progresses, but other information (such as exactly where the plant operates and for how long) would be assumed as a reasonable worst case.

13. Population and human health

13.1 NNNPS requirements

13.1.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

13.1.2 Key policy from the NNNPS relevant to this aspect includes:

- Paragraph 3.22 states that severance can be a problem in some locations. Where appropriate applicants should seek to deliver improvements that reduce community severance and improve accessibility.
- Paragraph 5.205 states that applicants should consider reasonable opportunities to support other transport modes in developing infrastructure, and that the applicant should provide evidence that they have used reasonable endeavours to address any existing severance issues that act as a barrier to non-motorised users.
- Paragraph 4.82 states that the applicant should identify measures to avoid, reduce or compensate for adverse health impacts as appropriate. These impacts may affect people simultaneously, so the applicant, and the SoS (in determining an application for development consent) should consider the cumulative impact on health.
- Paragraph 5.166 states that existing open space, sports and recreational buildings and land should not be developed unless the land is surplus to requirements or the loss would be replaced by equivalent or better provision in terms of quantity and quality in a suitable location. Applicants considering proposals which would involve developing such land should have regard to any local authority's assessment of need for such types of land and buildings.
- Paragraph 5.184 states that public rights of way, National Trails and other rights of access to land (e.g. open access land) are important recreational facilities for walkers, cyclists and equestrians. Applicants are expected to take appropriate mitigation measures to address adverse effects on coastal access, National Trails, other public rights of way and open access land and, where appropriate, to consider what opportunities there may be to improve access. In considering revisions to an existing right of way consideration needs to be given to the use, character, attractiveness and convenience of the right of way.
- Paragraph 5.206 states that for road and rail developments, if a development is subject to EIA and is likely to have significant environmental impacts arising from impacts on transport networks, the applicant's environmental statement should describe those impacts and mitigating commitments.

13.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

13.2 Study area

13.2.1 The study areas for the assessment of effects on population and human health are set out below and shown in Figure 13.1.

Land use and accessibility

13.2.2 The study area for land use and accessibility topics will be the provisional Order Limits plus a buffer of 500m as set out in the Design Manual for Roads and Bridges (DMRB) LA 112: Population and Health (Highways England, 2020; hereafter referred to as DMRB LA 112). This buffer has been defined as the main study area for this topic.

13.2.3 A wider context will also be considered to understand the sensitivity of routes within the study area used by walkers, cyclists and horse-riders (WCH) that could potentially be affected by the Proposed Scheme. For cyclists, recreational walkers and horse riders, consideration will be given to possible origins and destinations of up to 2 km from the construction footprint of the Proposed Scheme, as well as for regular walking journeys. The consideration of this wider context is deemed sufficient to provide insight into the likely purpose of journeys that cross the footprint of the Proposed Scheme.

Human health

13.2.4 The study area for human health will consist of the wards that coincide with the study area for land use and accessibility, this is set out in Figure 13.1.

13.2.5 The area defined above will capture potential direct effects on human health associated with changes in air and noise pollution, temporary and permanent changes in land use and access, and also indirect effects associated with changes in traffic volumes, speed or composition which could indirectly affect active travel or recreational journeys undertaken by pedestrians, cyclists and horse-riders.

13.3 Baseline conditions

13.3.1 This section provides a preliminary summary of the baseline context for population and human health. The purpose of this summary at the scoping stage is to identify the key baseline issues for population and health that are likely to be influenced by the Proposed Scheme. These key issues will then be the focus of further baseline study as part of the EIA process and will be described more fully in the Environmental Statement. The baseline has been developed from a desk-based review of various sources including:

- Ordnance Survey 1:25,000 mapping
- Geographic Information System (GIS) datasets
- Publicly available web-based sources such as:
  - Bury Council website (including documents to support the emerging Local Plan)
  - Office for National Statistics (ONS) datasets
  - Public Health England’s local health profiles

Baseline information – land use and accessibility

Residential property and housing

13.3.2 The key communities within 500m of the Proposed Scheme are the village of Simister (Simister Lane, Droughts Lane and Simister Green located to the south-east of M60 J18), Whitefield (which lies north of the M60 between J17 and J18), Unsworth (bordering the M66, north of M60 J18) and Prestwich (south of M60 J17), there are also residential properties which border the M60 both to the north and south, between M60 J17 and J18, which includes the community of Kirkhams. The populations of these communities, based on 2011 census data, are set out in Table 13.1. Other key communities within 2km are Gigg, Hollins, Blackford Bridge, Heaton Park, Higher Blackley, Boothroyden, Rhodes, Stand, Park Lane and Chapel Field.

13.3.3 There is no direct access to the M60, M62 or M66 from any of the residential areas surround the provisional Order Limits. However, there are residential properties that are next to the provisional Order Limits. There are also four residential properties within the provisional Order Limits. The closest residential areas to the Proposed Scheme outside of the provisional Order Limits are: Simister, Unsworth, Whitefield and Kirkhams. Many of these properties are within 10 to 20m of the provisional Order Limits.

Table 13.1: Communities and usual resident population within the main study area

Local authority	Wards	Population of Ward (mid-2019 estimate)	Community (i.e. name of area/neighborhood)
Bury	Holyrood	11,156	Simister, Kirkhams, Heaton Park
	Unsworth	9,462	Whitefield, Unsworth
	Besses	10,916	Whitefield, Unsworth
	Pilkington Park	9,695	Whitefield
	St Mary's	10,428	Prestwich
Note: mid-2019 estimates sourced from ONS ward-level population estimates (Office for National Statistics, 2020).			

13.3.4 There are several housing allocations in the local plans for Bury and Greater Manchester areas (Including the Greater Manchester Spatial Framework). Table 13.2 covers the housing allocations and applications within the study area which have been identified. Some of these allocations, such as ones at Whitefield, Heywood and Pilsworth and Simister, fall within the footprint of the Proposed Scheme.

13.3.5 The Greater Manchester Spatial Framework (GMSF) (a joint strategic land use plan for the ten Greater Manchester Local Authorities) will no longer be submitted for independent examination by the Secretary of State after Stockport Borough withdrew from the process in December 2020. Work on this document has therefore ceased. This plan identified a number of major potential development sites that were within the study area for the Proposed Scheme, as identified in Table 13.2.

13.3.6 It is now proposed that the remaining nine councils will work together to consider the potential development sites within a new document Places for Everyone. This would be a joint development plan for jobs, new homes and sustainable growth across the boroughs of Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford and Wigan. However, there is currently no published timescale for producing the new plan and it is likely that parts of the plan-making process would have to be repeated, although the

intention is to continue producing a plan and retaining the existing evidence base. The Proposed Scheme does require land that was previously identified for possible residential or commercial development in the GMSF before work on the plan ceased.

Table 13.2 Housing allocations and applications within the main study area

Source of allocation	Council	Location	Number of units
Greater Manchester Spatial Framework (2019 Consultation Draft)*	Greater Manchester Combined Authority	Simister	2,700 homes
	Greater Manchester Combined Authority	Heywood and Pilsworth	1,200,000 sqm employment, 1,200 homes
	Greater Manchester Combined Authority	Whitefield	600 homes
Unitary Development Plan (UDP)	Bury Metropolitan Borough Council	Hodder Way	14 homes
Unitary Development Plan (UDP)	Bury Metropolitan Borough Council	Albert Road and Hazel Road	55 homes
Unitary Development Plan (UDP)	Bury Metropolitan Borough Council	Land South of Albert Road	129 homes
Unitary Development Plan (UDP)	Bury Metropolitan Borough Council	Land at Hollins Mount Farm	140 homes
Unitary Development Plan (UDP)	Bury Metropolitan Borough Council	Prestwich Hospital	120 homes
Unitary Development Plan (UDP)	Bury Metropolitan Borough Council	Cedar Avenue	20 homes
*Note: Work on the Greater Manchester Spatial Framework has now ceased so the status and timescales of these allocations is now uncertain.			

Community land and assets

13.3.7 Community land and assets includes land, buildings and infrastructure which provide a service or resource to a community, for example open spaces, village greens, village halls, healthcare and education facilities.

13.3.8 Simister is a village to the east of the M60 J18. The key facilities within 500m of the Proposed Scheme are St George's Church, The Lady Wilton Hall, allotments/ community growing spaces and a play area.

13.3.9 Unsworth is a community bordering the M66, north of the M60 J18. There are a number of key facilities within 500m of the Proposed Scheme including places of worship and cemeteries, golf courses, retirement and care homes, primary and secondary schools, play spaces and Hollins Vale Local Nature Reserve (LNR).

13.3.10 Whitefield / Besses o' th' Barn which lies north of the M60 generally between J17 and J18 has a number of community assets within 500m of the Proposed Scheme. This includes places of worship, schools and other education centres, play spaces / fields, allotments and community growing spaces, Whitefield Golf Course, Sedgley Park Rugby Union Football Club (RUFC) and Whitefield Ambulance Station.

13.3.11 Within the Prestwich and Kirkhams community there are also a number of assets within 500m of the Proposed Scheme. This includes leisure centres, tennis courts, schools and education facilities, Prestwich Hospital, care homes, a post office, playing fields, Prestwich Heys Football Club (FC), allotments and community growing spaces, Heaton Park Golf Course, Philips Park and Mere Clough LNR, Prestwich Forest Park and Heaton Park (including Heaton Park Reservoir) which is a Grade II registered Park and Garden.

13.3.12 Whilst the schools and care homes discussed above are unlikely to be directly impacted by the Proposed Scheme, the close proximity of these is an important consideration for human health since children and resident populations of care homes are more likely to be vulnerable to health effects associated with air pollution and noise.

13.3.13 Other community facilities, such as dentists, doctors' surgeries, public houses, convenience stores and supermarkets, are located within the settlements within and close to the study area, so the proximity and potential impacts on access to these facilities will be an important consideration for the assessment.

Development land and business

13.3.14 There are a number of commercial businesses within the immediate area of the Proposed Scheme, some of these relate to farm businesses and other private properties in the adjacent settlements, including public houses. However, within 500m of the Proposed Scheme there are a larger number of commercial and industrial businesses, these are summarised in Table 13.3.

Table 13.3 Commercial and Industrial Properties within the Main Study Area

Community	Commercial and Industrial Properties within the Main Study Area
Simister	Within the 500m study area of the Proposed Scheme there is the Farmer's Arms public house.
Unsworth	On Parr Lane there are convenience stores, shops, salons and fast food outlets. The Queen Anne Inn is located on Hollins Lane. Unsworth South Social Club is located on Derwent Avenue. To the very north of the main study area there is a plant and machinery hire business.
Whitefield / Besses	There are a number of shops, fast food outlets, public houses and businesses located along the A56 'Bury New Road' and the A665 'Bury Old Road', as well as a veterinary hospital. There is an Aldi Superstore located at the junction of the A56 and the A665. The Frigate Public House is located on Thatch Leach Lane and there are a number of convenience stores.
Prestwich/ Kirkhams	There is a retail park located to the south of the M60 at J17 off the A56 'Bury New Road'. This has a Tesco's superstore and a number of restaurants and a Premier Inn. There is also a Shell garage just off of J17. There are also some commercial buildings located on Tottington Lane. On the A665 'Bury Old Road' there is an Esso garage and a number of shops and fast food outlets.

Agricultural land holdings

13.3.15 Land use within and adjacent to the study area includes both urban and agricultural land. There are agricultural land holdings within 500m. The main agricultural land holdings that will be considered are Cowl Gate Farm (directly to the west of the M60 J18) and Egypt Farm (directly to the north of the M60 J18), due to their proximity to the Proposed Scheme and potential land take within the design footprint of the Proposed Scheme. Other farm land is present to the east of the M66 within the study area, as well as to the south of Simister including Wild Goose Farm, Nutt Farm, Beldrine Farm, Whitehouse Farm and Mount Pleasant Farm, and Lower Droughts Farm to the north of Simister.

Walkers, cyclists and horse riders

13.3.16 Walkers and cyclists can be considered as two types - those who walk or cycle as part of an active travel journey (e.g. as part of a regular commute or to access services); and those who are walking or cycling for recreational purposes. The first type will typically be more interested in an efficient, convenient route while the second type would be more interested in the recreational amenity of the route. Equestrian activity is dominated by recreational horse-riding and therefore horse riders will be assumed to be recreational unless there is clear evidence otherwise.

13.3.17 Pedestrians, cyclists and horse riders are prohibited from using the motorways themselves, including the M60, M62 and M66. These motorways act as a barrier for WCH in many locations.

13.3.18 There are 12 public rights of way (PRoW) and routes that cross the Proposed Scheme, or are within the 500m study area; these are described in Table 13.4.

Table 13.4 Public rights of way and other routes which cross the Proposed Scheme

PRoW / route	Location	Description / baseline issues
Park Lane	Lane that crosses the M60 to the west of the Proposed Scheme in Prestwich	Lane that connects residents in Stand to the north of the Proposed Scheme to Prestwich Forest Park and Philips Park to the south via a bridge over the M60. Likely used by walkers and cyclists for recreation. There is pavement (without ramped access) for some parts of the lane, but no pavement on the bridge over the M60.
Footpath 33WHI	Footpath that crosses the M60 at the northern end of Prestwich Forest Park	Footpath that crosses the M60 (within the provisional Order Limits) at the northern end of Prestwich Forest Park via a foot/cycle bridge. This connect to routes to the north (including Footpaths 31WHI, 32WHI, 34aWHI and 34bWHI) as well as residential areas. And footpaths to south (including Footpaths 24PRE and 25PRE), which gives access to Prestwich Forest Park and Philips Park as well as to the nearby urban areas and Bury New Road. The footpaths surrounding the crossing are well used and are likely used by walkers and cyclists.
Bury New Road	Crosses the Proposed Scheme at the Whitefield Interchange	Bury New Road (A56) runs north to south across the Proposed Scheme between Besses o' th' Barn and Prestwich. The road and junction are largely a dual carriageway with pavement on either side. To cross the junction itself there is a subway system.

PRoW / route	Location	Description / baseline issues
Bury Old Road	Crosses the Proposed Scheme to the northeast of Whitefield Interchange	Bury Old Road (A665) runs north-west to south-east across the Proposed Scheme between Besses o' th' Barn and Prestwich. It crosses over the M60 and under the tram line, with pavements on both sides for pedestrians.
Sandgate Road / Footpath 18WHI	Crosses over the M60 on Sandgate Road, between Besses o' th' Barn and Kirkhams.	Public footpath that crosses over the M60 on Sandgate Road. Sandgate Road has pavements on either side of the road. Generally, this connects the residential areas either side of the M60. There is also a number of routes and footpaths that this crossing connects to that allows for walking and cycling recreationally. North of the crossing, it connects to Footpath 12WHI which if followed you get to Unsworth as well as crossing the M66 at Hills Lane. This joins to Footpath 9WHI which runs in a south-east direction within the provisional Order Limits. These routes feed into longer recreational routes to the north, east and south of the Proposed Scheme. To the south of the Sandgate Road crossing, this connects to routes to Heaton Park and Heaton Park Reservoir.
Permissive path connecting Heybrook Close to Parrenthorn Rd	Heybrook Close to Parrenthorn Rd	Permissive path that connects Derwent Avenue and Heybrook Close to Parrenthorn Road via an underpass under the M60. This is likely to be used by pedestrians to connect the communities in the north to the facilities in the south, including schools and leisure and sporting facilities. However, from aerial imagery it is not clear how well used this route is or whether it is lit as it crosses under the M60.
Simister Lane	Simister, south of the M60 J18	Simister Lane runs south west to north east across the M60, south of the M60 J18. This could be used by residents in Simister and Kirkhams to access recreational routes within the local area.
Bridleway 27aPRE	Crosses the M60 to the south of the Proposed Scheme, north of Heaton Park	Bridleway that crosses over the M60 which connects directly to Bridleway 27bPRE and Footpath 30PRE. This crossing isn't directly between residential communities but is likely to be used for recreational journeys around Simister and to Heaton Park as well as for horse riders in the local area.
Footpath 46WHI	Crosses the M62 to the north-east of the Proposed Scheme	Footpath starting at Simister Lane, that runs north to cross the M62 on an overbridge. This connects to a large number routes to the north, east and south. Directly it connects to Footpath 50PRE and Footpath 9WHI. Likely to be used for recreational journeys.
Footpath 8WHI	Crosses the M66 at Unsworth Academy	Footpath that crosses under the M66 at Unsworth Academy, which also allows access for school pupils to the school playing fields.
Castle Road / Restricted byway 85BUR	Crosses the M66 at Castle Road	Restricted byway that crosses over the M66 on Castle Road, which has pavements for some of its route. This connects directly to Footpaths 89BUR and 87BUR as well as bridleway 79BUR. Generally, this crossing connects residential areas in Unsworth to recreational routes to the north and east of the Proposed Scheme.
Aviation Road /	Crosses under the M66 on Aviation Road	Aviation Road crosses the M66 from east to west, which does not have pavements. This crossing connects to

PRoW / route	Location	Description / baseline issues
Bridleway 79BUR		Footpath 84BUR which runs parallel to the west of the Proposed Scheme and connects the community areas in Unsworth to recreational routes to the north-east, and east of the Proposed Scheme as well as the industrial areas to the north-west.

13.3.19 Within 2km of the Proposed Scheme there are numerous more PRoW which serve as access to green spaces and recreational walking, as well as providing routes within some of the more built up areas of the surrounding area. Most of the routes will likely be used for recreational purposes.

13.3.20 National Cycle Network (NCN) route 6 is within 2km of the Proposed Scheme. NCN 6 runs from London to the Lake District via the East Midlands and Manchester. The route in this location (through Prestwich Forest Park) is traffic-free and passes over the M60 via a foot/cycle bridge to the west of the Proposed Scheme. There are also a variety of mountain bike trails within Prestwich Forest Park and along the River Irwell. These routes also provide access to open space to the north.

13.3.21 There are four stables within 2km of the Proposed Scheme: Castlebrook Stables (less than 100m from the Proposed Scheme on Castle Road), The Stables at Whittle Fold Farm, Stables at Sandfield Farm and Stables at Brookvale Farm. There is therefore potential for horse riders to be using the lanes and footpaths and bridleways in the local area.

Public transport

13.3.22 Public transport has been considered in the scope to provide further context of local accessibility and where walkers and cyclists may need to access public transport hubs as part of a longer journey.

13.3.23 There are a large number of bus services that are run within the study area. These bus routes serve shorter routes in the local community but also for longer journeys out of the study area towards Bury to the north and Manchester city centre to the south. Two routes which use the M60 J18 are the X41 service connecting Manchester city centre with Accrington, and the X43 service which connects Manchester city centre with Burnley. A number of the services run from Prestwich Hospital. The routes include but are not limited to: Route 66, 92, 93, 94, 95, 96, 98, 135, 513, 713, 791, 792, 796, 798, 995.

13.3.24 There are no bus/coach stations within the study area.

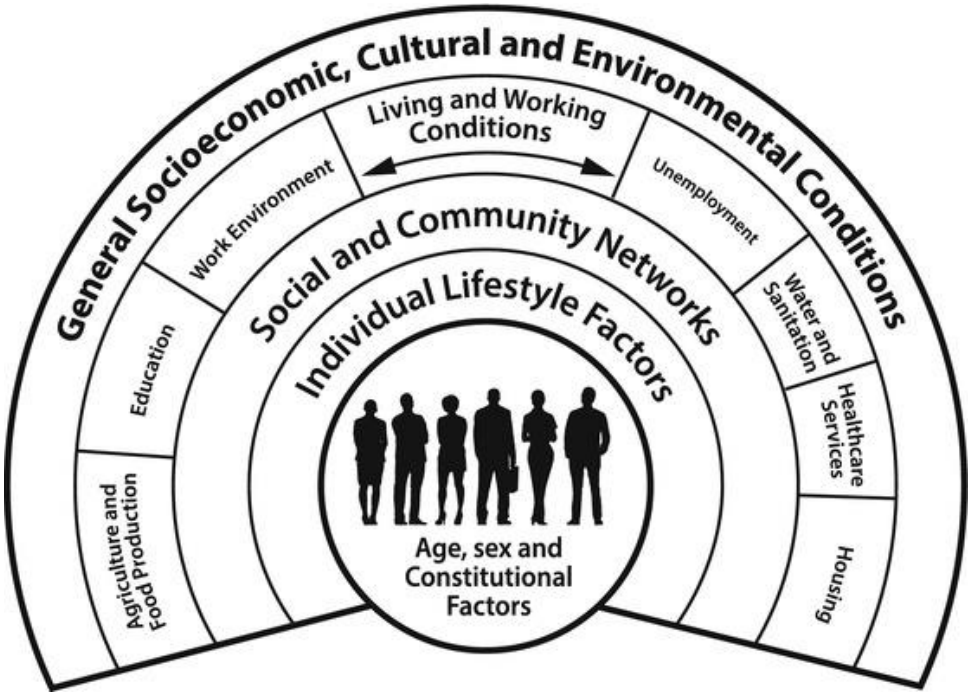
13.3.25 The Manchester Metrolink tram network bisects the study area and Proposed Scheme north to south at the point where Bury Old Road also crosses the Proposed Scheme. Within the study area there are four tram stops on this line, Heaton Park, Prestwich, Besses o' th' Barn and Whitefield. Services running northbound go to Bury, and southbound to Manchester Piccadilly or to Altrincham. This service could provide links for shorter journeys within the local area or longer journeys using links at Bury and Manchester.

Baseline information - human health

13.3.26 The World Health Organization (WHO) constitution defines health as *"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"*. This scope of assessment therefore includes consideration of potential impacts of the Proposed Scheme on physical and mental health as well as social well-being.

13.3.27 Health is determined by a complex interaction between individual characteristics, lifestyle and the physical, social and economic environment. Most public health experts agree that these 'wider determinants of health' are more important than formal healthcare for ensuring a healthy population. Plate 13.1 provides a widely cited conceptual illustration of the wider determinants of health.

Plate 13.1 The Dahlgren and Whitehead model of health determinants (Dahlgren and Whitehead, 1991)



13.3.28 A related issue, of key importance to public health, is the issue of social inequalities of health. The Marmot Review into health inequalities (Marmot, 2010) looked at differences in health and well-being between social groups and described how the social gradient on health inequalities is reflected in the social gradient on educational attainment, employment, income, quality of neighbourhood and other issues. Addressing the wider determinants of health is seen as an important means of tackling health inequalities and improving population health as a whole.

13.3.29 The preliminary health baseline therefore considers factors such as income deprivation as well as indicators for certain types of health condition in the area, before considering the specific resources and receptors within the study area.

13.3.30 Health data have been obtained from Public Health England. Data have been obtained for the wards which coincide with the study area to provide an indication of local health issues. This is based on aggregated population level data. It should be noted that the

health of individuals within the study area will vary considerably and cannot be inferred from these data.

13.3.31 Table 13.5 sets out data for each ward for certain health indicators which are relevant to transport. Cells in Table 13.5 which are shaded indicate health values which are significantly worse than the average for England. Whilst the ward of Higher Blackley does coincide with the 500m study area, it is worth nothing that communities within this ward are not within the 500m buffer, but are within 2km of the project. As can be seen from Table 13.5, some of the communities within Higher Blackley, Besses and St Mary's score significantly worse than England for indicators of chronic obstructive pulmonary disease (COPD) emergency admissions, long-term illness, indicators of coronary heart disease, life expectancy and income deprivation. These communities also score worse than average across a number of the other health indicators as well, including premature deaths. This indicates that these communities may be more sensitive to pollution and problems of traffic than other communities. However, there will be sensitive individuals in all communities, regardless of that community's average level of health. There may also be a greater dependency on public transport, taxis, walking and cycling among people in income deprived communities to access services and employment.

Table 13.5: Health profile of local communities (ward level data)

Health indicator	Ward in study area						England average
	Higher Blackley	Holyrood	Unsworth	Besses	Pilkington Park	St Mary's	
Percentage of total resident population age 0-15 years of age (2017)	23.5 (22.8 - 24.1)	18.4 (17.7 – 19.1)	17.6 (16.0 – 18.4)	21.7 (20.9 – 22.4)	17.3 (16.6 – 18.1)	17.6 (16.9 – 18.4)	19.1
Percentage of total resident population who are 65 and over (2017)	14.3 (13.8 - 15.1)	17.6 (16.9 – 18.5)	22.7 (21.8 – 23.8)	15.5 (14.9 – 16.4)	22.7 (21.9 – 23.8)	18.8 (18.1 – 19.8)	18.0
Emergency hospital admissions for COPD (2013/14 – 2017/18) (SAR)	**298.3 (261.9 – 318.8)**	83.5 (68.5 – 100.9)	75.5 (61.1 – 92.3)	**125.4 (105.2 – 148.3)**	60.5 (48.1 – 75.2)	68.5 (54.6 – 85.0)	100
Percentage of people who reported long-term illness or disability (2011)	**25.1 (24.4 – 25.8)**	17.6 (17.0 – 18.4)	**19.1 (18.3 – 19.9)**	**20.3 (19.5 - 21.0)**	18.0 (17.2 – 18.7)	**21.5 (20.7 – 22.3)**	17.6
Deaths from respiratory diseases, all ages, (2013-2017) (SMR)	**151.7 (125.2 – 182.2)**	116.0 (90.9 – 145.9)	72.4 (52.9 – 96.6)	120.1 (92.3 – 153.7)	96.7 (76.0 – 121.3)	104.6 (83.8 – 129.0)	100
Deaths from coronary heart disease, all ages, (2013-2017) (SMR)	**145.2 (117.0 – 178.1)**	88.7 (73.9 – 129.1)	104.5 (79.1 – 135.5)	**129.6 (98.6 – 167.2)**	105.5 (81.8 – 134.1)	**131.6 (105.3 – 162.6)**	100
Income deprivation (English Indices of Deprivation 2015) (%)	**30.5 (29.7 – 31.2)**	13.2 (12.6 – 13.9)	12.5 (11.9 – 13.2)	**21.7 (20.9 - 22.5)**	9.5 (9.0 – 10.1)	**16.4 (15.7 – 17.2)**	14.6
Life expectancy at birth (male) (2013-2017) (years)	**76.1 (74.5 – 77.6)**	78.7 (77.1 - 80.3)	81.1 (79.3 – 83.0)	**77.5 (75.9 - 79.1)**	79.8 (78.4 – 81.2)	**77.1 (75.6 – 78.7)**	79.5
Life expectancy at birth (female) (2013-2017) (years)	**80.3 (78.8 – 81.7)**	83.0 (81.3 – 84.7)	82.8 (81.1 – 84.5)	82.3 (80.9 – 83.8)	82.4 (81.1 – 83.6)	**81.2 (79.8 – 82.6)**	83.1
Source: Public Health England (2021).							

13.3.32 Certain health data are not available at ward level and yet are relevant in helping to inform a broad understanding of health which can be influenced by transport schemes. Table 13.6 sets out some district level health indicators. The data show that the rate of people killed or seriously injured is lower than the England average across both Bury and Manchester districts. The data also show that the percentage of physically active adults in both Bury and Manchester is slightly lower than average for England. Improvements to active travel infrastructure can provide opportunities to improve levels of physical activity as well as reduce risks of being killed or seriously injured on roads.

13.3.33 Active forms of travel, such as walking and cycling, are associated with a range of health benefits. These include improved mental health, reduced risk of premature death and prevention of chronic diseases such as coronary heart disease, stroke, type 2 diabetes, osteoporosis, depression, dementia and cancer (British Medical Association, 2012). Research also suggests that countries with highest levels of active travel generally have amongst the lowest obesity rates (Bassett et al., 2008).

Table 13.6: Physical activity and rates of killed and seriously injured (district level data)

Health indicator	Local authority area (districts)		England average
	Manchester	Bury	
Percentage adults physically active (%)	66.1 (63.9 – 68.2)	65.6 (62.5 – 68.5)	67.2
Rate killed or seriously injured on roads (2016-2018) (rate per 100,000)	32.1 (29.4 – 34.9)	21.8 (18.1 – 26.0)	42.6
Source: Public Health England (2021).			

Future baseline

13.3.34 The future baseline will likely be characterised by continued population growth within and around the study area as more of the residential development allocations get built out. Despite the current changes to the Greater Manchester Spatial Framework there is clear intent for housing growth in the area.

13.3.35 The COVID-19 pandemic that has affected the UK in 2020 and 2021 may influence future trends. For example, there may be an increase in people working from home. Some people may switch from the use of public transport to walking, cycling or using their own cars due to concern about communicable diseases. There may be a further increase in cycling levels, which have been increasing in England since 1993 (Cycling UK, 2019). In addition, people may have an increased preference for outdoor recreation where social distancing is easier than in indoor leisure and recreation venues. The level to which these types of behaviour change may occur will depend on the trajectory of the pandemic and individual responses to their experience of 2020 (e.g. heightened anxiety or concern) which is at this time uncertain.

13.4 Potential impacts

Construction: land use and accessibility

Residential property and housing

13.4.1 The Proposed Scheme will not lead to permanent loss of land from residential premises, however a number of properties are bounded by the provisional Order Limits. There are also four residential properties within the provisional Order Limits. Despite the proximity of construction work, the Proposed Scheme is unlikely to affect access to most properties within the study area.

Community land and assets

13.4.2 There would be potential loss of some areas of community land including golf courses.

13.4.3 Construction of the Proposed Scheme may cause temporary disruption of access to community facilities where PRoW have had to be temporarily closed or diverted or where access to cross the motorways are affected.

Development land and business

13.4.4 There is unlikely to be any land take required that would affect any businesses, with the exception of golf courses, in any of the communities within the study area. Businesses in these locations are also unlikely to have access severed or affected by the construction works required for the Proposed Scheme. Potential impacts on golf courses is covered under community land and assets.

Agricultural land holdings

13.4.5 There would be permanent and temporary loss of agricultural land from the construction footprint of the Proposed Scheme. The Proposed Scheme may cause temporary or permanent severance or access difficulties to some agricultural land holdings, particularly for Cowl Gate Farm and Egypt Farm.

Walkers, cyclists and horse riders

13.4.6 The construction footprint of the Proposed Scheme would require the diversion and temporary closures of PRoW throughout the study area, with associated impacts on local outdoor recreation and access. There would also be a likely loss of amenity during construction from factors such as dust, noise and visual intrusion.

Operation: land use and accessibility

Residential property and housing

13.4.7 The Proposed Scheme is unlikely to have an effect on access to homes and residential areas during operation. Changes in traffic on the wider network are unlikely to affect access to the majority of residential properties that bound the provisional Order Limits as they do not have direct access onto the affected roads. However, there are residential properties within the study area that are directly accessed off M60 J17 (onto the A56). For these properties impacts on access could potentially occur from changes in traffic flows in

the wider network (for example if higher traffic flows are induced along particular residential streets).

Community land and assets

13.4.8 Potential impacts on community land and assets would be similar to impacts on residential property and housing and arise from changes in accessibility related to changes in traffic conditions.

Employment land and business

13.4.9 Potential impacts on employment land and businesses would be similar to impacts on residential property and housing. The Proposed Scheme is designed to improve traffic flows and reduce congestion in the area and therefore could improve access to some areas of employment, opening up opportunities for further businesses to locate to the area.

Agricultural land holdings

13.4.10 There is potential for permanent severance of some agricultural land holdings. Should agricultural land holdings be severed, there is the potential for impacts on the long-term viability of the local agricultural economy, although it is anticipated that a relatively low number of agricultural land holdings would be affected by the Proposed Scheme.

Walkers, cyclists and horse riders

13.4.11 There would be potential beneficial impacts on access for WCH where the Proposed Scheme could address poor accessibility and inadequate cycleway and footway provision.

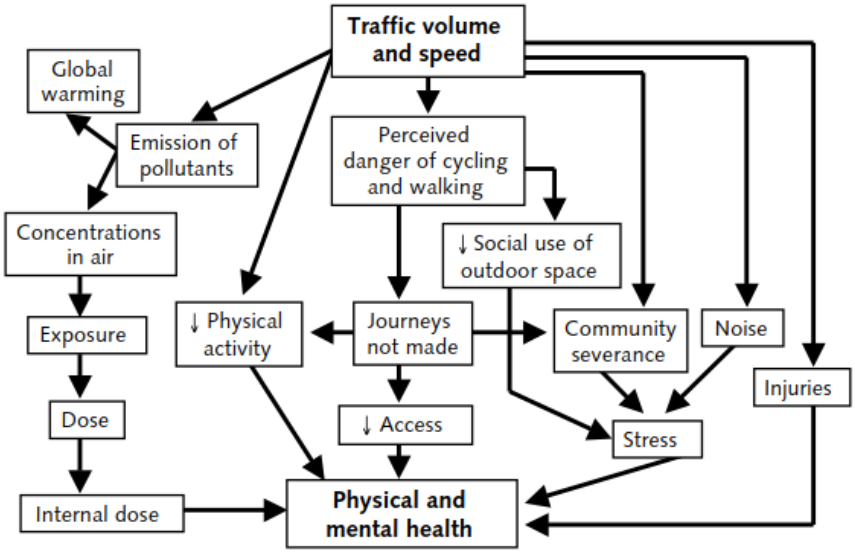
13.4.12 It is assumed that any PRoW or other routes temporarily severed by the Proposed Scheme would be reinstated and so no new operational severance is anticipated. However, there may be diversions and closures of existing PRoW with new routes being provided to access existing or proposed new crossing points.

13.4.13 Since the M60, M62 and M66 already exists in the baseline environment (meaning there is already traffic noise and highway infrastructure visible), it is assumed there would be no likely significant adverse effects on recreational amenity of PRoW during operation. However, this assumption will be reviewed against the findings of the landscape and visual impact assessment (see chapter 8) which will involve a greater analysis of the influence of topography, intervening vegetation and local landscape character to inform the understanding of local conditions on the PRoW network.

Construction and operation: Human Health

13.4.14 The human health assessment will draw together results from the environmental assessment reported in other aspects, particularly the results of the air quality and noise assessments, since air pollution and noise are the main risks to human health from transport projects. The other potential pathways between traffic and health outcomes are illustrated by Plate 13.2, which shows how potential impacts on health involve the interaction between a number of aspects.

Plate 13.2: Links between traffic volume and speed on health (adapted from Joffe and Mindell, 2002)



13.4.15 The assessment will consider impacts on wider determinants of health. Table 13.7 below sets out wider determinants of health identified by Public Health England for consideration in scoping major infrastructure projects. The likely potential impacts of construction and operation of the Proposed Scheme is set out against each determinant, which has informed the scoping.

Table 13.7: Scoping of wider determinants of health

Determinant	Commentary	Proposed scope
Access		
A1 Access to local public and key services and facilities	The nature of the Proposed Scheme is unlikely to affect provision of local public and key services and facilities temporarily or permanently. Access issues relating to accessibility and connectivity are discussed below under the theme of traffic and transport.	It is proposed to consider access in relation to impacts on traffic and transport only (see scope for T6 and T7).
A2 Access to good quality affordable housing	The land use and accessibility assessment will assess impacts on residential property. However, the Proposed Scheme will not have a significant influence on the availability of good quality affordable housing, which is influenced more by housing policy and market demand, and so no likely significant population level health effects from the Proposed Scheme are anticipated.	Scoped out for construction and operation.
A3 Access to healthy affordable food	It is not anticipated that the Proposed Scheme will significantly influence access to healthy affordable food, therefore this is not considered a likely significant effect.	Scoped out for construction and operation.
A4 Access to the natural environment	The Proposed Scheme is within both urban and rural landscapes and has the potential to	Scoped in for construction and operation. It is proposed to

Determinant	Commentary	Proposed scope
A5 Access to the natural environment within the urban environment	affect access in the local vicinity. The Proposed Scheme has the potential to affect access between settlements and the countryside via public footpaths and local roads. There are also a number of open green spaces that sit within the urban environmental surrounding the Proposed Scheme to which access could potentially be affected. This includes access to outdoor recreational facilities, including parks, playing fields and cycleways.	assess potential health impacts by considering these determinants together under '**access to the natural environment and outdoor recreation'**.
A6 Access to leisure, recreation and physical activities within the urban and natural environment		
Traffic and transport		
T1 Accessibility	The Proposed Scheme has the potential to affect some pedestrian routes and roads at least temporarily. Further investigation is required to understand if there are existing barriers to accessibility and if so, whether there are opportunities to address these through the Proposed Scheme design.	Scoped in for construction and operation. It is proposed to assess this under **'accessibility for walking and cycling'** (to combine the determinants T1, T3 and T4 due the interrelated nature of these issues).
T2 Access to/by public transport	The existing M60, M62 and M66 are not used to access bus services. While there is potential for disruption to bus services during construction due to traffic management, bus providers have the option of re-routing services and overall provision of services would remain unchanged by the Proposed Scheme. The Proposed Scheme is also unlikely to affect the provision of both bus and tram services within the Study Area. This is therefore not considered a likely significant population health effect.	Scoped out for construction and operation.
T3 Opportunities for access by cycling and walking	There may be opportunities to improve provision for walkers and cyclists as a result of the Proposed Scheme, including improving highway crossing provision opportunities. Access on some routes may be disrupted during construction.	Scoped in for construction and operation. It is proposed to assess this as under **'accessibility for walking and cycling'** (to combine the determinants T1, T3 and T4 due the interrelated nature of these issues). .
T4 Links between communities	The existing motorways linking to the M60 J18 limit links between the communities of Simister, Unsworth, Whitefield/Besses o' th' Barn and Prestwich and Kirkhams to a small number of crossing points (see Table 13.4). It is not anticipated there would be any significant impact on these links, except in relation to potential for improvements to accessibility for walkers, cyclists and horse riders as identified under T1 and T3.	Scoped in for construction and operation. It is proposed to assess this under **'accessibility, walking and cycling'** (to combine the determinants T1, T3 and T4 due the interrelated nature of these issues).
T5 Community severance	The Proposed Scheme has the potential to influence traffic flows on the wider road	Scoped in for operation.

Determinant	Commentary	Proposed scope
	network, some of which may result in increases or alleviation of community severance. Further information is required to investigate the locations of changes to traffic flows and whether changes are of a scale that may affect existing levels of severance or cause new severance. It is proposed to assess this for operational traffic flows only. There is also potential to address existing severance through inclusion of new safe crossing points that would help re-connect community networks and support community cohesion. Since community severance and social cohesion are considered longer-term issues, it is proposed to assess this during the operational phase only. Potential disruption to community access from construction activities will be considered under 'accessibility for walking and cycling' and 'connections to employment, services, facilities and leisure'.	
T6 Connections to jobs T7 Connections to services, facilities and leisure opportunities	The construction phase of the Proposed Scheme has the potential to disrupt connectivity. Once in operation there is potential for improved ease of access between communities and employment, services and leisure opportunities as a result of improvements to road, cycling and pedestrian infrastructure.	Scoped in for construction and operation. It is proposed the assess T6 and T7 together under the combined determinant '**connections to employment, services, facilities and leisure**'.
Socioeconomic		
S1 Employment opportunities including training opportunities	The Proposed Scheme may generate employment or training opportunities associated with the construction phase of works. If appropriately targeted, these opportunities could address some health inequalities. Social value opportunities will be explored for consideration as part of the Proposed Scheme. As a highway project, the Proposed Scheme will not generate many direct employment opportunities in operation and so this is not a likely significant effect on population health.	Scoped in for construction only.
S2 Local business activity	The Proposed Scheme is unlikely to affect local business activity, no businesses are required to be demolished.	Scoped out for construction and operation.
S3 Regeneration	Facilitating regeneration is not a direct objective of the Project, and the population and health baseline has not identified any potential regeneration areas within the study area for land use and access.	Scoped out for construction and operation.
S4 Tourism and leisure industries	The tourism and leisure industry is not identified as a key industry within the study area and the Proposed Scheme is unlikely to	Scoped out for construction and operation.

Determinant	Commentary	Proposed scope
	greatly influence this area of the economy. Therefore, this is not considered a likely significant issue for population health in the study area.	
S5 Community/social cohesions and access to social networks	The main pathway between the Proposed Scheme and effects on this determinant would be via accessibility, pedestrian interaction, links between communities and community severance as scoped under T1, T3, T4 and T5 above.	It is proposed to consider community/social cohesions and access to social networks as part of the **assessment of accessibility, walking and cycling**, and **community severance**.
S6 Community engagement	Consultation and stakeholder engagement will be undertaken as part of the Proposed Scheme but it is unlikely that there will be any impacts on community engagement as part of the construction and operation of the Proposed Scheme.	Scoped out for construction and operation.
Land Use		
L1 Land use in urban and/or rural settings	The land use and accessibility assessment will assess impacts on existing land use due to the footprint of the Proposed Scheme. However, the impacts are likely to be relatively localised to the existing interchange area and not likely to result in a likely significant effect in terms of population health, over and above the issues scoped in above such as access to outdoor recreation for local communities.	Scoped out for construction and operation.
L2 Quality of urban and natural environments	The Proposed Scheme has the potential to increase or decrease exposure of local communities to air and noise pollution, as well as access to areas of greenspace. .	Scoped in for construction and operation.

Summary of scope

13.4.16 Table 13.8 summarises the proposed scope for population and human health. As mentioned earlier in Section 13.4, there are interrelationships between population and human health and other environmental aspects, particularly air quality, landscape, and noise and vibration. The combined effect on community and health receptors from these aspects will be assessed within the population and human health assessment.

Table 13.8: Summary of population and human health scope

Matter	Scoped in - construction	Scoped in - operation
Land use and accessibility		
Population and housing	✓	✓
Community land and assets	✓	✓
Development land and business	✓	✓
Agricultural land holdings	✓	✓

Matter	Scoped in - construction	Scoped in - operation
Walkers, cyclists and horse riders	✓	✓
Human health (scope of wider determinants of health – see Table 13.7 for further information)		
Access to the natural environment and outdoor recreation	✓	✓
Accessibility for walking and cycling	✓	✓
Connections to employment, services, facilities and leisure	✓	✓
Community severance	✗	✓
Employment opportunities including training opportunities	✓	✗
Quality of urban and natural environments (including air pollution and noise)	✓	✓

13.5 Design, mitigation and enhancement measures

13.5.1 In accordance with DMRB LA 112 'Design and mitigation' (section 3.15) the mitigation hierarchy will be employed which will first seek avoidance and prevention of adverse impacts. Where this is not feasible, measures to reduce impacts will be considered, followed by remediation (i.e. provision of alternative equivalent facilities) as a last resort. The design of the Proposed Scheme, including construction activities, will seek to limit land-take as far as practicable. This would help to reduce the loss of property and land, and limit disruption to people's livelihoods.

13.5.2 Clear, regular and sensitive communication between the developer's land agents and affected parties would be maintained to reduce uncertainty and anxiety among the residential, business and agricultural communities.

13.5.3 Clear communication over construction activities and phasing would also be important to allow individuals to make necessary plans and better cope with any potential disruption. It would also create opportunities for individual residents to discuss their specific needs which may be possible to accommodate depending on the situation.

13.5.4 The use of noise bunds and barriers, and/or low noise surfacing may help to mitigate operational noise in some circumstances. The noise assessment will identify whether these types of measures are required to be incorporated into the final design of the Proposed Scheme, depending upon the results of the assessment (refer to Chapter 12: Noise and Vibration).

13.5.5 Good signposting would be incorporated to inform people of any new or diverted PRoW. The type and quality of surfacing, crossing and access points for PRoW and other routes used by WCH would be suitable for the intended use and context (i.e. whether rural or urban, or whether there is likely cyclist, wheelchair or horse rider use). Key design considerations include DMRB GG 142 Walking, Cycling and Horse-Riding Assessment and Review (WCHAR) guidance (Highways England, 2019), the Equality Act 2010, and relevant county council and district and borough council plans and strategies.

13.5.6 Opportunities to create new WCH routes will be explored where important linkages between communities and facilities can be made. Furthermore, opportunities to improve the existing WCH infrastructure will be explored to improve the quality and capacity of cycling and pedestrian infrastructure which could contribute to improvements in health by promoting and encouraging healthier, more active lifestyles.

13.5.7 Enhancement opportunities to address past severance will be explored, with the aim of recreating PRoW networks and useful routes via provision of safe crossings where feasible.

13.6 Description of the likely significant effects

13.6.1 There is potential for the Proposed Scheme to cause significant effects, as described below.

13.6.2 The construction of the Proposed Scheme may mean that several farm holdings are affected by severance and loss of land which would affect the wider agricultural economy in the area.

13.6.3 Due to the proximity of a large number of properties to the construction areas for the Proposed Scheme there is the potential for significant changes in air quality, noise and vibration and amenity during construction. Further assessment will be required to understand the significance of these construction effects. Since major highway infrastructure is already present, it is assumed that air quality, noise and vibration and local amenity during operation would not change to an extent likely to have significant effects on human health compared to the baseline situation. However, this assumption will be checked when the air quality and noise assessments of the operation effects are available.

13.6.4 During the construction stage there would be temporary disruption to parts of the PRoW network which could cause frustration and affect recreational opportunities for some local communities. However, with best practice mitigation and diversions, these effects would be minimised, and therefore unlikely to be significant.

13.6.5 It is anticipated that local routes (PRoW, cycle ways and local roads) would be reconnected. However, there is still potential for residual effects in the form of community severance due to loss of amenity of routes, increased distances to travel or increased inconvenience caused (for example through requirements to use bridges, ramps or underpasses). This has the potential to be significant due to potential effects on physical and mental health, and impacts on the local economy from loss of convenient access.

13.7 Assessment methodology

Land use and accessibility methodology

13.7.1 The assessment will be undertaken in line with DMRB LA 112, which provides the standard on what should be included within the topic of Population and Human Health.

13.7.2 The baseline will be developed further to identify and provide more detail on sensitive receptors within the study area. Sensitive receptors relating to each matter will be mapped out to allow for an assessment to be made as to whether and how they could be affected by the Proposed Scheme. In particular, the location and number of properties at risk of

demolition, as well as area of land-take, will be identified as the Proposed Scheme design is refined.

13.7.3 The assessment will be informed by other work being undertaken on the EIA and for the development consent application, including results of air quality and noise assessments, work (including frequency/use data) being undertaken for the Walking, Cycling and Horse Riding Assessment and Review (WCHAR) and land referencing activities.

13.7.4 Data sources to inform the assessment will also include a variety of desk-based sources including:

- Local authority local development plans, cycling action plans, rights of way plans and local transport plans (these will provide information on policy priorities, settlement hierarchies, proposed developments and transport, community and recreation initiatives)
- Web-based data sources including Office of National Statistics/NOMIS, Exeter University's Outdoor Recreation Valuation Tool (ORVal), Sustrans interactive mapping, Propensity to Cycle Tool, Strava Heatmap (see limitations in Section 13.8)
- Information on agricultural land holdings, businesses and other landowners from the developer's land agents
- Ordnance survey mapping, particularly 1:25,000 scale mapping which provides good information on PRoW
- Project-specific GIS data that have been developed, drawing on datasets from several sources

13.7.5 The judgement of likely significant effects on land use and accessibility will use the value/sensitivity and magnitude criteria from DMRB LA 112 (sections 3.11 and 3.12). Further information on the assessment criteria can be found in Appendix B. The estimated value/sensitivity of land use and accessibility receptors is set out in Table 13.9 and the estimated magnitude of impacts is set out in Table 13.10. The assessment of significance will consider how the community would be affected by the identified impacts, taking into account the wider context of resources (i.e. whether alternative resources would be available and unaffected) and the proportion of the community affected. This is in line with DMRB LA 104 which states that the assessment of the significance of effects shall cover factors such as the receptors/resources to be affected and geographic importance.

Table 13.9: Value of land use and accessibility receptors

Value/ sensitivity	Description
Very high	Private property and housing: 1) existing private property or land allocated for housing located in a local authority area where the number of households are expected to increase by >25% by 2041 (Office for National Statistics (ONS) data); and/or 2) existing housing and land allocated for housing (e.g. strategic housing sites) covering >5ha and / or >150 houses.

Value/ sensitivity	Description
	Community land and assets where there is a combination of the following: 1) complete severance between communities and their land/assets, with little/no accessibility provision; 2) alternatives are only available outside the local planning authority area; 3) the level of use is very frequent (approximately daily); and 4) the land and assets are used by the majority (>=50%) of the community.
	Development land and businesses: 1) existing employment sites (excluding agriculture) and land allocated for employment (e.g. strategic employment sites) covering >5ha
	Agricultural land holdings: 1) areas of land in which the enterprise is wholly reliant on the spatial relationship of land to key agricultural infrastructure; and 2) access between land and key agricultural infrastructure is required on a frequent basis (approximately daily). For the purposes of this assessment, these criteria are being interpreted as large commercial agricultural holdings which are dependent on very regular access between fields and agricultural infrastructure, for example dairy farms.
	WCH: 1) national trails and routes likely to be used for both commuting and recreation that record frequent (daily) use. Such routes connect communities with employment land uses and other services with a direct and convenient WCH route. Little / no potential for substitution. 2) routes regularly used by vulnerable travelers such as the elderly, school children and people with disabilities, who could be disproportionately affected by small changes in the baseline due to potentially different needs. 3) rights of way for WCH crossing roads at grade with >16,000 vehicles per day.
High	Private property and housing: 1) private property or land allocated for housing located in a local planning authority area where the number of households are expected to increase by 16-25% by 2041 (ONS data); and/or 2) existing housing and land allocated for housing (e.g. strategic housing sites) covering >1-5ha and / or >30-150 houses.
	Community land and assets where there is a combination of the following: 1) there is substantial severance between community and assets, with limited accessibility provision; 2) alternative facilities are only available in the wider local planning authority area; 3) the level of use is frequent (approximately weekly); and 4) the land and assets are used by the majority (>=50%) of the community.
	Development land and businesses: 1) existing employment sites (excluding agriculture) and land allocated for employment (e.g. strategic employment sites) covering >1 - 5ha.

Value/ sensitivity	Description
	Agricultural land holdings: 1) areas of land in which the enterprise is dependent on the spatial relationship of land to key agricultural infrastructure; and 2) access between land and key agricultural infrastructure is required on a frequent basis (approximately weekly). For the purposes of this assessment, these criteria are being interpreted as farm holdings dependent on access to extensive land to maintain high productivity, for example extensive arable farms.
	WCH: 1) regional trails and routes (e.g. promoted circular walks) likely to be used for recreation and to a lesser extent commuting, that record frequent (approximately daily) use. Limited potential for substitution; and/or 2) rights of way for WCH crossing roads at grade with >8,000 - 16,000 vehicles per day.
Medium	Private property and housing: 1) houses or land allocated for housing located in a local authority area where the number of households are expected to increase by >6-15% by 2041 (ONS data); and/or 2) existing housing and land allocated for housing (e.g. strategic housing sites) covering <1ha and / or <30 houses.
	Community land and assets where there is a combination of the following: 1) there is severance between communities and their land/assets but with existing accessibility provision; 2) limited alternative facilities are available at a local level within adjacent communities; 3) the level of use is reasonably frequent (approximately monthly); and 4) the land and assets are used by the majority (>=50%) of the community.
	Development land and businesses: 1) existing employment sites (excluding agriculture) and land allocated for employment (e.g. strategic employment sites) covering <1ha.
	Agricultural land holdings: 1) areas of land in which the enterprise is partially dependent on the spatial relationship of land to key agricultural infrastructure; and 2) access between land and key agricultural infrastructure is required on a reasonably frequent basis (approximately monthly). For the purposes of this assessment, these criteria are being interpreted as small agricultural land holdings requiring access to limited areas of land with potential for relocation, for example free range poultry sites.
	WCH: 1) public rights of way and other routes close to communities which are used for recreational purposes (e.g. dog walking), but for which alternative routes can be taken. These routes are likely to link to a wider network of routes to provide options for longer, recreational journeys, and / or 2) rights of way for WCH crossing roads at grade with >4000 – 8000 vehicles per day.
Low	Private property and housing: 1) proposed development on unallocated sites providing housing with planning permission/in the planning process.

Value/ sensitivity	Description
	Community land and assets where there is a combination of the following: 1) limited existing severance between community and assets, with existing full Equality Act 2010 compliant accessibility provision; 2) alternative facilities are available at a local level within the wider community; 3) the level of use is infrequent (approximately monthly or less frequent); and 4) the land and assets are used by the minority (>=50%) of the community.
	Development land and businesses: 1) proposed development on unallocated sites providing employment with planning permission/in the planning process.
	Agricultural land holdings: 1) areas of land which the enterprise is not dependent on the spatial relationship of land to key agricultural infrastructure; and 2) access between land and key agricultural infrastructure is required on an infrequent basis (approximately monthly or less frequent). For the purposes of this assessment, these criteria are being interpreted as diversified agricultural businesses not dependent on direct land access and with potential for relocation, for example farm shops.
	WCH: 1) routes which have fallen into disuse through past severance or which are scarcely used because they do not currently offer a meaningful route for either utility or recreational purposes, and/or 2) rights of way for WCH crossing roads at grade with <4000 vehicles per day.
Negligible	Community land and assets where there is a combination of the following: 1) no or limited severance or accessibility issues; 2) alternative facilities are available within the same community; 3) the level of use is very infrequent (a few occasions yearly); and 4) the land and assets are used by the minority (>=50%) of the community.
	Agricultural land holdings: 1) areas of land which are infrequently used on a non-commercial basis.
	Walkers, cyclists and horse-riders: N/A

Table 13.10: Magnitude of Impact

Magnitude	Descriptors of Effects
Major	Private property and housing, community land and assets, development land and businesses and agricultural land holdings: 1) Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. e.g. direct acquisition and demolition of buildings and direct development of land to accommodate highway assets; and/or 2) Introduction (adverse) or removal (beneficial) of complete severance with no/full accessibility provision. WCH: >500m increase (adverse) / decrease (beneficial) in WCH journey length.

Magnitude	Descriptors of Effects
Moderate	Private property and housing, community land and assets, development land and businesses and agricultural land holdings: 1) Partial loss of/damage to key characteristics, features or elements. e.g. partial removal or substantial amendment to access or acquisition of land compromising viability or property, businesses, community assets or agricultural holdings; and/or 2) Introduction (adverse) or removal (beneficial) of severe severance with limited / moderate accessibility provision. WCH: >250m - 500m increase (adverse) / decrease (beneficial) in WCH journey length.
Minor	Private property and housing, community land and assets, development land and businesses and agricultural land holdings: 1) A discernible change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements, e.g. amendment to access or acquisition of land resulting in changes to operating conditions that do not compromise overall viability of property, business, community assets or agricultural holdings: and/or 2) Introduction (adverse) or removal (beneficial) of severance with adequate accessibility provision. WCH: 1>50m – 250m increase (adverse) or decrease (beneficial) in WCH journey length.
Negligible	Private property and housing, community land and assets, development land and businesses and agricultural land holdings: 1) Very minor loss or detrimental alteration to one or more characteristics, features or elements. e.g. acquisition of non-operational land or buildings not directly affecting the viability of property, businesses, community assets or agricultural holdings: and/or 2) Very minor introduction (adverse) or removal (beneficial) of severance with ample accessibility provision. WCH: <50m increase (adverse) or decrease (beneficial) in WCH journey length.
No change	No loss or alteration of characteristics, features, elements or accessibility; no observable impact in either direction.

Human health methodology

13.7.6 The approach to assessment will follow DMRB LA 112 and will also consider a primer by the Institute of Environmental Management and Assessment (IEMA) (Cave et al., 2017) and recent guidance by the International Association for Impact Assessment (IAIA) and European Public Health Association (EUPHA) (2020).

13.7.7 The health baseline will be developed further as required for the communities likely to be affected by the Proposed Scheme.

13.7.8 The main source of health data for the communities will be from Public Health England's public health profiles website (https://fingertips.phe.org.uk). For some indicators the data are available at General Practice or ward level, allowing for more local insight, while for other health indicators, data are only available at district or larger area levels. All health data will be at an aggregated population level of data, rather than individual clinical level.

13.7.9 For some of the wider determinants of health scoped into the assessment, information will be drawn from other aspects of the EIA. For example, findings from the air quality assessment; noise and vibration assessment; and, landscape and visual impact assessment (refer to Chapters 6, 12 and 8 respectively) will be used to inform the assessment of health impacts relating to quality of the urban and natural environments. Many of the wider determinants of health are strongly interrelated with the issues covered by the land use and accessibility assessment scoped as part of this chapter. The land use and accessibility methodology will allow the identification of impacts relating to accessibility, walking and cycling opportunities and community severance. The human health assessment will then identify potential health outcomes associated with changes to those health determinants.

13.7.10 The human health assessment will explore the strength of evidence for associations between impacts on wider determinants and population health outcomes. Evidence sources will be good quality peer reviewed medical research papers identified through sites such as PubMed (https://pubmed.ncbi.nlm.nih.gov/) or the Cochrane Library (https://www.cochranelibrary.com/). Evidence will also be drawn from the Environmental Noise Guidelines for the European Region (WHO, 2018) and WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide (WHO, 2006). Professional judgement will be applied as to whether the population contexts of the studies in the evidence base are applicable to the population in the study area of the Proposed Scheme. This will indicate how much confidence can be ascribed to the evidence for use in the assessment.

13.7.11 Health effects will not be quantified as for many of the wider determinants of health there are no established methodologies to measure the level of effect attributable to a project such as the Proposed Scheme with any degree of certainty. There is likely to be uncertainty due to limited evidence for some health impacts as well as the high number of variables which cannot be known by desk study (for example variations in degree of exposure, lifestyle factors, exposure to other risk factors independently associated with the health outcomes of interest).

13.7.12 The sensitivity of communities will be described as ‘high’, ‘medium’ or ‘low’. The judgement of sensitivity will be guided by the IAIA/EUPHA (2020) guidelines. The guidelines set out several considerations for assigning sensitivity including the levels of deprivation, prevalence of relevant health conditions, public attitudes to the proposal (i.e. whether there is general concern or support), and capacity of community to adapt. Although it is known that some areas have higher prevalence of certain sensitive health conditions, it is not known exactly where individuals with those conditions are and whether they would be exposed to risk factors associated with the Proposed Scheme. Furthermore, there will be individuals with sensitive conditions located throughout the study area. Therefore, the assignment of sensitivity for each community will only provide a guide as to where the key population health issues would be expected. The degree to which individuals within those communities could go on to develop certain health outcomes associated with the changes will be subject to several factors which cannot be known for this type of assessment, such as individual genetics, lifestyle choices, personal circumstances, and many other factors.

13.7.13 Predicted health outcomes will be reported as positive, neutral, negative or uncertain, and no judgement of significance will be made.

13.8 Assessment assumptions and limitations

13.8.1 This scoping assessment has been undertaken based on a preliminary understanding of the baseline. Further potential receptors will be identified as part of the ongoing EIA process to close existing data gaps.

13.8.2 Data from the ONS have been used to form the baseline conditions. However, in some cases datasets are reliant on estimates (e.g. for population) or has not been updated since the 2011 Census. In all cases, the most up-to-date data are used.

13.8.3 The assessment will consider health effects and data relating to population level data, rather than health data and effects relating to individuals. The aggregated data and statistics used to support the assessment cannot be used to make inferences about the health of individuals within the communities assessed.

13.8.4 The EIA process will assess changes in concentrations of air pollutants, as well as changes in outdoor noise at specific receptor sites. These measurements do not equate to level of exposure experienced by people at these receptor sites. Several factors, such as amount of time people spend in the locations, quality of buildings or ventilation, will all affect the level of potential exposure that people may have, which cannot be reliably quantified in the EIA with the data available.

13.8.5 Although the assessment will refer to research that demonstrates evidence of association between changes in health determinants and effects on health, this should not be interpreted as causation. Conclusions on cause and effect relationships for human health cannot be drawn from aggregated population level data.

13.8.6 The assessment will not draw conclusions on the viability of any individual businesses, including farm businesses, that may be affected by changes in land or access from the Proposed Scheme. Such matters would relate to the relevant margins that support the businesses and any impacts on business viability would require direct negotiation between the interested parties and their representatives. Instead the assessment will present effects in relation to whether the existing land use can feasibly continue in light of likely physical impacts on land-take or access.

13.8.7 The use of the Strava Heatmap to inform cycling activity in the area has the limitation that it is likely to be a selective group of cyclists and runners who use the app. The app is likely used more by very keen and more competitive cyclists and runners and may not reflect the activities of occasional cyclists and runners, family rides with younger children or short regular commutes. Nevertheless, the app is widely used and provides an indication of routes regularly used and routes which tend to be avoided.

14. Road drainage and the water environment

14.1 NNNPS requirements

14.1.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

14.1.2 Key policies from the NNNPS relevant to this chapter include:

- Paragraphs 5.91 to 5.97 state that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk although essential transport infrastructure is permissible in areas of high flood risk subject to the Exception Test. But where development is necessary, it should be made safe without increasing flood risk elsewhere. The Environmental Statement will need to be accompanied by a FRA, which will identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account.
- Paragraph 5.93 states that the assessment of impact should take climate change into account.
- Paragraph 5.99 states that when determining an application, the SoS should be satisfied that flood risk would not be increased elsewhere, that the most vulnerable development is located in the areas of lowest risk, and that it is appropriately flood resilient and resistant.
- Paragraph 5.109 states that the scheme should be designed and constructed to remain operational and safe for users in times of flood.
- Paragraphs 5.219 and 5.220 state that the scheme should prevent both new and existing development from contributing to, or being put at unacceptable risk from, or being adversely affected by, water pollution.
- Paragraphs 5.221 to 5.223 require that the applicant carries out an assessment of the impacts of the proposed project on water quality, water resources and the physical characteristics of the water environment, as part of an Environmental Statement. It requires projects to adhere to National Standards for Sustainable Drainage Systems (SuDS), careful design, and good pollution control practice (para 5.229). It also states for those projects that are improvements to the existing infrastructure, such as road widening, opportunities should be taken to improve upon the quality of existing discharges where these are identified and shown to contribute towards Water Environment Regulation (WER). The NNNPS also states that the overall aim of projects should be no deterioration of ecological status in watercourses, ensuring that Article 4.7 of the WER Regulations does not need to be applied.
- Paragraph 5.226 states that in terms of Water Framework Directive (Water Environment Regulation) compliance, the overall aim of projects should be no deterioration of overall status in watercourses. Compliance should also be made with the WFD daughter directives, including those on priority substances and groundwater.

14.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

14.2 Study area

14.2.1 This scoping assessment has been undertaken based on the standard provided in the Design Manual for Roads and Bridges (DMRB) LA 113: Road Drainage and Water Environment (Highways England, March 2020; hereafter referred to as DMRB LA 113). The road drainage and the water environment (RDWE) aspect includes surface water in terms of water quality, hydrology and, hydromorphology, flood risk and groundwater. This chapter outlines the scope and methodology that will be followed in the PCF Stage 3 Environmental Statement.

14.2.2 The nature of the water environment means that impacts may be identified beyond the boundaries of the site. The extent of the affected geographical area depends on the nature of the impact, amongst other factors.

14.2.3 The surface water study area for the RDWE aspect has been based on organisational experience and has been extended to 500m for hydromorphology and 1km for water quality and flood risk. Where appropriate watercourses beyond the 1km study area have been scoped into the water quality assessment. The groundwater study area includes the provisional Order Limits of the Proposed Scheme and up to a 2km buffer in all directions. This is based on organisational experience regarding the maximum potential extent of effects likely on groundwater receptors in the type of aquifers present, and the uncertainties associated with the degree of heterogeneity of these aquifers. These include, for example, the extent of existing and historical mining shafts and adits, and their influence on the existing groundwater regimes present. Where the 2km buffer can be reduced, this will be justified in the groundwater assessment for the Environmental Statement. These extents could increase during the assessment should the potential for impacts beyond this area be identified as the design evolves. This distance will allow for an assessment of potential direct effects, as well as providing a broader catchment context appropriate for the purpose of the assessment. The proposed study area and key water environment features within it are shown on Figure 14.1.

14.2.4 The study area comprises surface water features including rivers, lakes and ponds and groundwater features potential mine workings, springs, sinks, sources, spreads, issues, wells, designated aquifers, source protection zones (SPZs), licensed non-potable groundwater abstractions, unlicensed potable and non-potable groundwater abstractions, licensed groundwater discharges, and groundwater dependent terrestrial ecosystems (GWDTEs).

14.3 Baseline conditions

Baseline sources

14.3.1 The baseline conditions have been established based on the following sources:

- Aerial imagery (Google Earth, 2021)
- British Geological Survey mapping (BGS, 2021) at 1:50,000 scale

- British Geological Survey baseline groundwater quality information for the Permo-Triassic Sandstones of Manchester and East Cheshire (Technical Report: NC/99/74/8) (Griffiths et al, 2003).
- British Geological Survey baseline groundwater quality information for the Pennine Coal Measures Group (Technical Report: OR/07/039) (Cheney, 2007).
- Bury Council Preliminary Flood Risk Assessment (JBA Consulting, 2011)
- Department for Environment, Food and Rural Affairs (Defra) Water Abstraction data sets (Defra, 2017).
- Designation data and mapping from Defra's MAGIC map application (Defra, 2021), including:
    - Environment Agency bedrock and superficial aquifer designations, which designate aquifers as one of the following:
        i. Principal aquifer: geology that exhibits high permeability and/or provides a high level of water storage. They may support water supply and/or river baseflow on a strategic scale.
        ii. Secondary A aquifer: permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of baseflow to rivers.
        iii. Secondary B aquifer: predominantly lower permeability strata which may in part have the ability to store and yield limited amounts of groundwater by virtue of localised features such as fissures, thin permeable horizons and weathering.
        iv. Secondary Undifferentiated aquifer: designation used in cases where it has not been possible to attribute either category A or B to a rock type.
        v. Unproductive strata: these are geological strata with low permeability that have negligible significance for water supply or river base flow.
    - Environment Agency groundwater Source Protection Zones (SPZs)
    - Environment Agency Nitrate Vulnerable Zones and Groundwater Vulnerability Map
    - Statutory and non-statutory designated ecological sites, and Habitats of Priority Importance (HPI) register
- Environment Agency Catchment Data Explorer for Water Framework Directive (WFD) surface water and groundwater bodies (Environment Agency, 2021)
- Environment Agency Ecology and Fish Data Explorer (Environment Agency, 2021)
- Environment Agency Flood Map for Planning (Environment Agency, 2021)
- Environment Agency Historic Flood Map (Environment Agency, 2021)
- Environment Agency Long Term Flood Risk Information Mapping (Environment Agency, 2021)
- Environment Agency Risk of Flooding from Reservoirs (Environment Agency, 2021)
- Environment Agency Risk of Flooding from Surface Water (RoFSW) Extent: 0.1, 1 and 3.3 percent annual chance (Environment Agency, 2021) datasets
- Environment Agency Water Abstraction data sets (Environment Agency, 2017)

- Highways Agency Drainage Data Management System (Highways England, 2021)
- Irwell Catchment Flood Management Plan (Environment Agency, 2009)
- OS Open Rivers (Ordnance Survey, 2019) dataset
- Sites of Biological Importance (SBI) register (GMEU, 2020)
- Springs, sinks, sources, spreads, issues, wells (in digital format, digitised from both contemporary and historic Ordnance Survey mapping)
- The Coal Authority Interactive Map Viewer (Coal Authority, 2018)
- M60 J18 Simister Island Water Quality Study Final Report (Jacobs, 2020)

14.3.2 The following data were unavailable at the time of writing (see Section 14.7), but will be used to inform the baseline conditions in the Environmental Statement:

- British Geological Survey mapping at 1:10,000 scale, historical borehole records, and permeability index/aquifer properties datasets (where required)
- British Geological Survey groundwater flooding susceptibility dataset
- Cranfield Soil Institute's soil properties dataset
- Environment Agency 'Water Quality Archive' data
- Environment Agency – WER mitigation measures
- Environment Agency groundwater level/quality monitoring data, and groundwater flood incident records (where available)
- Environment Agency licensed surface water and groundwater abstractions and permitted discharges
- Environment Agency pollution incidents, present and historical land uses, and contaminated land (part 2A) datasets
- Unlicensed groundwater abstractions and groundwater flooding records (obtained from the local authority)
- Results from a future ground investigation (GI), currently being scoped, including groundwater level and quality data (where available)
- Results from a future drainage survey, currently being scoped, including identifying outfall locations (where possible)
- Mining and groundwater information from the Coal Authority (including mine abandonment plans, current/historic abstractions, monitoring data etc.), in relation to the potential coal mining areas located in the west of the study area
- UK Habitat Classification (UKHab) survey, and National Vegetation Classification (NVC) survey data within a buffer of at least 500m around the Proposed Scheme, as well as results from hydrogeological walkover surveys (where required) to determine the groundwater dependency of potential GWDTEs and to establish the presence of surface water features and surface water dependent habitats such as ponds and wetlands.

14.3.3 Site walkovers including ground investigation (GI) works and water quality sampling have not yet been undertaken for this stage of the Proposed Scheme and therefore the assessment is based upon desk-based sources and site visits undertaken during previous stages. The data will be utilised in subsequent reporting of the baseline conditions within the Environmental Statement.

Baseline information

Surface water features

14.3.4 There are no Main Rivers crossed by the Proposed Scheme. However, there are numerous main rivers and surface watercourses within the 1km study area, as summarised in Table 14.1. All watercourses are within the River Irwell catchment.

Table 14.1: Features of the water environment within the study area (1km)

Watercourse	Description
Hollins Brook (Main River)	The source (SD826080) of Hollins Brook is the confluence of Whittle Brook and Castle Brook, approximately 440m east of the M66 southbound carriageway. It continues in a north-westerly direction for approximately 600 m before entering a culvert conveying it beneath the M66. The brook continues in a general westerly direction for approximately 1.5km before joining the River Roch.
Brightly Brook (Main River)	The sources (SD840092) of Brightly Brook is south of Pilsworth Road flowing westwards beneath Moss Hall Road and south of Pilsworth South Landfill before merging with Hollins Brook.
Castle Brook (Main River)	The source (SD828066) of Castle Brook is on the north side of the M62 and east of the M66 near Unsworth Moss and Moss Side. From its source it flows westwards through Pike Fold Golf Course and then northwards to discharge into Whittle Brook. This watercourse receives runoff from the M66 highways network (via Outfall 2 described below).
Tributary 1 of Castle Brook (Egypt Farm Drain) (Ordinary Watercourse - Bury MBC)	This watercourse rises (SD832068) by Egypt Farm, north of the M66 and approximately 500m east of M60 J18. It flows in a northerly direction for approximately 500m before reaching the southern boundary of Pike Fold Golf Course and its confluence with Tributary 2 of Castle Brook.
Tributary 2 of Castle Brook (Golf Course Drain) (Ordinary Watercourse - Bury MBC)	This watercourse rises (SD826064) along the southern boundary of Pike Fold Golf Course. It flows through the golf course and continues northwards for approximately 1.4km before merging with Castle Brook. This tributary receives runoff from the M66, M62 and M60 highways networks (via Outfall 1 described below).
Parr Brook (Main River)	The source (SD815062) of Parr Brook is north of Ribble Drive in Sunny Bank, approximately 1.3km north west of M60 J18. It flows north through Sunny Bank Wood, approximately 800m west of the M66 and Bury Golf Club, approximately 600m west of the M66, before flowing west into Lamb Lodge Reservoir 1.3km west of the M66.
Tributary of Parr Brook (Ordinary Watercourse - Bury MBC)	The tributary rises (SD822058) approximately 550m west of M60 J18 by Hodder Way, Whitefield. From here the watercourse is culverted beneath the residential housing, flowing south towards the M62 by Derwent Avenue before flowing northwards, still culverted, to Cambeck Close where is merges with Parr Brook.

Watercourse	Description
Whittle Brook (Main River)	The source (SD848085) of Whittle Brook is near Heywood to the north west of Junction 19. Whittle Brook passes in culvert under the M62 twice, at its closest to the Proposed Scheme it crosses approximately 1.8km east of M60 J18.Castle Brook joins on the west bank near Thurston Fold and then it is joined by Brightley Brook from the east after which it is called Hollins Brook. The watercourse then passes under the M66, approximately 700m south of Junction 3. From here it flows west for approximately 1.2km before discharging into the River Roch. This watercourse receives runoff from the M62 highways network (via Outfall 3 described below).
Tributary 1 of Whittle Brook (Ordinary Watercourse - Bury MBC)	The tributary rises (SD835066) on the north side of the M62 flowing eastwards then in a northeasterly direction through the field adjacent to the M62 and Simon Lane (farm access track). The tributary appears to be culverted beneath Simon Lane before continuing north east past Unsworth Moss Farm and merging with Whittle Brook approximately 1.5km east of M60 J18.
Bradley Brook (Ordinary Watercourse - Bury MBC)	Bradley Brook rises (SD808045) on the south side of the M60 approximately 400m south west of Junction 17. The Brook flows through Philips Park, generally south westwards for approximately 1.6km before its confluence with the River Irwell. Bradley Brook is classified as an ordinary watercourse. The Brook has three tributaries, two of which are in the study area.
Tributary 1 of Bradley Brook (Ordinary Watercourse - Bury MBC)	The tributary rises (SD8000048) approximately 550m north of the M60 to the east of Philips Drive, from which it flows southwards through Whitefield Golf Course. It cross under the M60, approximately 650m west of J17 and after approximately 200m joins the Bradley Brook. This tributary receives runoff from the M60 highways network (via Outfall 6 described below).
Tributary 2 of Bradley Brook (Ordinary Watercourse - Bury MBC)	The source (SD794047) of this tributary is located approximately 800m west of the western end of the scheme extent. The tributary originates in woodland between Philips Park Jewish cemetery and Parkstone Avenue on the north side of the M60. It flows southwards for approximately 200m before being culverted under Philips Park Road and the M60 after which it flows for a further 500m in culvert under Outwood Farm. The watercourse is then in open channel for approximately 150m before entering Bradley Brook. DDMS records an outfall located immediately upstream of the M60 crossing on this watercourse. Based upon current knowledge, the drainage catchment of this outfall does not include areas within the scheme extent. This tributary is not considered further.
Heaton Park Reservoir (Bury MBC and Manchester CC)	Owned and operated by United Utilities, the reservoir lies approximately 750m directly south of M60 J18 and covers an area of some 33ha. The reservoir is fed by Haweswater aqueduct which carries up to 450,000m^3 of water per day from Haweswater in the Lake District to provide public drinking water to the Manchester region. The reservoir is not hydrologically connected to the watercourses within the study area (SD826049).
Other unnamed watercourses and drains	There are several unnamed drains and watercourses within the study area, some of which are small field and road drains. These watercourses do not receive road runoff and their alignment will not be impacted by the Proposed Scheme. Therefore, these watercourses are not considered further in the assessment.

Watercourse	Description
Ponds, lakes and reservoirs	There are three ponds within 500m of the centre of M60 J18 associated with Egypt Farm, located to the north east of the junction; at their nearest, these ponds are approximately 75m from the eastbound carriageway. There are also several ponds within Pike Fold Golf Club. Some of these ponds may be man-made and not considered as natural features. Other ponds and lakes within the 1km study area have not been identified at this stage but are likely to not be directly affected by the Proposed Scheme and thus will not be considered further unless they are identified at the Environmental Statement stage as being affected by the works (this may depend upon construction compound locations etc. and land required for mitigation which is unknown at this stage). At present it is not known if ponds are groundwater fed or rainfall fed.

14.3.5 Beyond the 1km study area there are several other major watercourses that are hydrologically connected to those within the study area, and thus for now have been included in the assessment as potential downstream receptors. These include:

- River Roch (Spodden to Irwell) – Hollins Brook which flows within the study area joins the River Roch approximately 1.5km west of the M66. The River Roch then flows west through Lomax Woods, beneath Heap Bridge on the A58 Bury New Road. It meanders south west of the M66 Junction 2 then flows underneath the M60, Waterfold and the East Lancashire Railway before flowing south merging with the River Irwell approximately 2km west of the Proposed Scheme.
- River Irwell (Main River) – The River Roch merges into the River Irwell by Radcliffe Ees approximately 2km west of the Proposed Scheme. It flows in a southerly direction west of the scheme. This watercourse is also approximately 1.6km downstream of the source of Bradley Brook (which receives road runoff from areas within the Proposed Scheme).
- River Irk – The River Irk is located approximately 1.5km south of the Proposed Scheme and receives road runoff (via Outfall 5) from areas of the highway within the Proposed Scheme and thus is included in the assessment. The River Irk flows in a westerly direction passing under the M60 approximately 100m south of the centre of M60 J19. It continues flowing south before merging with the River Irwell in Manchester city centre approximately 6km south of the Proposed Scheme.

Surface water quality

14.3.6 The Environment Agency Catchment Data Explorer website classifies Water Environment Regulation (WER) (formerly known as WFD) waterbodies according to their ecological and chemical status and whether they have been heavily modified or not. Waterbodies are required to achieve ‘good’ ecological and chemical status (or potential, if designated as heavily modified or artificial) by 2021 or 2027. Table 14.2 summarises the current overall, chemical, physico-chemical status of WER monitored waterbodies within the study area and their downstream water body. The Catchment Data Explorer website identifies the source and diffuse pollution pressures for the catchments also presented in Table 14.2.

14.3.7 All of the waterbodies ‘fail’ for chemical status. The failures, based upon 2019 published data, are mostly due to priority hazardous substances, notably: polybrominated diphenyl ethers (PBDE) and mercury and its compounds which all waterbodies fail and perfluorooctane sulphonate (PFOS) which the River Roch and River Irk fail.

14.3.8 Vehicles and road runoff are not typically considered as significant sources of these pollutants. PFOS can be found in car polish and textiles, and PBDE found in spare parts for vehicles and car seats. Several of these pollutants are banned in the UK with pollution now restricted to historical use.

14.3.9 All the watercourses have a 'moderate' classification for phosphate except the River Roch and River Irwell which are classified as 'poor'. This pollutant is typically associated with wastewater works rather than highway runoff.

14.3.10 As shown in Table 14.1, there are other water bodies and watercourse crossings in the study area, including several brooks, unnamed tributaries and unnamed drains (see Figure 14.1). These watercourses are not classified as WER waterbodies and therefore their water quality statuses are unknown. However, WER objectives can be extended to all tributaries within the catchment of a WER classified waterbody. Existing water quality in these smaller watercourses is likely to be influenced by surrounding land uses (which are predominantly residential and agricultural), surface water runoff, road drainage, sewerage misconnections, nutrient inputs from agriculture and golf courses, accidental spillages and unlicensed discharges. There is likely to be a significant network of surface water sewers which discharge into the watercourses listed above.

Table 14.2: Current WER status (2019, Cycle 2) for surface water bodies, data derived from Catchment Data Explorer

Water body name	Whittle Brook (Irwell)	Roch (Spodden to Irwell)	Irwell (Roch to Croal)	Irk (Wince to Irwell)
Water body ID	GB112069061250	GB112069064600	GB112069060840	GB112069061131
Water body type	River	River	River	River
Upstream water body	-	Whittle Brook (Irwell)	Roch (Spodden to Irwell)	Irk (Source to Wince Brook)
Downstream water body	Roch (Spodden to Irwell)	Irwell (Roch to Croal)	Irwelll (Croal to Irk)	Irwell/Manchester Ship Canal
Hydromorphological designation	Not designated	Heavily modified	Heavily modified	Heavily modified
Overall ecological status	Moderate	Moderate	Moderate	Moderate
Overall chemical status	Fail	Fail	Fail	Fail
Overall water body classification	Moderate	Moderate	Moderate	Moderate
Acid-neutralising capacity	-	High	High	High
Ammonia	Good	Moderate	Moderate	Good
Dissolved oxygen	High	High	High	High
pH	High	High	High	High
Temperature	High	High	High	High
Phosphate	Moderate	Poor	Poor	Moderate
Biological oxygen demand	-	-	-	High

Water body name	Whittle Brook (Irwell)	Roch (Spodden to Irwell)	Irwell (Roch to Croal)	Irk (Wince to Irwell)
Hydrological regime	Supports Good	-	Supports Good	-
Morphology	Supports Good	-	-	-
Pollution Pressures	Agriculture and rural land management Urban and transport	Urban and transport Water Industry	Agriculture and rural land management Urban and Transport Water Industry	Agriculture and rural land management Urban and Transport Water Industry Domestic General Public

Surface water resources

14.3.11 Based on Environment Agency data, available up to 2017, there are two surface water abstraction locations within the 1km study area, both for industrial, commercial and public services (Environment Agency, 2017). It is possible further small-scale surface water abstractions could be present within the study area but not recorded within the Environment Agency data. It is also possible additional licences have been granted since 2017, updated data will be requested for the next stage of assessment and reported in the Environmental Statement.

14.3.12 According to Environment Agency data there are no Drinking Water Safeguard Zones (Surface Water) located within the study area.

14.3.13 The study area falls within two surface water nitrate vulnerable zones (NVZ). Nitrate vulnerable zones (NVZ) are areas designated as being at risk from agricultural nitrate pollution. Nitrate pollution is typically associated with agricultural land use rather than highways. There are two NVZs (2017 designations) within the study area:

- Irwell/Manchester Ship Canal (Kearsley to Irlam Locks)
- River Irk (Moston Brook to River Irwell)

14.3.14 A small section of the southern end of the scheme along the M60 lies within the NVZ.

Surface water flows

14.3.15 On the National River Flow Archive (NRFA) website, data is available from several gauging stations along watercourses within, upstream or downstream of the study area. The Q95 is the flow that is exceeded 95% of the time and is representative of low flows. Data on the Baseflow Index (BFI) has also been included in Table 14.3; this gives an indication as to how much groundwater contributes to the flow in a watercourse. Data has also been taken from the Simister Island Water Quality Study report (Jacobs, 2020) for the proposed outfalls at PCF Stage 2. The outfall locations are described in paragraph 14.3.17 and shown on Figure 14.2.

Table 14.3: Q95 flows for gauged watercourses upstream and downstream of the study area

Watercourse name	Gauging station ID number	Q95 (m^3/s)	BFI
Values from NRFA website			
River Roch (at Blackford Bridge) (upstream of Proposed Scheme) NGR: SD806077	69023	1.485	0.53
River Irk (Collyhurt Weir) (downstream of the Proposed Scheme) NGR: SJ848996	69043	0.912	0.6
River Irwell (at Adelphi) NGR: SJ824987	69002	5.01	0.49
Values from the M60 J18 Simister Island Water Quality Study (Jacobs, 2020)			
Un-named tributary of Castle Brook (Outfall 1) NGR: SD828065	-	0.00081	0.799
Un-named tributary of Whittle Brook (Outfall 3) NGR: SD836068	-	0.00532	0.707
River Irk (Outfall 5) NGR: SD845047	-	0.24065	0.597
Bradley Brook (Outfall 6) NGR: SD803044	-	0.00429	0.721

Existing drainage

14.3.16 The Highways England priority drainage assets programme was developed to identify nationally those outfalls and soakaways that represent a potential risk to receiving water quality and culverts that represent a potential risk of flooding. The results of this programme are recorded on Highways England's Drainage Data Management System (DDMS). Under this programme, outfalls can be classified as any of six categories which describe the level of risk of pollution to a receiving watercourse. Categories include A (very high), B (high), C (moderate), D (low), X (risk addressed) or 'Not Determined' for those lacking data. According to HADDMS information, there are no Category A or Category B outfalls, 10 Category C, one Category D, and no Category X or 'Not determined' outfalls within the study area for those outfalls currently recorded on DDMS and these are presented in Table 14.4 and shown on Figure 14.2. It should be noted that the risk status of the outfalls is yet to be verified through site specific assessments and this will be done as part of the assessment stage. It should also be noted that those outfalls identified as part of the Simister Island Water Quality Study (Jacobs, 2020) are not currently recorded on DDMS as outfalls but are described below.

Table 14.4: Outfalls within the study area recorded on HADDMS

Outfall ID	Risk	Location
SD8208_0858j SD8208_0858k SD8208_0858l	Category C (moderate risk)	Situated approx. 290 m south of the first slip road to the M66 J3 on the western side of the M66. Discharges indirectly into Hollins Brook via drains.
SD8208_1556o SD8208_1556p SD8208_1556q	Category C (moderate risk)	Situated approx. 290 m south of the first slip road to the M66 J3 on the eastern side of the M66. Discharges indirectly into Hollins Brook via drains.
SD8208_2232b	Category C (moderate risk)	Discharges directly into Hollins Brook on the eastern side of the M66.
SD8306_4225b	Category D (low risk)	Located on one of the un-named tributaries of Castle Brook. Outfall located on the south side of M62 on the northern edge of Simister.
SD7904_5327a	Category C (moderate risk)	Located on a tributary of Bradley Brook which flows north to south under the M62 and is located approximately 1.5 km westbound from the centre of M60 J17. Although outside the study area this outfall is the closest to both options in a westbound direction along the M62 from J17 and may receive runoff from the existing highways within the scheme extents for both options.

14.3.17 During earlier stages of the project, six drainage catchments and corresponding outfalls, were identified, using as-built drawings on DDMS, as potentially receiving runoff from the existing carriageway within the scheme extents. A site visit was undertaken to confirm the location of the outfalls and to collect data to be used in water quality assessment using the Highways England Water Risk Assessment Tool (HEWRAT). Of the six outfalls, two could not be located and were not assessed at PCF Stage 2. However, drainage surveys are to be undertaken which will aim to identify these drainage outfalls. For the remainder (Outfalls, 1, 3, 5 and 6) an assessment of routine runoff impacts was undertaken at PCF Stage 2 for the existing situation and for the design options considered at PCF Stage 2. The results of this were presented in the Simister Island Water Quality Study Report (Jacobs, 2020) which is summarised below.

14.3.18 There were four outfalls verified during site visits for the Simister Island Water Quality Study Report (Jacobs, 2020) undertaken at the end of PCF Stage 2:

- For the M66 through J18, the roundabout circulatory, the M66 north facing slip roads, M62 east facing slip roads and M60 eastbound exit slip road, the drainage flows to the north-east of J18, before heading north under Egypt Lane and outfalls into a ditch on the boundary of Pike Fold golf course (Outfall 1). This ditch connects into Castle Brook.
- For the M62 from the centre of J18 to north-east of Simon Lane overbridge the drainage outfalls north of the M62 into a ditch that connects to Whittle Brook (Outfall 3).

- For the M60 from J18 to just east of J19, including the J18 south facing slip roads, the drainage outfalls into the River Irk (Outfall 5).
- For the M60 from the centre of J18 to just west of J17 the drainage outfalls just south of Whitefield Golf Course to Bradley Brook (Outfall 6).

14.3.19 HEWRAT assessments were undertaken on Outfalls 1, 3, 5, and 6. For the existing situation, the HEWRAT assessments identified that all of the four drainage catchments assessed pass for sediment-bound pollutants and thus treatment for settlement of sediments is not deemed to be required.

14.3.20 For the existing situation, Outfall 1, which discharges to a small ditch which flows into a tributary of Castle Brook (north east of the M60 J18), fails the national Environmental Quality Standards (EQS) for dissolved Copper. The EQS limits are based upon annual average concentrations in a receiving watercourse and provide an indication of long-term impacts. This outfall also currently fails for acute soluble impacts of both copper and zinc, which are measures of short-term impacts over a 6 hour and 24 hour period undertaken by HEWRAT. Whilst an assessment point at the location of the outfall was chosen, sensitivity analysis has also shown that flows of an order of magnitude greater than that predicted would be required in order to provide adequate dilution, and these are unlikely to be provided by the tributary of Castle Brook.

14.3.21 Outfall 3 fails the EQS for dissolved Copper and fails the short-term (i.e. acute) limits for both dissolved copper and zinc. Under the Priority outfall programme this would be a Category A outfall.

14.3.22 Outfall 5 passes all the HEWRAT assessments for soluble pollutants, resulting in this being a “Risk Addressed” category outfall. This outfall discharges to the River Irk, near junction 19 of the M60, which has a significantly larger dilution capacity than the other watercourses affected by the scheme.

14.3.23 Outfall 6, which discharges to a tributary of Bradley Brook to the west of the M60 J17 (outside the scheme extents) fails both the long-term water quality limits (i.e. the EQS) and the short-term (i.e. acute) limits for both dissolved copper and zinc. Under the Priority outfall programme this would be a Category A outfall.

14.3.24 HEWRAT also identifies the % treatment required to fully mitigate the impacts for each pollution type (i.e. soluble or sediment-bound pollutants). For the failures relating to the existing situation, Outfalls 1, 3 and 6 require some form of mitigation and, due to the extents of the failures identified in HEWRAT, it is likely that more than one mitigation component will be required. Sustainable drainage systems (SuDS) features can provide mitigation components, those which provide the highest treatment efficiencies for both copper and zinc, (i.e. remove the most dissolved pollutants from water) include grassed channels known as swales, ponds which are permanently wet and wetlands. Combined surface and sub-surface drains/filter drains can also provide a reasonable amount of treatment for dissolved zinc (but not for copper).

14.3.25 It should be noted that the M-BAT assessments to be undertaken at PCF Stage 3 may not produce the same level of EQS failures as those reported at PCF Stage 2, after undertaking HEWRAT assessments. Ambient Background Concentrations (ABC) of Copper were also not considered at PCF Stage 2. Environment Agency data will be used during the assessment to determine the ABC value for the catchments assessed and this may be based upon values of similar catchments.

14.3.26 Assessments of routine runoff were also undertaken for the design options considered at PCF Stage 2 and reported in detail in the Simister Island Water Quality Summary Report (Jacobs, 2020). These assessments showed that the use of SuDs, such as ponds, swales and wetlands, is highly likely to be required to mitigate for failures. The assessment undertaken by HEWRAT is influenced the most by the impermeable area discharging to the outfall (i.e. the greater the road surface area the more pollutants there are in the runoff from that road area) and the Q95 of the watercourse (i.e. the lower the flows the lower the dilution capacity). Traffic flows (i.e. more traffic results in more pollutants) can also be influential. Option assessment is based upon a "design year", this is the year 15 years from when the scheme is likely to open. Due to predicted growth in traffic, traffic figures used in the assessments of the options were therefore greater than for the existing situation. In addition, the options result in an increase in the impermeable area for most of the drainage catchments, compared to the existing situation, and thus present a worsening from the existing situation.

14.3.27 The presence of existing surface water attenuation features such as attenuation ponds, underground attenuation tanks, etc. or pollution control measures could not be confirmed during previous stages. A drainage survey will be undertaken to inform the design work at this stage and any existing drainage assets will be confirmed and reported in the Environmental Statement.

Water-dependent designated sites

14.3.28 Within the 1km study area there are several Sites of Biological Importance and Local Nature Reserves:

- Hollins Vale – Grade B site, ponds and small lodges
- Pilsworth – Grade B site, large standing water and small lodges
- Hazlitt Wood – Grade A site, reedbed, swamp and fen, ponds and small lodges, aquatic invertebrates
- Philips Park and North Wood – Grade A site, ponds and lodges

14.3.29 Further details are presented in Chapter 9: Biodiversity and Figure 9.1.

Recreation

14.3.30 Within the study area, those watercourses close to public rights of way, parks (i.e. Philips Park) and within golf courses have the potential to be utilised for recreational purposes and provide amenity value.

Hydromorphology

14.3.31 Figures 14.1 and 14.3 and Table 14.5 show the location of all hydromorphology receptors within the boundary of the Proposed Scheme. There are 14 watercourses and one reservoir within the study area.

14.3.32 Baselines for WER water bodies will be detailed in a Preliminary WER Assessment to accompany the Environmental Statement.

Table 14.5: Hydromorphology baseline

Watercourse	Scoping	Scoping Reasoning	Baseline Conditions	Sensitivity/ Value
Tributary of Bradley Brook 1	Scoped In	Within 500m study area	Morphological features likely limited. Part of a drainage channel that historically flowed from the north but is now cut off by the M60.	Low
Bradley Brook	Scoped In	Within 500m study area	Straight channel. Morphological features likely limited. Long culvert under M60.	Low
Parr Brook	Scoped In	Within 500m study area	Culverted within study area. No morphological features likely.	Low
Heaton Park Reservoir	Scoped In	Within 500m study area	Artificial reservoir. No morphological features likely	Low
Castle Brook Tributary	Scoped In	Within 500m study area	Straight drainage channel. No morphological features likely. No modifications.	Low
Tributary of Castle Brook Tributary	Scoped In	Within 500m study area	Culverted within study area. No morphological features likely.	Low
Tributary of Unnamed Watercourse	Scoped In	Within 500m study area	Straight drainage channel. No morphological features likely. No modifications.	Low
Blackfish	Scoped In	Within 500m study area	Small straight streams through Heaton Park. Three ponds on watercourse. Ten bridges.	Low
Unnamed Watercourse 1	Scoped In	Within 500m study area	Straight drainage channel. No morphological features likely. No modifications.	Low
Hollins Brook	Scoped In	Within 500m study area	Small vegetated berms and bars. Several weirs and culverts.	Medium
Brightley Brook	Scoped In	Within 500m study area	Straightened channel. No morphological features visible. Culverting. Three reservoirs along the watercourse with a bypass channel.	Low
Whittle Brook	Scoped In	Within 500m study area	Sinuous channel. Evidence of localised erosion and deposition. No modifications within the study area.	Medium
Castle Brook	Scoped In	Within 500m study area	Castle Brook Sinuous channel. Evidence of local erosion and deposition. One road crossing. Several footbridges.	Medium
River Irk	Scoped In	Within 500m study area	Sinuous channel. Mid channel bars and berms viable. our culvert crossings.	Medium
Unnamed Watercourse 2	Scoped In	Within 500m study area	Straight drainage channel. No morphological features likely. No modifications.	Low

Groundwater

14.3.33 Chapter 10: Geology and Soils provides the baseline information for the geology beneath the Proposed Scheme. The groundwater study area covers a larger extent, i.e. up to 2km from the provisional Order Limits, compared to the 250m buffer used for Chapter 10. However, the bedrock and superficial geology are expected to be broadly similar to that described in Chapter 10, on the basis that most of the formations and deposits described within 250m of the Proposed Scheme are also expected to be present within the 2km buffer. Where important variations in the underlying geological composition arise, and/or additional formations and deposits are identified in the groundwater study area, these will be highlighted in the relevant sections of the groundwater assessment of the Environmental Statement.

14.3.34 The mapped superficial deposits within the study area are classified mainly as secondary A and secondary undifferentiated aquifers (Defra, 2021), with pockets of unproductive strata (Table 14.6). It should be noted, however, that made-ground deposits are likely to be extensive throughout the area immediately surrounding the Proposed Scheme, due to the presence of the existing motorway junction. The exact presence, lithology, understanding of groundwater levels/flows, and hydrogeological properties of the superficial deposits and made ground across the provisional Order Limits are currently unknown. As described in Chapter 10, a large area of infilled ground also borders the M66 and is a registered landfill site.

Table 14.6: Aquifer designations in the study area

Superficial deposits	**Aquifer designation**
Glacial till (diamicton)	Secondary Undifferentiated
Peat	Unproductive strata
Glaciolacustrine deposits	Unproductive strata
Glaciofluvial/glaciofluvial ice contact deposits	Secondary A
Hummocky (moundy) glacial deposits	Secondary Undifferentiated
Alluvium	Secondary A
Head	Secondary Undifferentiated
River terrace deposits	Secondary A
Bedrock	**Aquifer designation**
Pennine Lower Coal Measures Formation	Secondary A
Pennine Middle Coal Measures Formation	Secondary A
Pennine Upper Coal Measures Formation	Secondary A
Chester Formation	Principal
Collyhurst Sandstone Formation	Principal
Manchester Marls Formation	Secondary B
Rossendale Formation (Rough Rock Formation)	Secondary A

14.3.35 Each bedrock formation listed in Table 14.6 comprises several individual members and beds. The aquifer designations are therefore discussed at the formation level only.

14.3.36 The Pennine Coal Measures Group (hereafter referred to as Coal Measures) and the Rossendale Formation are Carboniferous in age, and designated as Secondary A bedrock aquifers, the former of which underlies a large part of the Proposed Scheme. The younger Permo-Triassic Chester and Collyhurst sandstone formations, present at depth beneath the southern and western parts of the study area, comprise Principal bedrock aquifers. Units of mudstone (belonging to the Permian age Manchester Marls Formation), are shown to have been thrust between the sandstone bearing strata of the Chester Formation, by extensive faulting in the area, and are classified as Secondary B aquifers.

14.3.37 The bedrock and superficial aquifer designations are included in Figure 14.4.

14.3.38 There is potential for the western part of the Proposed Scheme to be affected by shallow coal-mine workings (see Figure 14.4). Mine entry points, abandoned mines, and Development High Risk areas are shown in and around J17 of the M60 (Coal Authority, 2020). With the provisional Order Limits situated within the centre of multiple coal seams (BGS, 2021), the potential for underground coal mining cannot therefore be dismissed.

14.3.39 The groundwater vulnerability map (Defra, 2021) shows that the majority of the Proposed Scheme lies on aquifers with medium-high or medium vulnerability. Small areas of low vulnerability are also present, which correlate with the mapped extent of peat deposits.

14.3.40 A high-level assessment of groundwater levels reported in historical borehole logs shown on the BGS GeoIndex website has not yet been undertaken. In addition, no formal groundwater monitoring has been completed to validate groundwater levels as part of the Proposed Scheme to date, notably during the winter period when groundwater levels are expected to be at their highest. Groundwater monitoring is planned to be undertaken in several boreholes across the Proposed Scheme, to gain an understanding of baseline groundwater levels, fluctuations, and quality in the area. The work will be included as part of the future GI work and will inform the groundwater assessment of the Environmental Statement (where available).

14.3.41 The local groundwater may be connected (either directly or indirectly) to watercourses (as baseflow, sinks, sources, spreads, issues etc), and spring discharges. Changes to groundwater quality and levels beneath the Proposed Scheme may therefore influence water quality and/or flows in these watercourses/hydrological features.

14.3.42 There are two WER groundwater bodies (Environment Agency, 2021) within the groundwater study area (see Figure 14.4). The Northern Manchester Carboniferous Aquifers (GB41202G101800) are achieving ‘poor’ overall status as of 2019, with good quantitative status and poor chemical status. The Manchester and East Cheshire Permo-Triassic Sandstone Aquifers (GB41201G101100) are also achieving poor overall status as of 2019, but with both poor chemical and quantitative status.

14.3.43 There are no SPZs within the study area or its vicinity (Defra, 2021). This indicates that there are no licensed groundwater abstractions (used for potable supply) within the groundwater study area.

14.3.44 However, the sandstone formations that comprise the Permo-Triassic Sherwood Sandstone aquifer, Coal Measures, and the more permeable superficial deposits do provide groundwater sources for industrial/commercial users, as well as for agriculture and leisure activities (including golf courses). Licensed groundwater abstraction information

within the study area, will be obtained from the Environment Agency and used to inform the groundwater assessment of the Environmental Statement.

14.3.45 Groundwater abstractions of less than $20m^3$/day do not require a licence. The location of unlicensed groundwater abstractions, or private water supplies (PWSs), may be recorded by the local authority. This information will be obtained for the groundwater assessment of the Environmental Statement. It should be noted, however, that for most PWSs there is an onus on the abstraction owner to provide details to the local authority. As such, there may be other PWSs which the local authority is not aware of. This would need to be confirmed for the groundwater assessment of the Environmental Statement, with questionnaires sent to local residents and PWS surveys (where required).

14.3.46 Groundwater users may be particularly vulnerable to any disruptions of groundwater flow, provision, and quality, and (if present), would therefore require consideration in the groundwater assessment of the Environmental Statement, due to the Proposed Scheme.

14.3.47 Discharges of liquids to ground or groundwater may be occurring within the study area. The location of these are currently unknown for the full extent of the study area and permitted discharge data will be obtained from the Environment Agency for the Environmental Statement stage.

14.3.48 According to the UK Technical Advisory Group (UKTAG) guidance (UKTAG, 2005), groundwater-dependent terrestrial ecosystems (GWDTEs) are defined as wetlands which critically depend on groundwater flows or chemistry. A full assessment of GWDTEs has not been undertaken at this stage. However, an initial screening assessment of the locally designated ecological sites (see Chapter 9: Biodiversity) has been undertaken to determine the potential groundwater dependency of local nature reserves (LNR) and sites of biological importance (SBI). An initial screening buffer of 250m has been applied, based on Scottish environmental protection agency guidance (SEPA, 2017). The initial screening assessment has been undertaken from desk-based data such as maps (Defra, 2021), citations (GMEU, 2020), and brief online descriptions of the site from local authority websites. This will be followed up for the Environmental Statement stage of the EIA by field surveys, if needed, and consultation with the Lancashire Wildlife Trust. Sites defined as wetlands and coastal and floodplain grazing marsh under the habitats of priority importance (HPI) inventory have also been included in the initial assessment of GWDTEs. No statutory designated sites (such as Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC) or Ramsar sites) are present in the groundwater study area. Potential GWDTE's within the study area are listed in Table 14.7 and shown in Figure 14.4.

Table 14.7: Potential GWDTEs and an initial assessment of their groundwater dependency

Ecologically designated site name	Initial assessment of potential groundwater dependency
Hazlitt Wood SBI	Low to high
Hollins Vale LNR, SBI, and Hollins Plantation SBI	Low to high
Philips Park and North Wood LNR and SBI	Moderate to high
Lowland fen HPI in Pike Fold Golf Club	Moderate to high
Heaton Park Reservoir (West) SBI	Not groundwater dependent

14.3.49 Groundwater quality information for the two main bedrock aquifers underlying the study area is provided in various Environment Agency reports (Griffiths et al, 2003; Cheney, 2007). The key points, of pertinence to this assessment, are summarised below.

14.3.50 The Permo-Triassic Sandstone aquifer comprises a predominantly calcium bicarbonate type groundwater, the baseline chemistry of which is thought to be primarily influenced by the dissolution of carbonate and dolomite cements (Griffiths et al, 2003). As a result, it is likely that shallower parts of the aquifer have been decalcified, i.e. the original calcite has been dissolved, reflected by low alkalinity and pH values. The presence of thick, relatively impermeable superficial deposits over much of the aquifer may also permit reducing conditions to exist, even at shallow depths, resulting in high iron and manganese concentrations, but low nitrate concentrations (due to denitrification). Saline groundwater has occurred in parts of Greater Manchester, most notably in the Trafford Park area and near Chat Moss. This has been attributed to the dissolution of halite derived from the Triassic Mercia Mudstone Group, which overlies the sandstone aquifer in the Cheshire area to the south. Given the absence of this particular geology beneath the study area, saline groundwater from this source is unlikely to be a concern for the Proposed Scheme.

14.3.51 Coal Measures groundwater is typically dominated by calcium, magnesium, and bicarbonate ions (Cheney, 2007). However, elevated concentrations of chloride and iron in groundwater from deep coal mines can also be encountered. Reducing conditions are common throughout the Coal Measures, with the evolution of methane and hydrogen sulphide often reported. Mining activities tend to lower the level of the groundwater table, allowing oxidation of certain minerals (e.g. pyrite) within the coal measures, and the production of iron oxide and sulphate. On the cessation of mine dewatering, groundwater levels rise, and dissolved concentrations of sulphate, arsenic, iron, and other metals increase in the groundwater. This can result in localised areas of acid groundwater conditions within mined areas. Such conditions may exist in the far west of the provisional Order Limits for the Proposed Scheme where probable shallow mine workings are mapped. Where mine-impacted groundwater discharges (whether this be naturally or artificially), this can lead to rust-coloured watercourses due to precipitation of some or all of the dissolved iron to form the red, orange, or yellow ochreous sediments in the bottom of channels and banks.

14.3.52 Groundwater-quality data has been requested from the Environment Agency and is also expected to be collected as part of the future proposed GI. Both sources of groundwater quality data will be considered in the groundwater assessment of the Environmental Statement (where available).

14.3.53 Baselines for WER water bodies will be detailed in a Preliminary WER Assessment to support the Environmental Statement.

Flood risk

Fluvial flood risk

14.3.54 The Environment Agency has permissive powers to undertake flood defence works on Main Rivers, while the responsibility for maintenance rests with riparian owners. The Proposed Scheme does not cross any Main Rivers. However, within the 1km study area there are five Main Rivers, as presented in Table 14.1.

14.3.55 The Environment Agency's Flood Map for Planning (Environment Agency, 2021) indicates that there are areas designated as Flood Zone 3 (greater than a 1% (1 in 100) annual

exceedance probability (AEP) of fluvial flooding) and Flood Zone 2 (between 0.1% (1 in 1000) and 1% (1 in 100) AEP of fluvial flooding) within the study area (see Figure 14.5).

14.3.56 There are areas of Flood Zone 2 and 3 associated with several watercourse in the study area:

- Whittle Brook – flood zones east of the Proposed Scheme as it crosses under the M62. However, as the M62 is raised above surrounding land there is no risk to the carriageway from fluvial or groundwater sources.
- Hollins Brook – flood zones as it crosses underneath the M66. As the brook flows underneath the M66, the risk of flooding to the carriageway from fluvial or groundwater sources is low.
- There is a floodplain (Flood Zones 2 and 3) associated with Parr Brook north west of the Proposed Scheme. Parr Brook is culverted from its headwaters adjacent to the M60 to north of Parr Lane. Residential houses between Parr Lane and Mersey Drive are at risk of flooding.
- River Irk - south of the Proposed Scheme, and just beyond the study area, south of the M60 J19. However, the carriageway is raised on an embankment and therefore there is no risk of fluvial flooding.

14.3.57 Most of the study area is within Flood Zone 1, which is land that has less than 1 in 1000 annual probability of river or sea flooding.

14.3.58 Flood risk from ordinary watercourses, which is overseen by Bury Metropolitan Borough Council (BMBC) as the Lead Local Flood Authority (LLFA), may not be accounted for in the Environment Agency's Flood Map for Planning. A review of the Environment Agency's RoFSW mapping has been undertaken to account for baseline risk associated with ordinary watercourses. The flood risk associated with these watercourses has been detailed in the surface water flood risk sub-section below.

Surface water flood risk

14.3.59 The Environment Agency's RoFSW mapping shows that large areas of the study area are within an area at very low risk (less than 0.1% (1 in 1000) AEP). However, there are several overland flow routes and isolated areas of ponding which could interact with the Proposed Scheme with high (greater than 3.3% (1 in 30) AEP) medium (between 1% and 3.3% AEP) and low (between 0.1% (1 in 1000) and 1% (1 in 100) AEP) risk of surface water flooding.

14.3.60 The RoFSW indicates that the M60 J18 circulatory carriageway and slip roads are at risk of flooding during the 1 in 30 year event as well as areas of isolated ponding in the land adjacent to the junction. This could be a result of topography and the raised junction embankments.

14.3.61 There is an area of surface water ponding to the north east of M60 J18 where the proposed new 'Northern Loop' would be. Therefore, this area of carriageway may be at high risk of surface water or ordinary watercourse flooding.

14.3.62 As shown on HADDMS, sections of the carriageway fall within flood hotspots, including areas classified as Highest risk (A1), Very High risk (A), High risk (B), Moderate (C) and others are within Risk Addressed (X) areas. However, flood events were not from fluvial sources but from surface water on the carriageway as a result of drainage issues, e.g.

blocked gullies. Further investigation will be undertaken to ascertain the impacts on local drainage.

Tidal flood risk

14.3.63 The Irwell Catchment Flood Management Plan (Environment Agency, 2009) does not identify tidal flooding as a cause of flood risk in the catchment. None of the watercourses within the study area are tidal rivers. The nearest tidal point is the upstream tidal limit of the River Mersey at Howey Weir, approximately 28km downstream from the study area. Therefore, tidal and coastal flood risk is scoped out of the assessment.

Groundwater flood risk

14.3.64 The Bury Council Preliminary Flood Risk Assessment (PFRA) (JBA Consulting, 2011) shows the Areas Susceptible to Groundwater Flooding (AStGF) dataset for the municipal borough as a whole. This dataset has been superseded since 2011, but until the updated British Geological Survey mapping is obtained (at Environmental Statement stage), it provides a coarse, high level indication of potential shallow groundwater emergence, at a 1km grid square scale.

14.3.65 The northern half of the study area is classified as having a moderate to high (50% to 75%) susceptibility to groundwater flooding. The southern and western extents, however, are shown to have a moderate (25% to 50%) or low (less than 25%) susceptibility to groundwater flooding, respectively.

14.3.66 Given the varied lithology and hydrogeological properties of the made ground deposits, superficial geology, and bedrock aquifers present, the potential for shallow groundwater levels is also likely to vary throughout the study area.

14.3.67 The extensive faulting, and presence of sub-surface structures (e.g. building/embankment foundations, sheet piles, etc.), and the corresponding interactions with groundwater flows, adds further uncertainty to understanding the potential for localised shallow groundwater emergence. In addition, if historic shallow coal-mining activities have taken place in the west of the Proposed Scheme, as indicated by the Coal Authority's interactive viewer, then groundwater rebound as a potential flooding mechanism also cannot be scoped out.

14.3.68 Based on the information presented above, plus the intrusive nature of the proposed works (e.g. cuttings, foundations, sheet piles etc.), further investigation will be needed to understand the baseline groundwater flood risk in the study area. This will be undertaken in terms of potential shallow groundwater levels acting as a direct source of groundwater flooding, as well as the indirect effects that a shallow water table may have on other flooding mechanisms present (e.g. fluvial, surface water, and drainage/sewer infrastructure).

Reservoir flood risk

14.3.69 The Environment Agency's Risk of Flooding from Reservoirs mapping (Environment Agency, 2021) indicates that parts of the Strategic Road Network, including the circulatory carriageway and slip roads, are at risk of flooding due to failure of large raised reservoirs, as defined under the Reservoir Act 1975. The potential extent of reservoir flooding also reaches residential areas in Prestwich and Whitefield to the west of the M60 J18.

14.3.70 All large raised reservoirs, as defined by the Reservoirs Act, are regularly inspected and maintenance is supervised by reservoir engineers. Therefore, the risk of failure is considered to be very low due to their monitoring and inspection regime and reservoir flood risk will not be considered further.

Utilities

14.3.71 The Bury Council Preliminary Flood Risk Assessment (PFRA) (JBA Consulting, 2011) presents mapping to help to understand the volume of water discharging from the modelled sewer system during a 1 in 30-year rainfall period. The map indicates the land and receptors in the south west of the study area are at greater risk of sewer flooding than land in the north and east.

14.3.72 The exact location of sewer networks and water mains have not been considered at the scoping stage and will be assessed in the Environmental Statement.

Other Sources of Flooding

14.3.73 There are no canals within the study area. The closest canal is the Manchester and Bury Canal located over 3km west of the Proposed Scheme to the west of the River Irwell. Therefore, canal flood risk is scoped out of the assessment.

14.3.74 A review of the Environment Agency Flood Map for Planning (Environment Agency, 2021) reveals that there are no areas benefiting from flood defences within the study area. Liaison will be undertaken with the LLFA to determine if there are any other flood defences in the study area.

Historical flood events

14.3.75 The Environment Agency's Historic Flood Map (Environment Agency, 2021) identifies the maximum extent of recorded flood outlines from the rivers, sea and groundwater springs. A review of the map indicates there are no areas of historical flooding identified within the 1km study area.

Future baseline

Surface water

14.3.76 The future baseline conditions for water quality could change as a consequence of land use changes and measures to improve water bodies in line with Water Environment Regulations 2017 objectives. It is anticipated that in the future the baseline water quality will generally improve over time.

Groundwater

14.3.77 Impacts on groundwater resources and associated receptors that could significantly change the groundwater baseline over the anticipated lifetime of the Proposed Scheme have not yet been assessed. This includes, for example, those impacts that could arise from external third-party projects. The cumulative effects assessment will be carried out in the Environmental Statement.

14.3.78 In general, any new dewatering activities have the potential to reduce groundwater levels in the study area. Conversely, if existing dewatering regimes or abstractions cease, then groundwater levels may rise.

14.3.79 Over the medium term and long term, groundwater resources in the study area may be affected by climate change. However, any changes would be complex and may result in:

- a long-term decline in groundwater storage due to higher soil moisture deficits due to warmer, drier summers
- increased frequency and severity of groundwater droughts leading to reduction in base flow to watercourses or GWDTEs
- increased groundwater flooding from high intensity summer storms

14.3.80 Baseline conditions for water quality could change over the anticipated lifetime of the Proposed Scheme, as a consequence of land use changes and measures to improve water bodies in line with WER objectives. It is likely that groundwater quality would generally improve, as historical pollution sources are removed, and better water quality management measures are put into place.

14.3.81 However, based on currently available information, there is unlikely to be a significant change in the baseline groundwater quality. Changes to the groundwater regime brought about by climate change are unlikely to affect groundwater quality (for example, increases in saline groundwaters would not be anticipated, see paragraph 14.3.50).

Flood risk

14.3.82 Over the anticipated lifetime of the Proposed Scheme (100 years) changes to the baseline as a consequence of climate change would likely occur, including a likely increase in the frequency and magnitude of flood events.

14.3.83 Future baseline accounting for climate change will be assessed in line with the latest Environment Agency guidance for increases in fluvial flows and rainfall intensity (Environment Agency, 2020).

Value of receptors

14.3.84 DMRB LA 113 section 3 (Highways England, 2020) will be the methodology used for the environmental assessment process. Further information on this methodology is provided below and in Appendix B. The approach to the assessment is based on the value/importance of the water features. In terms of hydromorphology and groundwater, each receptor has been assigned a sensitivity, which is detailed in Table 14.8. The sensitivity is subject to change with more detailed assessment.

14.3.85 The value of receptors within the study area and scoped into further assessment have been identified based upon the baseline data presented above. The value / importance of these water receptors has been based on criteria set out in Table 3.70 in DMRB LA 113 (see Appendix B).

14.3.86 It is not considered appropriate at this stage to identify each of the numerous un-named watercourses within the total 1km study area as individual receptors, unless directly affected by the Proposed Scheme. These unaffected watercourses have been scoped out and have not been assigned a value/importance (Table 14.1). Those un-named

watercourses scoped in have been given names and numbers for the purposes of this assessment as listed in Table 14.1 and are included in Table 14.8.

14.3.87 At this stage, individual ponds have also not been identified within the 1km study area as the majority will not be affected and can be scoped out. Where ponds will be affected (i.e. at Pike Fold Golf Course) these have been identified in the baseline section and listed in Table 14.1 and are included in the general "ponds" category in Table 14.8 below. These will all be individually identified as receptors at the Environmental Statement stage. Based upon the criteria for establishing importance in DMRB LA 113 the ponds identified have all been assigned the same level of importance.

14.3.88 Ponds and un-named watercourses are unlikely to be more than low importance. However, a precautionary approach has been taken and therefore a medium value has been assigned to all but hydromorphology. Receptors and attribute importance will be reconfirmed during the assessment process reported in the Environmental Statement.

Table 14.8: Value of receptors in the study area for road drainage and the water environment

Value/ sensitivity	RDWE matter	Typical examples (based upon Table 3.70 in LA 113)	Receptors within the study area
Very high	Surface water quality	Watercourse having a WER classification shown in the River Basin Management Plan (RBMP) and a Q95≥1.0m^3/s.	River Irwell River Roch
	Hydromorphology	A watercourse that appears to be in complete natural equilibrium and exhibits a natural range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, free from any modification or anthropogenic influence.	No receptors of this value within the study area.
	Groundwater	Principal aquifer providing a valuable resource because of its high quality and yield, or extensive exploitation for public and/or agricultural and/or industrial supply.	Chester Formation/Collyhurst Sandstone Formation.
		Internationally designated sites of nature conservation dependent on groundwater.	No receptors of this type within the study area (study area of 250m).
		SPZ1.	No receptors of this type within the study area (2km).
		World Heritage Sites. Nationally important infrastructure and buildings.	To be confirmed at the Environmental Statement stage.
	Flood risk	Essential infrastructure or highly vulnerable development.	M62, M60, A56, A665 and Middleton Road. Metrolink.
High	Surface water quality	Watercourse having a WER classification shown in RBMP and a Q95<1.0m^3/s.	Whittle Brook and River Irk

Value/ sensitivity	RDWE matter	Typical examples (based upon Table 3.70 in LA 113)	Receptors within the study area
	Hydromorphology	A watercourse that appears to be in natural equilibrium and exhibits a natural range of morphological features (such as pools and riffles). There is a diverse range of fluvial processes present, with very limited signs of modification or other anthropogenic influences.	No receptors of this value within the study area.
	Groundwater	Principal or secondary A aquifer providing locally important resource or supporting a river ecosystem.	Coal Measures, Rossendale Formation, river terrace deposits, alluvium, glaciofluvial/glaciofluvial ice contact deposits.
		Licensed non-potable abstractions and unlicensed potable abstractions.	To be confirmed following receipt of data from the Environment Agency and local authority.
		Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with high or moderate groundwater dependency.	Groundwater supporting Hazlitt Wood SBI, Hollins Vale LNR, SBI, and Hollins Plantation SBI, Philips Park and North Wood LNR and SBI, Lowland fen HPI in Pike Fold Golf Club.
		SPZ2.	No receptors of this type within the study area (2km).
		Grade I and II* listed buildings. Regionally important infrastructure and buildings.	To be confirmed at the Environmental Statement stage.
	Flood risk	More vulnerable development.	Residential properties within the study area for example in Sunny Bank and Whitefield in close proximity to Parr Brook and the River Roch.
Medium	Surface water quality	Watercourse not having a WER classification shown in RBMP and a Q95>0.001m^3/s.	Bradley Brook, Castle Brook, Hollins Brook, Parr Brook, Brightly Brook, Heaton Park Reservoir, Tributary of Bradley Brook. Ponds (based upon precautionary approach)
	Hydromorphology	A watercourse showing signs of modification, recovering to a natural equilibrium, and exhibiting a limited range of morphological features (such as pools and riffles). The watercourse is one with a limited range of fluvial processes and is affected by modification or other anthropogenic influences.	Whittle Brook, Hollins Brook, Castle Brook
	Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water.	Manchester Marls Formation, glacial till (diamicton), hummocky (moundy) glacial deposits, head.

Value/ sensitivity	RDWE matter	Typical examples (based upon Table 3.70 in LA 113)	Receptors within the study area
		Unlicensed non-potable groundwater abstractions.	To be identified via data request to the local authority.
		Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with low groundwater dependency, or groundwater supporting a non-designated site (including HPI) with a moderate or high groundwater dependency.	Groundwater supporting parts of Hazlitt Wood SBI, Hollins Vale LNR, SBI, and Hollins Plantation SBI, and groundwater supporting Philips Park and North Wood LNR and SBI, Lowland fen HPI in Pike Fold Golf Club.
		SPZ3.	No receptors of this type within the study area (2km).
		Grade II listed buildings. Locally important infrastructure and buildings.	To be confirmed at the Environmental Statement stage.
	Flood risk	Less vulnerable development.	Commercial and recreational properties within the study area – for example Heaton park BT Tower (historical landmark)
Low	Surface water quality	Watercourse not having a WER classification shown in RBMP and a Q95≤0.001m^3/s.	Although there are receptors that match this description, a precautionary approach has been taken and a medium classification assigned (see above).
	Hydromorphology	A highly modified watercourse that has been changed by channel modification or other anthropogenic pressures. The watercourse exhibits no morphological diversity and has a uniform channel, showing no evidence of active fluvial processes and not likely to be affected by modification.	Bradley Brook, Tributary of Bradley Brook 1, Parr Brook, Brightley Brook, Castle Brook Tributary, Tributary of Castle Brook Tributary, Unnamed Watercourse, Tributary of Unnamed Watercourse, Blackfish, Heaton Park Reservoir
	Groundwater	Unproductive strata.	Peat, glaciolacustrine deposits.
		Groundwater supporting a non-designated site (including HPI) with low groundwater dependency.	No receptors of this type identified at this stage within the study area (250m).
		Undesignated historic buildings.	To be confirmed at the Environmental Statement stage.
	Flood risk	Water compatible development.	Pike Fold Golf Club

14.4 Potential impacts

14.4.1 Potential impacts on the water environment could arise from a number of direct and indirect sources during the construction and operational phases. This section summarises the potential effects associated with the Proposed Scheme. At this stage, due to the level of information, it is not possible to define specific magnitude of impact values for the

activities and each receptor. These will be further developed in detail as part of the environmental assessment.

Construction

Surface water quality

14.4.2 During construction, there are generally two sources of pollutants; sediments and the use of potentially polluting substances. There would be an increased pollution risk from sediments being mobilised in runoff which could reach watercourses via the drainage network and impact water quality. This could occur during earthworks (i.e. regrading and construction of new embankments), and the movement of heavy plant, and due to runoff from stockpiles. There is high likelihood of silt being generated from construction activities which would be greater after rainfall events.

14.4.3 During construction, there is a risk of pollution to surface waters from activities involving polluting substances such as fuels, concrete, and other chemicals. There is also a risk of accidental spillages.

14.4.4 The risks of pollution are greater where works occur within or immediately adjacent to a watercourse, such as during the construction or modifications of outfall structures and culverts. There is potential for construction work to take place on outfalls (shown on Figure 14.2) by Whitefield Interchange along the M60 (approximately 300m east of M60 J17) and Castle Road along the M66 (approximately 1.7km north of M60 J18). There is also a higher risk where works would take place close to existing gullies or drains forming part of the existing highways drainage network, creating a pathway for pollutants to reach the watercourses.

Hydromorphology

14.4.5 The greatest risks to hydromorphology are likely to occur during the construction phase. Potential impacts to the hydromorphology of each watercourse within the study area could include:

- Potential increase in fine-sediment delivery due to runoff from construction activities, bare earth surfaces and following site clearance. Additional sediment delivery could smother the channel's bed and alter morphological features.
- Potential increase in impermeable area (hardstanding, compacted soil) during construction which could alter drainage to the channels increasing overland flow and fine sediment delivery.
- Potential clearance of riparian vegetation increasing fine sediment delivery and destabilising the banks.
- Potential in-channel works damaging morphological features of the watercourse. This would potentially directly impact on the hydromorphology of the watercourse, removing sensitive features such as natural bed and banks (leading to altered channel dimensions), altering longitudinal and lateral connectivity.
- Potential for temporarily altering existing drainage channels and hydrological connectivity within the catchment affecting hydromorphological processes in downstream receptors e.g. altered flow velocities, altered discharge and sediment volumes.

- Potential dewatering activities to enable construction would reduce groundwater levels and could reduce the baseflow of watercourses.
- Potential discharge of dewatered groundwater to watercourses.
- Potential bankside working increasing bank erosion and fine sediment delivery and risk of failure altering channel morphology and hydromorphological processes.

14.4.6 These impacts, however, would be dependent on the proximity of the construction phase activities to the watercourses and would likely be mitigated through design interventions, therefore impacts are unlikely to be significant.

Groundwater

14.4.7 During construction it is considered likely that potential impacts to groundwater features (including superficial and bedrock aquifers, and associated groundwater receptors, such as licensed abstractions, PWSs, GWDTEs etc,) could arise from the following:

- Increased pollution risks, including the accidental spillage of fuels, lubricants, cements, hydraulic fluids or other harmful substances, which may be stored on site during the construction phase, and which could migrate into groundwater bodies.
- Physical contamination of groundwater from ground disturbance such as soil stripping, construction of cuttings, and foundations for embankments (if they need to reach bedrock and penetrate the full thickness of the superficial deposits), bridge abutments/gantries, other excavations required (for attenuation ponds for example), and piling, leading to the potential for increased sediment in aquifers reaching groundwater features. The pollution risk to groundwater bodies, from the disturbance of contaminated ground specifically, is covered in Chapter 10: Geology and Soils.
- Local groundwater drawdown as a result of temporary de-watering. This may be required to construct any sub-surface structures, such as cuttings, foundations, borrow pits, and other excavations required, that intercept the groundwater table. Drawdown impacts on groundwater levels, flows, and quality may be experienced in areas outside of the works area. Discharges from dewatering may also impact on receiving surface water or groundwater.
- The construction of cuttings, foundations, and piling activities could create vertical pathways for contaminated groundwater to migrate between aquifers. Even if groundwater is not contaminated, there is potential for mixing of different groundwater chemistries, which could be significant for WER groundwater body status, as well as for sensitive groundwater receptors, including groundwater abstractions and GWDTEs. Of particular importance is the potential for these works to intercept coal workings and mobilise mine water in the west of the Proposed Scheme, which would have resulting impacts on groundwater flows, levels, and quality.
- Impedance of groundwater flow from temporary below ground structures, and the potential corresponding impact on groundwater levels and/or quality.
- Buildings have the potential to be affected by dewatering which may cause localised subsidence. The cultural heritage chapter (Chapter 7) identifies listed buildings in the vicinity the Proposed Scheme. Other buildings of regional and local importance are identified in the population and health chapter (Chapter 13).
- Interception of overland flows through the introduction of impervious structures or compaction of soils, and the movement and storage of earth materials within the

study area, potentially disrupting local groundwater recharge. The working area for construction is likely to be relatively small in comparison to the scale of the majority of aquifer(s) being crossed. Any effects, if they were to occur, would therefore likely be negligible, and as such, this effect is scoped out of the groundwater assessment, except for where sensitive groundwater receptors are present, such as GWDTEs.

Flood risk

14.4.8 Temporary works located within or adjacent to watercourses could affect the frequency, depth, extent and duration of fluvial flooding. At present it is not anticipated that works will take place within the floodplains of Main Rivers, however there is a floodplain associated with all watercourses including minor watercourses and ditches. Construction activities taking place in floodplains have the potential to create a loss of floodplain storage. Alterations to culverts and other structures conveying water could also result in a temporary loss of capacity. This has the potential to increase flood risk to receptors up or downstream.

14.4.9 Surface-water flow paths could be altered due to construction activities or haul roads blocking existing flow paths or creating new flow paths. Alterations to culverts and other structures conveying water could result in a temporary loss of capacity, and the potential blocking of drainage systems with construction debris could result in overflowing drains. These potential impacts could result in an increased surface water flood risk.

14.4.10 The temporary increase in impermeable surfaces due to haul routes and construction compounds could lead to increased runoff volumes and velocities, as opportunity for infiltration to groundwater could be reduced. This could lead to an increase in the risk of flooding downstream.

14.4.11 Temporary drainage could increase both the rate and volume of surface water runoff to a receiving watercourse and has the potential to transfer sediment to the receiving watercourse (potentially affecting flooding mechanisms).

14.4.12 Activities that could cause changes to groundwater flood risk, and its contribution to other flood sources and mechanisms, due to groundwater levels and flows being altered are as follows:

- Temporary dewatering activities (for cuttings, and/or excavations required for embankment foundations, borrow pits, bridge abutments etc.), drawing down the level of the groundwater table and temporarily reducing groundwater flood risk.
- The release of artesian groundwater pressures within bedrock aquifers and/or mine groundwater stored in mine workings/adits.
- The potential discharge to ground (depending on GI results and the preferred drainage strategy) of dewatered groundwater could cause local groundwater levels to rise.
- Impedance of groundwater flow from temporary below ground structures, which could cause groundwater levels to rise on the upgradient side and fall on the downgradient site (i.e. resulting in an increase and decrease in groundwater flood risk, respectively).

Operation

Surface water quality

14.4.13 There are two main types of pollution from roads during the operational phase: road runoff and accidental spillage risk. The main contaminants from road runoff include:

- Fuel and other oil deposits on the road surface due to leakage
- Hydrocarbons from exhaust deposits
- Lead, copper, zinc, iron and cadmium deposits from exhaust emissions, brake dust and tyre wear
- Synthetic rubber deposits from tyre wear
- Chemicals used in windscreen washes such as detergents or de-icer
- De-icing agents such as road salt, but also potentially including trace amounts of impurities such as cyanide, metals and clays

14.4.14 These pollutants, when combined with rainfall, can run off into the highway drainage system and have an adverse effect on the receiving watercourses. Contaminants deposited on the road surface are quickly washed off during rainfall. Where traffic levels are high, the level of contamination increases and therefore, the potential for unacceptable harm being caused to the receiving water also increases. The potential impact of pollutants on the ecology of surface waters is also dependent on the characteristics of the receiving waters, particularly its water quality, hardness, flow rate and flow velocity.

14.4.15 A change in the risk will depend upon whether traffic volumes or impermeable areas are increased as a result of the Proposed Scheme. Any increases may result in a potential adverse impact on the water quality of any receiving watercourse. For WER-classified waterbodies, discharges from roads must not lead to a deterioration in the classification status of the receiving surface water body as determined in the relevant River Basin Management Plan. This will be assessed in the Preliminary WER Assessment in support of the Environmental Statement.

14.4.16 During operation, there is a risk that polluting materials may be accidentally spilt onto the road surface as a result of a road accident. The aim of the Proposed Scheme, as well as reducing congestion and improving journey time reliability, is to reduce the number of accidents. This would result in a beneficial impact as the likelihood of spillages occurring would be reduced.

14.4.17 Data relating to abstraction licences and environmental permits for water discharge activities have not been obtained at this scoping stage nor the 2017 data reconfirmed and any impacts will be assessed at the Environmental Statement stage once data is obtained. Impacts are not anticipated to be significant due to a lack of larger watercourses within the study area which could support major abstractions.

Hydromorphology

14.4.18 Potential impacts to hydromorphology during operation include:

- Impacts resulting from culverting works on a watercourse.

- Impacts resulting from modifications to existing outfall structures, new outfall structures if required and discharge from outfalls to a watercourse.
- Impacts resulting from the bridging of a watercourse if required.
- Impacts resulting from earthworks.
- Impacts resulting from drainage channels.
- Impacts resulting from new impermeable surfaces.
- Impacts resulting from realignment of watercourses.

14.4.19 These impacts are likely to be localised to the Proposed Scheme, whilst significant effects would be mitigated through design interventions during the detailed design stage.

Groundwater

14.4.20 During operation, it is considered likely that potential impacts to groundwater features could arise from the following:

- Increased pollution risks from routine runoff during the operational life of the Proposed Scheme if drainage is discharged to the ground or groundwater. Potential substances would primarily consist of silts, hydrocarbons and dissolved heavy metals, which may migrate to groundwater bodies. Notably, drainage features such as soakaways installed and operating in or near designated areas, or licensed and unlicensed groundwater abstractions and GWDTEs.
- Increased pollution risks from accidental spillages of fuels and chemicals during the operational phase, for example due to road traffic accidents. However, as noted above (paragraph 14.4.16), the aim of the Proposed Scheme, as well as reducing congestion and improving journey time reliability, is to reduce the number of accidents. This should result in a lower likelihood of spillages occurring, but the magnitude of change in groundwater quality could be important for sensitive groundwater receptors, such as groundwater abstractions and GWDTEs.
- There is potential for the embankments proposed to result in groundwater stored in pore spaces in the superficial deposits (where present), to be squeezed out, causing the ground beneath the embankment to compress. Groundwater levels, flows, and quality in the superficial deposits, both underneath the embankment, and in its vicinity, could therefore be altered (which is of particular importance for groundwater abstractions and GWDTEs).
- Changes to groundwater levels, flows and quality, due to the presence of permanent below ground structures, such as foundations for bridge abutments and sheet piles, resulting in barriers to sub-surface flows, and/or providing new pathways for groundwater migration. This could lead to subsequent changes to groundwater levels, flows, quality, and locations of discharge points, for example to GWDTEs.
- Potential ongoing de-watering effects from cuttings may cause the groundwater table to fall, impacting on GWDTEs, surface water flows and water users. Where cuttings are proposed, additional assessment of the long-term dewatering requirements will be needed.
- Permanent reduction in recharge rates due to the increased surface area of impermeable ground. However, the increased area of impervious surfaces is likely to be relatively small in comparison to the scale of most aquifer(s) being crossed. Any effects, if they were to occur, would therefore be likely to be negligible, and as such,

this effect is scoped out of the groundwater assessment, except for where sensitive groundwater receptors are present, such as GWDTEs.

Flood risk

14.4.21 The addition of new (or modification of existing) culverts and associated infrastructure, the interception of overland flows, and the realignment of watercourses, could potentially disrupt local flow routes and result in an increase in flood risk.

14.4.22 Significant cuttings may result in long term discharges of dewatered groundwater to watercourses.

14.4.23 Discharges of groundwater or mine water due to dewatering or the change in direction or magnitude of flow could have possible flooding consequences, depending on the volume of change over time.

14.4.24 Roads are designed to drain freely in order to prevent a build-up of standing water on the carriageway, whilst avoiding exposure to, or causing, flooding. A permanent increase in impermeable area could result in an increased amount of runoff volume and the rate of discharge from the road surface, and a subsequent increase in flood risk elsewhere.

14.4.25 Long-term changes to groundwater flood risk, and its contribution to other flood sources and mechanisms, due to groundwater levels and flows being altered are as follows:

- Permanent below ground structures, which could provide a barrier to groundwater flow. This could cause groundwater levels to rise on the up-gradient side, and fall on the down-gradient side (resulting in an increase and decrease in localised groundwater flood risk, respectively)
- Groundwater stored in pore spaces in the made ground and/or superficial deposits, being squeezed out due to loading effects, as the ground beneath an embankment compresses. This would lead to localised increases in groundwater levels and flood risk adjacent to the proposed structure
- Potential long-term dewatering requirements, which would permanently lower level of the water table and decrease groundwater flood risk.

Summary of scope

14.4.26 Table 14.9 summarises the proposed scope of the assessment for road drainage and the water environment.

Table 14.9: Summary of road drainage and the water environment scope

Matter	Scoped in - construction	Scoped in - operation
Surface water quality	✓	✓
Water Resources	✓	✓
Hydromorphology	✓	✓
Groundwater	✓	✓
Flood risk	✓	✓

14.5 Design, mitigation and enhancement measures

14.5.1 Mitigation measures will be incorporated into the design and assessment using a hierarchical approach, in accordance with section 3.2.3 of DMRB LA 104: Environmental Assessment and Monitoring (Highways England, August 2020) and section 3 of DMRB LA 113. The drainage design at PCF Stage 2 included for an attenuation pond for drainage network 1 which discharges into the Tributary of Castle Brook (Golf Course) via Outfall 1. The pond would be located in the field north west of M60 J18. No other specific design or mitigation measures have been identified at this stage. A number of standard mitigation measures could be incorporated within the design of the options to limit their impacts at source wherever possible. The avoidance of impacts will be considered as the design progresses, however at this time avoidance is considered to be limited as the majority of the scheme is connected to the existing highway. The design will also seek methods to reduce impacts such as through the siting of scheme elements and these will be outlined in the Environmental Statement. Enhancements will also be considered as the design progresses and these will be based around incorporating green solutions, soft engineering approaches and following best design approaches where appropriate. Opportunities to improve watercourses will also be identified.

14.5.2 The Proposed Scheme would alter the runoff volume and the rate of discharge from the road surface as a result of an increase in impermeable area. Attenuation will be required to be incorporated into the design in line with current Government guidance and Highways England standards. The greater the impermeable area the greater the attenuation required.

14.5.3 Consultation will be undertaken with the Environment Agency, LLFA, statutory bodies and local flood risk management authorities in order to identify the most appropriate drainage strategy for the Proposed Scheme. Controlled discharge to ground using infiltration techniques would be the preferred option (subject to the outcome of the GI). If discharge to the ground is not possible then controlled discharge to ordinary watercourses and surface water bodies or to existing drainage infrastructure (highways drainage or public sewers) will be investigated. This will need to be confirmed once the outcome of the GI results and feasibility of using infiltration techniques are known and the drainage strategy has been developed, along with details including the discharge rates and any associated attenuation.

Construction

14.5.4 Mitigation during construction would be managed through the implementation of an Environmental Management Plan (EMP). The EMP will be prepared in alignment with DMRB LA 120: Environmental Management Plans (Highways England, March 2020) and include best practice measures to limit the risk of pollutants entering surface water features. The EMP will detail the procedures and methods that should be followed to minimise the potential environmental effects of construction activities.

Surface water quality

14.5.5 Potential mitigation measures that could be applied to surface water quality are as follows:

- Pollution prevention guidelines and best practice guidance produced by CIRIA for the protection of watercourses would be outlined in an EMP to mitigate changes in contaminant pathways.

- Production of a Water Management Plan to form part of the EMP.
- Production of an Emergency Pollution Response Plan to form part of the EMP.

Hydromorphology

14.5.6 Mitigation measures, which could be implemented to avoid, prevent and reduce possible impacts upon hydromorphology during the construction phase of the Proposed Scheme, are provided below:

- Drainage and sediment management to control the quantity and quality of runoff from construction areas
- Limiting the amount of vegetation clearance along the riparian corridor and floodplain
- Attenuating discharge arising from construction drainage and aligning outfalls downstream
- Culverts for temporary haul roads and access tracks would be kept to minimal length and tied into the bed and banks to prevent bank instability (e.g. respectively submerging the culvert beneath the bed substrate to prevent knickpoints and bed destabilisation up and downstream of the culvert connection, and align wingwalls with the banks to prevent outflanking)
- Preventing knickpoints from forming in the channel as a result of culvert crossings, and reinstate natural bed substrate material following the removal of culverts

Groundwater

14.5.7 Best-practice recommendations for the prevention of contamination will be detailed in an EMP and agreed with relevant statutory consultees prior to commencement of construction works. This will include measures to comply with relevant legislation, standards, guidance and best practice measures and in line with CIRIA guidance including that in CIRIA document C532 Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (CIRIA, 2001).

14.5.8 If piling is required for the construction of any structures, such as bridge abutments, then a piling risk assessment in line with Environment Agency guidance (Environment Agency, 2006) may be required. This would be of most relevance for areas of piling where contaminated land is identified. Other below-ground works would be considered, and risk assessed in a similar way.

14.5.9 If temporary de-watering is required in order for construction activities to take place, such as for cuttings, embankment/bridge foundations, or borrow pits, a dewatering risk assessment would be performed, for example by following the hydrogeological impact appraisal for dewatering abstractions (Environment Agency, 2007). If the hydrogeological impact appraisal suggests significant impacts could be experienced away from the site area being de-watered, then temporary mitigation could be required. During construction, several actions can be taken to mitigate the potential impacts to groundwater users and sensitive groundwater receptors. These measures could include, but are not limited to, the following:

- Lowering of groundwater abstraction pumps below the temporary revised groundwater table
- Re-drilling of water well(s) where water user abstraction wells are not deep enough to accommodate pump lowering

- Water recycling practices whereby dewatered groundwater is recycled into the aquifer, maintaining groundwater contributions to groundwater users, protecting springs, seeps, issues, sinks, sources etc. and maintaining baseflow contributions to watercourses. Consideration would need to be given to the mixing of water chemistries between different groundwater/surface water bodies, including between different WER water bodies
- The provision of alternative water supplies during construction (for example from a road tanker)

Flood risk

14.5.10 To mitigate potential impacts, it is proposed that construction works within the floodplain will be reduced as far as reasonably practicable and temporary mitigation measures and emergency response measures put in place for any such works that are required. The alterations to the existing bridge structures will be designed so as to maintain existing channel capacity wherever practicable.

14.5.11 Construction areas and temporary compounds would be designed to avoid impacts on flow paths.

14.5.12 Temporary culverts and other drainage channels would be designed to mimic existing conveyance to prevent impacts upstream and downstream.

14.5.13 Temporary drainage and attenuation would be designed to accommodate any temporary increases in volumes of runoff due to increased impermeable area for haul roads and compounds.

14.5.14 Site-specific groundwater level monitoring data will be used to identify design requirements that may be needed to minimise groundwater flood risk, both to and from the proposed scheme. Additional ways of reducing potential increases in groundwater flood risk may also be captured in the piling and dewatering risk assessments (where required).

Operation

Surface water quality

14.5.15 At present specific mitigation for water quality has not been committed to but the outline drainage design proposes the use of an attenuation pond for the discharge from Outfall 1, located adjacent to M60 J18 by Egypt Lane discharging into a tributary of Castle Brook, which would also provide water quality benefits.

14.5.16 During PCF Stage 2, the extent and nature of mitigation required for water quality impacts was assessed for Outfalls 1, 3 and 6 as discussed in paragraphs 14.3.17 to 14.3.21. For Outfall 1, it was suggested the attenuation pond included in the drainage design at PCF Stage 2 would not be sufficient and additional mitigation may be required. For Outfall 3, the provision of grassed channels or swales would be sufficient. For Outfall 6, it is likely that more than one treatment component would be required, with the creation of ponds, wetlands or swales as the preferred options. However, feasibility has not been considered in terms of cost, land take, utilities and maintenance. Therefore, these mitigation options will be explored further as the design develops and once the drainage surveys confirm drainage catchments. It is likely, depending upon confirmation of catchment areas, that a detailed assessment of water quality impacts will be undertaken using the Metal -

Bioavailability Assessment Tool (M-BAT) supported by water quality sampling that was undertaken for the water quality assessments at PCF Stage 2. This would inform mitigation requirements and will be reported in the Environmental Statement.

Hydromorphology

14.5.17 For all aspects of hydromorphology, following best practice and CIRIA guidance is required with specific regard to culvert and outfall design standards (CIRIA C786).

Groundwater

14.5.18 If drainage systems that discharge to ground are proposed during the operation of the Proposed Scheme (subject to outcome of GI results and feasibility of using infiltration techniques), groundwater level information will be used to inform drainage design as high groundwater levels could undermine the performance of drainage features, or discharges could lead to increased risk from groundwater flooding.

14.5.19 While controlled discharge of runoff from the Proposed Scheme to ground would be preferred (subject to the outcome of the GI), re-use of existing infrastructure and groundwater pollution risk control mean it is likely that discharge will be to surface waters, although this is not confirmed. If this were to be the case, significant impacts from road drainage on the groundwater environment would be reduced. However, under low flow conditions there is potential for road drainage to seep from the stream beds to ground and groundwater. An appropriate groundwater risk assessment (in accordance with DMRB LA 113) will inform mitigation to be incorporated into the drainage design where appropriate.

14.5.20 Winter hydrometric monitoring data may be obtained (where possible), notably if features that use infiltration techniques such as soakaways or infiltration ponds are likely to be installed within the study area, and within/adjacent to sensitive groundwater receptors. Winter monitoring data would be used (where available) to determine the unsaturated zone thickness between the base of such features and highest groundwater levels. Groundwater monitoring commitments are currently being confirmed as part of the GI scope.

14.5.21 The collection of site-specific groundwater level monitoring data would determine if the Proposed Scheme would permanently or seasonally intercept groundwater. If the base of any proposed cuttings, or excavations intercepted groundwater, then permanent passive or active groundwater management measures would be required. These measures could include, but not be limited to, the installation of perimeter drains and dewatering pumping wells.

14.5.22 If groundwater controls were to be required for excavations likely to be below the level of the water table, there is the possibility that local groundwater receptors could be impacted. If impacts were determined to be significant, then mitigation measures could include, but not be limited to, the following:

- Lowering of groundwater abstraction pumps below the revised groundwater table.
- Re-drilling of water well(s) where water user abstraction wells are not deep enough to accommodate pump lowering.
- Water recycling practices whereby dewatered groundwater is recycled into the aquifer, maintaining groundwater contributions to groundwater users or features such as GWDTEs.

Flood risk

14.5.23 A drainage design will be developed for the Proposed Scheme, with an allowance for climate change. Discharge to ground (subject to outcome of GI results and feasibility of using infiltration techniques) will be considered as mitigation for a permanent increase in discharge rate and volume of surface water runoff caused by an increase in impermeable areas. Where this is not possible, road runoff would be attenuated using a combination of techniques including, but not limited to, attenuation ponds and oversized pipes. The collection of site-specific groundwater level monitoring data would also be used to determine if the Proposed Scheme would permanently, or seasonally, alter existing groundwater flood risk.

14.6 Description of the likely significant effects

Construction

14.6.1 For the most part, the implementation of a robust EMP will be sufficient to mitigate potential risks to a residual negligible or neutral effect during construction. Only when works are immediately adjacent to or within a watercourse will a potential residual risk be likely to remain.

Surface water quality

14.6.2 The Water Quality Study Report produced during PCF Stage 2 identified significant water quality failures related to the existing situation. These have the potential to be exacerbated by the Proposed Scheme. Without mitigation, significant effects would be likely to occur upon some of the watercourses which receive runoff from the road network which could lead to impacts upon water quality and flows. At this time the feasibility of mitigation to ensure that the requirements of the Environmental Quality Standards (EQS) and DMRB standards can be achieved is unknown and uncertain. However, it should be noted the M-BAT assessments, to be undertaken at PCF Stage 3, may not produce the same level of EQS failures as those reported at PCF Stage 2.

Hydromorphology

14.6.3 Significant impacts (either direct or residual) would be unlikely following the implementation of mitigation measures. Potential for any significant effects from the Proposed Scheme will be identified in further stages of the assessment and mitigation measures designed as required.

Groundwater

14.6.4 Given the sensitivity and importance of the environmental attributes in the study area, including potential GWDTEs, the potential impacts from changes to groundwater, levels, flows, quality and pollution from accidental spillages and routine runoff are all considered to be potentially significant if appropriate and adequate mitigation (as outlined in Section 14.5) is not implemented during both the construction and operational phases. However, it is anticipated that with mitigation measures in place the Proposed Scheme would not have a significant residual effect on the groundwater environment.

Flood risk

14.6.5 Mitigation will be incorporated to comply national planning policy (NPPF) and DMRB standards which would result in no significant effects. The nature and extent of mitigation required will be determined through the FRA and drainage strategy completed as part of the Environmental Statement.

Scoping questions

14.6.6 DMRB LA 113 (paragraph 3.2.1) confirms that ten scoping questions (that are not exhaustive) should be answered in order to gain an understanding of the need to undertake further assessment for the Road drainage and water aspect. Where the response to one or more of these questions is 'yes', then further assessment should be undertaken.

14.6.7 The responses to the scoping assessment questions for the Proposed Scheme are provided in Table 14.10, based on the application of organisational experience to the current design information.

Table 14.10: DMRB LA 113 Scoping questions and responses

Scoping questions	Response	Scoped in/out
1) does the project have the potential to affect an existing watercourse in terms of water quality, hydromorphology or water quantity?	Yes	Scoped in
2) does the project have the potential to affect a floodplain?	No	Scoped out
3) does the project have the potential to cross an existing watercourse where upstream flooding is an existing problem or where there has been significant development in the upstream catchment since the crossing was built?	No	Scoped out
4) does the project have the potential to change either the road drainage or natural land drainage catchments?	Yes	Scoped in
5) does the project have the potential to lead to an increase in traffic flow of more than 20%?	Uncertain	Scoped in
6) does the project have the potential to change the number or type of junctions?	Yes	Scoped in
7) is any of the project located within flood zone 2, flood zone 3 or a source protection zone?	No	Scoped out
8) can earthworks result in sediment being carried to watercourses?	Yes	Scoped in
9) can earthworks alter the groundwater flow regime?	Yes	Scoped in
10) does the project have the potential to allow drainage discharges to the ground	Yes	Scoped in

14.6.8 Having answered ‘yes’ or ‘uncertain’ to one or more of the DMRB LA 113 scoping questions for Road drainage and water, it is recommended that this aspect is scoped into the EIA.

14.7 Assessment methodology

14.7.1 Initial discussions have been held with the Environment Agency and Bury Council in January 2021 regarding the Northern Gateway Development and its interaction with the Proposed Scheme. Further consultation will be required to agree any parameters associated with the proposed assessment methodologies where appropriate.

14.7.2 DMRB standard LA 113 provides the methodologies for the assessment and management of the impacts that new construction, improvement, technology and maintenance projects may have on the water environment. The assessment criteria for assessing the value of water environment receptors and the magnitude of impacts are included in Appendix B. The significance of effects will be assessed in line with section 3.8 of DMRB LA 104 (see Chapter 5).

Surface water quality

14.7.3 The DMRB standard LA 113 contains a Simple level assessment methodology for assessing the effects of routine runoff on surface waters and pollution impacts from spillages. A simple level assessment for routine runoff to surface waters was undertaken at PCF Stage 2, the qualitative assessment in the PCF Stage 2 Environmental Assessment Report (EAR) (CH2M, 2019) was based upon DMRB HD45/09 (now superseded by LA 113) and the Water Quality Study at the end of PCF Stage 2 was based upon DMRB LA 113. DMRB LA 113 also provides a detailed level assessment methodology which if deemed appropriate will be undertaken and reported in the Environmental Statement. This will depend upon the results of the drainage survey, the drainage design and the scope of the Proposed Scheme in terms of requirements to mitigate for the existing situation. At present it is anticipated that a detailed level assessment will be appropriate for Outfall 6. This will be supported by water quality sampling were data does not already exist.

14.7.4 At present discharges to ground are not proposed, however some watercourses have low flow rates and may act as soakaways. Where appropriate these will be assessed for impacts to groundwater and reported in the Environmental Statement.

14.7.5 A simple level assessment for spillage risk to surface and groundwaters will be undertaken and reported in the Environmental Statement.

14.7.6 The assessment of the impact of the Proposed Scheme on surface water quality at outfalls will follow the Highways England Water Risk Assessment Tool (HEWRAT) methodology. Where a detailed assessment is required for routine runoff the Metal-Bioavailability Assessment Tool (M-BAT) developed by the Water Framework Directive Technical Advisory Group (WFD-TAG) will be used in accordance with DMRB LA 113.

Hydromorphology

14.7.7 Additional guidance to be used for the assessment for hydromorphology includes:

- C786 Culvert Design and Operation Guide (CIRIA, 2019)
- C753 SuDS Manual (CIRIA, 2015)
- C763 River Weirs Guide (CIRIA, 2016)
- Scottish Environment Protection Agency (SEPA) Good Practice Guide: Outfall and Intake (SEPA, 2019)
- SEPA Good practice guide: River crossings (SEPA, 2010)

14.7.8 A hydromorphology assessment will be carried out, which will include a desk-based study using the sources outlined in Section 14.3 and a field survey to support the desk-study.

14.7.9 A preliminary WER assessment will be undertaken in parallel to the hydromorphology assessment. This will determine whether a detailed WER compliance assessment will be required. The detailed WER compliance assessment will determine whether any elements of the Proposed Scheme could risk WER water body deterioration and will also detail potential mitigation and benefits that could be incorporated in order to enable no likely deterioration. The following legislation documentation will be referred to during the assessment:

- Water Environment (Water Framework Directive (WFD)) Regulations (WER, 2017)

Groundwater

14.7.10 The assessment to determine the significance of effects for the groundwater environment will largely be by qualitative assessments based on organisational experience. This will include establishing a conceptual site model as outlined in Appendix A of DMRB LA 113 to include details of:

- Groundwater flow directions
- Depth to groundwater
- Aquifer layering and hydraulic characteristics
- Groundwater quality
- Groundwater interaction with surface water and GWDTEs

14.7.11 The conceptual site model will be used to determine how the construction and operation of the Proposed Scheme could impact on identified groundwater receptors and how impacts could vary over time with the different phases of work.

14.7.12 If required from the qualitative assessment, simple calculations to identify potential zones of influence and drawdown from cuttings, excavations, or borrow pits will be undertaken to better define the effects of dewatering or mitigation measures required. At this stage the location of borrow pits has not been identified.

14.7.13 Future GI results will be used to assess the feasibility of controlled discharges to ground using infiltration techniques. Any proposed discharges to ground (which may be via unlined ditches or ponds, filter drains etc) may require a groundwater risk assessment.

14.7.14 In relation to the potential impacts on GWDTEs, Highways England's GWDTE screening assessment methodology (DMRB LA 113, Appendix B) will be used. This takes a stepped, risk-based approach which establishes linkages between potential impacts from the road development on the hydrogeological regime and a GWDTE. The simple assessment determines whether there is a hydrogeological link with the GWDTE. If a potential GWDTE can be clearly scoped out because of no linkage in the conceptual site model, then the GWDTE will not be considered further. If the conceptual site model indicates that there could be a plausible link then the groundwater dependency of each site will be identified as described in DMRB LA 113. DMRB LA 113 Section 3.19 states: "*where scoping concludes the potential for a likely significant effect on a GWDTE, a simple assessment shall be undertaken*". This simple assessment will be undertaken for the Environmental Statement and may include hydrogeological walkover surveys (where required). More detailed assessment and the design of mitigation will then be undertaken if potential for significant effects are identified.

14.7.15 To assess the impacts from operational discharges or spillages to ground or small streams, Highways England's HEWRAT methodology (DMRB LA 113, Appendices C and D) will be used to determine the potential for significant effects and if further mitigation is needed. The methods are based on the 'source-pathway-receptor' pollutant linkage principle. The key factors affecting the persistence and movement of pollutants within the pathway from discharge to the water table are determined and a scoring system is used to determine the overall risk (high, medium or low). This will help to identify which parameters are associated with the greatest risk and therefore where more detailed assessment or mitigation would be most usefully targeted.

14.7.16 The proposed qualitative assessment and simple calculations are considered adequate to assess the impacts of groundwater dewatering. No groundwater modelling for the Proposed Scheme is proposed.

14.7.17 The Environmental Statement will be supported by a groundwater baseline appendix, providing baseline data, GWDTE assessment and impact calculations (if required).

14.7.18 By utilising the above methodology, this will satisfy NNNPS policy requirements in relation to groundwater (see Section 14.1).

Flood risk

14.7.19 The typical examples included in DMRB LA 113 require hydraulic modelling to determine significance of effect, although this has not been undertaken at this stage as the scheme does not cross Main Rivers. However, the assessment of Tributary 1 (Egypt Farm Drain) and Tributary 2 (Golf Course Drain) of Castle Brook should follow that of main rivers due to their potential to interact with the site. The assessment of impacts is based on fluvial and surface water (pluvial) sources as the principal sources of flood risk. Groundwater flooding information will be obtained for the Environmental Statement. Other residual flood sources such as reservoir flooding have also not been included in the criteria due to their very low probability of occurrence relative to fluvial and surface water flooding, because of the inspection and maintenance regime they are subject to under the 1975 Reservoir Act.

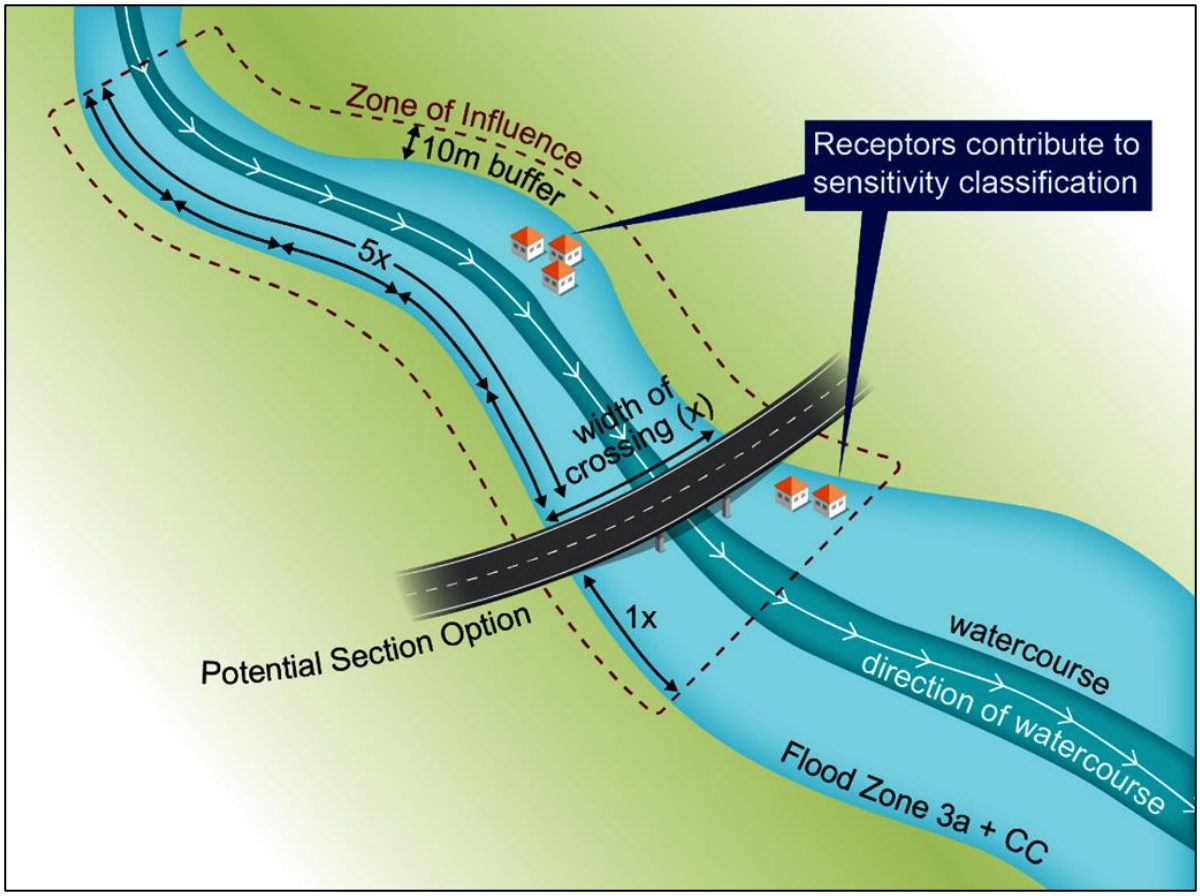
14.7.20 The sensitivity of a receptor to impacts from surface water and fluvial flood risk has been defined in terms of a Zone of Influence (ZOI). The ZOI has been defined using the width of the floodplain or surface water flow path at the potential impact location (i.e. where a potential option crosses an area designated to be at flood risk, referred to as a 'crossing').

The area of the ZOI extends upstream to five times the width of the identified crossing and downstream a distance equivalent to the width of the identified crossing at the potential impact location. A 10m buffer is then further applied to establish the area of the ZOI at each identified potential impact location. An illustrated example of the ZOI area is shown on Plate 14.1. The data used to apply and assess the ZOI for each source of flood risk is described in Table 14.11.

Table 14.11: Determination of ZOI for flood risk sources

Flood Source	Data Used to Assess Flood Risk
Fluvial	The assessment of the ZOI associated with the fluvial flood risk areas has been based on Flood Zone (FZ) 3a taking into account predicted climate change (FZ3a + climate change (CC)), capturing the fluvial flood risk over the scheme's lifetime. This dataset has not been obtained from the relevant Local Planning Authority therefore, Flood Zone 2 extent is to be used as a proxy dataset.
Surface water (pluvial)	The Environment Agency's Risk of Flooding from Surface Water dataset has been used to identify areas of high and medium risk of surface water flood risk[5] that are distinct from the floodplain (FZ3a + CC) assessed, associated with the ZOI. Surface water flow paths associated with watercourses are included within fluvial risk.

Plate 14.1: ZOI assessment for fluvial flood risk



[5] Environment Agency classification - High Risk: greater than 3.33% (1 in 30) annual exceedance probability (AEP) and Medium: between 1% (1 in 100) AEP and 3.3% (1 in 30) AEP

14.7.21 At the Environmental Statement stage, a FRA will be undertaken for the Proposed Scheme. The FRA will be produced in accordance with the technical guidance to the National Planning Policy Framework (NPPF). The FRA will demonstrate compliance with the requirements of the NPPF, specifically, that the Proposed Scheme will:

- Remain operational and safe for users in times of flood
- Result in no net loss of floodplain storage
- Not impede water flows
- Not increase flood risk elsewhere

14.7.22 The flood risk design criteria and requirements for the FRA will be agreed and further developed through consultation with the Environment Agency, the LLFA (Bury Metropolitan Borough Council) and other relevant stakeholders.

14.7.23 The scope of the FRA will be likely to include:

- Assessment of flood risk to the Proposed Scheme due to fluvial, surface water and groundwater flood risk, as well as the potential for flooding from water retaining, water supply or drainage infrastructure
- Assessment of change in flood risk from all sources
- Design of mitigation measures to prevent adverse impact on flood risk
- The completion of the Sequential and Exception Tests

14.8 Assessment assumptions and limitations

14.8.1 The scoping report has been produced early in PCF Stage 3, when the designs, proposed construction methodology and phasing are still in development and currently unavailable. As such, the assessment may change as the design evolves. The scheme alignment (Design Fix 1) and provisional Order Limits are shown on Figure 2.1.

14.8.2 The scoping report has been based on readily available web-based data sources and organisational experience.

14.8.3 Scoping has been based on a scheme boundary with only outline details on road design or construction activities. Construction activities including site compound activities, the use of access tracks and/or haul roads have not yet been identified. These will be considered in the Environmental Statement. Also, highway structures, such as gantries and drainage outfalls are still in the early stages of design (or unconfirmed), and therefore, potential impacts may change as design details progress.

14.8.4 There is no ground investigation data available at this scoping stage and no drainage data survey. Drainage surveys and GI will take place during summer 2021 to confirm existing drainage assets and their location and ground conditions.

Surface water quality

14.8.5 It has been assumed that there will be no new outfalls to surface waters and that the existing outfalls in the Water Quality Study Report (Jacobs, 2020) will be utilised. This has yet to be confirmed in the drainage design. It is likely that the size of the drainage catchments per outfall may change following the receipt of the drainage survey data.

14.8.6 Due to the nature of the existing drainage network and the local environment the contributing permeable areas for each outfall are complicated to establish. This is compounded by areas outside the Highways England network, including residential areas, contributing to the portion of flows from permeable areas.

14.8.7 The identification of potential mitigation options in this scoping report has not taken into account constraints or the presence of statutory undertakers' apparatus, land take, access and maintenance requirements.

14.8.8 The assumptions and limitations related to the HEWRAT assessment undertaken at PCF Stage 2 are detailed in the Simister Island Water Quality Study Report (Jacobs, 2020).

Groundwater

14.8.9 As indicated in the baseline text, for groundwater; a number of data sets still need to be obtained. A full list of data to be used within the Environmental Statement is provided in Section 14.3. For the purposes of scoping, it has assumed that these groundwater receptors will be present, and they will be included in the assessment of impacts.

14.8.10 This scoping report has been produced prior to undertaking a site-specific GI. An assessment of data from the GI will be included in the groundwater assessment of the Environmental Statement (if available at that time). Assessment of the data will aim to determine the impact on the groundwater regime.

14.8.11 Multiple aspects pertaining to the outline design of the Proposed Scheme are currently unknown at this scoping stage, and include but are not limited to:

- Formation/invert levels for cuttings, subsurface earthworks, and structures, and as-built alignments
- Ground improvement schedule (including piles, cut-off walls, retaining walls etc.), and excavations depths/locations for each
- Temporary works information (including the need for excavations for temporary access tracks, enabling works, soil stripping etc., temporary dewatering requirements, storage areas, stockpile mounds, landscaping)
- Drainage Strategy (including the location and excavation depth of attenuation ponds, permanent dewatering requirements, and the need to discharge to ground etc.)

Flood risk

14.8.12 Baseline fluvial flood risk has been considered based on the Environment Agency's Flood Map for Planning (Environment Agency 2020). Whilst this provides flood risk associated with Main Rivers, the risk of flooding from ordinary watercourses has not been accounted for. For this scoping report the RoFSW mapping is considered to give a reasonable representation of the risk associated with ordinary watercourses.

14.8.13 The hydraulic modelling used for the Flood Map for Planning is likely to be broad-scale modelling in places, and therefore unlikely to give an accurate representation of flood risk in all locations. It also does not incorporate an allowance for climate change. Hydraulic modelling will be completed to inform the identification of flood risk on Main Rivers in the study area and to inform the FRA. The hydraulic modelling will include the appropriate allowances for climate change.

14.8.14 Data from the proposed GI will be included in the assessment of groundwater flood risk for the FRA (if available at that time). It's assumed that the data provided will be sufficient to characterise baseline groundwater flood risk and any potential impacts that could arise as a result of the proposed scheme.

15. Climate

15.1 NNNPS requirements

15.1.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on Development Consent Order (DCO) applications.

15.1.2 Key policy from the NNNPS relevant to this aspect includes:

- Paragraph 4.40 states that new national networks infrastructure should typically be long-term investments which should remain operational over many decades, in the face of a changing climate. Therefore, applications should consider the impacts of climate change when planning location, design, build and operation.
- Paragraph 4.41 states where transport infrastructure has safety-critical elements and the design life of the asset is 60 years or greater, the applicant should apply the UK Climate Projections 2009 (UKCP09) high emissions scenario (high impact, low likelihood) against the 2080 projections at the 50% probability level.
- Paragraph 4.42 states that applications should consider the potential impacts of climate change, over the estimated lifetime of the new infrastructure, using the latest UK Climate Projections available at the time, and that any environmental statement which is prepared should identify appropriate mitigation or adaptation measures.
- Paragraph 4.43 states that applications should demonstrate that there are no critical features of the design of new national networks infrastructure which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK climate projections.
- Paragraph 5.17 states that applicants need to consider carbon impacts as part of the appraisal of scheme options and to describe an assessment of any likely significant climate factors within the Environmental Statement. The NNNPS states that it is very unlikely that the impact of a road project will, in isolation, affect the ability of the Government to meet its carbon reduction targets. However, the NNNPS requires that applicants should provide both evidence of the carbon impacts of a scheme and an assessment of these impacts against the Government's carbon budgets.
- Paragraph 5.19 outlines the need for appropriate climate mitigation measures to be implemented, in both design and construction of a road scheme, so that the associated carbon footprint is not unnecessarily high.

15.1.3 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

15.2 Study area

15.2.1 In line with the Design Manual for Roads and Bridges (DMRB) LA 114: Climate (Highways England, 2019; hereafter referred to as DMRB LA 114), different study areas are required to be defined for each matter considered. As such, the following study areas are defined:

- Greenhouse Gas (GHG) emissions resulting from construction - this is the study area necessary to consider all of the GHG emissions associated with construction materials and their associated transport to site from the supplier. It also includes GHG emissions associated with construction activities carried out within the Order Limits, the distances that workers travel to and from the construction site and the transport and processing of waste off-site for re-use, recycling or treatment/disposal. As such, the study area is defined by the greatest extent of these activities, some of which, it is assumed, may occur at a national scale (i.e. within England).
- GHG emissions resulting from operation and maintenance - the study area is based on a similar extent as the construction phase (e.g. to include materials used during maintenance activities which may be delivered from suppliers located across England). It also includes the GHG emissions from the energy consumed within the proposed Order Limits required to operate the Proposed Scheme.
- GHG emissions resulting from operational road users - the study area comprises the road network included within the Traffic Reliability Area (TRA) of the traffic model developed for the Proposed Scheme.
- The Proposed Scheme's vulnerability to climate change - the study area comprises the construction footprint of the Proposed Scheme, including compounds and temporary land take, within the provisional Order Limits.

15.2.2 The Proposed Scheme design and provisional Order Limits are shown on Figure 2.1 (Figure 2.1).

15.3 Baseline conditions

Baseline sources

15.3.1 For the purposes of this scoping report, baseline conditions have been established with reference to the following information sources:

- Carbon dioxide (CO_2) emissions at a UK, regional and local authority level - UK local authority and regional CO_2 emissions national statistics: 2005-2018 (Department for Business, Energy & Industrial Strategy (BEIS), 2020a)
- Current climate data for England and the North West of England region - HadUK-Grid regional observations dataset v1.0.2.1 for the "climate normal" period of 1981-2010 (Met Office et al., 2019)
- Projected climate data for the North West of England - UK Climate Projections 2018 (UKCP18), under the high emissions scenario (i.e. Receptor Concentration Pathway 8.5 (RCP8.5)) and for a 50% probability of occurrence (Met Office, 2020)
- Climate extreme indices - State of the UK Climate 2017: Supplementary Report on Climate Extremes (Met Office, 2018)
- Historical flooding events and areas at flood risk – see 'Chapter 14: Road Drainage and the Water Environment'

- Potential geological hazards e.g. subsidence, landslides – British Geological Survey (BGS) GeoIndex (BGS, 2021a) and GeoClimate Open (BGS, 2021b) datasets

Baseline information

GHG emissions

15.3.2 With regard to baseline conditions, DMRB LA 114 indicates that:

- GHG emissions without the project shall be identified for the current and future (Do Minimum) baseline scenarios
- The boundary of the baseline GHG emissions should include current operational maintenance GHG emissions and operational road user GHG emissions
- The baseline GHG emissions should be consistent with the study area outlined for the project

15.3.3 At the time of writing, no quantitative information was available on current baseline operational maintenance or operational road user GHG emissions within the study areas defined in Section 15.2. Therefore, in order to understand baseline GHG emissions going forwards, baseline road user and operational maintenance GHG emissions will be estimated (e.g. based on modelled traffic data), or collated where existing information is available (e.g. GHG emissions estimated by, or on behalf of, Highways England for maintenance activities associated with the existing assets). This will be reported in the Preliminary Environmental Information Report (PEIR) and Environmental Statement.

15.3.4 In the absence of baseline information relevant to the study area for the Proposed Scheme, baseline conditions have been established for the purposes of this scoping report with reference to estimated CO_2 emissions by source within the area administered by Bury Metropolitan Borough Council (as shown in Table 15.1). Data are also presented for England and the North West of England region to provide context. These data are derived from the UK National Atmospheric Emissions Inventory (NAEI) and the Department for Business, Energy & Industrial Strategy (BEIS) national statistics of energy consumption for local authority areas (BEIS, 2020a), which provide a spatial breakdown of estimated UK CO_2 emissions on an 'end-user" basis. Within this dataset, therefore, UK CO_2 emissions are distributed according to the point of energy consumption (e.g. electricity consumed in residential properties) or point of emission (if not energy related). These data help identify the key contributors to total UK CO_2 emissions in an area. Whilst data are only provided on this basis for CO_2 (and not other GHGs), CO_2 is the main GHG, accounting for approximately 81% of estimated UK GHG emissions in 2018.

15.3.5 Estimated CO_2 emissions within the Bury Metropolitan Borough Council area in 2018 totalled 845 kilotonnes (kt), representing approximately 2% of total estimated CO_2 emissions within the North West of England and less than 1% of total estimated CO_2 emissions within England.

15.3.6 Road transport CO_2 emissions are estimated to comprise a significant proportion of the total CO_2 emissions within the Bury Metropolitan Borough Council area (45%), the North West of England (34%) and England (36%). Motorways, including the M60, M66 and M62, of which the Proposed Scheme forms part, are estimated to contribute approximately 23% of total CO_2 emissions within the Bury Metropolitan Borough Council area, 13% of total CO_2 emissions within the North West of England, and 9% of total CO_2 emissions within England.

15.3.7 In total, road transport emissions within the Bury Metropolitan Borough Council area are estimated to contribute approximately 3% of total road transport CO_2 emissions within the North West of England and less than 1% of total road transport CO_2 emissions in England. Of this contribution, approximately 51% is attributable to road traffic emissions from motorways within the Bury Metropolitan Borough Council area.

Table 15.1: England, North West of England and Bury CO_2 emissions estimates by source (2018)

Emission source	Estimated 2018 CO_2 emissions					
	England		North West of England		Bury Metropolitan Borough Council	
	kt	% of total	kt	% of total	kt	% of total
Industry and commercial electricity	34,138	12%	4,500	12%	80	9%
Industry and commercial gas	29,742	11%	4,898	13%	74	9%
Large industrial installations	20,560	7%	2,716	7%	<1	<1%
Industrial and commercial 'other fuels'	12,726	5%	1,647	4%	22	3%
Agriculture	3,512	1%	418	1%	2	<1%
Industry and commercial total	**100,678**	**36%**	**14,179**	**37%**	**176**	**21%**
Domestic electricity	20,718	7%	2,629	7%	68	8%
Domestic gas	52,145	19%	7,350	19%	209	25%
Domestic 'other fuels'	6,360	2%	730	2%	8	1%
Domestic total	**79,223**	**28%**	**10,709**	**28%**	**285**	**34%**
Road transport (A roads)	44,021	16%	4,323	11%	74	9%
Road transport (motorways)	26,441	9%	5,050	13%	197	23%
Road transport (minor roads)	31,371	11%	3,773	10%	112	13%
Diesel railways	1,607	1%	209	1%	-	-

Emission source	Estimated 2018 CO_2 emissions					
	England		North West of England		Bury Metropolitan Borough Council	
	kt	% of total	kt	% of total	kt	% of total
Transport other	1,960	1%	293	1%	2	<1%
Transport total	**105,399**	**38%**	**13,648**	**36%**	**385**	**46%**
Land use, land-use change, and forestry (LULUCF) net emissions	-5,341	-2%	-232	-1%	-2	>-1%
Total	**279,960**	-	**38,304**	-	**845**	-

Vulnerability

15.3.8 With regard to baseline climate impacts DMRB LA 114 indicates that:

- The assessment of a project's vulnerability to climate change shall use published historical regional weather data to demonstrate the current climate impacts on a study area
- Recent weather patterns and extreme weather events should be identified to provide an indication of how the project will account for climate change in the immediate future (i.e. during construction)
- Historical events as a result of weather patterns and extreme weather events (i.e. landslides after heavy rainfall) shall be identified to provide an indication of past vulnerability

15.3.9 As such, baseline climate data for the North West of England are summarised in Table 15.2, based on data for the most recent 'climate normal' period available from the Met Office (i.e. 1981-2010). These data have been compared to similar data for England as a whole, which indicate that:

- The climate in the North West of England region is colder compared to across England as a whole, throughout the year, with the most sizeable differences recorded during summertime
- The climate in the North West of England region is wetter compared to across England as a whole, throughout the year, with the greatest difference in precipitation being in wintertime

Table 15.2: Baseline climate data (1981 – 2010) for England and North West of England

Climate variable	Period	England	North West of England	Difference
Daily maximum temperature (°C)	Winter	7.1	6.4	-0.7
	Spring	12.7	11.7	-1.0
	Summer	20.1	18.4	-1.7
	Autumn	13.9	12.7	-1.2
Daily minimum temperature (°C)	Winter	1.3	1.0	-0.3
	Spring	4.4	4.1	-0.3
	Summer	10.9	10.5	-0.4
	Autumn	6.8	6.3	-0.5
Daily mean temperature (°C)	Annual	9.6	8.9	-0.7
	Winter	4.2	3.7	-0.5
	Spring	8.5	7.9	-0.6
	Summer	15.5	14.4	-1.1
	Autumn	10.3	9.5	-0.8
Mean accumulated precipitation (mm)	Annual	855	1,247	+392
	Winter	230	350	+120
	Spring	181	247	+66
	Summer	194	274	+80
	Autumn	250	376	+126

15.3.10 An overview of historical and more recent extreme weather conditions recorded in the North West of England is presented in Table 15.3, based on data contained within the State of the UK Climate 2017: Supplementary Report on Climate Extremes (Met Office, 2018). These data indicate that:

- Maximum temperatures in the North West of England region are lower than across England as a whole, and appear to be increasing
- The duration of ‘warm spells’ in the North West of England region, and across England as a whole, appear to be increasing
- The duration of ‘cold spells’ and number of ‘icing days’ are generally slightly higher in the North West of England region than across England as a whole, but appear to be decreasing
- Rainfall from ‘extremely wet days’ is higher in the North West of England region than across England as a whole, and appears to be increasing
- Maximum ‘5-day precipitation’ is higher in the North West of England region than across England as a whole, and appears to be decreasing
- The ‘longest dry spell’ is shorter in the North West of England region than across England as a whole, and appears to be decreasing

Table 15.3: Summary of climate extremes for England and the North West of England

Climate variable	Period	England	North West of England	Difference
Highest maximum temperature [a]	1961-1990	27.3	26.2	-1.1
	1981-2010	28.3	26.9	-1.4
	2008-2017	28.5	26.8	-1.7
Warm spell duration index (days) [b]	1961-1990	5.3	6.5	+1.2
	1981-2010	10.0	10.4	+0.4
	2008-2017	15.0	12.7	-2.3
Cold spell duration index (days) [c]	1961-1990	3.1	2.9	-0.2
	1981-2010	2.8	3.5	+0.7
	2008-2017	2.0	3.1	+1.1
Number of icing days [d]	1961-1990	3.6	4.3	+0.7
	1981-2010	2.5	3.1	+0.6
	2008-2017	1.9	2.9	+1.0
Rainfall from extremely wet days (mm) [e]	1961-1990	64.8	92.9	+28.1
	1981-2010	69.3	93.1	+23.8
	2008-2017	72.0	104.2	+32.2
Maximum 5-day precipitation (mm) [f]	1961-1990	64.7	88.0	+23.3
	1981-2010	67.3	91.3	+24.0
	2008-2017	65.7	93.0	+27.3
Longest dry spell (days) [g]	1961-1990	22.7	20.0	-2.7
	1981-2010	22.2	18.8	-3.4
	2008-2017	20.1	17.0	-3.1

[a] Average highest daily maximum temperature recorded on an annual basis

[b] Count of days with at least 6 consecutive days when daily maximum temperature is above the 90th percentile centred on a 5-day window for the base period of 1961-1990

[c] Count of days with at least 6 consecutive days when daily minimum temperature is below the 10th percentile centred on a 5-day window for the base period of 1961-1990

[d] Number of days when the daily minimum temperature is below 0ºC

[e] Total rainfall falling on days with daily rainfall total in excess of the 99th percentile of daily rainfall

[f] Highest value of rainfall accumulated over 5 days

[g] Largest number of consecutive days with < 1 mm rainfall

15.3.11 As detailed in Chapter 14: Road Drainage and the Water Environment, in terms of fluvial flood risk, the Highways Agency Drainage Data Management System (HADDMS) suggests sections of the existing carriageway fall within flood hotspots, including areas classified as Highest risk (A1), Very High risk (A), High risk (B), Moderate (C) and others are within Risk Addressed (X) areas. However, flood events were not from fluvial sources but are from surface water on the carriageway as a result of drainage issues, e.g. blocked gullies.

15.3.12 Chapter 14: Road Drainage and the Water Environment also indicates that in terms of surface water flood risk, the Environment Agency's Risk of Flooding from Surface Water (RoFSW) mapping (Environment Agency, 2021) shows that, whilst large areas of the study area are within an area at very low risk (less than 0.1% (1 in 1000) Annual Exceedance Probability (AEP)), there are several overland flow routes and isolated areas of ponding which could interact with the Proposed Scheme with high (greater than 3.3% (1 in 30) AEP), medium (between 1% and 3.3% AEP) and low (between 0.1% (1 in 1000) and 1% (1 in 100) AEP) risk of surface water flooding.

15.3.13 The RoFSW indicates M60 J18 circulatory carriageway and slip roads are at risk as well as areas of isolated ponding in the land adjacent to the junction. This could be a result of topography and the raised junction embankments.

15.3.14 There is also an area of surface water ponding to the north-east of the junction where the proposed new 'Northern Loop' will be. Therefore, this area of carriageway may be at high risk of surface water flooding.

15.3.15 Based on GeoIndex (BGS, 2020a), no historical landslide events are recorded in the vicinity of the Proposed Scheme, and therefore no such past vulnerability has been identified at this point.

15.3.16 No records were available at the time of writing regarding past incidences of subsidence within the footprint of the Proposed Scheme.

Receptors

15.3.17 In line with the DMRB LA 114, the following receptors have been identified:

- With regard to GHG emissions:
  - UK carbon budgets (as a proxy for the global climate)
- With regard to the Proposed Scheme's vulnerability to climate change:
  - receptors associated with the construction process (including the workforce, plant and machinery)
  - the assets and their operation, maintenance and refurbishment (e.g. road pavement surfaces, structures, earthworks and drainage, technology assets, soft estate)
  - end-users (e.g. members of the public or commercial operators using the Proposed Scheme)

Future baseline

GHG emissions

15.3.18 At the time of writing, no quantitative information on future baseline GHG emissions is available. Therefore, in order to understand future baseline conditions for assessment purposes, GHG emissions will be estimated for the following as part of the PEIR and Environmental Statement:

- Operational road user GHG emissions within the study area defined in Section 15.2 for the Do-Minimum scenario over a 60-year appraisal period from the Proposed Scheme opening year (2027), as required by DMRB LA 114.

- Operational maintenance GHG emissions within the study area defined in Section 15.2 for the Do-Minimum scenario over a 60-year appraisal period from the Proposed Scheme opening year (2027), as required by DMRB LA 114.

Vulnerability

15.3.19 Projected changes in climate for the North West of England region, under the UKCP18 high emissions scenario and for a 50% probability of occurrence, are presented in Table 15.4 for the periods 2020 – 2049, 2050 – 2079 and 2079 – 2099 (i.e. covering the 60-year appraisal period from the Proposed Scheme opening year (2027) advised by DMRB LA 114).

Table 15.4: Future climate projections for the North West of England region

Climate variable	Projected change under the high emissions scenario (i.e. RCP8.5) and for a 50% probability of occurrence		
	2020 – 2049 (2030s)	2050 – 2079 (2060s)	2070 – 2099 (2080s)
Temperature			
Summer daily maximum temperature (°C)	+1.2	+2.9	+4.6
Winter daily minimum temperature (°C)	+0.8	+2.0	+2.9
Mean annual daily temperature (°C)	+1.0	+2.2	+3.4
Precipitation			
Summer mean accumulated rainfall (%)	-7.6	-21.2	-28.2
Winter mean daily accumulated (%)	+2.2	+10.7	+16.1

15.3.20 Based on the UKCP18 data for the North West of England region for the period up to 2099, under the high emissions (RCP8.5) scenario and for a 50% probability of occurrence, maximum summer and minimum winter daily temperatures are projected to increase by up to 4.6°C and 2.9°C, respectively, whereas mean daily rainfall is projected to increase by up to 16.1% during winter and decrease by up to 28.2% during summer.

15.3.21 Overall, climatic changes in the region of the Proposed Scheme are projected to result in increasingly wetter and warmer winters and drier and warmer summers.

15.3.22 As noted in Chapter 14: Road Drainage and the Water Environment, over the anticipated lifetime of the Proposed Scheme changes to the baseline as a consequence of climate change would likely occur, including a likely increase in the frequency and magnitude of flood events.

15.3.23 Based on GeoIndex (BGS, 2020b) and specifcally the GeoClimateUKCP09 dataset, subsidence is considered '*improbable*' under '*average*' soil humidity conditions in the region of the Proposed Scheme in the 2080s.

Value of receptors

15.3.24 The receptors relevant to climate are outlined in the baseline information above. In the absence of specific guidance in DMRB LA 114 on the valuation of receptors with regard to climate impacts, all receptors are considered to be of equally high value.

15.4 Potential impacts

Construction

GHG emissions

15.4.1 GHG emissions would be generated during the construction phase as a result of the following activities, in alignment with modules A1 to A5 of the 'before use' life cycle stage identified in Publicly Available Specification (PAS) 2080:2016 Carbon Management in Infrastructure (BSI, 2016):

- Embodied GHG emissions associated with the required raw materials (product stage (modules A1 – A3))
- Transport of materials to the construction site (construction process stage (module A4))
- Transport of waste from the construction site and subsequent treatment (construction process stage (module A5))
- Transport of construction workers, on-site staff and visitors to and from the construction site (construction process stage (module A5))
- Operation of construction plant and on-site activities (construction process stage (module A5))
- On-site consumption of fuel, electricity and water (construction process stage (module A5))
- GHG emissions mobilised by vegetation losses or disturbance of soils (construction process stage (module A5))

15.4.2 Substantial increases in GHG emissions could potentially impact the global climate as a result of the cumulative impact of GHG emissions. Furthermore, as discussed in Section 15.6, below, the UK Government has set a number of legally binding carbon budgets over different time periods, which it is required to meet in working towards a 2050 net zero emissions target. Increases in GHG emissions, should they be of sufficient magnitude, could potentially impact on the ability of Government to meet these carbon reduction targets.

15.4.3 Whilst quantitative estimates of baseline and construction related GHG emissions relating to the Proposed Scheme are not currently available, due to the scale and extent of the proposed construction activities, it is expected that construction phase GHG emissions would increase by more than 1% compared to the baseline scenario (i.e. GHG emissions and energy use associated with existing maintenance activities). In accordance with DMRB LA 114, therefore, the potential impacts on climate associated with GHG emissions during the construction of the Proposed Scheme are scoped in for further assessment.

15.4.4 As per paragraph 2.3 of DMRB LA 114, GHG emissions associated with decommissioning of the Proposed Scheme (i.e. modules C1 to C4 of the 'end of life' life cycle stage identified in PAS 2080 (BSI, 2016)) are excluded from the assessment due to the length of the operational phase of the Proposed Scheme's assets.

Vulnerability

15.4.5 As identified in Table 15.3, the North West of England region appears to have experienced increasing temperatures and precipitation events of higher intensity in recent years. Furthermore, the projected changes in climate variables over the relatively short term (2020 – 2049) shown in Table 15.4, suggest these trends will potentially continue, resulting in further increases in temperatures (especially during summer, +1.2^{o}C) and precipitation during winter (+2.2%). Table 15.5 identifies climate related impacts on receptors during construction, including temporary works, which could potentially occur as a result of these changes.

Table 15.5: Potential impacts resulting from climate effects during construction

Climate effect	Receptor	Potential impacts
Increased temperatures, including prolonged periods of hot weather	Construction workforce	Health risks to construction workers associated with increased potential for dust generation and dispersal. Health risks to construction workers associated with higher working temperatures, such as dehydration and sunstroke.
Increased precipitation, including intense periods of rainfall	Construction workforce	Increased risk of flooding of temporary works areas, including construction compounds.
	Geotechnics	Risks to slope stability associated with changes in pore water pressure. Risk of scour and erosion of earthworks.
	Soft estate	Increased risk of contamination of waterbodies due to flooding of construction areas / compounds or through runoff.
	Scheme operator	Increased risk of disruption to supply of materials and goods required to support construction activities. Increased risk of delay to construction programme, and associated costs incurred (e.g. if staff are unable to travel to / access site due to flooding).

15.4.6 Based on the impacts described in Table 15.5, the vulnerability of construction activities associated with the Proposed Scheme to climate impacts is scoped in for further assessment.

Operation

GHG emissions

15.4.7 GHG emissions would be generated during the operational phase of the Proposed Scheme as a result of the following activities, in alignment with the modules B1-B9 of the 'use' life cycle stage identified in PAS 2080:2016 (BSI, 2016):

- Maintenance and operation of the road infrastructure - through consumption of energy (e.g. through petrol or diesel combustion and use of electricity) and materials to support activities such as the repair and replacement of lighting and structures (including fencing) and highway resurfacing (modules B2 – B6)
- Consumption of energy (e.g. through petrol and diesel combustion and use of electricity) by motorised vehicles using the road infrastructure - the Proposed Scheme

has the potential to alter traffic volumes, composition and flows on the local road network, both positively and negatively, which could act to alter the magnitude of road traffic emissions (module B9)

- Ongoing changes in the emissions / sequestration balance within the scheme footprint associated with changes in land use, for example, through changes in the spatial extents and management of carbon sinks such as woodland (module B1)

15.4.8 These emissions have the potential to impact the global climate and, should they be of sufficient magnitude, the UK Government's ability to meet legally binding carbon budgets in combination with other GHG emissions from across the UK.

15.4.9 Whilst traffic data are not currently available to understand changes in road traffic conditions as a result of the Proposed Scheme, based upon traffic modelling undertaken at previous stages, it is considered likely that the following criteria will be met or exceeded on a number of road links as a result of the operation of the Proposed Scheme:

- Change of more than 10% in Annual Average Daily Traffic (AADT) flow
- Change of more than 10% in Heavy Duty Vehicles (HDV)
- Change in daily average speed of more than 20kph

15.4.10 In accordance with DMRB LA 114, the potential impacts on climate associated with GHG emissions during the operation of the Proposed Scheme are therefore scoped in for further assessment.

Vulnerability

15.4.11 As identified in Table 15.4, projected changes in climate variables over the longer term suggest that substantial increases in temperature, especially during summer (+4.6^{o}C), and precipitation during winter (+16.1%) have the potential to occur in the North West of England region. Table 15.6 sets out how changes in temperature and precipitation could affect receptors during operation of the Proposed Scheme, including infrastructure elements (e.g. structures, earthworks, drainage, road surfacing, lighting and signage, soft estate), end users, scheme operators and maintenance workers.

15.4.12 It should be noted that Chapter 14: Road Drainage and the Water Environment, has identified surface water flooding as a potential risk, which suggest a potential vulnerability of the Proposed Scheme to this issue.

Table 15.6: Potential impacts resulting from climate effects during operation

Climate effect	Receptor	Potential impacts
Increased precipitation, particularly in winter	Earthworks	Increased scour and erosion of earthworks. Risks to slope stability associated with changes in water levels/pore pressure.
	Pavements	Stress on road surfaces (i.e. degradation of macrotexture and reduction of texture depth, wearing away of asphalt compromising support layers).
	Soft estate	Risks to long term viability of landscape planting.
	Structures	Risk of scour to foundations.

Climate effect	Receptor	Potential impacts
	End users	Disruption of access to highway infrastructure as a result of flooding or drainage issues. Increased risk / frequency of accidents.
	Scheme operator	Increased costs associated with increased maintenance / renewal requirements.
	Maintenance workforce	Challenges for maintenance regime.
Increased average and peak temperatures	Pavements	Stress on road surfaces (i.e. degradation of macrotexture and reduction of texture depth, wearing away of asphalt compromising support layers).
	Structures	Stress on structures as a result of thermal loads applied to superstructure.
	Scheme operator	Increased costs associated with increased maintenance requirements.
	Technology	Overheating and subsequent failure.

15.4.13 The impacts described in Table 15.6 are considered to have the potential to be significant (in the absence of appropriate mitigation). The vulnerability of the Proposed Scheme to climate change during its operation is therefore scoped in for further assessment.

Summary of scope

15.4.14 Table 15.7 summarises the proposed scope for the climate aspect.

Table 15.7: Summary of climate scope

Matter	Sub-matter	Scoped in - construction	Scoped in - operation
GHG emissions	Product stage (embodied carbon in construction materials)	✓	✓[a]
	Transport of construction materials to site	✓	✓[a]
	Fuel consumption (on-site plant and machinery)	✓	✓[a]
	Fuel consumption (all staff vehicles)	✓	✓[a]
	Electricity, natural gas and water consumption	✓	✓
	Transportation, treatment and disposal of waste materials	✓	✓[a]
	Land use change and forestry	✓	✓
	Road users	N/A	✓
Vulnerability of scheme to climate change	Changes in seasonal precipitation and temperature	✓	✓
	Increased frequency of extreme precipitation and temperature events	✓	✓

Matter	Sub-matter	Scoped in - construction	Scoped in - operation
[a] During maintenance activities (including repair, replacement and refurbishment). N/A: Not applicable			

15.5 Design, mitigation and enhancement measures

GHG emissions

15.5.1 DMRB LA 114 indicates that all projects should seek to minimise GHG emissions to contribute to the UK's target for a net reduction in carbon emissions.

15.5.2 The following options will therefore be considered when identifying potential opportunities to reduce GHG emissions (in the order of priority shown):

- Avoid / prevent:
  - maximise potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required, and/or explore alternative lower carbon options to deliver the project objectives (i.e. shorter route options with smaller construction footprints)
  - identify through project and delivery programmes opportunities to influence road user GHG emissions
- Reduce:
  - apply low carbon and/or reduced resource consumption solutions (including technologies, materials and products) to minimise resource consumption during the construction, operation, and at end of life
- Remediate:
  - identify, assess and integrate measures to further reduce carbon through on or off-site offsetting or sequestration

15.5.3 Indicative opportunities to reduce the magnitude of GHG emissions associated with construction activities include:

- Reduce the use of resources, and maximise the use renewables or materials with recycled or secondary content to reduce the amount of carbon embodied in the construction materials
- Reduction of import and export of fill and materials (e.g. by reusing site-won materials)
- Using lower carbon and more energy efficient construction plant and machinery such as hybrid, electric, hydrogen or alternative lower carbon fuels

15.5.4 Indicative opportunities to reduce the magnitude of GHG emissions associated with the maintenance of the Proposed Scheme include:

- Designing, specifying and constructing the scheme with a view to increasing the operational lifespan of surfaces and structures and reducing the need for maintenance
- Employing modular construction techniques to reduce on-site maintenance requirements and / or allow the use of lower carbon replacements in the future

- Making adequate provision to support the use of low emission vehicles where appropriate
- Specifying high efficiency and low emission mechanical and electrical equipment such as LED lighting and signal gantries
- Maintaining equipment using current best practice techniques

15.5.5 The creation and enhancements of additional ecological habitats and / or tree planting could also potentially be used to offset some GHG emissions through natural sequestration and soil carbon storage.

Vulnerability

15.5.6 Up-to-date design and construction standards, along with good engineering practice, are expected to be applied to the design and construction of the Proposed Scheme. The use of such adaption measures, which will be embedded in the design of the Proposed Scheme, is expected to secure the resilience of the Proposed Scheme for its whole lifecycle.

15.5.7 Specific mitigation measures identified as being relevant to the construction stage include:

- Modular design and off-site construction, to reduce on-site construction activities where it is practicable to do so
- Installing site compound drainage that has sufficient capacity to withstand extreme precipitation events (potentially even re-using this water (e.g. for dust suppression) to reduce overall water consumption)
- Undertaking additional inspections of material stockpiles and structures during and following extreme weather events (e.g. floods, heatwaves, storms) to ensure stability and incorporating such measures into materials management plans
- Proactively managing work patterns / automating work to avoid human exposure to extreme temperatures and, where this is not possible, the provision of appropriate personal protective equipment (e.g. sun cream) and facilities (e.g. cool rooms and shade) for workers during high temperature periods
- Allowing sufficient time within the construction programme to accommodate a reduction of risks to site operatives, plant and machinery and other elements of the scheme associated with periods of high temperature and prolonged periods of heavy precipitation

15.5.8 The following mitigation measures would potentially help reduce the vulnerability of the Proposed Scheme to climate effects during operation:

- Developing the Proposed Scheme design (in particular the drainage system) with reference to Environment Agency and Local Lead Flood Authority guidance regarding peak rainfall (including appropriate climate change allowances)
- Avoid or reduce the positioning of permanent structures within channels or within the floodplain and provision of flood compensation storage
- Slope stabilisation measures (ideally low impact measures, which avoid the use of concrete)

- Designing and specifying pavement construction, expansion joints and other elements which are resilient to projected increases in peak summer temperatures
- Designing and specifying pavement construction, drainage systems, embankments and other elements with a view to projected changes in precipitation characteristics as well as increased variability of ground conditions (wetting and drying)
- Proactively planning the need for and location of material stockpiles etc., with regard to weather forecasts and the potential for extreme weather events (e.g. as part of materials management plan)
- Specifying regular inspection of drainage infrastructure, materials and structures to identify any deterioration along with additional inspections after extreme weather events

15.6 Description of the likely significant effects

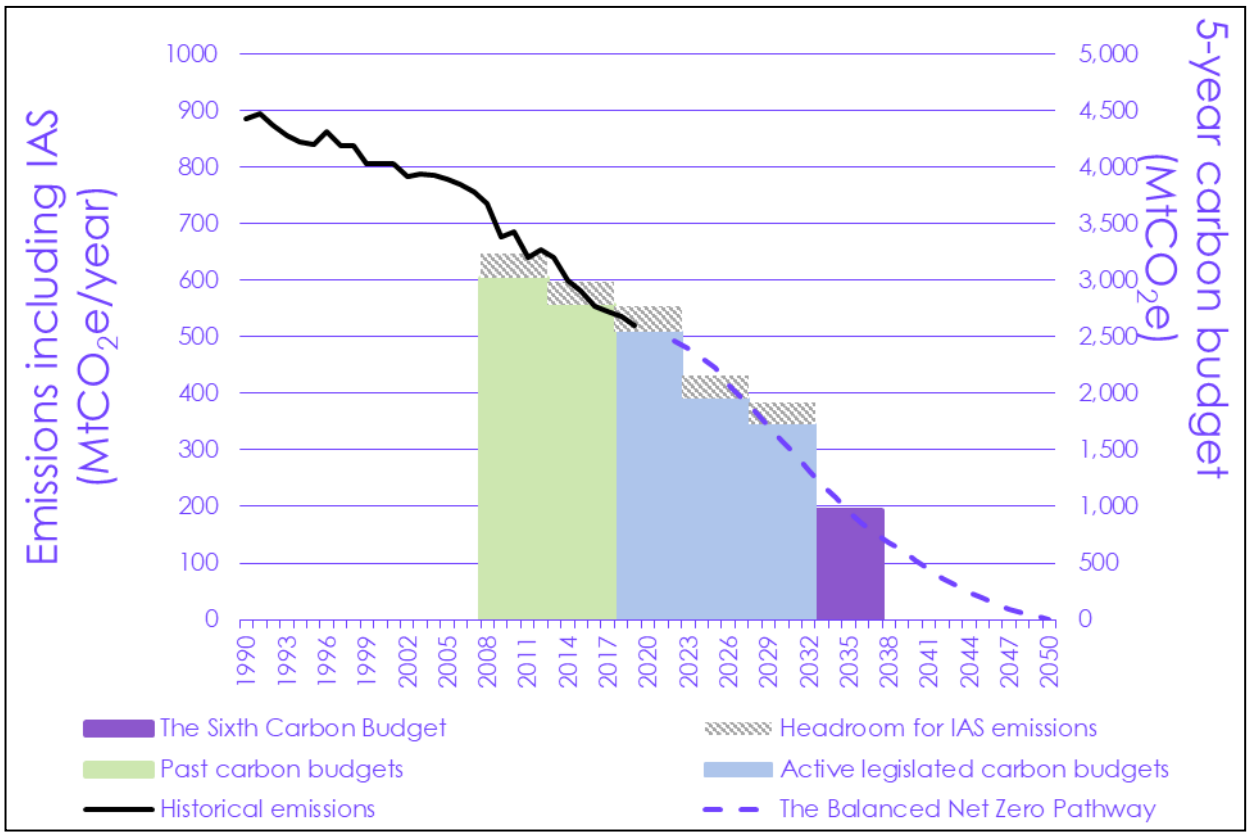
GHG emissions

15.6.1 In December 2015, the Paris Agreement, a global climate agreement, was adopted. The central aim of the Paris Agreement, which was ratified and entered into force in November 2016, is to strengthen the global response to the threat of climate change by keeping the rise in average global temperature this century well below 2ºC above pre-industrial levels, and to pursue efforts to limit the temperature increase even further to 1.5 ºC. The UK was one of the 160 countries which signed this agreement.

15.6.2 The UK's response to meeting its commitments under the Paris Agreement resulted in 2019 to an amendment to the Climate Change Act 2008, within which the UK Government has committed to reduce emissions by at least 100% of 1990 levels (net zero) by 2050.

15.6.3 To meet this carbon reduction target, the UK Government has set five-yearly carbon budgets, which currently run until 2032. They restrict the amount of GHGs the UK can legally emit in a five-year period. The Climate Change Committee (CCC, 2020) has also recently made its recommendation for the 6th carbon budget, covering the period 2033 – 2037, which is yet to be adopted into UK law. These carbon budgets are summarised in Plate 15.1 below.

Plate 15.1: UK carbon budgets set to achieve net zero carbon by 2050 (CCC, 2020)



15.6.4 The Proposed Scheme has the potential to result in an increase in GHG emissions as a result of its construction and operational phase emissions. Whilst any increase in GHG emissions can be considered a negative impact, due to the cumulative effect of GHG emissions on the global climate, the accumulation of GHG emissions as a result of the Proposed Scheme is considered unlikely to have a material impact on the ability of Government to meet its carbon reduction targets (as advised by the NNNPS and DMRB LA 114). As such, the effect of the Proposed Scheme on GHG emissions is considered unlikely to be significant.

Vulnerability

15.6.5 The climate assessment will identify how the project has been designed or adapted to protect it from future climate change in order to reduce any potential impacts so that resulting effects are not significant.

Scoping questions

15.6.6 DMRB LA 114 (paragraph 3.3) confirms that two scoping questions should be answered in order to gain an understanding of the need to undertake further assessment for the Climate aspect. Where the response to one or more of these questions is 'yes', then further assessment should be undertaken.

15.6.7 The responses to the scoping assessment questions for the Proposed Scheme are provided in Table 15.8, based on the application of professional engineering judgement to the current design information.

Table 15.8: DMRB LA 114 Scoping questions and responses

Scoping questions	Response	Scoped in/out
1) 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%?	Uncertain	Scoped in
2) during operation, will roads meet or exceed any of the following criteria? a) a change of more than 10% in AADT; b) a change of more than 10% to the number of heavy duty vehicles; and c) a change in daily average speed of more than 20 km/hr.	Uncertain	Scoped in

15.6.8 Having answered 'yes' or 'uncertain' to one or more of the DMRB LA 114 scoping questions for Climate, it is recommended that this aspect is scoped into the EIA.

15.7 Assessment methodology

GHG emissions

15.7.1 An assessment of the net change in GHG emissions associated with the Proposed Scheme against UK Government carbon budgets (in metric tonnes of carbon dioxide equivalent (tCO_{2e})) will be undertaken in accordance with DMRB LA 114, and as required by the NNNPS. As the construction and operational phases of the Proposed Scheme would extend over multiple carbon budget periods, GHG emissions will be reported against each relevant carbon budget, for the construction and operation phases respectively. An assessment will then be made, based on professional judgement, as to whether changes in GHG emissions as a result of the Proposed Scheme would have a material impact on the ability of the UK Government to meet its carbon reduction targets (and would therefore potentially be significant).

15.7.2 GHG emissions associated with the Proposed Scheme will be estimated over a 60-year appraisal period from the Proposed Scheme opening year (2027) using the following methods and data sources, as summarised in Table 15.9:

- Embodied carbon and construction activities - using the Highways England Carbon Tool v.2.3, based on the bill of quantities, mass haul, enabling works activities and waste management plans for the Proposed Scheme and anticipated construction activities and processes
- If there is likely to be substantial tree planting or losses as a result of the Proposed Scheme – using the Woodland Carbon Code Carbon Calculation Spreadsheet
- If there is likely to be substantial land use changes or changes to the carbon stock as a result of the Proposed Scheme – using appropriate emission and sequestration factors such as those reported by Natural England (Natural England, 2012) and changes in the areas of various land uses
- If there is likely to be substantial excavation and / or drainage of peat as a result of the Proposed Scheme – using emission factors taken from the UK Annual National Inventory Report (BEIS, 2021)

- Operational road users – using the methodology set out in the Transport Analysis Guidance (TAG) Data Book (DfT, 2020) and traffic data for the Do-Minimum and Do-Something scenarios in the Opening Year (2027), Design Year (2042) and Future Year (2051) of the Proposed Scheme. Emissions would then be interpolated between the Opening Year, Design Year and Future Year, and assumed to remain constant thereafter, in order to estimate GHG emissions over the assumed 60-year life span of the Proposed Scheme. The TAG Data Book approach is proposed to be used (as opposed to Highways England's speed band emission factors, for example) so as to take account of more recent vehicle fleet composition projections and GHG emissions associated with the electricity consumed by electric vehicles
- Operational electricity consumption – using estimated electricity consumption and forecast electricity emission factors by year (BEIS, 2020b)
- Embodied carbon and operational maintenance and asset replacement activities – using the Highways England Carbon Tool v.2.3 and assumptions regarding likely maintenance activities

Table 15.9: Summary of GHG emissions estimation methods by source

Emissions source	Emission estimation methodology	Data sources
Product stage (embodied carbon in construction materials)	Highways England Carbon Tool (v.2.3)	Estimated types and quantities of materials / items (including mass haul and soil stabilisation assumptions)
Transport of construction materials to site		Estimated distances from suppliers to site
Energy consumption (on-site plant and machinery)		Anticipated type, number, power rating, load and operating hours of construction plant and / or estimates of on-site fuel, electricity and water consumption.
Energy consumption (staff vehicles)		Estimated staff numbers, travel modes and distances travelled to / from site
Electricity, gas and water consumption (construction)		Anticipated on-site electricity, gas and water consumption
Transportation, treatment and disposal of waste materials		Estimated type, quantities, disposal method and transportation distances
Maintenance activities		Assumptions regarding likely maintenance activities and frequencies
Replacement of assets at end of design life		Design life of assets to calculate number of replacement cycles within the study reference period

Emissions source	Emission estimation methodology	Data sources
Land use change and forestry	Natural England; Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources (NERR043) Equilibrium soil carbon density changes from Annex 3 of the UK Annual National Inventory Report (BEIS, 2021) Woodland Carbon Code Carbon Calculation Spreadsheet (v2.3, May 2020)	Type and area of land use disturbed during construction Type and area of land use permanently lost / gained Number of trees, type and planting / management plans.
Peat extraction and / or drainage	On-site and off-site peat extraction and peat condition emission factors from Annex 3 of the UK Annual National Inventory Report (BEIS, 2021)	Mass of peat extracted Condition and area of drained peatland
Electricity consumption (operation)	Electricity emission factors (BEIS, 2020b)	Anticipated electricity consumption (e.g. for lighting)
Road users	TAG Databook (DfT, 2020)	Modelled traffic data

15.7.3 Whilst the assessment will follow DMRB LA 114, reference will also be made, where relevant and appropriate to do so, to the following:

- Assessing Greenhouse Gas Emissions and Evaluating their Significance (Institute of Environmental Management and Assessment (IEMA), 2017)
- PAS 2080: Carbon Management in Infrastructure (BSI, 2016)
- Woodland Carbon Code Carbon Calculation Guidance (UK WCC, 2018)
- Highways England Carbon Tool Guidance (Highways England, 2020)

Vulnerability

15.7.4 For the assessment of the Proposed Scheme's vulnerability to climate impacts, the following will be included, in line with DMRB LA 114, and as required by the NNNPS:

- Detailed receptor identification for the construction and operation phase, in liaison with the Proposed Scheme design team (as per paragraph 3.34 of DMRB LA 114)
- Analysis of current and projected baseline climate conditions, at a finer resolution than presented herein, utilising appropriate UKCP18 datasets in order to identify any likely significant climate changes and likely project exposure to these changes (as per paragraph 3.28 of DMRB LA 114)
- Identification of adaptation measures for any significant impacts, in liaison with the Proposed Scheme design team and relevant environmental discipline specialists (as per paragraph 3.43 of DMRB LA 114)

15.7.5 Once the climate change impacts have been identified, a qualitative risk assessment of those impacts on the identified receptors will be undertaken with reference to the

indicative framework set out in Table 3.39a (likelihood categories) and Table 3.39b (measure of consequence) of DMRB LA 114 (replicated in Appendix B).

15.7.6 The likelihood and consequence of each impact will then be combined in the form of a matrix to subsequently identify the significance of each impact as per Table 3.41 (significance matrix) of DMRB LA 114 (replicated in Table 15.10).

Table 15.10: Evaluation of significance

Measure of consequence	Measure of likelihood / sensitivity				
	Very Low	Low	Medium	High	Very High
Very large	Not significant	Significant	Significant	Significant	Significant
Large	Not significant	Not significant	Significant	Significant	Significant
Moderate	Not significant	Not significant	Significant	Significant	Significant
Minor	Not significant	Not significant	Not significant	Not significant	Not significant
Negligible	Not significant	Not significant	Not significant	Not significant	Not significant

15.7.7 For the construction phase, a qualitative description of disruption risk will be reported.

15.7.8 Where appropriate, the assessment approach will also consider the principles set out in the IEMA Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation (IEMA, 2020).

15.8 Assessment assumptions and limitations

15.8.1 In line with DMRB LA 114, a proportionate approach will be applied to capture the principal contributing factors associated with GHG emissions, as such, some minor sources of GHG emissions may not be considered. Should any specific emission sources, for which emissions could potentially be estimated, be excluded from the assessment of GHG emissions, justification will be provided.

15.8.2 A small number of assumptions will need to be made within the assessment when estimating GHG emissions (for example, regarding likely maintenance activities and frequencies). Wherever assumptions are made, however, this will be made clear, and justification provided as to the assumptions made wherever possible.

15.8.3 Limited data may be available regarding GHG assumptions associated with existing operational electricity consumption and operational maintenance activities. Assumptions may therefore need to be made to estimate Do-Minimum GHG emissions associated with these activities. Should assumptions need to be made, these assumptions will be consistent, as much as possible, with those made for the Do-Something scenario (where relevant) so as to provide as direct a comparison of Do-Minimum and Do-Something GHG emissions as possible.

15.8.4 Assumptions regarding the composition of the national vehicle fleet (in particular the proportion of electric vehicles in the fleet) have the potential to have a substantial

influence on estimated operational road user GHG emissions. It is recognised, however, that there is uncertainty in the composition of the national vehicle fleet in future years, particularly in response to future Government policy (for example, the proposed ban on the sale of petrol and diesel cars and vans).

15.8.5 There are inherent uncertainties in the UKCP18 climate projections, however, the use of data for the high emissions scenario and for a 50% probability of occurrence is considered to represent a precautionary assessment of potential climate changes.

16. Assessment of cumulative effects

16.1 Introduction

16.1.1 This chapter sets out the scope of the cumulative effects assessment (CEA) that will be undertaken as part of the Environmental Statement. The CEA will be undertaken in accordance with the environmental assessment methodology outlined in DMRB LA 104: Environmental Assessment and Monitoring (Highways England, 2020) and the guidance outlined in Planning Inspectorate Advice Note Seventeen: Cumulative Effects Assessment (Version 2, 2019).

16.1.2 In general terms, cumulative effects result from multiple actions on receptors over time and are generally additive or interactive (synergistic) in nature. They can also be considered as effects resulting from incremental environmental, social, or economic impacts caused by other past, present, or reasonably foreseeable actions together with a scheme. Cumulative effects can occur during both construction and operation of a scheme.

16.1.3 For the purposes of the CEA, the following types of cumulative effects will be considered:

- Combined effects (also referred to as 'interrelationships between topics' in Planning Inspectorate Advice Note Seventeen (2019)) – this relates to the combined effects of a single project and the interrelationship between a number of different environmental aspects (e.g. between ecology and hydrology, population and human health) upon a single resource/receptor. Combined effects will be summarised in the cumulative effects chapter of the Environmental Statement where there is considered potential for a significant combined effect.
- Cumulative effects – this relates to the combined action of a number of different projects, in combination with the project being assessed, on a single resource/receptor. With inter-project effects there is the potential for additive or interactive (synergistic) effects on a single resource/receptor.

16.2 Legislative and policy background

16.2.1 The requirement for cumulative effects assessment for Nationally Significant Infrastructure Projects (NSIP) under the Planning Act 2008 (as amended) are set out in the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ('the EIA Regulations').

16.2.2 In the EIA Regulations, Schedule 3 paragraph 1(b) refers to the selection criteria for screening Schedule 2 development, and states that *'the characteristics of development must be considered with particular regard to…(b) the cumulation with other existing development and/or approved development'*. Schedule 3 paragraph 3(g), which relates to the types and characteristics of the potential impact, also requires *'(g) the cumulation of the impact with the impact of other existing and/or approved development'* to be taken into account. The EIA Regulations expand the definition set out in Annex III of the Directive, which simply refers to 'the cumulation with other projects'.

16.2.3 In relation to the information for inclusion in an Environmental Statement, Schedule 4 paragraph 5 of the EIA Regulations requires:

- '*A description of the likely significant effects of the development on the environment resulting from, inter alia: (e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources*'; and
- '*The description of the likely significant effects on the factors specified in regulation 5(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.'*

16.2.4 The need to consider cumulative effects in planning and decision making is also set out in planning policy, in particular the National Policy Statements for National Networks (NNNPS). NNNPS under point 4.3 stipulates that:

- *'…in considering any proposed development, and in particular, when weighing its adverse impacts against its benefits, the Examining Authority and the Secretary of State should take into account its potential adverse impacts, including any longer-term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.'*

16.2.5 The NNNPS under point 4.16 stipulates that *'…When considering significant cumulative effects, any environmental statement should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been granted, as well as those already in existence)'*. In this instance this would comprise 'other existing development and/or approved development' which is taken to include existing developments and existing plans and projects that are 'reasonably foreseeable'.

16.2.6 The NNNPS under point 4.17 also states that the Examining Authority should *'consider how significant cumulative effects and the interrelationship between effects might as a whole affect the environment, even though they may be acceptable when considered on an individual basis with mitigation measures in place.'*

16.2.7 The NNNPS under point 4.55 also stipulates that *'the effects of existing sources of pollution in and around the project are not such that the cumulative effects of pollution when the proposed development is added would make that development unacceptable, particularly in relation to statutory environmental quality limits.'*

16.2.8 In addition to the national policy set out in the NNNPS, the Proposed Scheme will also have regard to relevant legislation, local planning policy documents (see Appendix A) as well as any statutory guidance for this aspect. Full details of legislation, local planning policy and statutory guidance relevant to this aspect will be detailed in the Environmental Statement.

16.3 Cumulative assessment methodology

Assessment of combined effects

16.3.1 Combined effects will be presented in the cumulative effects chapter of the Environmental Statement for receptors which could be affected by more than one environmental aspect. Where a receptor has been identified as only experiencing one effect or where only one

environmental aspect has identified effects on that receptor there is no potential for combined effects to occur.

16.3.2 The combined effects will only be identified where more than one environmental aspect chapter of the Environmental Statement has identified a residual effect on an individual or group of receptors. The combined effects assessed as moderate or above (adverse or beneficial) will be deemed to be significant.

16.3.3 There is no standard approach to the assessment of combined effects. A checklist matrix will be used to scope-in receptors subject to multiple effects. The matrix approach is useful as a tool as it can visually represent relationships between project impacts and environmental components.

16.3.4 The study area for the assessment of combined effects for the Proposed Scheme reflects the study areas (also termed as the spatial Zone of Influence (ZOI)) identified within relevant aspect chapters of the Environmental Statement (refer to Table 16.1). Combined effects on receptors will be summarised in the cumulative effects chapter of the Environment Statement where there is considered potential for a significant combined effect.

Assessment of cumulative effects

16.3.5 In terms of assessing cumulative effects DMRB LA 104: Environmental Assessment and Monitoring (Highways England, 2020) notes that the CEA should report on:

1) Road projects which have been confirmed for delivery over a similar timeframe
2) Other development projects with valid planning permissions or consent orders, and for which EIA is a requirement
3) Proposals in adopted development plans with a clear identified programme for delivery

16.3.6 For the purposes of this CEA, it is considered that the categories of development identified in DMRB LA 104 would cover existing plans and projects that are ‘reasonably foreseeable’, and as such will be reported on in the Environmental Statement as per point 4.16 of the NNNPS. However, it should also be noted that the Planning Inspectorate Advice Note Seventeen (2019) lists broader types of developments to be included in the CEA than the DMRB LA 104 standard, as it lists developments which have been submitted for planning but have yet to be determined (see Table 16.3), and it also does not restrict the scope to planning applications for which EIA is a requirement. This has been taken into account in the methodology to be applied for this CEA, in accordance with paragraph E/1.6 of DMRB LA 104, which states that the methodology set out in Planning Inspectorate Advice Note Seventeen (2019) shall be applied to all Nationally Significant Infrastructure Project (NSIP) environmental assessments.

16.3.7 DMRB LA 104 notes that the assessment of cumulative effects shall:

1) Establish the zone of influence of the project together with other projects
2) Establish a list of projects which have the potential to result in cumulative impacts
3) Obtain further information and detail on the list of identified projects to support further assessment

16.3.8 In addition, DMRB LA 104 notes that there are no defined limits or criteria for selecting the list of projects for cumulative assessment and professional judgement using Annex III of the EIA Directive should be applied and justification provided for developments selected (and excluded). Furthermore, DMRB LA 104 notes that the temporal and spatial scope,

together with characteristics of the identified projects, are key considerations in identifying projects that require further assessment as part of the CEA.

16.3.9 Therefore, given the above, the proposed CEA methodology captures the standard given in DMRB LA 104 together with the staged approach and broader interpretation set out in Planning Inspectorate Advice Note Seventeen (2019). The proposed methodology is outlined in further detail below.

Stage 1: Establish the zones of influence and long list of other development

16.3.10 Stage 1 has been provisionally undertaken as part of the scoping exercise for this Environmental Scoping Report to inform the Scoping Opinion. ZOIs have been determined for each aspect and relevant matters according to the reasoning set out in Table 16.1. A preliminary long list of 'other existing development and/or approved development' which fall within one or more of the ZOIs has been developed and is presented in the matrix in Appendix F.3. It should be noted that the ZOIs vary according to environmental aspects and matters. Therefore, some developments on the long list would be included in further stages of the CEA for some environmental aspects and matters, but not for others.

16.3.11 The traffic modelling will take into account future developments in the future traffic flow forecasts as part of its core scenario modelling. The air quality and noise assessments for operational effects will be based on the traffic core scenario as part of their standard methodologies so the assessments presented in these two aspect chapters are inherently cumulative. Therefore, operational air and noise will not be included within the CEA chapter of the Environmental Statement to avoid duplication, and the ZOI for operational noise and air quality effects are not defined in Table 16.1 below.

16.3.12 Additional aspects which have not had a ZOI defined include:

- Material assets and waste – assessment reported in this aspect chapter considers the influence of constructing the Proposed Scheme on national material recovery targets, regional recycled aggregate targets, sub-regional minerals sterilisation and regional landfill capacity; and therefore does not require further assessment in the CEA.
- Climate – assessment reported in the aspect chapter considers the Proposed Scheme's potential to affect the global climate (as a result of changes in Greenhouse Gas (GHG) emissions) and the effect of changes in climate on the Proposed Scheme itself, and therefore does not require further assessment in the CEA. Furthermore, the Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation (2020) advises that the extent to which climate exacerbates or ameliorates the effects of a Proposed Scheme on the environment 'in-combination' effects should be considered. The IEMA guidance advises that the 'in-combination assessment' (where climate has the potential to exacerbate or conversely diminish the effect of an existing impact of a Proposed Scheme) is best analysed in the existing environmental aspect chapters of an Environmental Statement and is suited to using traditional significance criteria from the respective chapters.

Table 16.1: Criteria for determining the zone of influence for the CEA for each environmental aspect

Environmental aspect	Zone of Influence	Reasoning
Air quality	Construction dust – 0.2km of all construction activity.	Follows DMRB LA 105 – refer to Chapter 6, Section 6.2.
	Construction traffic emissions – 0.2km of Affected Road Network (to be determined during PCF Stage 3).	
	Operational emissions – N/A (refer to paragraph 16.3.10).	
Cultural heritage	Effects on setting of designated heritage assets (construction and operation) – 1km from provisional Order Limits.	Follows DMRB LA 106 – refer to Chapter 7, Section 7.2.
	Effects on non-designated assets and their settings (construction and operation) – 0.3km from provisional Order Limits.	
Landscape	Construction and operation effects – 2km from provisional Order Limits.	Based on professional judgement and landscape and visual study area - refer to Chapter 8, Section 8.2. The potential for landscape and visual effects associated with the Proposed Scheme are unlikely to be significant beyond 2km due to distance and intervening features.
Biodiversity	General construction and operation effects – 2km from provisional Order Limits.	Follows DMRB LA 108 and likely significant effects – refer to Chapter 9, Section 9.2.
	Protected and notable species – • Great crested newt – 500m from provisional Order Limits (extending further if part of a meta population). • Badger – 100m from provisional Order Limits (extending further if based on clan territories). • Terrestrial invertebrates – provisional Order Limits. • Reptiles – provisional Order Limits. • Birds, otter and water vole and bats to be further refined on completion of surveys.	
	European Sites – • 30km where bats are a qualifying feature of a European site. • 2km for other European sites or where there is a hydrological link between Proposed Scheme and European site.	

Environmental aspect	Zone of Influence	Reasoning
Geology and soils	Construction and operation effects – 0.25km from provisional Order Limits.	Follows relevant guidance and professional judgement (in the absence of a defined study area in DMRB LA 109) – refer to Chapter 10, Section 10.2. It is not considered likely that significant effects would arise beyond this distance.
Noise and vibration	Construction noise effects – 0.3km from provisional Order Limits.	Follows DMRB LA 111 – refer to Chapter 12, Section 12.2. Operational vibration scoped out in accordance with DMRB LA 111.
	Construction vibration effects – 0.1km from provisional Order Limits.	
	Operational noise effects – N/A (refer to paragraph 16.3.10).	
	Operational vibration effects – Scoped out.	
Population and human health	Land use and community health effects (construction and operation) – 0.6km from provisional Order Limits.	Refer to Chapter 13, Section 13.3. Follows DMRB LA 112, LA 111, LA 105 and professional judgement that likely significant effects on land use and population health from noise, air quality, visual intrusion and local disruption would be typically up to 600m. A distance of 2km is considered for regular walking journeys and physical activity.
	Effects on physical activity opportunities (construction and operation) – 2km from provisional Order Limits.	
Water environment	Effects on groundwater, hydromorphology, flood risk and water quality (construction and construction) – 1km from provisional Order Limits.	Based upon professional judgement and similar schemes of this nature. This extent could increase during the assessment should the potential for significant impacts beyond this area be identified.

16.3.13 The following local planning authorities are within 2km of the provisional Order Limits: Bury Metropolitan Borough Council (BMBC), Manchester City Council (MCC), Salford City Council (SCC), and Rochdale Borough Council (RBC). The search for 'other existing development and/or approved development' for the preliminary long list has included a review of:

- Planning applications registered with the relevant Local Planning Authorities (Town and Country Planning Act 1990) since January 2016, including:

  - development with planning consent and under construction (but not completed)
  - extant planning consent (consent granted and not expired, but construction has not commenced)
  - planning applications currently under consideration by the Local Planning Authority
  - screening / scoping opinions currently under consideration by the Local Planning Authority (which may indicate a planning application is forthcoming)

- Development allocations proposed in an approved or emerging (with at least a draft having been submitted to the Planning Inspectorate) Local Plan
- Nationally Significant Infrastructure Projects listed on the Planning Inspectorate's register of projects (Planning Act 2008) including:
  - where the developer has advised the Planning Inspectorate in writing that they intend to submit an application in the future
  - where an application has already been made to the Planning Inspectorate and is undergoing the development consent process
  - where a proposal has been decided
- Development of transport systems authorised by Transport and Works Act Order (TWAO) (Transport and Works Act 1992) including:
  - applications currently under consideration by the Secretary of State; and
  - Made Orders
- Hybrid Bills currently before parliament
- Reserved matter applications and discharge of conditions – these have been reviewed for cases where although the planning application to which they relate may pre-date 2016, they indicate large scale developments which are being brought forward in phases and so there is potential for temporal overlap with the Proposed Scheme

16.3.14 The Planning Inspectorate Advice Note Seventeen (2019) does not specify any criteria to be considered before selecting other developments for the long list at Stage 1, other than being within a relevant ZOI for CEA. However, it is considered that the inclusion of all minor planning applications into the long list would not be proportionate and these have therefore been excluded from the preliminary long list prior to Stage 1. The exclusion of minor developments is justified on the basis that these would be developments of not more than local significance and are highly unlikely to give rise to cumulative effects of a scale that would be environmentally significant over and above the Proposed Scheme in isolation.

16.3.15 Therefore, for the preliminary long list (Appendix F.3) only planning applications which meet the criteria set out in Table 16.2 have been included and it is the intention to apply these criteria for future reviews of the long list as the CEA is developed and updated for the Environmental Statement.

Table 16.2: Selection criteria for other development to be included in the Stage 1 long list

Buffer from provisional Order Limits	Long list selection criteria	Reasoning
2km	Nationally Significant Infrastructure Projects (NSIP). All Major Development (development with >10 dwellings, >1,000 m^2 of floor space or site area between greater than 1 ha).	The 2km buffer is set based on the maximum environmental topic ZOI determined for the assessment. The criteria of a major development is used in order to avoid the inclusion of small scale projects such as building conversions and single dwellings which would, in any case, be sifted out prior to Stage 2 (identifying the short list).

16.3.16 All developments identified in the preliminary long list have been categorised into Tier 1 to 3 development stages based on the Planning Inspectorate Advice Note Seventeen (2019)

guidance (refer to Table 16.3); additional criteria have been applied using professional judgement to ensure that tier of development can be assigned to developments where screening requests and scoping reports have been submitted to local planning authorities.

16.3.17 Stage 1 of the CEA involves screening the developments in the long list to set out which of the various environmental aspects' ZOIs they fall within, and therefore which environmental aspects are relevant considerations in the CEA process for each of the developments.

16.3.18 In some cases a development will not be taken through to Stage 2 because, although it falls within a ZOI, the nature of the development is not relevant in terms of being likely to affect the environmental factors for which that ZOI has been determined.

Table 16.3: Criteria for determining tier of development for CEA (adapted from Planning Inspectorate Advice Note Seventeen, 2019)

Tier	Development Status	
Tier 1	Under construction.	Decreasing level of available data ↓
	Permitted applications whether under the Planning Act 2008 (Planning Act 2008) or other regimes, but not yet implemented.	
	Submitted applications whether under the Planning Act 2008 or other regimes, but not yet determined.	
Tier 2	Projects on the Planning Inspectorate's Programme of Projects or in the local planning authorities' portal where a Scoping Report has been submitted.	
Tier 3	Projects on the Planning Inspectorate's Programme of Projects or in the local planning authorities' portal where a Scoping Report has not been submitted.	
	Identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that there will be limited information available on the relevant proposals.	
	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.	
	Projects that have requested a screening opinion from the relevant local planning authority.	

16.3.19 As noted above, Stage 1 has been provisionally undertaken to inform the Scoping Opinion. The preliminary long list will be reviewed further to take account of feedback through the Scoping Opinion and will be updated and reported in the Preliminary Environmental Information Report. Subsequent reviews and updates will be undertaken to account for feedback as part of the pre-application statutory consultation and any additional development applications or allocations made during the interim period. A cut-off point for adding new development applications to the long list will be required to allow sufficient time for completion of the CEA process and compilation of the Environmental Statement prior to the submission for development consent. This is likely to be two to three months following the completion of pre-application statutory consultation. A further update to the long list will be made during the pre-Examination period to allow for an up-to-date record of relevant 'other existing development and/or approved development' to be available should questions arise during the Examination.

Stage 2: Identify a short list of other development for CEA

16.3.20 The next stage of the CEA is to create a short list of 'other existing development and/or approved development'. This will involve taking the developments screened in from Stage 1 and determining if there is potential for significant effects to arise in combination with the Proposed Scheme. Professional judgement will be used to identify whether potential cumulative impacts are likely to be significant, with consideration to the inclusion / exclusion criteria set out in Table 16.4.

16.3.21 Only likely significant effects will be taken forward to the next stages of the CEA, rather than every potential interaction. The matrix in Appendix F.1 will be used to record the outcome of Stage 2 and document the short list of other developments. Justification will be provided in the matrix to assist in providing a clear record of 'other existing development and/or approved development' considered and the decision-making process taken with respect to including / excluding development from further assessment.

Table 16.4: CEA Stage 2 exclusion criteria

Consideration	Criteria
Temporal scope	Other development with overlapping construction (2025-2027) and operational periods (2027-2042) to the Proposed Scheme will be considered further. Other development with temporal scopes outside these periods will not be short-listed for the CEA.
Scale and nature of development	Development identified as Schedule 1 and 2 developments in the EIA Regulations will be considered further. Other development not identified as Schedule 1 or 2 development will not be short-listed for the CEA unless, after reviewing it against criteria in Schedule 3 of the EIA Regulations, it is considered that it has characteristics by which there is a likelihood of significant effects when considered in combination with other development.
Sensitivity of the receiving environment	Where there are potential source-pathway-receptor linkages between other development and the Proposed Scheme, cumulative effects will be considered further. Other development with no clear source-pathway-receptor linkage will not be short-listed for the CEA.

16.3.22 The CEA shortlisting process will be reviewed and updated where necessary to take account of stakeholder engagement and feedback from the pre-application statutory consultation, as well as updates made to the long list as described above.

16.3.23 The long list and the short list will be reviewed and updated during the pre-application period up to the time when assessment work must cease to allow time for the preparation and review of the Environmental Statement. A clear record of the final review date will be provided within the CEA chapter. However, the long list will be reviewed again up until the actual point of submission of the application for development consent to allow for any new allocations and applications that emerge during that intervening time period to be screened and an addendum updating the CEA can be prepared to support the Examination, if required.

Stage 3: Information gathering

16.3.24 The CEA will rely on the environmental assessment information being published as part of the planning applications or planning documents for the 'other existing developments and/or approved developments'. This data will be obtained from ongoing engagement with

the relevant local authorities, from the local authority planning application searches and Local Plan websites (TCPA applications), the Planning Inspectorate's website, and other relevant interactive sources to inform the CEA. Key details from the information gathering exercise will be captured and presented in the matrix format included in Appendix F.2.

Stage 4: Assessment

16.3.25 The CEA will be undertaken by a competent EIA practitioner, working with all aspect assessors, reviewing the relevant planning material, and drawing links to potential effects with the Proposed Scheme. Matrix 2 from the Planning Inspectorate Advice Note Seventeen (2019) will be completed to record the results of this assessment process (refer to Appendix F.2). The competence of the EIA practitioner and other assessors involved in the preparation of the CEA (i.e. in terms of their suitable experience, qualifications, and professional memberships) will be set out in the Environmental Statement.

Assessment of significance

16.3.26 DMRB LA 104 (Highways England, 2019) states that the significance should be determined by the extent to which the impacts can be accommodated by the resource (receptor).

16.3.27 For the purpose of the CEA, the value of a resource (receptor) and magnitude of impact is determined according to the criteria set within the environmental aspect chapters. The significance of effect will then be carried forward from the environmental aspect chapters to identify the significance of cumulative effects with other developments. Effects will be identified as short-term or long-term, permanent or temporary and adverse or beneficial. Mitigation measures will be considered, and the residual significance of the effects will be assessed. Where the significance of an effect is moderate or above (adverse or beneficial), it is likely to be material to the decision-making process.

16.3.28 The Planning Inspectorate Advice Note Seventeen (2019) outlines that the CEA will give due consideration to the following when determining significance:

- The duration of effect, i.e. will it be temporary or permanent
- The extent of effect, e.g. the geographical area of an effect
- The type of effect, e.g. whether additive (loss of two pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss) or synergistic (two discharges combine to have an effect on a species not affected by discharges in isolation)
- The frequency of the effect
- The 'value' and 'resilience' of the receptor affected
- The likely success of any mitigation required

16.3.29 The above process will be captured in the CEA matrices, as set out in Appendix F.1 and Appendix F.2, in accordance with Planning Inspectorate Advice Note Seventeen (2019).

Assumptions and limitations

16.3.30 The key difficulties in any CEA relate to the level of detail available in relation to 'other existing development and/or approved development' and the reliance that needs to be made on environmental assessments carried out by others. For those applications at earlier stages of development or those for which EIA has not been undertaken,

professional judgement and knowledge of the study area will be employed to consider the receptors or resources that may be affected by the Proposed Scheme and the 'other existing development and/or approved development' in question. In these circumstances environmental assessment will not be undertaken for these 'other existing development and/or approved development' and the CEA will be limited by the availability of relevant information.

16.3.31 There is a tendency for variation in terminology used between different EIAs. For example, one project may use 'major positive' while another may use 'large beneficial'. Therefore, some interpretation may be needed by the EIA practitioner undertaking the CEA, to allow for comparison of effects from different developments.

16.3.32 There are differences in what Local Planning Authorities report and include on their planning portals. As part of the progression of updating the long list of developments there will be a reliance on the relevant host Local Planning Authorities to advise on developments deemed to be suitable for inclusion in the CEA and also to provide supporting documentation / details relating to these identified developments.

16.3.33 Only planning applications submitted since January 2016 have been considered on the basis that it is likely that older ones will have been completed prior to the Proposed Scheme commencement and are therefore unlikely to give rise to cumulative effects. The exception is for some identified reserved matters applications which indicate large-scale planning applications pre-dating 2016 that are yet to have commenced.

16.3.34 Planning applications which have been refused will not be taken forward to Stage 2 on the assumption that it is most likely they will not be pursued. However, these will be reviewed prior to completion of the CEA to check for any successful appeals which may have been made during the intervening period. In such cases, these applications will be considered further in the CEA in the same way that any new planning applications which have come forward will be reviewed.

16.4 Assessment of combined effects

16.4.1 Combined effects resulting from the Proposed Scheme will be considered in the cumulative effects chapter of the Environmental Statement. Professional judgement will be used to determine the potential for combined effects, with effects identified as significant or not. Any likely significant combined effects, along with any identified mitigation and residual effects, will be presented within the Environmental Statement.

16.5 Assessment of cumulative effects

16.5.1 The assessment is currently at the preliminary stage of identifying the long list of developments to be considered. No assessment of the associated cumulative effects has been carried out at this scoping stage.

16.5.2 Following the identification of the long list and refined short list of developments, an assessment of potential impacts and inter-project cumulative effects with 'other existing development and/or approved development' on the surrounding environment and receptors (during construction and operation) will be undertaken.

17. Summary of assessment scope

17.1 Aspects scoped into the assessment

17.1.1 Table 17.1 summarises the environmental aspects that have been scoped into the Environmental Impact Assessment (EIA) as well as the specific matters that will be assessed in the Environmental Statement.

17.1.2 The scope of the EIA may be refined following receipt of the Planning Inspectorate's Scoping Opinion.

17.2 Aspects scoped out of the assessment

17.2.1 The construction and operation of the Proposed Scheme would not introduce any source of radiation and would only generate limited amounts of heat from technology. The assessment of heat and radiation is therefore not considered relevant to the Proposed Scheme and has been scoped out of further assessment.

17.2.2 No further environmental aspects have been scoped out of the assessment in their entirety.

17.2.3 Certain matters of environmental aspects have been scoped out of the assessment, as shown in Table 17.1. In summary, these are:

- Effects on archaeological remains during the operational phase (Chapter 7) – archaeological remains would be sensitive only to the potential for changes in the way in which sound and noise currently contribute to their heritage value. Their value is primarily derived from their physical remains and any intrusion on their setting during operation would have limited to no impact on our understanding and appreciation of these heritage assets. Using the criteria for the assessment of impacts set out in Appendix B, this would not be on a scale that would result in significant effects. Based on this, impacts on archaeological remains during operation are scoped out.
- European designated ecological sites (Chapter 9) – there are no Special Protection Area (SPA) or Ramsar sites within 2km of the Proposed Scheme or PCF Stage 2 ARN and European sites designated for bats within 30km of the Proposed Scheme, therefore SPAs and Ramsar sites are scoped out of further assessment.
- National nature reserves (NNR) (Chapter 9) – there are no NNRs within 2km of the Proposed Scheme or PCF Stage 2 ARN, therefore NNRs are scoped out of further assessment.
- Invasive and non-native plant and animal species (INNS) (Chapter 9) – given the negligible value assigned to INNS, invasive species are scoped out of further assessment during operation, however, they will be considered in relation to legislative compliance during construction.
- Designated geological sites and sensitive / valuable non-designated geological features (Chapter 10) – there are no receptors located within the study area, therefore this matter of geology is scoped out of further assessment.
- Effects on soils during the operational phase (Chapter 10) – no additional impacts are predicted on soils during the operational phase. The permanent loss of agricultural land occurring during construction would persist during operation but is not considered

as an additional effect. Temporary effects arising during construction on soil quality in relation to degradation during handling may extend into operation but should not be persistent assuming that the best practice mitigation measures in Section 10.5 are applied. Operational effects on soils are therefore scoped out of further assessment.

- Effects on the health of site users and the general public during the operational phase (Chapter 10) – contamination within the Proposed Scheme extents would have been removed during construction, reducing the potential for contact with contaminated soil. Furthermore, implementing appropriate site-specific risk assessments and method statements would reduce exposure. This is likely to have a negligible magnitude of impact, resulting in a slight effect on human health. Therefore, human health for site users has been scoped out of the assessment.
- Effects on groundwater and surface water from contaminated land during the operational phase (Chapter 10) – during the operational stage, potential contaminated land linkages would have been broken due to the construction of the carriageway, therefore no additional impacts are predicted in relation to water receptors. Operational effects on surface water and groundwater from contaminated land are therefore scoped out of further assessment.
- Effects from material assets and waste during the operational phase (Chapter 11) – DMRB LA 110 specifies that the assessment should only report on the first year of operational activities (opening year). Any construction phase effects overlapping within this period will be captured within the construction phase assessment. It is assumed that the assessment of any environmental impacts and effects associated with material assets and waste during any large scale future maintenance, renewal, or improvement works, would be undertaken by Highways England's North West Asset Delivery Contractor(s) (or equivalent) in accordance with the requirements of DMRB LA 110.
- Effects from traffic vibration during the operational phase (Chapter 12) – DMRB LA 111 states that operational vibration should be scoped out of the assessment methodology as a maintained road surface will be free of irregularities so operational vibration will not have the potential to lead to significant adverse effects. It is considered that there is nothing within the initial design of the Proposed Scheme that would change this assumption.
- Community severance during the construction phase (Chapter 13) – the Proposed Scheme has the potential to influence traffic flows on the wider road network, some of which may result in increases or alleviation of community severance. Further information is required to investigate the locations of changes to traffic flows and whether changes are of a scale that may affect existing levels of severance or cause new severance. It is proposed to assess this for operational traffic flows only. There is also potential to address existing severance through inclusion of new safe crossing points that would help re-connect community networks and support community cohesion. Since community severance and social cohesion are considered longer-term issues, it is proposed to assess this during the operational phase only. Potential disruption to community access from construction activities will be considered under 'accessibility for walking and cycling' and 'connections to employment, services, facilities and leisure'.
- Effects on employment opportunities including training opportunities during the operational phase (Chapter 13) – as a highway project, the Proposed Scheme will not generate many direct employment opportunities in operation and so this is not a likely

significant effect on human health. Operational effects on employment opportunities are therefore scoped out of the assessment.

Table 17.1: Aspects and matters scoped into the environmental assessment

Aspect	Matters to assess	Scoped in - construction	Scoped in - operation
Air Quality	Construction dust receptors (human and ecological)	✓	n/a
	Human health receptors	✓	✓
	Designated ecological sites	✓	✓
	PCM compliance risk	✓	✓
Cultural Heritage	Archaeological remains	✓	×
	Historic buildings	✓	✓
	Historic landscape	✓	✓
Landscape	Effects on local landscape character that would potentially be directly or indirectly affected	✓	✓
	Visual effects	✓	✓
Biodiversity	European designated sites (SAC)	×	✓
	SSSI	×	✓
	Local Nature Reserves	✓	✓
	Local Wildlife Sites	✓	✓
	Ancient Woodland Inventory sites and ancient woodland habitat	✓	✓
	Priority habitats	✓	✓
	Notable vascular plants	✓	✓
	Badger	✓	✓
	Bats	✓	✓
	Birds – breeding, wintering and schedule 1 species	✓	✓
	Freshwater fauna (fish and macro-invertebrates)	✓	✓
	Great crested newt	✓	✓
	Otter	✓	✓
	Reptiles	✓	✓
	Terrestrial invertebrates	✓	✓
	Water vole	✓	✓
	Priority species	✓	✓
	INNS – plants and animals	✓	×
Geology and Soils	Soils	✓	×
	Human health (site users/general public)	✓	×
	Human health (construction/maintenance workers)	✓	✓
	Human health (residential properties)	✓	✓

Aspect	Matters to assess	Scoped in - construction	Scoped in - operation
	Groundwater and surface water from contaminated land	✓	×
Material Assets and Waste	Materials assets	✓	×
	Waste	✓	×
	Construction noise	✓	n/a
Noise and Vibration	Construction vibration	✓	n/a
	Operational traffic noise	n/a	✓
	Operational traffic vibration	n/a	×
Population and Human Health	Land use and accessibility (Population and housing)	✓	✓
	Land use and accessibility (Community land and assets)	✓	✓
	Land use and accessibility (Development land and business)	✓	✓
	Land use and accessibility (Agricultural land holdings)	✓	✓
	Land use and accessibility (Walkers, cyclists and horse riders)	✓	✓
	Human health (Access to the natural environment and outdoor recreation)	✓	✓
	Human health (Accessibility for walking and cycling)	✓	✓
	Human health (Connections to employment, services, facilities and leisure)	✓	✓
	Human health (Community severance)	×	✓
	Human health (Employment opportunities including training opportunities)	✓	×
	Human health (Quality of urban and natural environments (including air pollution and noise))	✓	✓
Road Drainage and the Water Environment	Surface water quality	✓	✓
	Water resources	✓	✓
	Hydromorphology	✓	✓
	Groundwater	✓	✓
	Flood risk	✓	✓
Climate	GHG emissions from the product stage (embodied carbon in construction materials)	✓	✓ [a]
	GHG emissions from transport of construction materials to site	✓	✓ [a]
	GHG emissions from fuel consumption (on-site plant)	✓	✓ [a]
	GHG emissions from fuel consumption (workers vehicles)	✓	✓ [a]

Aspect	Matters to assess	Scoped in - construction	Scoped in - operation
	GHG emissions from electricity and water consumption	✓	✓
	GHG emissions from transportation, treatment and disposal of waste materials	✓	✓ [a]
	GHG emissions from land use change and forestry	✓	✓
	GHG emissions from road users	n/a	✓
	Vulnerability of scheme to climate change from changes in seasonal precipitation and temperature	✓	✓
	Vulnerability of scheme to climate change from increased frequency of extreme precipitation and temperature events	✓	✓
	Vulnerability of scheme to climate change from increased frequency of extreme precipitation and temperature events	✓	✓

Acronyms

Abbreviation	Term
µg	Microgram
µg/m^3	Microgram per metre cubed
AADT	Annual Average Daily Traffic
ADMS	Atmospheric Dispersion Modelling System
AEP	Annual Exceedance Probability
AIA	Arboricultural Impact Assessment
ALC	Agricultural Land Classification
ALR	All Lane Running
AMI	Advanced Motorway Indicator
AOD	Above ordnance datum
AONB	Area of Outstanding Natural Beauty
AoS	Area of Search
AQMA	Air Quality Management Area
AQO	Air Quality Objective
ARN	Affected Road Network
AStGF	Areas Susceptible to Groundwater Flooding
AW	Ancient Woodland
AWI	Ancient Woodland Inventory
AWP	Aggregates Working Party
BEIS	Department for Business, Energy & Industrial Strategy
BFI	Baseflow Index
BGS	British Geological Survey
BIS	Department of Business Innovation & Skills
BMBC	Bury Metropolitan Borough Council
BMV	Best and Most Versatile
BNL	Basic Noise Level
BRE	Building Research Establishment
BS	British Standard
BSI	British Standards Institution
C&D	Construction and Demolition
CA	Conservation Area
CCC	Committee on Climate Change
CEA	Cumulative Effects Assessment
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
CITB	Construction Industry Training Board
CL:AIRE	Contaminated Land: Applications in Real Environments
CLR 11	Contaminated Land Report 11
CMLI	Chartered Member of the Landscape Institute
CNI	Critical National Infrastructure
CO_2	Carbon dioxide
$CO2_e$	Carbon dioxide equivalent
CoCP	Code of Construction Practice
COPD	Chronic Obstructive Pulmonary Disease

Abbreviation	Term
COVID-19	Coronavirus disease 2019
CPRE	Campaign to Protect Rural England
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
D5M	Dual 5-lane Motorway
dB	Decibel
DBA	Desk Based Assessment
DCLG	Department of Housing, Community and Local Government
DCO	Development Consent Order
DDMS	Drainage Data Management System
Defra	Department for Environment, Food and Rural Affairs
DfRE	Design for Resource Efficiency
DfT	Department for Transport
DM	Do-Minimum
DMOY	Do-Minimum Opening Year scenario
DMRB	Design Manual for Roads and Bridges
DS	Do-Something
DSFY	Do-Something Future Year scenario
DSOY	Do-Something Opening Year scenario
EA	Environment Agency
EAR	Environmental Assessment Report
EB	Eastbound
EEA	European Economic Area
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Fields
EMP	Environmental Management Plan
ENVIS	Environmental Information System
EQS	Environmental Quality Standard
ES	Environmental Statement
ETCCDI	Expert team on climate change detection and indices
EU	European Union
EUPHA	European Public Health Association
FC	Football Club
FRA	Flood Risk Assessment
GCN	Great Crested Newt
GHG	Greenhouse Gases
GI	Ground Investigation
GIR	Ground Investigation Report
GIS	Geographic Information System
GLVIA3	Guidelines for Landscape and Visual Impact Assessment
GMCA	Greater Manchester Combined Authority
GMLRC	Greater Manchester Local Records Centre
GMSF	Greater Manchester Spatial Framework
GWDTE	Groundwater Dependent Terrestrial Ecosystem
GWP	Global-Warming Potential

Abbreviation	Term
ha	Hectare
HADDMS	Highways England Drainage Data Management System
HAGDMS	Highways England Geotechnical Data Management System
HAPMS	Highways England Pavement Management System
HASP	Health and Safety Plan
HDV	Heavy Duty Vehicle
HER	Historic Environment Record
HEWRAT	Highways England Water Risk Assessment Tool
HGV	Heavy Goods Vehicles
HLC	Historic Landscape Characterisation
HLT	Historic Landscape Type
HPI	Habitat of Priority Importance
HRA	Habitats Regulations Assessment
IAIA	International Association for Impact Assessment
IEMA	Institute of Environmental Management and Assessment
INNS	Invasive Non-Native Species
IROPI	Imperative Reasons of Over-Riding Public Interest
JNCC	Joint Nature Conservation Committee
kt	Kilotonne
LAQM	Local Air Quality Management
LAR	Local Access Road
LCA	Landscape Character Area
LCRM	Land Contamination Risk Management
LCT	Landscape Character Type
LDF	Local Development Framework
LED	Light Emitting Diode
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LNS	Low Noise Surface
LOAEL	Lowest Observed Adverse Effect Level
LSE	Likely Significant Effect
LTT	Long Term Trend
LULUCF	Land Use, Land-Use Change, and Forestry
LV	Limit Values
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
MAGIC	Multi Agency Geographic Information for the Countryside
M-BAT	Metal-Bioavailability Assessment Tool
mbgl	metres below ground level
MCC	Manchester City Council
MLP	Minerals Local Plan
MMP	Materials Management Plan
MNWQ	Manchester North-West Quadrant
MPA	Minerals Planning Authority
mph	Miles per hour
MSA	Mineral Safeguarding Area

Abbreviation	Term
MSM	Manchester Smart Motorway
Mt	Megatonne (or million tonne)
Mtpa	Million Tonnes per Annum
NAEI	National Atmospheric Emissions Inventory
NB	Northbound
NCA	National Character Area
NCN	National Cycle Network
NGR	National Grid reference
NHLE	National Heritage List for England
NIA	Noise Important Area
NNNPS	National Networks National Policy Statement
NNR	National Nature Reserves
NO_2	Nitrogen Dioxide
NOMIS	National Online Manpower Information System (only 'NOMIS' is now used)
NO_x	Nitrogen Oxides
NPPF	National Planning Policy Framework
NPSE	Noise Policy Statement for England
NRFA	National River Flow Archive
NRR	National Risk Register
NSIP	Nationally Significant Infrastructure Project
NTS	Non-Technical Summary
NVZ	Nitrate Vulnerable Zones
OAR	Options Appraisal Report
ONS	Office for National Statistics
ORVal	Outdoor Recreation Valuation Tool
OS	Ordnance Survey
PAQAP	Project Air Quality Action Plan
PAS	Publicly Available Specification
PBDE	Polybrominated diphenyl ethers
PCF	Project Control Framework
PCM	Pollution Climate Mapping (model)
PEIR	Preliminary Environmental Information Report
PFA	Pulverised Fuel Ash
PFOS	Perfluorooctane sulphonate
PHE	Public Health England
PINS	Planning Inspectorate
PLCM	Pennine Lower Coal Measures
PM	Photomontage Location
PM_{10}	Particulate matter 10 micrometres or less in diameter
$PM_{2.5}$	Particulate matter 2.5 micrometres or less in diameter
PMCM	Pennine Middle Coal Measures
PRA	Preferred Route Announcement
PRoW	Public Right of Way
PSSR	Preliminary Sources Study Report
PWS	Private Water Supplies
RBC	Rochdale Borough Council

Abbreviation	Term
RBMP	River Basin Management Plan
RBS	Route Based Strategy
RCB	Rigid Concrete Barrier
RCP	Receptor Concentration Pathway
RDWE	Road Drainage and the Water Environment
REAC	Register of Environmental Actions and Commitments
RIGS	Regionally Important Geological Site
RIS	Road Investment Strategy
RoFSW	Risk of Flooding from Surface Water
RPA	Root Protection Area
RSP	Responsible Sourcing Plan
RUFC	Rugby Union Football Club
SAC	Special Area of Conservation
SAR	Standardised Admissions Ratio
SB	Southbound
SBI	Site of Biological Interest
SCC	Salford City Council
SEPA	Scottish Environment Protection Agency
SFRA	Strategic Flood Risk Assessment
SMR	Standardised Mortality Ratio
SNRHW	Stable Non-Reactive Hazardous Wastes
SOAEL	Significant Observed Adverse Effect Level
SOBC	Strategic Outline Business Case
SoCC	Statement of Community Consultation
SON	High Pressure Sodium
SoS	Secretary of State
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPI	Species of Principle Interest
SPZ	Source Protection Zone
SRN	Strategic Roads Network
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
SWMP	Site Waste Management Plan
TAG	Transport Analysis Guidance
TAR	Technical Appraisal Report
TCA	Townscape Character Area
tCO_2e	Tonnes of Carbon Dioxide Equivalent
TCPA	Town and Country Planning Act
TfGM	Transport for Greater Manchester
TPO	Tree Preservation Order
TRA	Traffic Reliability Area
UDP	Unitary Development Plan
UKCP	United Kingdom Climate Projections
UKTAG	UK Technical Advisory Group
UNESCO	United Nations Educational, Scientific and Cultural Organisation

Abbreviation	Term
UXO	Unexploded Ordnance
VP	Representative Viewpoint
VRS	Vehicle Restraint System
WB	Westbound
WCH	Walkers, Cyclists and Horse Riders
WCHAR	Walking, Cycling and Horse-Riding Assessment and Review
WCRP	World Climate Research Programme
WER	Water Environment Regulations
WFD	Water Framework Directive
WFD-TAG	Water Framework Directive Technical Advisory Group
WHO	World Health Organization
WMO	World Meteorological Organization
WRAP	Waste and Resources Action Programme
ZOI	Zone of Influence
ZTV	Zone of Theoretical Visibility

Glossary

Term	Definition
Abstraction point	An area or point where water is extracted from either surface water or pumped up from groundwater.
Active travel	Travelling to specific destinations (e.g. work or school) by active modes such as walking or cycling.
Additive (cumulative effects assessment)	Where similar types of impact from a scheme or different developments affect a receptor at the same time and in a similar way e.g. loss of two pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss overall.
ADMS-Roads	Atmospheric Dispersion Modelling System (ADMS)-Roads. A commonly used piece of computer software which is used to model the dispersion of road traffic emissions.
Affected Road Network (ARN)	All roads that trigger any of the traffic screening criteria defined in DMRB LA 105, namely a change between the Do-Something traffic (with the Proposed Scheme) compared to the Do-Minimum traffic (without the Proposed Scheme) in the opening year of: 1) annual average daily traffic (AADT) ≥ 1,000 2) heavy duty vehicle (HDV) AADT ≥ 200 3) a change in speed band 4) a change in carriageway alignment by ≥ 5 m
Aggregates	Minerals which are used primarily to support the construction industry including soft sand, sand and gravel, and crushed rock.
Air Quality Management Area (AQMA)	An area declared by a local authority which has been determined will exceed the relevant air quality objective.
Air Quality Objectives (AQOs)	The target date on which exceedances of an air quality standard (i.e. concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment) must not exceed a specified number.
Air quality threshold	Generic term to represent the relevant pollutant averaging period and concentration value described by the air quality strategy objectives or EU limit values.
Ambient noise	Ambient noise is the total sound in a given situation at a given time usually composed of sound from many sources, near and far.
Annual average daily traffic (AADT)	A description of daily traffic characteristics for the representative average seven-day period (Monday to Sunday).
Annual Exceedance Probability (AEP)	Annual Exceedance Probability (AEP) refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which may be calculated to have a 1% chance to occur in any one year, is described as 1%AEP.
Aquifer	A subsurface layer or layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater.
Arboriculturist	Person who has, through relevant education, training and experience, gained expertise in the field of trees in relation to construction (BS5837:2012 Trees in Relation to Design, Demolition and Construction – Recommendations).
Aspect	This refers to an environmental topic (e.g. air quality, biodiversity, noise etc.).
Assessment of Effects	The assessment of changes arising from the development that is being assessed.

Term	Definition
A-weighting	In addition to its non-linear amplitude response, the human ear has a non-linear frequency response; it is less sensitive at low and high frequencies and most sensitive in the mid-range frequencies.
Backfilling (Material assets and waste)	Backfilling means a recovery operation where waste is used in excavated areas for the purpose of slope reclamation or safety or for engineering purposes in landscaping and where the waste is substituting other non-waste materials which would have had to be used for the purpose.
Barn owl roost	A barn owl's home.
Base year traffic data	The outputs of the traffic model coinciding with the year the traffic data was collected.
Baseline	In EIA, 'baseline conditions' are the environmental conditions in existence before the occurrence of an impact from a development i.e. they are the existing conditions that would be affected.
Baseline (Landscape and visual)	Work to provide an outline, understanding of landscape and visual conditions before or without implementation of the project requiring a mix of desk study consultation and field work. DMRB LA 107
Basic noise level (BNL) calculations	BNL calculations are undertaken by using traffic flow, speed and HGV percentage to calculate a reference noise emission from the road link, as set out in CRTN.
Bat roost	A bat's home.
Bed substrate	The material that rests at the bottom of a stream and along the channel margins.
Best overall environmental outcome	A departure from the waste hierarchy which delivers better overall environmental outcomes.
Bill of quantities	A document containing details on the volumes of excavated arisings from, and materials required for, a development. Also 'Schedule of Rates'.
Borrow pit	A temporary mineral working to supply material for a specific construction project.
British Geological Society (BGS)	Location of British data on geology
Carbon budgets	UK GHG targets over defined periods of time.
Carbon dioxide equivalent (CO_2e)	Carbon dioxide equivalent (abbreviated as CO_2e) is a metric used to compare the emissions of various greenhouse gases, based on their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of CO_2 with the same GWP. For example, the GWP for methane (CH_4) is 25 and for nitrous oxide (N_2O) is 298. This means that an emission of 1 tonne of CH4 is equivalent to an emission of 25 tonnes of CO_2 and an emission of 1 tonne of N_2O is equivalent to 298 tonnes of CO_2.
Carbon emissions	Shorthand for emissions of any of the seven GHGs covered by the Kyoto protocol that contribute to climate change.
Characteristics (Landscape and visual)	Elements or combination of elements, which make a particular contribution to distinctive character. DMRB LA 107
Circular economy	A circular economy is an alternative to a traditional linear economy (of make, use, dispose) in which we keep resources in use for as long as possible; extract the maximum value from resources while in use; recover and regenerate products and materials at the end of life; and keep products, components and materials at their highest utility and value at all times.

Term	Definition
Climate	Long-term weather conditions prevailing over a region.
Climate extreme indices	With regard to climate change, extreme weather events and climate events are often referred to collectively as climate extremes. The World Climate Research Programme (WCRP) and World Meteorological Organization (WMO) expert team on climate change detection and indices (ETCCDI) coordinate, organise and collaborate on climate extremes, indices and climate change detection. This team have defined a set of 27 core indices (the 'ETCCDI' indices) which can be derived from land surface observations of daily temperature and precipitation.
Climate scenario	UKCP18 uses emissions scenarios, called Representative Concentration Pathways (RCPs). RCPs specify the concentrations of greenhouse gases that would result in target amounts of radiative forcing at the top of the atmosphere by 2100, relative to pre-industrial levels. Four forcing levels have been set: 2.6, 4.5, 6.0 and 8.5 W/m^2. These create four RCPs that are used in UKCP18; RCP 2.6, RCP 4.5, RCP 6.0 and RCP 8.5.
Cold spell duration index	Count of days with at least six consecutive days when daily minimum temperature is below the 10th percentile.
Committed development	A development that has full or outline planning permission, or is allocated in an adopted development plan.
Competent expert for biodiversity/ecology	Individuals who can demonstrate that they have relevant: 1) qualifications; and 2) expertise in biodiversity assessment of infrastructure projects.
Competent expert for traffic	Individuals who can demonstrate that they have relevant: 1) qualifications; and 2) expertise in traffic assessment of infrastructure projects.
Conceptual Model (CM)	A conceptual model is a representation of a system that uses concepts and ideas to form said representation. here it provides conceptual information on contamination within the area of the site
Conservation area	An area designated under section 69 of the Planning (Listed Building and Conservation Areas) Act 1990 as being an area of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance.
Construction materials	Primary, recycled / secondary and renewable sources of materials required for constructing a project.
Construction, demolition and excavation waste	Arisings and waste from the demolition of buildings and structures, site preparation and clearance, remediation, excavation and construction activities.
Cumulative effects	Effects upon the environment that result from the incremental impact of an action when added to other past, present or reasonably foreseeable actions. Each impact by itself may not be significant but can become a significant effect when combined with other impacts.
Decibel	The unit of measurement used for sound pressure levels and noise levels quoted in decibels (dB). The decibel scale is logarithmic rather than linear; the threshold of hearing is zero decibels while, at the other extreme, the threshold of pain is about 130 decibels. These limits are seldom experienced and typical levels lie within the range of 30 dB(A) (a quiet night time level in a bedroom) to 90 dB(A) (at the kerbside of a busy road).
Design Manual for Roads and Bridges (DMRB)	Provides standards, advice notes and other documents relating to the design, assessment and operation of trunk roads, including motorways in the United Kingdom.
Designated habitats	Internationally, nationally and locally designated sites of ecological conservation importance on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity.

Term	Definition
Detailed assessment	Use of a detailed dispersion model to determine if a particular emission source is likely to create an exceedance of a given air quality objective.
Development Consent Order (DCO)	Introduced by the Planning Act in 2008, a DCO is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIP).
Discharge	The volume of flow passing a point in a given time period.
Dispersion modelling	The mathematical computation of the dispersal of emissions as they travel through the atmosphere.
Disposal	Any operation which is not recovery, even where the operation has as a secondary consequence the reclamation of substances or energy.
Do-Minimum (DM)	The scenario that represents the situation that would occur without the Proposed Scheme in operation, which includes permitted developments.
Do-Something (DS)	The scenario that represents the situation that would occur with the Proposed Scheme in operation, which includes permitted developments.
Drainage network	The streams, rivers, lakes and other water bodies that form a particular drainage basin. NB: This would not include the surface water drainage network that drains water from the carriageway
Dust	Solid particles that are suspended in air or have settled out onto a surface after having been suspended in air. The terms dust and particulate matter (PM) are often used interchangeably, although in some contexts one term tends to be used in preference to the other. In this assessment the term 'dust' has been used to include the particles that give rise to soiling, and to human health and ecological effects.
Effect	Term used to express the consequence of an impact. The significance of effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Embedded Mitigation	Mitigation measures which are embedded into the project design and have been developed through an iterative design process
Embodied / embedded carbon	Carbon (GHG) emissions associated with energy consumption and chemical processes during the extraction, transport (to point of installation) and / or manufacture of construction materials or products.
Enabling works	Site preparation works that might take place prior to the main construction contract works.
End of first life	The point at which an asset is no longer useful in the capacity for which it was originally intended.
Enhancement	A beneficial measure that is over and above what is required to mitigate the adverse effects of a project.
Environmental Impact Assessment (EIA)	Environmental Impact Assessment. A process by which information about environmental effects of a proposed development is collected, assessed and used to inform decision making. For certain projects, EIA is a statutory requirement.
Environmental Management Plan (EMP)	Plan of environment mitigation for contractors.
Environmental Statement (ES)	A document produced in accordance with the EIA Directive as transported into UK law by the EIA Regulations to report the results of an EIA.

Term	Definition
Examining Authority	The person(s) appointed by the Secretary of State (SoS) to assess the Development Consent Order application and make a recommendation to the SoS.
Exceedance	Where ambient concentrations for a given pollutant and averaging period are above the corresponding air quality objective at a location representative of public exposure.
Exception Test	The Exception Test is set out in the National Planning Policy Framework (NPPF). If the Sequential Test identifies that a proposed development is not 'appropriate' the Exception Test is used to demonstrate and ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.
Features (landscape)	Particularly prominent, "eye-catching" elements or characteristic components (i.e. tree clumps, church towers, or wooded skylines).
First study area (material assets and waste)	Project footprint (including temporary land take) for which consent is being sought. The area within which construction materials will be consumed (used / deployed), and waste generated (including temporary compounds and storage areas etc.).
Flood risk	The exposure, vulnerability and hazard associated with flooding.
Flood zone	Flood zones refer to the probability of river and sea flooding, ignoring the presence of defences. Flood zone 3 shows the area that could be affected by a 1 in 100 year (1% chance) flood event. Flood zone 2 shows the area that could be affected by a major flood (1 in 1000, or 0.1% chance). Flood zone 1 shows areas that are very unlikely to experience flood (<0.1%).
Floodplain	A floodplain is flat, or nearly flat, land adjacent to a stream or river, stretching from the banks of its channel to the base of the enclosing valley walls and (under natural conditions) experiences periods of flooding.
Fluvial hydromorphology	The scientific study of the form and function of rivers and the interaction between streams and the landscape around them.
Future Year	The year 15 years after the first full calendar year of opening, also known as the "design year".
Geology	The physical structure, substance and history of the earth (rocks and minerals).
Greenhouse gases (GHG)	A gaseous compound that absorbs infrared radiation and traps heat in the atmosphere. Greenhouse gases are usually expressed in terms of carbon dioxide equivalent (CO_2e).
Groundwater dependent terrestrial ecosystem (GWDTEs)	Wetlands which critically depend on groundwater flows and/or chemistry.
HAGDMS	Highways Agency Geotechnical Data Management System (HAGDMS)
Haul roads	Temporary routes set up within the Order Limits which will be used during installation by construction vehicles.
Hazardous waste	Defined in line with Article 3(2) of the Waste Framework Directive (Council Directive 2008/98/EC) as: 'waste which displays one or more of the hazardous properties listed in Annex III' of the Directive.
Health inequalities	The unfair and avoidable differences in health across the population, and between different groups within society.
Heavy Duty Vehicles (HDVs)	Rigid and articulated Heavy Goods Vehicles (HGVs) and buses/coaches.

Term	Definition
Heritage assets	The historic environment assets such as archaeological remains, historic buildings and historic landscapes which have archaeological, architectural, artistic or historic value.
Highways England	Highways England is the public body that operates, maintains and improves England's motorways and major A roads.
Holt	An otter's home.
Impact	Action being taken. GLVIA 3. For consistency within LVIA "impact" cannot be used interchangeably with "effect" nor to mean a combination of several effects. DMRB LA 107
Incidental extraction	Incidental extraction: Where any minerals that are incidentally extracted during site preparation would be processed and used on site (e.g. from excavating the road box, foundations, drainage works etc). This is typically the minimum level of prior extraction that the MPA would seek as part of any non-minerals development in an MSA.
In-combination effects	When a projected future climate impact (e.g. increase in temperatures) interacts with an effect identified by another topic and exacerbates its impact.
Inert waste	Waste which meets one or more of the following criteria: 1) that does not undergo any significant physical, chemical or biological transformations; 2) that does not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health; and 3) where its total leachability and pollutant content and the ecotoxicity of its leachate are insignificant and, in particular, do not endanger the quality of any surface water or groundwater. See Directive 1999/31/EC and Council Decision 2003/33/EC.
Institute of Environmental Management and Assessment (IEMA)	A professional body for environmental managers and EIA professionals.
Inter-project cumulative effects	The combined action of a number of different projects, in combination with the project being assessed, on a single resource/receptor.
Intra-project effects (interrelationship of effects)	The combined action of a number of different environmental topic specific effects upon a single resource/receptor.
Key construction material	Construction materials which, by weight, constitute the majority of material required to deliver the scheme.
LA_{10}	The A-weighted sound level, in dB, that is exceeded 10% of the time.
$L_{A10,18hr}$	The A-weighted sound level, in dB, that is exceeded 10% of the time between 06:00 and 24:00.
L_{Aeq}	The equivalent continuous sound level (L_{Aeq}) is the level of a notional steady sound, which at a given position and over a defined period of time, would have the same A-weighted acoustic energy as the fluctuating noise.
Land bank	The stock land with planning permissions but where minerals development has yet to take place.
Landfill capacity	The known, forecast or estimated remaining landfill void space, either regionally or nationally. Landfill capacity is generally measured in cubic metres.

Term	Definition
Landscape	An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors. European Landscape Convention (ELC) 2000. About the relationship between people and place. Inclusive, covering natural, rural, urban, and peri-urban areas and applies not only to special or designated landscapes or countryside but to everyday or degraded landscapes. 'A resource that results from the way that different components of our environment - natural and cultural - interact together and are perceived. (GLVIA3).
Landscape and visual impact assessment (LVIA)	A "... tool used to identify and assess the significance of and the effects of change resulting from... a project on both the landscape as a resource and on people's views and visual amenity." (GLVIA3)
Landscape architect	Competent expert to mean: 1) Chartered Member of the Landscape Institute (CMLI) or; 2) member of a recognised equivalent landscape professional body.
Landscape character	A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse. (GLVIA3)
Landscape character area (LCA)	Single unique areas which are the discrete geographical areas of particular landscape type. (GLVIA3)
Landscape character assessment	Process of identifying and describing variation in character of the landscape - the unique combination of elements and features that make landscapes distinctive - to assist in managing change in the landscape. (GLVIA3)
Landscape character type	Distinct types of relatively homogeneous landscape, generic in nature but share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetics attributes. (GLVIA3)
Landscape component	Interplay of physical, natural and cultural factors of our surroundings.
Landscape elements	Individual parts of the landscape include physical influences (geology, soils, landform, drainage, and water bodies); land cover (different types of vegetation, patterns, and types of tree cover); and human influences (land use and management, character of settlements of buildings, and pattern and type of fields and enclosure). (GLVIA3)
Landscape quality (or condition)	Measure of the physical state of the landscape based on judgements, which can include typical character represented in individual areas, integrity of the landscape, and condition of individual elements. (GLVIA3)
Landscape receptor	Defined aspect of the landscape resource that potentially could be affected by the project.
Landscape resource	Natural and physical attribute (i.e. soils vegetation).
Landscape sensitivity	Applied to specific landscape receptors, combining judgements of the susceptibility of the receptor to the specific type of change proposed and the value related to the receptor. (GLVIA3)
Life cycle stage	PAS 2080:2016 proposes a modular approach for the quantification of infrastructure related GHG emissions over a number of stages over the 'life cycle' of a project, namely 'before use (A)', 'use (B)' and 'end of life (C)'. These stages are further disaggregated into modules (e.g. Product Stage (A1-A3) and construction process stage (A4-A5)).
Limit Value	Legally binding parameters that must not be exceeded. Limit values are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved.

Term	Definition
Listed building	A building or structure designated under section 69 of the Planning (Listed Building and Conservation Areas) Act 1990 as being of special architectural or historic interest.
L_{night}	The equivalent continuous sound level $L_{Aeq,8hr}$ for the period 23:00 to 07:00 hours. This is derived from the $L_{A10,18hr}$ using the TRL conversion method TRL PR/SE/451/02.
Local air quality	Assessment of the impact of pollutant concentrations on sensitive receptors within 200 m of a road.
Local Air Quality Management (LAQM)	Through the Local Air Quality Management system local authorities are required to assess air quality in their jurisdiction and to designate Air Quality Management Areas if improvements are necessary.
Local Nature Reserve (LNR)	Sites that are designated by the local authority under Section 21 of the National Parks and Access to the Countryside Act 1949 for nature conservation which have wildlife or geological features that are of special interest locally.
Long Term Trend (LTT)	The application of adjustment factors which take into consideration the assumed rate of reduction in roadside NO_2 resulting from the use of Defra's modelling tools, compared to monitored trends at the roadside i.e. the gap between predicted reductions and those which have been observed.
Longest dry spell	Highest number of consecutive days with < 1 mm rainfall.
Long-term (in relation to noise assessment)	Noise change based on the +15-year assessment (for example Do-minimum opening year scenario (DMOY) against Do-minimum future year scenario (DMFY) and DMOY against Do-something future year scenario (DSFY)).
Magnitude of effect	Combines judgements about size and scale of effect, extent of area it occurs over, whether reversible or irreversible and whether short or long term in duration.
Main river	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers. Main river designation is not an indication of size, although it is often the case that they are larger than ordinary watercourses.
Material impact	An event/outcome that is a key decision-making consideration.
Matter	This relates to sub-topics of an environmental aspect (e.g. designated sites, protected species, etc.).
Maximum 5-day precipitation	Highest value of rainfall accumulated over five days.
Meandering channel	A single channel that follows a winding course, with a sinuosity ratio typically over 1.5.
Mineral area of search	A broad area within which mineral sites are sought for development.
Mineral Planning Authority	The mineral planning authority is the county council (in 2-tier parts of the country), the unitary authority, or the national park authority responsible for planning control of minerals development.
Mineral resource	Natural concentrations of minerals in or on the Earth's crust that are or may become of economic interest because they are present in such form, quality and quantity that there is the potential for eventual economic extraction. Generally, a mineral resource is known to exist within the boundaries outlined by BGS geological mapping.
Mineral safeguarding area	An area designated by a Mineral Planning Authority which covers known deposits of minerals which are desired to be kept safeguarded from unnecessary sterilisation by non-mineral development.
Mineral safeguarding sites	Operational extraction sites or mineral sites specifically identified / allocated in strategic planning documents as those that will be mined or extracted.

Term	Definition
Mitigation	The action of reducing the severity and magnitude of change (impact) to the environment. Measures to avoid, reduce, remedy or compensate for significant adverse effects.
Model verification	A comparison of the modelled results versus monitoring results at relevant locations to enable the adjustment of model outputs, minimising the inherent uncertainties associated with dispersion modelling.
Morphological features	Natural, physical shape of land or watercourse, e.g. of a riverbed or banks.
National Character Assessment (NCA)	Natural England has divided England into 159 distinct natural areas. Each is defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity. Their boundaries follow natural lines in the landscape rather than administrative boundaries.
National Network National Policy Statement (NNNPS)	The NPS for National Networks (NNNPS) sets out *"the need for, and the Government's policies to deliver development of nationally significant infrastructure projects on the national road and rail networks"*.
National Policy Statement (NPS)	National Policy Statements (NPS) are produced by Government. They give reasons for the policy set out in the statement and must include an explanation of how the policy takes account of Government policy relating to the mitigation of, and adaptation to, climate change.
Nationally Significant Infrastructure Project (NSIP)	Major infrastructure developments in England and Wales, such as proposals for power plants, large renewable energy projects, new airports and airport extensions, and major road projects, as set out in the Planning Act (2008). See entry for Development Consent Order.
Natural England	A public body responsible for ensuring that England's natural environment is protected and improved.
Natural resources	Any physical, tangible and valued element of the natural environment (e.g. soil, land, water and biodiversity).
Net zero	Net zero means any emissions would be balanced by schemes to offset an equivalent amount of greenhouse gases from the atmosphere, such as planting trees or using technology like carbon capture and storage.
Nitrate vulnerable zones (NVZ)	A designation required under the Nitrates Directive (91/676/EEC) for all land draining to and contributing to the nitrate pollution in "polluted" waters. Polluted waters are those where nitrate levels exceed, or are likely to exceed, the levels set in the Directive.
Noise modelling	Software to predict noise levels. NOTE: This can be undertaken either by specialist software to provide a 3D representation of the project and nearby noise sensitive receptors or a simple spreadsheet.
Noise monitoring	Measurement of noise levels.
Noise sensitive receptor	Receptors which are potentially sensitive to noise. NOTE: Examples include dwellings, hospitals, healthcare facilities, education facilities, community facilities, END quiet areas or potential END quiet areas, international and national or statutorily designated sites, public rights of way and cultural heritage assets.
NOMIS	NOMIS is a service provided by the Office for National Statistics, ONS, providing free access to detailed and up-to-date UK labour market statistics from official sources.
Non-hazardous waste	Waste that is neither classified as inert nor hazardous.
Opening year	The first full calendar year of operation.

Term	Definition
Ordinary watercourse	All watercourses that are not designated as a main river, and which are the responsibility of LLFA or, where they exist, IDB. Note that ordinary watercourse does not imply a “small” river, although it is often the case that ordinary watercourses are smaller than main rivers.
Particulate Matter (PM_{10} and $PM_{2.5}$)	Airborne particulate matter with an aerodynamic diameter of 10µm or less (PM_{10}) or 2.5 µm or less ($PM_{2.5}$).
PAS 2080	PAS 2080:2016 ‘Carbon Management in Infrastructure’ specifies requirements for the management of whole life carbon in infrastructure.
Peat resource	Existing or potential peat extraction sites.
Pennine Lower Coal Measures (PLCM)	Term to describe local geology.
Pennine Middle Coal Measures (PMCM)	Term to describe local geology.
Phase 1 habitat survey	A rapid system for the recording of semi-natural vegetation and other wildlife habitats first published by the Joint Nature Conservancy Council in 1990.
Photomontage	Visualisation which superimposes an image of a proposed development upon a photograph.
Planning Inspectorate (PINS)	The Planning Inspectorate for England and Wales is an executive agency of the Ministry of Housing, Communities and Local Government with responsibility to make decisions and provide recommendations and advice on a range of land use planning-related issues including operating the planning process for Nationally Significant Infrastructure Projects.
Pollutant concentrations	Concentrations of pollutants normally reported as micrograms per cubic metre of air (µg/m3).
Pollution Climate Mapping (PCM) model	Government's national air quality modelling used to assess and report on compliance with the Ambient Air Quality Directive to the European Commission.
Pools and riffles	Periodic undulations in bed elevation where relatively shallow, coarse grained riffles are separated by deeper pools.
Preliminary sources study report	A combination of desk study and site reconnaissance, the purpose of which is to develop an initial conceptual site model.
Preparing for reuse	Checking, cleaning or repairing operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.
Prevention (Material assets and waste)	Measures taken before a substance, material or product has become waste, that reduce: 1) the quantity of waste, including through the re-use of products or the extension of the life span of products; 2) the adverse impacts of the generated waste on the environment and human health; or 3) the content of harmful substances in materials and products.
Primary materials	Physical substances from non-renewables sources, i.e. those that cannot or will not be replaced in short (non-geological) periods of time. Also referred to as 'virgin' materials.
Principal aquifer	Geology that exhibits high permeability and/or provides a high level of water storage. They may support water supply and/or river baseflow on a strategic scale.
Project Air Quality Action Plan (PAQAP)	A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the AQOs will be achieved.
Protected species mitigation licence	The licence issued to permit an activity affecting protected species that would otherwise be an offence.

Term	Definition
Proximity principle	The requirement to treat and/or dispose of wastes in reasonable proximity to their point of generation.
Public right of way (PRoW)	A widely known right to cross private land is known as a 'right of way'. If this is a right granted to everyone it is a 'public right of way'.
Pulverised Fuel Ash (PFA)	is the ash resulting from the burning of pulverised coal in coal-fired electricity power stations
Rainfall from extremely wet days	Total rainfall falling on days with daily rainfall total in excess of the 99th percentile of daily rainfall.
Ramsar site	Wetlands of international importance designated under the Ramsar Convention 1971.
RCP 8.5	RCP 8.5 refers to the concentration of carbon that delivers global warming at an average of 8.5 watts per square meter across the planet. The RCP 8.5 pathway delivers a temperature increase of about 4.3˚C by 2100, relative to pre-industrial temperatures and is based on a high GHG emissions scenario.
Realignment (water environment)	The artificial straightening of a river channel to accommodate structures, flood control, or navigation.
Receptor	A defined individual environmental feature usually associated with population, fauna and flora that have potential to be impacted by a development.
Recovery (material assets and waste)	Any operation, the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.
Recycled aggregates	Aggregates that are typically derived from reprocessing materials previously used in construction, such as road planings, railway ballast, crushed concrete or masonry from construction and demolition activities.
Recycling	Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. Recycling includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for back filling operations.
Region	The defined geographical areas or physical extents of the second study area. For the purposes of this aspect, the recommended physical extent is the former North West England Planning Region.
Region (material assets and waste)	The defined geographical areas or physical extents of the second study area. For the purposes of this aspect, the recommended physical extent is the former East of England Planning Region.
Registered park and garden	Gardens, grounds and other planned open spaces with historical significance. Registration is a 'material consideration' in the planning process.
Representative viewpoints	Locations that represent individuals and / or defined groups of people who have the potential to be affected by a proposed development.
Residual effect	The predicted consequential change on the environment from the impacts of a development after mitigation.
Re-use	Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.
Runoff	The movement of water above and below the surface.
Scheduled monument	Scheduled monuments are protected by law designated under the Ancient Monuments and Archaeological Areas Act 1979 and are, by definition, of national importance.

Term	Definition
Scoping	The process of identifying the issues to be addressed by an environmental impact assessment process. It is a method of ensuring that an assessment focuses on the important issues and avoids those that are considered unlikely to be significant.
Second study area (material assets and waste)	1) Feasible sources and availability of construction materials required to construct the main elements of a project. 2) Suitable recovery and waste management infrastructure that could accept arisings and/or waste generated by a project.
Secondary A aquifer	Permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of baseflow to rivers.
Secondary B aquifer	Predominantly lower permeability strata which may in part have the ability to store and yield limited amounts of groundwater by virtue of localised features such as fissures, thin permeable horizons and weathering.
Secondary materials / aggregates	Useful by-products from manufacturing or industrial processes. Secondary aggregates are typically by-products of industrial and other processes. These can be subdivided into manufactured and natural aggregates, depending on their source and can include materials such as pulverised fuel ash, ground granulated blast furnace slag, furnace bottom ash, incinerator bottom ash, recycled glass etc. Both secondary and recycled aggregates offer appropriate engineering specifications to allow them to replace primary aggregates.
Secondary Undifferentiated aquifer	Designation used in cases where it has not been possible to attribute either category A or B to a rock type.
Sensitive receptor	Includes residential properties, back gardens, schools, hospitals, care homes, public open spaces, public access.
Sensitivity	Receptor or resource environmental value.
Sequential Test	The Sequential Test is set out in the National Planning Policy Framework (NPPF). The Sequential Test ensures that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. Following application of the Sequential Test, Planning Practice Guidance identifies the circumstances when the Exception Test should be applied.
Sett	A badger's home.
Setting (cultural heritage)	The setting of an asset is the surroundings in which a place is experienced, while embracing an understanding of perceptible evidence of the past in the present landscape.
Short-term (in relation to noise assessment)	Noise change based on parallel assessment year (for example do-minimum opening year scenario (DMOY) against do-something opening year scenario (DSOY)).
Significance	A measure of the importance, or gravity, of the environmental effect, defined by significance criteria specific to the environmental aspect.
Site arisings	Construction, demolition, excavation and other arisings generated from within a project boundary, during both construction, and operation and maintenance phases.
Site of Special Scientific Interest (SSSI)	Site designated as being of special interest for its flora, fauna or geological or physiographical features and protected under the Wildlife and Countryside Act 1981.
Soil	An assemblage of mineral particles and/or organic matter which includes variable amounts of water and air (and sometimes other gases).
Source Protection Zone (SPZ)	Zones around groundwater sources used for potable supply or food processing, including wells, boreholes and springs, which show the level of risk to the source from contamination.

Term	Definition
Special Area of Conservation (SAC)	An area which has been identified as being important for a range of vulnerable habitats, plant and animal species within the EU and is designated under the Habitats Directive.
Special Protection Area (SPA)	A site designated under the Birds Directive due to its international importance for the breeding, feeding, wintering, or the migration of, rare and vulnerable species of birds.
Speed band	A range of categories for which outputs from the traffic model are grouped into to describe their emissions.
Spraint	An otter's dung.
Stable non-reactive hazardous waste	Hazardous waste, the leaching behaviour of which will not change adversely in the long-term, under landfill design conditions or foreseeable accidents: in the waste alone (for example, by biodegradation); under the impact of long-term ambient conditions (for example, water, air, temperature or mechanical constraints); by the impact of other wastes (including waste products such as leachate and gas).
Standardised admissions ratio (SAR)	The SAR is a health measure that allows a comparison of hospital admissions data between areas, whilst accounting for differences in population structures (i.e. age profile) between those areas. It is calculated by using admissions data from a standard population to estimate the number of admissions expected in the study population. The estimate is then compared with the actual (observed) number of admissions and multiplied by 100 to yield the SAR. If the observed admissions are the same as the expected admissions the SAR will be 100. An SAR greater than 100 indicates that admissions are higher than would be expected for the age structure in the study population. An SAR less than 100 indicates it is lower than expected.
Standardised mortality ratio (SMR)	The SMR is a health measure that allows a comparison of mortality data between areas, whilst accounting for differences in population structures (i.e. age profile) between those areas. It is calculated from mortality data using the same approach as for the SAR.
Sterilise	Substantially constrain / prevent existing and potential future use and extraction of mineral resources, typically by constructing infrastructure over or adjacent to a deposit.
Strava Global Heatmap	A web-based source of information activities undertaken by users of the Strava fitness app (www.strava.com). The heatmap shows 'heat' made by aggregated, public activities over the last two years. The heatmap is updated monthly.
Sub-region (in relation to material assets and waste)	The defined geographical areas or physical extents of Greater Manchester sub-region (Association of Greater Manchester Authorities).
Susceptibility	The ability of a defined landscape or visual receptor to accommodate the specified proposed development without undue negative consequences. GLVIA3
Synergistic	Where different types of impact affect a receptor and interact to increase their combined significance e.g. two discharges combine to have an effect on a species not affected by discharges in isolation.
Townscape	The landscape within the built-up area, including the buildings, urban open spaces, including green spaces and the relationship between buildings and between buildings and open spaces. GLVIA3
Traffic reliability area (TRA)	Defined in DMRB LA 105 Air Quality (Highways England, 2019) as the "*area covered by the traffic model, that the competent expert for traffic has identified as reliable for inclusion in an environmental assessment*".
Tranquil areas	Places which are sufficiently away from visual or noise intrusion of development or traffic to be considered unspoilt by urban influences.

Term	Definition
UKCP18	The UK Climate Projections 2018 (UKCP18) are a set of UK climate projection tools designed to help decision-makers assess their risk exposure to climate. The UKCP18 project uses cutting-edge climate science to provide climate change projections out to 2100. UKCP18 provides probabilistic projections over land and a set of high-resolution spatially-coherent future climate projections for the UK at 12km scale. The 12km climate model has been further downscaled to 2.2km scale - a level previously only used for short-term weather forecasts, allowing realistic simulation of high impact events such as localised heavy rainfall in summer.
Unproductive strata	These are geological strata with low permeability that have negligible significance for water supply or river base flow.
Value	Relative value or importance of a landscape's quality, special qualities including perceptual aspects such as scenic beauty, tranquility, or wildness, cultural associations or other conservation issues. GLVIA3
Visual amenity	Overall enjoyment of a particular area, surroundings, or views in terms of people's activities - living, recreating, travelling through, visiting, or working. GLVIA3
Visual effects	Effects on specific views and on the general visual amenity experienced by people.
Visual receptor	Individuals and/or defined groups of people who potentially could be affected by a project. GLVIA3
Visual sensitivity	Visual experience, be it sensitivity to light or visual clutter. DMRB LA 107
Vulnerability (climate change)	The degree to which a system/asset is exposed and resilient to adverse effects of climate change.
Walkers, cyclists and horse riders (WCH)	A term to describe users of the highway who do not travel by motorised vehicles e.g. pedestrians, cyclists or horse riders.
Warm spell duration index	Count of days with at least six consecutive days when daily maximum temperature is above the 90th percentile.
Waste	Defined in line with Article 3(1) of the Waste Framework Directive (Council Directive 2008/98/EC) as: ‘any substance or object which the holder discards or intends or is required to discard’. Waste is commonly split into the following classifications: Inert, Hazardous and Non-hazardous: waste that is classified neither as inert nor hazardous.
Waste classification	As part of waste Duty of Care, waste holders must classify their waste: before it is collected, disposed of or recovered; to identify the controls that apply to the movement of the waste; to complete waste documents and records; to identify suitably authorised waste management options; and to prevent harm to people and the environment. Technical Guidance WM3 ‘Waste Classification - Guidance on the classification and assessment of waste’ provides guidance on waste classification in the UK. It is a comprehensive reference manual for anyone involved in producing, managing and regulating waste. Appendix A of WM3 includes the waste classification codes, also referred to as LoW (List of Waste) or EWC (European Waste Catalogue) codes.
Waste infrastructure	Facilities that handle, treat/prepare for reuse, recycle and dispose (landfill) of waste.
Water Environment Regulations (WER)	The Water Environment Regulations (previously known as Water Framework Directive) (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) is an EU directive which commits EU member states to achieve good qualitative and quantitative status of all water bodies (including marine waters up to one nautical mile from shore).

Term	Definition
Wider determinant of health	Personal, social, economic and environmental factors which determine the health status of individuals and communities.
Zone of Theoretical Visibility (ZTV)	Visibility modelling undertaken to determine the theoretical extent of visibility of a proposed scheme. The modelling will be undertaken for two situations. As 'bare earth' terrain data modelling without considering the influence of vegetation and buildings, and separately modelled taking into account screening features such as buildings and large woodland blocks, in line with guidance in LA 107.

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ENVIRONMENTAL SCOPING REPORT

APPENDIX A

LOCAL PLANNING FRAMEWORK

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01/06/21

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Appendix A. Local planning framework

A.1.1 Local planning policy is important and relevant to the consideration of an application for development consent as it may inform the Local Impact Report.

A.1.2 Table A.1 sets out the local planning policy documents prepared by each local planning authority along the Proposed Scheme corridor.

A.1.3 Emerging local plans have been identified. Planning policies set out in emerging plans are important, though until the plans are adopted, they hold limited weight in planning decisions. Given the programme for adoption for the relevant local plans it is reasonable to assume that some or all the emerging local plans will have been adopted prior to submission of the DCO application. Emerging plans will therefore be attributed increasing material weight as they progress through the adoption process.

A.1.4 Emerging plans and planning policy will be monitored, and policies added as they are adopted, so that the Environmental Statement and other planning documents are up to date at the point that the application for development consent is submitted.

Table A.1: Local planning policy framework

Local planning authority	Planning policy documents
Bury Metropolitan Borough Council	• Unitary Development Plan (1997) – Adopted. • Local Plan – Emerging. • Strategic Housing Land Availability Assessment (2020). • Supplementary Planning Documents (SPD).
Manchester City Council	• Local Plan. *Note: A revised Local Plan will be produced following consultation (consultation closed May 2020).* • Core Strategy 2012-2027 (2012) – Adopted. • Unitary Development Plan (1995) – Adopted. *Note: Most policies superseded by the Core Strategy.* • Interactive Proposals Map. • Strategic Housing Land Availability Assessment (2019). • Supplementary Planning Documents (SPD).
Rochdale Borough Council	• Local Plan – Adopted. • Core Strategy (2016) – Adopted. • Unitary Development Plan (2006) – Adopted. • Strategic Housing Land Availability Assessment (2019). • Strategic Housing Market Assessment (2015). • Transport Strategy (2014). • Allocations Plan (2018) – Emerging. • Supplementary Planning Documents (SPD).
Salford City Council	• Unitary Development Plan 2004-2016 (2006) – Adopted. • Salford Publication Draft Local Plan: Development Management Policies and Designations (2020) – Emerging. • Interactive Proposals Map. • Salford Local Plan: Core Strategy and Allocations – Emerging.

Local planning authority	Planning policy documents
Greater Manchester Combined Authority	• Places for Everyone joint plan – Emerging. *Note: All Greater Manchester councils except Stockport. Greater Manchester Spatial Framework no longer being progressed.* • Greater Manchester Minerals Plan (2013) – Adopted. • Greater Manchester Waste Plan (2012) – Adopted. • Greater Manchester Transport Strategy 2040 (2021).

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ENVIRONMENTAL SCOPING REPORT

APPENDIX B

ASSESSMENT CRITERIA

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Appendix B. Assessment criteria

B.1 Sensitivity criteria

B.1.1 This tabulates how the baseline has been assessed in terms of its value and sensitivity. The assessment is based on Table 3.2N from DMRB LA 104 (recreated in Table B.1). It has then been interpreted by technical specialists for each aspect in Table B.2. Additional notes are provided under the aspect heading where applicable. The table is used as guidance for the assessment and is not designed to be prescriptive. Technical judgement will be used to provide the final values.

Table B.1: Criteria to assign value (sensitivity) to receptors, taken from DMRB LA 104

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

Table B.2: Topic-specific interpretation of the DMRB value (sensitivity) criteria for the Proposed Scheme

Value (sensitivity)	Typical descriptors
Air Quality (operational and construction traffic/dust effects; DMRB LA 105)	
Note:	All sensitive receptors are considered to be of equal value (high).

Value (sensitivity)	Typical descriptors
Cultural Heritage (DMRB LA 104, DMRB LA 106 and using professional judgement)	
Very high	**Archaeological remains**: World Heritage Sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives. **Historic buildings**: Structures recognised as of universal importance as World Heritage Sites. Other buildings of recognised international importance. **Historic landscapes**: World Heritage Sites recognised for their historic landscape qualities. Historic landscapes of international value, whether designated or not. Extremely well-preserved historic landscapes with exceptional coherence, time-depth, or other critical factor(s).
High	**Archaeological remains**: Scheduled monuments (including proposed sites). Undesignated assets of schedulable quality and importance. Assets that can contribute significantly to acknowledged national research objectives. **Historic buildings**: Scheduled monuments with standing remains. Grade I, Grade II* and Grade II listed buildings. Other listed buildings that can be shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the listing grade. Conservation areas containing very important buildings. Undesignated structures of clear national importance. **Historic landscapes**: Designated historic landscapes of outstanding interest. Undesignated landscapes of outstanding interest. Undesignated landscapes of high quality and importance, and of demonstrable national value. Well preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factor(s).
Medium	**Archaeological remains**: Designated or undesignated assets that contribute to regional research objectives. **Historic buildings**: Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical associations. Conservation areas containing buildings which contribute significantly to their historic character. Historic townscape or built-up areas with important historic integrity in their buildings or built settings (e.g. including street furniture and other structures). **Historic landscapes**: Designated special historic landscapes. Undesignated historic landscapes that would justify special historic landscape designation, landscapes of regional value. Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor(s).
Low	**Archaeological remains**: Designated and undesignated assets of local importance. Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives. **Historic buildings**: 'Locally listed' buildings. Historic (unlisted) buildings of modest quality in their fabric or historical association. Historic townscape or built-up areas of limited historic integrity in their buildings or built settings (e.g. including street furniture and other structures). **Historic landscapes**: Robust undesignated historic landscapes. Historic landscapes with importance to local interest groups. Historic landscapes whose value is limited by poor preservation and/or poor survival of contextual associations.

Value (sensitivity)	Typical descriptors
Negligible	**Archaeological remains:** Assets with very little or no surviving archaeological importance. **Historic buildings:** Buildings of no architectural or historical note; buildings of an intrusive character. **Historic landscapes:** Landscapes with little or no significant historical interest.
Landscape and Visual (DMRB LA 107)	
Note:	DMRB LA 107 considers landscape 'sensitivity' which incorporates judgements on 'value' and 'susceptibility', Table 3.22 Landscape sensitivity (susceptibility and value) and typical descriptions. This differs from LA 104 Table 3.2N, Environmental value (sensitivity) and descriptions, which describes value for determining sensitivity. LA 107 Table 3.22, sensitivity criteria will be used.
Very high	**Landscape:** 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). **Visual:** • Static views from and of major tourist attractions • Views from and of very important national/international landscapes, cultural/historical sites (e.g. National Parks, UNESCO World Heritage sites) • Receptors engaged in specific activities for enjoyment of dark skies
High	**Landscape:** 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). **Visual:** • Views by users of nationally important PRoW / recreational trails (e.g. national trails, long distance footpaths) • Views by users of public open spaces for enjoyment of the countryside (e.g. country parks) • Static views from dense residential areas, longer transient views from designated public open space, recreational areas • Views from and of rare designated landscapes of national importance

Value (sensitivity)	Typical descriptors
Medium (Landscape) Moderate (Visual)	**Landscape:** Landscapes of local or regional recognition of importance able to accommodate some change (i.e. features worthy of conservation, some sense of place or value through use/perception). **Visual:** • Static views from less populated residential areas, schools and other institutional buildings and their outdoor areas • Views by outdoor workers • 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 • Views from and of landscapes of regional importance
Low	**Landscape:** 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). **Visual:** • Views by users of main roads or passengers in public transport on main arterial routes • Views by indoor workers • Views by users of recreational/formal sports facilities where the landscape is secondary to enjoyment of the sport • Views by users of local public open spaces of limited importance with limited variety or distinctiveness
Negligible	**Landscape:** Landscapes of very low importance and rarity able to accommodate change. **Visual:** • Quick transient views such as from fast moving vehicles • Views from industrial area, land awaiting re-development • Views from landscapes of no importance with no variety or distinctiveness

Value (sensitivity)	Typical descriptors
Biodiversity (DMRB LA 108)	
International or European importance	Sites including: • European sites: - Sites of Community Importance (SCI) - Special Protection Areas (SPA) - potential SPAs (pSPA) - Special Areas of Conservation (SAC) - Candidate or possible SACs (cSAC or pSAC) - Wetlands of International Importance (Ramsar sites) • Biogenetic Reserves, World Heritage Sites (where recognised specifically for their biodiversity value) and Biosphere Reserves • Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such
	Habitats: N/A
	Species: Resident, or regularly occurring, populations of species which can be considered at an international or European level where: • The loss of these populations would adversely affect the conservation status or distribution of the species at an international or European scale; or • The population forms a critical part of a wider population at this scale; or • The species is at a critical phase of its life cycle at an international or European scale
UK or national importance	Sites including: • Sites of Special Scientific Interest (SSSI) or Areas of Special Scientific Interest (ASSI) • National Nature Reserves (NNR) • National Parks • Marine Protected Areas (MPA) including Marine Conservation Zones (MCZ) • Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such

Value (sensitivity)	Typical descriptors
	Habitats including: • Areas of UK BAP priority habitats • Habitats included in the relevant statutory list of priority species and habitats • Areas of irreplaceable habitats including: - ancient woodland - ancient or veteran trees - blanket bog - limestone pavement - sand dunes - salt marsh - lowland fen • Areas of habitat which meet the definition for habitats listed above but which are not themselves designated or listed as such
	Species: Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: • The loss of these populations would adversely affect the conservation status or distribution of the species at a UK or national scale; or • The population forms a critical part of a wider population at this scale; or • The species is at a critical phase of its life cycle at a UK or national scale
Regional importance	Designated sites (non-statutory) including heritage coasts.
	Areas of habitats identified (including for restoration) in regional plans or strategies (where applicable).
	Species including: • Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: - the loss of these populations would adversely affect the conservation status or distribution of the species at a regional scale; or - the population forms a critical part of a wider regional population; or - the species is at a critical phase of its life cycle • Species identified in regional plans or strategies

Value (sensitivity)	Typical descriptors
County or equivalent importance	Wildlife / nature conservation sites designated at a county (or equivalent) level including: • Local Wildlife Sites (LWS) • Local Nature Conservation Sites (LNCS) • Local Nature Reserves (LNR) • Sites of Importance for Nature Conservation (SINC) • Sites of Nature Conservation Importance (SNCI) • County Wildlife Sites (CWS)
	Areas of habitats identified in county or equivalent authority plans or strategies (where applicable).
	Species including: • Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: - the loss of these populations would adversely affect the conservation status or distribution of the species at a county or unitary authority scale; or - the population forms a critical part of a wider county or equivalent authority area population, e.g. metapopulations; or - the species is at a critical phase of its life cycle • Species identified in a county or equivalent authority area plans or strategies
Local importance	Wildlife / nature conservation sites designated at a local level including: • Local Wildlife Sites (LWS) • Local Nature Conservation Sites (LNCS) • Local Nature Reserves (LNR) • Sites of Importance for Nature Conservation (SINC) • Sites of Nature Conservation Importance (SNCI) • Sites of Local Nature Conservation Importance (SLNCI)
	Areas of habitat considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange.
	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.

Value (sensitivity)	Typical descriptors
Geology and Soils (DMRB LA 109, LA 113)	
Very high	**Geology:** international designated sites of geological value (e.g. UNESCO World Heritage Sites). **Soil:** ALC grades 1 and 2 or LCA grade 1 & 2. Soils directly supporting an EU designated site (e.g. Special Area of Conservation or Special Protection Area). **Human health:** very sensitive land use such as residential or allotments. **Groundwater quality:** Groundwater that locally supports a groundwater dependent terrestrial ecosystem (GWDTE). Inner source protection zone (SPZ1). Principal aquifer. **Surface water quality:** Watercourse having a Water Framework Directive (WFD) classification shown in a River Basin Management Plan (RBMP) with a Q95≥1.0m^3/s. **Site protected/designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water)/Species protected by EC legislation LA 108.**
High	**Geology:** rare and of national importance with little potential for replacement (e.g. geological SSSI). **Human health:** high sensitivity land use such as public open space. **Soil:** ALC subgrade 3a or LCA grade 3.1. Soils directly supporting a UK designated site (e.g. SSSI). **Groundwater quality:** principal or secondary A aquifer providing locally important resource or supporting a river ecosystem. SPZ2. **Surface water quality:** watercourse having a WFD classification shown in RBMP with a Q95<1.0m^3/s. Species protected under EC or UK legislation LA 108.

Value (sensitivity)	Typical descriptors
Medium	**Geology:** Regionally Important Geological Sites (RIGS) with limited potential for replacement. **Human health:** medium sensitivity land use such as commercial or industrial. **Soil:** ALC subgrade 3b or LCA grade 3.2. Soils supporting non-statutory designated sites (e.g. LNR). **Groundwater quality:** aquifer providing water for agricultural or industrial use with limited connection to surface water. Unlicensed private water supply. SPZ3. **Surface water quality:** watercourse not having a WFD classification shown in RBMP and a Q95>0.001m^3/s.
Low	**Geology:** geology of local importance / interest with potential for replacement (e.g. non designated geological exposures, former quarries / mining sites). **Human health:** low sensitivity land use such as highways and rail. **Soil:** ALC grades 4 and 5. Soils supporting non-designated notable or priority habitats. **Groundwater quality:** unproductive strata. **Surface water quality:** watercourses not having a WFD classification shown in a RBMP and Q95 ≤0.001m^3/s.
Negligible	**Geology:** no geological exposures, little / no local interest. **Human health:** undeveloped surplus land / no sensitive land use proposed. **Soil:** previously developed land formerly in 'hard uses' with little potential return to agriculture. **Groundwater quality:** not applicable. **Surface water quality:** not applicable.
Material Assets and Waste (no sensitivity criteria assigned to this aspect in DMRB LA 110 as assessment is based on significance criteria alone)	
Noise and Vibration (DMRB LA 111)	
Notes	The DMRB LA 111 does not explicitly refer to the concept of receptor value (sensitivity), nor does it define a value for receptors. Rather, the assumption is made that a receptor is either sensitive or not sensitive. Within DMRB LA 111 are examples of receptors that are potentially sensitive to noise and vibration. Examples include dwellings, hospitals, healthcare facilities, education facilities, community facilities, international and national designated sites, public rights of way and cultural heritage assets.

Value (sensitivity)	Typical descriptors
Population and Human Health (criteria for land use and accessibility adapted from DMRB LA 112)	
Very high	**Residential property and housing** • Residential settlements within the study area which exceed 5ha or 150 houses • Land allocated for housing located in a local authority area where the number of households are expected to increase by >25% by 2041 (ONS data)
	Community land and assets • Community land and assets providing essential services for the daily health and functioning of the community where: - there are no alternatives within a reasonably accessible distance - they are frequently used by the majority of the community or by vulnerable groups who could be disproportionately affected by changes in the baseline due to potentially different needs • Locations where access between residents and community land and assets is physically severed, or highway conditions prevent access for people with characteristics protected under the Equality Act 2010
	Development land and businesses: Large employment sites and allocations within study area which exceed 5ha.
	Agricultural land holdings: Large agricultural holdings which are dependent on very regular access between fields and agricultural infrastructure, for example dairy farms.
	Walkers, cyclists and horse riders • National trails and routes likely to be used regularly by high numbers for commuting and/or recreation (with limited potential for substitution) • Routes regularly used by vulnerable travelers such as the elderly, school children and people with disabilities, who could be disproportionately affected by small changes in the baseline due to potentially different needs • Rights of way for walkers, cyclists and horse riders crossing existing roads at grade with >16,000 vehicles per day
High	**Residential property and housing** • Small settlements (>1-5ha / circa 30 – 150 houses) • Land allocated for housing located in a local planning authority area where the number of households are expected to increase by 16-25% by 2041 (ONS data)

Value (sensitivity)	Typical descriptors
	Community land and assets • Community land and assets supporting the health and functioning of the community where: - alternatives are available only by travel to other settlements / areas - they are regularly used by a large portion of the community or by vulnerable groups who could be disproportionately affected by changes in the baseline due to potentially different needs • Locations where access between residents and community land and assets is substantially severed or difficult to negotiate, or highway conditions offer limited provision which is compliant with Equality Act 2010 standards
	Development land and businesses: Employment sites and allocations (circa >1 – 5ha).
	Agricultural land holdings: Farm holdings dependent on access to extensive land to maintain high productivity, for example extensive arable farms.
	Walkers, cyclists and horse riders • Regional trails and routes (e.g. promoted circular walks) located close to communities likely to be used for recreation and to a lesser extent commuting, that record frequent (daily) use and have limited potential for substitution • At grade crossings with >8,000 - 16,000 vehicles per day and/or routes with limited accessibility provision
Medium	**Residential property and housing:** Isolated houses and very small hamlets (<1ha and/or <30 houses) within study area.
	Community land and assets • Community land and assets supporting the health and functioning of the community where: - limited alternatives are available within an easily accessible distance (i.e. in adjacent neighbourhoods) - they are regularly used by the community • Locations where access between residents and community land and assets is indirect due to areas of severance but has access provision compliant with the Equality Act 2010
	Development land and businesses: Small employment sites and land allocated for employment (circa <1ha).
	Agricultural land holdings: Small agricultural land holdings requiring access to limited areas of land with potential for relocation, for example free range poultry sites.

Value (sensitivity)	Typical descriptors
	Walkers, cyclists and horse riders • Public rights of way and other routes close to communities which are used for recreational purposes (e.g. dog walking), but for which alternative routes can be taken. These routes are likely to link to a wider network of routes to provide options for longer, recreational journeys • Rights of way for WCH crossing roads at grade with >4000 – 8000 vehicles per day
Low	**Residential property and housing:** Proposed housing development on unallocated sites providing housing with planning permission or are in the planning process.
	Community land and assets • Community land and assets where: - alternatives are available at a local level in the wider community; or - level of use is infrequent; or - land and assets are used by a minority in the community
	Development land and businesses: Proposed employment development on unallocated sites providing employment with planning permission or are in the planning process.
	Agricultural land holdings: Agricultural business not dependent on direct land access and with potential for relocation, for example farm shops.
	Walkers, cyclists and horse riders: Routes which have fallen into disuse through past severance and/or which are scarcely used because they do not offer a meaningful route for either utility or recreational purposes.
Negligible	**Residential property and housing:** • Community land and assets where there is a combination of the following: - 1) no or limited severance or accessibility issues; - 2) alternative facilities are available within the same community; - 3) the level of use is very infrequent (a few occasions yearly); and - 4) the land and assets are used by the minority (>=50%) of the community.
	Community land and assets: N/A.
	Development land and businesses: N/A.
	Agricultural land holdings: Areas of land which are infrequently used on a non-commercial basis.

Value (sensitivity)	Typical descriptors
	Walkers, cyclists and horse riders: N/A.
Road Drainage and the Water Environment (DMRB LA 113)	
Very high	**Flood risk and drainage**: Essential infrastructure or highly vulnerable development. **Surface water**: Watercourse having a WFD classification shown in a RBMP and Q95 ≥ 1.0 m^3/s. Site protected/designated under EC or UK legislation (SAC, Special Protection Area (SPA), SSSI, Ramsar site, salmonid water) and species protected by EC legislation. **Hydromorphology**: A watercourse that appears to be in complete natural equilibrium and exhibits a natural range of morphological features. There is a diverse range of fluvial processes present, free from any modification or anthropogenic influence. Morphological features and processes would be highly sensitive to change as a result of temporary or permanent works. **Groundwater**: Principal aquifer providing a regionally important resource because of its high quality and yield, or extensive exploitation for public and/or agricultural and/or industrial supply. Internationally designated sites of nature conservation dependent on groundwater. Groundwater quality within a Source Protection Zone (SPZ) 1 (Inner Protection Zone) for a licensed abstraction. World Heritage Site. Nationally important infrastructure and buildings.
High	**Flood risk and drainage**: More vulnerable development. **Surface water**: Watercourses having a WFD classification shown in a RBMP and Q95 <1.0m^3/s. **Hydromorphology:** A watercourse that appears to be in natural equilibrium and exhibits a natural range of morphological features. There is a diverse range of fluvial processes present, with very limited signs of modification or other anthropogenic influences. Morphological features and processes would be sensitive to change as a result temporary or permanent works. **Groundwater**: Principal or secondary A aquifer providing locally important resource or supporting a river ecosystem. Licensed non-potable abstractions and unlicensed potable abstractions. Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with high or moderate groundwater dependency. Groundwater quality within a SPZ2 (outer protection zone) for a licensed abstraction. Grade I and II* listed buildings. Regionally important infrastructure and buildings.

Value (sensitivity)	Typical descriptors
Medium	**Flood risk and drainage**: Less vulnerable development. **Surface water**: Watercourses not having a WFD classification shown in a RBMP and Q95 >0.001m^3/s. **Hydromorphology**: A watercourse showing signs of modification, recovering to a natural equilibrium, and exhibiting a limited range of morphological features (such as pools and riffles). The watercourse is one with a limited range of fluvial processes and is affected by modification or other anthropogenic influences. Morphological features and processes could be sensitive to change as a result temporary or permanent works. **Groundwater:** Aquifer providing water for agricultural or industrial use with limited connection to surface water. (Secondary B and Secondary undifferentiated aquifers, as defined by the Environment Agency, are assigned a Medium importance). Unlicensed non-potable groundwater abstractions. Groundwater supporting a nationally designated or non-statutory locally designated site of nature conservation with low groundwater dependency, or groundwater supporting a non-designated site (including HPI) with a moderate or high groundwater dependency. Groundwater quality within a SPZ3 (total catchment zone) for a licensed abstraction. Grade II listed buildings. Locally important infrastructure and buildings.
Low	**Flood risk and drainage**: Water compatible development. **Surface water**: Watercourses not having a WFD classification shown in a RBMP and Q95 ≤0.001m^3/s. **Hydromorphology**: A highly modified watercourse that exhibits no morphological diversity and has a uniform channel, showing no evidence of active fluvial processes. Has likely been significantly affected by anthropogenic factors which may include modification of flow regime, resulting in a dry channel during prolonged dry periods. Morphological features and processes would be unlikely to be sensitive to temporary or permanent works. Includes heavily modified main rivers and drainage channels. **Groundwater:** Unproductive strata. Groundwater supporting a non-designated site (including HPI) with low groundwater dependency. Undesignated historic buildings.
Climate (DMRB LA 114, Table 3.39a)	
Note:	The assessment criteria below relate to the Proposed Scheme's vulnerability to climate change. The assessment of significance is a function of the likelihood of a climate event occurring, and the consequence if an event occurred. The below criteria therefore relate to likelihood, rather than sensitivity / value of receptor.
Very high	The event occurs multiple times during the lifetime of the project (60 years) e.g. approximately annually, typically 60 events.
High	The event occurs several times during the lifetime of the project (60 years) e.g. approximately once every five years, typically 12 events.
Medium	The event occurs limited times during the lifetime of the project (60 years) e.g. approximately once every 15 years, typically 4 events.
Low	The event occurs during the lifetime of the project (60 years) e.g. once in 60 years.

Value (sensitivity)	Typical descriptors
Very low	The event can occur once during the lifetime of the project (60 years).

B.2 Magnitude criteria

B.2.1 This section tabulates how the magnitude of impacts will be determined. The criteria are based on Table 3.4N from DMRB LA 104 (recreated in Table B.3). It has then been interpreted by technical specialists for each aspect in Table B.4.

Table B.3: Criteria to assess the magnitude of impacts, taken from DMRB LA 104

Magnitude of impact	Typical criteria descriptors
Major adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.
Moderate adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
Minor adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
Negligible adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Negligible beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
Minor beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Moderate beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Major beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.

Table B.4: Topic-specific interpretation of the DMRB magnitude of impact criteria for the Proposed Scheme

Magnitude	Typical descriptors
Air Quality (using the criteria of change set out in DMRB LA 105 to support the determination of significant effects)	
Note:	Change in pollutant levels can be either adverse or beneficial, depending on the direction of change. Construction dust impacts will be assessed in accordance with DMRB LA 105.
Large	Large change (>4 µg/m³). Greater than of 10 % of annual mean NO_2 and PM_{10} air quality objectives (4µg/m³). For receptors above the air quality objective or limit value.
Medium	Medium change (>2 to 4 µg/m³). Greater than 5 % (2µg/m³), but less than (4µg/m³) of 10% of annual mean NO_2 and PM_{10} air quality objectives. For receptors above the air quality objective or limit value.
Small	Small change (>0.4 to 2µg/m³). More than 1% of objective (0.4µg/m³) and less than 5% (2µg/m³). For receptors above the air quality objective or limit value.
Imperceptible	Imperceptible change (≤ 0.4 µg/m³). Less than or equal to 1% of annual mean NO_2 and PM_{10} air quality objectives (0.4µg/m³). For receptors above the air quality objective or limit value.
Ecological receptors	Greater than 1% change in nitrogen deposition (then to be assessed by scheme ecologist for significance and associated mitigation).
Cultural Heritage (using criteria set out in DMRB LA 104, DMRB LA 106 and using professional judgement)	
Note:	Changes to asset setting can be either adverse or beneficial, depending on the direction of change.
Major	**Archaeological remains**: Change to most or all key archaeological materials, such that the resource is totally altered. Comprehensive changes to setting. **Historic buildings**: Change to key historic building elements, such that the resource is totally altered. Comprehensive changes to the setting. **Historic landscapes**: Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit.

Magnitude	Typical descriptors
Moderate	**Archaeological remains**: Changes to many key archaeological materials, such that the resource is clearly modified. Considerable changes to setting that affect the character of the asset. **Historic buildings**: Change to many key historic building elements, such that the resource is significantly modified. Changes to the setting of an historic building, such that it is significantly modified. **Historic landscapes**: Changes to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access; resulting in moderate changes to historic landscape character.
Minor	**Archaeological remains**: Changes to key archaeological materials, such that the asset is slightly altered. Slight changes to setting. **Historic buildings**: Change to key historic building elements, such that the asset is slightly different. Change to setting of an historic building, such that it is noticeably changed. **Historic landscapes**: Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality; slight changes to use or access; resulting in limited changes to historic landscape character.
Negligible	**Archaeological remains**: Very minor changes to archaeological materials or setting. **Historic buildings**: Slight changes to historic buildings elements or setting that hardly affect it. **Historic landscapes**: Very minor changes to key historic landscape elements, parcels or components, virtually unchanged visual effects, very slight changes in noise levels or sound quality; very slight changes to use or access; resulting in a very small change to historic landscape character.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Landscape and Visual (DMRB LA 107)	
Note:	DMRB LA 107 refers to 'magnitude of effects', not 'magnitude of impacts'.
Landscape	
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).
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).
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.

Magnitude	Typical descriptors
Negligible adverse	Very minor loss, damage or alteration to existing landscape character of one or more features and elements.
No change	No noticeable alteration or improvement, temporary or permanent, of landscape character of existing features and elements.
Negligible beneficial	Very minor noticeable improvement of character by the restoration of one or more existing features and elements.
Minor 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.
Moderate 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.
Major 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.
Visual	
Note:	Effects may be adverse or beneficial, depending on the direction of change.
Major	The project, or a part of it, would become the dominant feature or focal point of the view.
Moderate	The project, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor.
Minor	The project, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the project work or activity 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 project work or activity would be discernible.
Biodiversity (DMRB LA 108)	
Major adverse	• Permanent/irreversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource
Moderate adverse	• Temporary/reversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource

Magnitude	Typical descriptors
Minor adverse	• Permanent/irreversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource
Negligible adverse	• Temporary/reversible damage to a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource
No change	No observable impact, either positive or negative.
Negligible beneficial	• Temporary addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource
Minor beneficial	• Permanent addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource
Moderate beneficial	• Temporary addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource
Major beneficial	• Permanent addition of, improvement to, or restoration of a biodiversity resource • The extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource
Geology and Soils (DMRB LA 109)	
Note:	The descriptors below all relate to adverse effects. Beneficial effects will be based on the potential for betterment of adverse soil quality which may be harmful to human health, surface water and groundwater. This could be through removal of impacted soils off site or in situ / ex-situ remediation of soils as part of the site development. Where there is the potential for beneficial effects to soils quality as part of the development, professional judgement will be used. **Human health:** contaminant concentrations reduced below levels outlined in relevant screening criteria (e.g. category 4 screening levels). **Surface water quality:** removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification **Groundwater quality:** 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.

Magnitude	Typical descriptors
Major	**Geology:** Loss of geological feature / designation and/or quality and integrity, severe damage to key characteristics, features or elements. **Human health:** Significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels) with potential for significant harm to human health. Contamination heavily restricts future use of land. **Soil:** Physical removal or permanent sealing of agricultural land. **Groundwater quality:** 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) **Surface water quality:** 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 ≥2% annually (spillage assessment). Loss of regionally important public water supply (licensed surface water abstraction for public water supply). 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. **Human health:** Contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category 4 screening levels). Significant contamination can be present. Control / remediation measures are required to reduce risks to human health / make land suitable for intended use **Soil:** Permanent 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). **Groundwater quality:** 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. Contribution to reduction in water body WFD classification. **Surface water quality:** Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages ≥1% annually and <2% annually. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification

Magnitude	Typical descriptors
Minor	**Geology:** Minor measurable change in geological feature / designation attributes, quality or vulnerability. Minor loss of, or alteration to, one (maybe more) key characteristics, features or elements **Human health:** Contaminant concentrations are below relevant screening criteria (e.g. category 4 screening levels). Significant contamination is unlikely with a low risk to human health. Best practice measures can be used to avoid or reduce risks to human health. **Soil:** 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). **Groundwater quality:** Potential low risk of pollution to groundwater from routine runoff - risk score <150. Calculated risk of pollution from spillages ≥0.5% annually and <1% annually. Minor effects on an aquifer and abstractions. **Surface water quality:** Failure of either acute soluble or chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages ≥0.5% annually and < 1% annually. Minor effects on water supplies.
Negligible	**Geology:** Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature / designation. Overall integrity of resource not affected. **Human health:** Contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. category 4 screening levels). No requirement for control measures to reduce risks to human health / make land suitable for intended use. **Soil:** No discernible loss / reduction of soil function(s) that restrict current or approved future use. **Groundwater quality:** No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages <0.5%. **Surface water quality:** No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%.
Material Assets and Waste (no magnitude criteria assigned to this aspect in DMRB LA 110 as assessment is based on significance criteria alone)	
Noise and Vibration	
Noise and Vibration – effect levels (DMRB LA 111)	

	Time period	LOAEL	SOAEL

Magnitude	Typical descriptors		
Construction time period LOAEL and SOAEL	Day (0700-1900 weekday and 0700-1300 Saturdays)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 of BS 5228-1
	Night (2300-0700)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 of BS 5228-1
	Evening and weekends (time periods not covered above)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 of BS 5228-1
Construction vibration LOAELs and SOAELs for all receptors	All time periods	0.3mm/s PPV	1.0mm/s PPV
Operational noise LOAELs and SOAELs for all receptors	Day (06:00-24:00)	55dB $L_{A10,18hr}$ facade	68dB $L_{A10,18hr}$ facade
	Night (23:00-07:00)	40dB $L_{night, outside}$ (free-field)	55dB $L_{night, outside}$ (free-field)
Noise and Vibration – magnitude (DMRB LA 111)			
Note:	Beneficial effects are not possible from construction noise or vibration as construction activities cannot lower the existing acoustic climate at a receptor.		
Major adverse	**Construction Noise: Construction noise level above or equal to SOAEL +5dB** **Construction traffic noise:** Increase in BNL of closest public road used for construction traffic (dB) above or equal to +5dB. **Construction vibration:** Vibration level above or equal to 10 mm/s PPV. **Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) greater than or equal to +5.0. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) greater than or equal to +10.0.		
Moderate adverse	**Construction Noise: Construction noise level above or equal to SOAEL and below SOAEL +5dB** **Construction traffic noise:** Increase in BNL of closest public road used for construction traffic (dB) above or equal to +3dB and below +5dB. **Construction vibration:** Vibration level above or equal to SOAEL and below 10 mm/s PPV. **Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) +3.0 to +4.9. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) +5.0 to +9.9.		

Magnitude	Typical descriptors
Minor adverse	**Construction Noise: Construction noise level above or equal to LOAEL and below SOAEL** **Construction traffic noise:** Increase in BNL of closest public road used for construction traffic (dB) above or equal to +1dB and below+3dB. **Construction vibration:** Vibration level above or equal to LOAEL and below SOAEL. **Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) +1.0 to +2.9. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) +3.0 to +4.9.
Negligible adverse	**Construction Noise: Construction noise level below LOAEL** **Construction traffic noise:** Increase in BNL of closest public road used for construction traffic (dB) below +1dB. **Construction vibration:** Vibration level below LOAEL. **Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) less than +1.0. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) less than +2.9.
No change	**Operational noise (short-term / long-term):** No noise change
Negligible beneficial	**Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) less than -1.0. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) less than -2.9.
Minor beneficial	**Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) -1.0 to -2.9. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) -3.0 to -4.9.
Moderate beneficial	**Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) -3.0 to -4.9. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) -5.0 to -9.9.
Major beneficial	**Operational noise (short-term):** Short term noise change (dB $L_{A10,18hr}$ or L_{night}) greater than or equal to -5.0. **Operational noise (long-term):** Long term noise change (dB $L_{A10,18hr}$ or L_{night}) greater than or equal to -10.0.
Population and Human Health (DMRB LA 112)	
Major	**Private property and housing, community land and assets, development land and businesses, and agricultural land holdings:** • Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. e.g. direct acquisition and demolition of buildings and direct development of land to accommodate highway assets • Introduction (adverse) or removal (beneficial) of complete severance with no/full accessibility provision **Walkers, cyclists, horse riders:** >500m increase (adverse) / decrease (beneficial) in walking/cycling/horse rider journey length.

Magnitude	Typical descriptors
Moderate	**Private property and housing, community land and assets, development land and businesses, and agricultural land holdings:** • Partial loss of/damage to key characteristics, features or elements, e.g. partial removal or substantial amendment to access or acquisition of land compromising viability of property, businesses, community assets or agricultural holdings • Introduction (adverse) or removal (beneficial) of severe severance with limited / moderate accessibility provision **Walkers, cyclists, horse riders:** >250m - 500m increase (adverse) or decrease (beneficial) in walking/cycling/horse rider journey length.
Minor	**Private property and housing, community land and assets, development land and businesses, and agricultural land holdings:** • A discernible change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements, e.g. amendment to access or acquisition of land resulting in changes to operating conditions that do not compromise overall viability of property, businesses, community assets or agricultural holdings • Introduction (adverse) or removal (beneficial) of severance with adequate accessibility provision **Walkers, cyclists, horse riders:** >50m - 250m increase (adverse) or decrease (beneficial) in walking/cycling/horse rider journey length.
Negligible	**Private property and housing, community land and assets, development land and businesses, and agricultural land holdings:** • Very minor loss or detrimental alteration to one or more characteristics, features or elements. e.g. acquisition of non-operational land or buildings not directly affecting the viability of property, businesses, community assets or agricultural holdings • Very minor introduction (adverse) or removal (beneficial) of severance with ample accessibility provision **Walkers, cyclists, horse riders:** <50m increase (adverse) or decrease (beneficial) in walking/cycling/horse rider journey length.
No change	No loss or alteration of characteristics, features, elements or accessibility; no observable impact in either direction.

Magnitude	Typical descriptors
Road Drainage and the Water Environment (DMRB LA 113)	
Major adverse	**Flood risk:** Increase in peak flood level (1% annual probability event) >100mm. **Hydromorphology**: Loss or extensive damage to habitat due to extensive modification of natural channel planform, and/or sediment and flow processes. Replacement of a large extent of the natural bed and/or banks with artificial material. **Surface water quality**: Failure of both soluble and sediment bound pollutants in HEWRAT and compliance failure with environmental quality standard (EQS) values. Calculated risk of pollution from a spillage >2% annually (spillage assessment). Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification. **Groundwater:** Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Potential high risk of pollution to groundwater from routine runoff or spillages on the carriageway. Loss of, or extensive change to GWDTEs, baseflow contributions to protected surface water bodies, or springs/sinks/sources/issues. Reduction in water body WFD classification. Loss or significant damage to major structures through subsidence or similar effects.
Moderate adverse	**Flood risk:** Increase in peak flood level (1% annual probability event) >50mm. **Hydromorphology**: Moderate deterioration from baseline conditions, with partial loss or damage to habitat due to modifications and/or changes to natural fluvial forms and processes. Replacement of the natural bed and/or banks with artificial material. **Surface water quality**: Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from a spillage >1% annually and <2% annually. Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification. **Groundwater:** 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 or spillages on the carriageway. Partial loss of the integrity of GWDTEs, baseflow contributions, or springs/sinks/sources/issues. Contribution to reduction in water body WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.
Minor adverse	**Flood risk**: Increase in peak flood level (1% annual probability event) >10mm. **Hydromorphology**: Slight deterioration from baseline conditions, with partial loss/damage to habitat due to modifications and/or changes to natural fluvial forms and processes. **Surface water quality**: Failure of either soluble or sediment bound pollutants in HEWRAT. Calculated risk of pollution from a spillage ≥0.5 annually and <1% annually. Minor effects on water supply. **Groundwater:** Potential low risk of pollution to groundwater from routine runoff or spillages on the carriageway. Minor effects on an aquifer, GWDTEs, abstractions, baseflow contributions, springs/sinks/sources/issues, and structures.

Magnitude	Typical descriptors
Negligible	The project may adversely affect the integrity of the water environment, although this is not considered measurable. **Flood risk:** Negligible change to peak flood level (1% annual probability event) ≤ ± 10mm. **Hydromorphology:** Very slight change from surface water baseline conditions, approximating to a 'no change' situation. **Surface water quality:** No risk identified in HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5% annually. **Groundwater:** No measurable impact upon an aquifer and/or groundwater receptors.
Minor beneficial	**Flood risk:** Creation of flood storage and decrease in peak flood level (1% annual probability event) >10mm. **Hydromorphology**: Slight improvement of baseline conditions through partial improvement/gain in riparian or in-channel habitat. Slight diversification of flow processes and/or sediment processes. **Surface water quality**: HEWRAT assessment of either acute-soluble or chronic-sediment related pollutants becomes a 'pass' from an existing baseline of a 'fail' condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage is <1% annually). **Groundwater:** Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.
Moderate beneficial	**Flood risk:** Creation of flood storage and decrease in peak flood level (1% annual probability event) >50mm. **Hydromorphology**: Moderate improvement from baseline conditions, with partial creation of both in-channel and riparian habitat. Removal of existing superfluous structure or artificial channel bed/bank. Moderate diversification of flow processes and/or sediment processes. **Surface water quality**: HEWRAT assessment of both acute-soluble and chronic-sediment-bound pollutants becomes a 'pass' from an existing baseline of a 'fail' condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage is >1% annually). Contribution to improvement in water body WFD classification. **Groundwater:** Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management Strategy (or equivalent) classification. Support to significant improvements in damaged GWDTE.
Major beneficial	**Flood risk:** Creation of flood storage and decrease in peak flood level (1% annual probability event) >100mm. **Hydromorphology**: Extensive enhancement in-channel habitat and/or riparian habitat, as well as diversification of flow and sediment processes. Removal of an existing superfluous structure or artificial channel bed/bank. Extensive diversification of flow processes and/or sediment processes. **Surface water quality**: Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification. **Groundwater:** Recharge of an aquifer. Improvement in water body WFD classification.

Magnitude	Typical descriptors
Climate (DMRB LA 114, Table 3.39b)	
Note	The assessment criteria below relate to the project's vulnerability to climate change and the associated consequences, rather than magnitude of impact.
Very large adverse	National level (or greater) disruption to strategic route(s) lasting more than 1 week.
Large adverse	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	Regional level disruption to strategic route(s) lasting more than 1 day but less than 1 week.
Minor adverse	Regional level disruption to strategic route(s) lasting less than 1 day.
Negligible	Disruption to an isolated section of a strategic route lasting less than 1 day.

M60/M62/M66 Simister Island Interchange

ENVIRONMENTAL SCOPING REPORT

APPENDIX C

MAJOR ACCIDENTS AND DISASTERS

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Contents

Appendix C. Major accidents and disasters

C.1 Introduction

C.1.1 A disaster is defined as a sudden, catastrophic event that can result in serious damage to human welfare or the environment. A disaster can result in major disruption to society or communities and can result in economic and environmental losses. Disasters can be caused by both natural processes, and by human actions.

C.1.2 The EIA Regulations require that risks due to accidents and disasters are considered within the EIA. This appendix provides a risk assessment of the major accidents and disasters that could affect the Proposed Scheme, and where these are being reported and mitigated within the environmental assessment.

C.2 Methodology

C.2.1 A screening matrix (Table C.1) has been completed detailing major accidents and disasters that could reasonably occur. This list has been compiled using information from the International Federation of Red Cross and Red Crescent Societies' website[1] and National Risk Register (NRR) of Civil Emergencies[2].

C.2.2 The screening matrix takes into consideration the Proposed Scheme's location and intended land-use to determine if it is at risk from a major accident or disaster. For example, as there are areas close to the scheme at high risk of surface water flooding, the location presents a potential risk from major flooding. Likewise, as the scheme would be used as a transport route, the risk of a major transport accident exists. Where potential risks were identified, these were taken forward for further consideration.

C.2.3 Accidents and disasters requiring further consideration were subject to a more detailed risk assessment (Table C.2). This looked at the probability of an event occurring, and the consequence / effect if an event did occur. Probabilities of event occurrence were obtained from the NRR, with consideration to the local context of the Proposed Scheme and future climate change (see Chapter 15: Climate Change of the Environmental Scoping Report). These factors were used to determine if an event presented a significant risk and how this is considered in the environmental assessment. In this instance a significant risk is one with the potential to cause loss of life or long lasting / permanent environmental damage and would require a response beyond existing response measures in place.

C.3 Screening and scoping

C.3.1 The risk assessment (Table C.2) has been used to scope potential environmental impacts from major accidents and disasters.

[1] International Federation of Red Cross and Red Crescent Societies. http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/. Accessed April 2021

[2] Cabinet Office. (2020). National Risk Register of Civil Emergencies 2020 Edition

C.3.2 This shows how risks are being managed through the scheme design or reported and mitigated within other areas of the environmental assessment (e.g. climate change adaptation). Major accidents and disasters will therefore not be scoped into the environmental assessment as an EIA aspect chapter but will be reported on within relevant aspects. The scheme design will consider the potential effects associated with accidents and disasters, with mitigation embedded into the design where required.

Table C.1: Major accidents and disasters screening matrix

Accident / disaster	Location risk	Land-use risk	Further consideration required
Biological hazards: epidemics	×	×	×
Biological hazards: animal and insect infestation	×	×	×
Earthquakes	×	×	×
Mass movements / ground hazards	✓	×	✓
Tsunamis	×	×	×
Volcanic eruptions	×	×	×
Drought	×	×	×
Heatwaves	✓	×	✓
Wildfires	×	×	×
Inland floods	✓	×	✓
Coastal floods	×	×	×
Tropical storms	×	×	×
Storms and gales	✓	×	✓
Industrial accidents	×	×	×
Transport accidents	✓	✓	✓
Famine	×	×	×
Displaced populations	×	×	×
Malicious attacks on infrastructure	×	✓	✓
Cyber attacks	×	×	×
Public disorder	×	×	×
Critical infrastructure failure	×	✓	✓
Heavy snowfall / low temperatures	✓	×	✓
Armed conflict / complex emergency	×	×	×

Table C.2: Major accidents and disasters risk assessment (orange - risks considered within the scheme design; green - risks that are not considered further)

Event	Likelihood	Consequence	Further considerations
Mass movements / ground hazards	A Preliminary Sources Study Report (PSSR) has been produced for the Proposed Scheme at PCF Stage 2. This contains a risk register which has identified several ground hazards which are 'likely' to occur, including collapsible and compressible ground.	Subsidence and other ground hazards can occur rapidly with little warning. They can cause damage to infrastructure, disruption to the traffic network, and casualties/fatalities. Depending on the nature of the incident, environmental damage can occur through release of contaminants and opening source-pathway-receptor linkages.	Geophysical hazards are being considered in the scheme design. The PSSR summarises the potential hazards and risks associated with the ground conditions that need to be factored into the design process and assessed going forward. Ground investigations will be undertaken. The findings of the investigations, along with the associated design requirements and risk mitigation, will be documented in a Ground Investigation Report.
Heatwaves	The NRR probability of a heatwave occurring in the next year is between 25 to 125 in 500. Summer temperatures are predicted to increase in the UK due to climate change, potentially increasing the likelihood of this event occurring.	Hot weather increases the risk of tarmac melting and technology overheating. This could result in unsafe driving conditions, potentially leading to accidents. Hot temperatures could also result in increased driver stress, increasing the likelihood of an accident occurring. Environmental damage could occur if a crash resulted in discharge of contaminants (e.g. if an oil tanker crashed).	The UK Met Office has a system in place for providing warnings of extreme weather, which reduces the risk of drivers driving in extreme weather. There is a minor risk of high temperatures damaging the road surface and technology, however, the likelihood of this resulting in a catastrophic event is considered unlikely. Heatwaves will therefore not be considered further.
Storms and gales	The NRR probability of a storm/gale occurring in the next year is between 25 to 125 in 500. It is uncertain if wind speeds are likely to increase or decrease in the north of England due to climate change.	High wind speeds can fell trees and man-made structures. This can result in property damage, disruption to the transport network, disruption to critical infrastructure, and casualties/fatalities. Large scale events have the potential to impact at a regional or even national scale.	High wind speeds have caused historic disruption to transport networks in England, and there is potential for future events to impact the M60, M62 and M66. The Proposed Scheme will be designed in accordance with best practice (BS EN 1991-1-4:2005 – Actions on Structures (covering wind) and the associated UK National Annex), and no further measures taken. Therefore, no additional consideration is needed.

Event	Likelihood	Consequence	Further considerations
Inland floods	The NRR probability of inland flooding occurring in the next year is between 5 to 25 in 500. Locally, the Proposed Scheme is located in areas of Flood Zone 1 (1 in 1000-year event), however there are areas at medium to high risk from surface water flooding. Winters are predicted to get wetter in the UK due to climate change, potentially increasing the likelihood of this event occurring.	Large scale flooding events can result in damage to property, disruption of the transport network, casualties and fatalities. There can also be impacts on local communities if they are not equipped to deal with a large-scale event in their area. Depending on the nature of the event, environmental damage can occur through release of contaminants and opening source-pathway-receptor linkages. The magnitude and severity of an event could increase due to future climate change and land use change (e.g. development within floodplain).	The Proposed Scheme is located in areas of Flood Zone 1, however there are areas at medium to high risk from surface water flooding. There are also areas at medium to high risk of flooding from rivers. The Proposed Scheme is therefore at risk from a flood event and potentially increases the risk of flooding elsewhere. This problem is likely to be exacerbated by future climate change. As such this event is being considered in the scheme design, along with other climate change adaptation measures. The flood risk assessment will also consider future risk due to climate change and propose mitigation measures as required.
Transport accidents	The NRR probability of a major transport accident occurring in the next year is less than 1 in 500. This probability could increase (e.g. due to future stress on the network) or decrease (e.g. through advances in technology).	Major accidents can result in fatalities, casualties, and damage to infrastructure, causing disruption to the network. There can also be impacts on local communities if they are not equipped to deal with a large-scale event in their area. Environmental damage could occur if a crash resulted in discharge of contaminants (e.g. if an oil tanker crashed).	Although accidents are likely to take place on the M60, M62 and M66, these are not likely to occur at a scale that would be considered a national or regional disaster. The Proposed Scheme is also being designed to increase capacity and improve safety, which should reduce the probability of an incident occurring. Traffic accidents would be managed through existing emergency service procedures and would unlikely need a coordinated government response. Traffic accidents will therefore not be considered further.
Critical infrastructure failure	The NRR probability of a widespread electricity failure occurring in the next year is between 5 to 25 in 500. A regional or national blackout has never occurred in the UK; however it has occurred in Argentina and South Australia within the last decade. The risk could increase due to the increased risk of severe weather.	The M60/M62/M66 Simister Island Interchange is a strategic route that relies on powered technology, such as variable message signs and traffic signals, to allow safe operation of the road. A critical electricity failure could disrupt this technology, resulting in potential casualties / fatalities due to road accidents.	The Department for Business, Energy & Industrial Strategy works closely with industry and government to provide contingency planning in the event of a widespread electricity shutdown occurring. Existing measures are in place to manage this event, and it is therefore not considered further.

Event	Likelihood	Consequence	Further considerations
Malicious attacks on infrastructure	The NRR probability of a malicious attack on critical infrastructure occurring in the next year is between 25 to 125 in 500. Terrorists in the UK have previously attacked, or planned to attack, national infrastructure; attempts were made to attack electricity substations in the 1990s.	Consequences of an attack on a transport system may include fatalities and physical and / or psychological casualties, damage to property and infrastructure, disruption to essential services, particularly transport, and disruption and negative impact on local, regional and national economy.	The UK has a comprehensive and well-established programme of work to protect its national infrastructure from terrorism and other security threats. The Centre for the Protection of National Infrastructure is the government authority providing protective security advice to businesses and organisations who own or operate UK Critical National Infrastructure (CNI). They provide integrated advice on physical and personnel security, which aims to reduce risk and vulnerability to terrorism, espionage and other national security threats. Existing measures are in place to manage this event, and it is therefore not considered further.
Heavy snowfall / low temperatures	The NRR probability of low temperatures and heavy snowfall occurring in the next year is between 25 to 125 in 500. Winters are predicted to get milder in the UK due to climate change, potentially reducing the likelihood of this event occurring.	Heavy snowfall can result in serious disruption to the transport network, resulting in road closures and increasing the hazard of vehicle accidents. This has the potential to result in casualties and fatalities. Environmental damage could occur if a crash resulted in discharge of contaminants (e.g. if an oil tanker crashed).	The UK Met Office has a system in place for providing warnings of extreme weather. Highways England and local authorities operate gritting lorries and manage operations for removing snow. These existing mitigation measures reduce the risk of accidents occurring. Although a residual risk remains for an accident to occur, the chance of one resulting in catastrophic damage to human health or the environment is considered unlikely. As such snowstorms will not be considered further.

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ENVIRONMENTAL SCOPING REPORT

APPENDIX D

TRANSBOUNDARY EFFECTS SCREENING MATRIX

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Appendix D. Transboundary effects screening matrix

Criteria and relevant considerations	Result of screening considerations
Characteristics of the development: Size of the development Use of natural resources Production of waste Pollution and nuisances Risk of accidents Use of technologies	Respective to Junction 18 of the M60, the provisional Order Limits extend approximately 2.2km north along the M66, approximately 0.3km east along the M62, approximately 0.7km south along the M60, and approximately 3km west along the M60. It is fully contained within the UK, in the metropolitan county of Greater Manchester. Some of the resources required for the construction of the scheme are likely to be obtained from the global market, e.g. steel, but it is envisaged that materials would be obtained locally wherever possible. No waste, nuisances or accidents are likely that would extend beyond the border of the UK. No novel technologies are proposed that have potential for transboundary effects.
Location of development and geographical area: What is the existing use? What is the distance to another European Economic Area (EEA) state? (Name EEA state) What is the extent of the area of a likely impact under the jurisdiction of another EEA state?	The existing land use is highways, with urban, recreational and agricultural areas located adjacent to the Proposed Scheme. The Proposed Scheme is located approximately 250km from the Republic of Ireland. No physical works or impacts are likely to extend beyond the jurisdiction of the UK.
Environmental importance: Are particular environmental values (e.g. protected areas – name them) likely to be affected? Capacity of the natural environment. Wetlands, coastal zones, mountain and forest areas, nature reserves and parks, Natura 2000 sites, areas where environmental quality standards already exceeded, densely populated areas, landscapes of historical, cultural or archaeological significance.	There are no European sites designated under the Habitats Directive within 2km of the Proposed Scheme, or sites designated for bats within 30km. There is one internationally designated site located 5.5 km east of the Proposed Scheme. A Habitats Regulations Assessment (HRA) screening exercise at PCF Stage 2 identified no possible source-receptor pathways to designated sites and determined that the Proposed Scheme was not likely to significantly affect any European sites. Currently there is Rochdale Canal Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) within 200m of the Stage 2 Affected Road Network (ARN). The Stage 3 ARN is yet to be defined; any sites present within 200m of the Stage 3 ARN will be subject to an HRA. The Proposed Scheme may result in significant effects to landscape and visual and water quality. These impacts would be mitigated to reduce the significance of any effect. These impacts would not result in impacts to an EEA member state.
Potential impacts and carrier: By what means could impacts be spread (i.e. what pathways)?	The pathways by which impacts could be spread are via air and water. However, none of the anticipated effects are likely to impact an EEA member state.
Extent: What is the likely extent of the impact (geographical area and size of the affected population)?	No significant effects are anticipated that could impact on an EEA member state.

Criteria and relevant considerations	Result of screening considerations
Magnitude: What will the likely magnitude of the change in relevant variables relative to the status quo, taking into account the sensitivity of the variable?	None of the anticipated effects from the Proposed Scheme are likely to occur at a magnitude that would impact an EEA member state.
Probability: What is the degree of probability of the impact? Is the impact likely to occur as a consequence of normal conditions or exceptional situations, such as accidents?	The probability of the Proposed Scheme impacting an EEA state is considered very unlikely during both normal and abnormal operating conditions.
Duration: Is the impact likely to be temporary, short-term or long-term? Is the impact likely to relate to the construction, operation or decommissioning phase of the activity?	The impact is likely to be long-term, relating to both construction and operation.
Frequency: What is likely to be the temporal pattern of the impact?	The temporal pattern is likely to be relatively constant.
Reversibility: Is the impact likely to be reversible or irreversible?	Reversibility varies depending on the impact. In general, the impacts are considered irreversible over the Proposed Scheme's lifetime.
Cumulative impacts: Are other major developments close by?	There are a number of other developments within 2km of the Proposed Scheme, including residential developments near to M60 Junction 19 and several residential and employment developments in Whitefield. The traffic model developed to assess impacts for the Proposed Scheme includes assumptions on traffic generation from proposed development in the area. The potential cumulative effect upon transport emissions from the Proposed Scheme and proposed development will therefore be accounted for in the Scheme EIA. However, it is not anticipated that there is potential for cumulative transboundary effects from these developments.

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ENVIRONMENTAL SCOPING REPORT

APPENDIX E

SPECIES SURVEY SCOPE AND METHODOLOGY

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Appendix E. Species survey scope and methodology

Survey	Methodology	Survey area and timeframe	Surveys undertaken and proposed programme
Desktop records	The Barn Owl Conservation Network (BOCN) will be contacted for their barn owl breeding records for a 2km buffer.	• Records for a 2km buffer (to be obtained prior to statutory consultation)	• Survey summer 2021 • Records to be obtained prior to statutory consultation
Badger	Walk over survey in natural habitats (woodlands, field edges etc.) within 100m of provisional Order Limits to identify potential setts and habitats (Harris et al., 1989). If deemed necessary, and based on results of sett identification survey, setts will be monitored to determine sett classification (main breeding sett; annex; subsidiary; or outlier) and whether the sett is in active use (Harris et al., 1989). If deemed necessary, based on results of sett identification survey and likely impact, a badger territory survey will be conducted by leaving peanuts (baited with different coloured plastic balls and mixed in syrup / molasses) at main setts and other appropriate locations (Delahey et al., 2000). The bait would be provided daily for at least 10 - 21 consecutive days and the area searched each day for latrines, which would indicate the territorial area of each main sett.	• 100m • Walk over survey - All year round • Territory survey best undertaken February to April or September to Mid-October	• Walk over survey undertaken March 2021 • Additional surveys, if required, will take place in 2021
Barn owl	Barn owl habitat will be surveyed in accordance with Shawyer (2012). This is a four-stage process; an initial desktop study, stage 1 field surveys to scope habitats and broadly define habitat features of potential value, stage 2 field surveys to identify potential nest sites, active roosts and potential foraging and commuting habitat, and lastly, stage 3 surveys to confirm the presence of occupied breeding sites.	Surveys will only be undertaken up to 500m from Proposed Scheme (a deviation from best practice but considered sufficient to provide a robust baseline and consistent with the approach on other Highways England schemes). Stage 3 surveys should avoid March to May when young may be more susceptible to disturbance.	• Surveys to be undertaken June-September 2021

Survey	Methodology	Survey area and timeframe	Surveys undertaken and proposed programme
Bats (activity and roosts)	All bat surveys will be carried out with reference to standard survey methodology (Collins, 2016). Ground roost assessments for trees and structures will be undertaken in accordance with Collins, 2016. Trees identified as having potential to support roosting bats (as well as previously confirmed roosts) will be subject to climbing inspections where it is safe to do so. Climbing surveys will replace dusk emergence / dawn re-entry surveys where they can be safely undertaken as it is evidenced that these surveys are more effective at detecting roosts (Bat Tree Habitat Key, 2018). Climbers will inspect potential roost features for signs of use by bats (e.g. droppings, presence of live or dead bats). Data collected will be used to up or down grade roost categories and to inform the need for additional climbing surveys throughout the summer. Trees with low potential will not be surveyed. Trees which cannot be inspected from ground level or safely climbed, which have been identified as having moderate or high potential to support roosting bats, as well as structures will be subject to dusk/dawn emergence and re-entry surveys. Bat activity surveys in the form of walked transects will be undertaken along a pre-determined route in 2021 in three months coinciding with seasons, spring, summer and late summer/autumn. Three static bat detectors will be deployed on site to monitor bat flight lines and levels of bat activity. Static detectors will be deployed for a minimum of five nights a month for three months coinciding with three seasons, spring, summer and late summer/autumn.	• Roosts (trees) – up to 100m from Proposed Scheme • Activity – up to 1km – dependent on transect route • May-September	• Surveys to be undertaken May-September 2021

Survey	Methodology	Survey area and timeframe	Surveys undertaken and proposed programme
	Surveys designed to identify the presence and relative frequency of bats commuting along hedgerows that will be lost due to the scheme will be undertaken in three months coinciding with three seasons (spring, summer and late summer/autumn). Surveyors will be positioned at a vantage point overlooking the hedgerows or at either end of it and will record activity along its length		
Breeding birds	Key habitats within 250m of the Proposed Scheme have been identified using aerial maps. Breeding bird surveys comprise walking pre-determined transects through habitats with the potential to be impacted by the Proposed Scheme. Surveys will be undertaken following best practice guidance (Gilbert et al., 1998). Transects will be visited once a month for four months between April and July.	• 250m from Proposed Scheme • April to July	• Surveys to be April to July 2021

Freshwater environment – River Condition Assessment	The River Condition Assessment combines information gathered during a field survey and desk-based assessment to determine a River Condition Assessment (RCA) score for each impacted watercourse which will ultimately feed into the Biodiversity Metric 2.0, of which the RCA is one of seven elements which feed into the metric. Surveyors undertake the River Condition Assessment according to the MoRPh survey methodology in order to provide the two required outputs for use in the Biodiversity Metric 2.0. Calculation Tool (spreadsheet): • River Type • Condition score A Modular River Survey (MoRPh survey) will be undertaken. The MoRPh survey records all morphological features along the bank top (within 10m of the break in slope from the bank face), the bank face, and the channel bed at five river "modules". The length of each module varies depending on the MoRPh river width but is approximately two channel widths. Five contiguous MoRPh surveys are carried out. This set of five surveys is known as MoRPh5 survey and provides the characterisation for a "sub-reach" of the river. MoRPh5 surveys should be located to best capture the variations in the characteristics of the river and should include the most natural and most modified reaches of the channel. (If only two sub-reaches are needed, the most impacted/modified and the most natural sub-reaches in the project site should be captured.) MoRPh5 surveys should be conducted at equally spaced intervals (no greater than four times the sub-reach length) and should cover a length of the river channel greater than 20% of the length of the river that	• Waterbodies within Order Limits	• 2021

Survey	Methodology	Survey area and timeframe	Surveys undertaken and proposed programme
	lies within the red line boundary for the scheme/scheme element. According to the MoRPh5 methodology, when undertaking River Condition Assessments where only one survey is required it should target the most modified length of the watercourse. Once surveys have been completed, the data gathered on the morphological characteristics of the watercourses surveyed can be entered into the Cartographer website (www.cartographer.io). Along with desk study information, the Cartographer website is then used to conduct the necessary analyses to provide the River Condition Assessment score and River Type outputs required for use in the Biodiversity Metric Tool 2.0.		
Great crested newt	Great crested newt surveys will be undertaken in 2021. Habitat suitability index (HSI) survey were undertaken in accordance with Oldham et al. (2000). Ponds with a HSI score greater than "Poor" within 500m of the Proposed Scheme will then be subject to presence/absence surveys in accordance with best practice survey methodology (Froglife, 2013) (four surveys), and where great crested newts are recorded within ponds, population class size assessments will be undertaken (two additional surveys for a total of six per pond with great crested newt presence).	• March-June 2021	• HSI (undertaken March 2021) • Presence / absence surveys between April and mid-May with at least three surveys between mid-April and mid-May, where great crested newts are present two population size class assessments will be undertaken May-June 2021
Otter	The otter survey will reference standard survey methodology (Chanin, 2003) and involve systematically walking all pre-determined watercourse and waterbodies to search for evidence of otter, including: holts, spraints, footprints, slides, feeding signs (fish scales etc.) and actual sightings.	• All waterbodies within 200m of the online sections of the Proposed Scheme • All year-round surveys possible, dependent on water levels	• To be undertaken Spring/summer 2021

Survey	Methodology	Survey area and timeframe	Surveys undertaken and proposed programme
UK Habitats survey including INNS and important hedgerow assessment	UK Habitats surveys undertaken in April 2021. Surveys use UK habitats classification system Butcher, B., Carey, P., Edmonds, R., Norton, L. and Treweek, J. (2020), and collect habitat condition information for use with Defra Metric 2.0 net gain calculations.	• 500m from the Proposed Scheme • Can be undertaken at any time of year but is best undertaken in the main plant growing season (April-August)	• Undertaken April 2021.
Reptiles	Surveys to be undertaken in 2021 within habitats to the north-east of the Proposed Scheme. Surveys will be undertaken in accordance with best practice guidelines, Froglife (1999).	• North-east of existing M60 J18 within provisional Order Limits. Surveys can be undertaken in Spring and Autumn, but the months of July and August must be avoided.	• To be undertaken Spring-Autumn 2021
Terrestrial invertebrates	Aerial photographs will be used to identify suitable habitats that may be optimal for terrestrial invertebrates. If suitable habitats are identified a two-person survey team will carry out standard surveying protocols including, but not limited to, sweep netting, beating, aerial netting and hand searching of suitable habitats. Surveys will be carried out in line with Natural England's Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation (Report NERR005). Each site will be subject to a visual appraisal and separated into stations for survey according to the size of the site, habitats, and likely species present. All samples will be timed to allow analysis by Natural England's Pantheon system if required.	• Within provisional Order Limits • Surveys to be undertaken in Spring and Summer	• To be undertaken May to September 2021

Survey	Methodology	Survey area and timeframe	Surveys undertaken and proposed programme
Water vole	Water vole survey will be undertaken with reference to Dean et al., (2016). Search for evidence of water vole, including: burrows, latrines, footprints, runs, feeding signs (grazed 'lawns') and actual sightings. Two surveys necessary, approximately two months apart.	• All waterbodies within 200m of the Proposed Scheme • April to October with one visit in the first half of the season (mid-April to end of June) and one in the second half of the season (July-September) with at least two months between surveys	• To be undertaken Summer 2021
Wintering birds	Field surveys were undertaken in winter 2021/22 following guidance from British Trust for Ornithology Winter Farmland Bird Survey (Gillings, *et al.*, 2008). The purpose of the survey was to identify the importance of habitats around the Proposed Scheme for winter farmland birds; waders and waterfowl; and uncommon bird species, using professional judgement. Transects that extended approximately 500m from the Proposed Scheme were surveyed three times.	• Up to 500m from Proposed Scheme. • October-March	• Undertaken winter 2021 (February and March) • Will be undertaken winter 2022 from October 2021 to January 2022

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APPENDIX F

CUMULATIVE EFFECTS ASSESSMENT

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Appendix F. Cumulative effects assessment

F.1 Matrix for the identification of 'other development' for CEA

F.1.1 Matrix 1 (Planning Inspectorate Advice Note Seventeen, 2019) provides a means of summarising Stage 1 and Stage 2 of the CEA and will be used to demonstrate that a systematic approach to identifying development for inclusion in CEA has been adopted.

'Other development' details						Stage 1		Stage 2			
ID	Application reference	Applicant for 'other development' and brief description	Distance from project	Status	Tier	Within ZOI?	Progress to Stage 2?	Overlap in temporal scope?	Scale and nature of development likely to have a significant effect?	Other factors	Progress to Stage 3/4?

F.2 Assessment matrix

F.2.1 The assessment matrix (Planning Inspectorate Advice Note Seventeen, 2019) will provide a means of summarising the potential adverse or beneficial cumulative effects of the Proposed Scheme with 'other development' and will be used to demonstrate that a systematic approach to CEA has been adopted.

ID	Tier	Application reference	Applicant for 'other development' and brief description	Assessment of cumulative effect with Proposed Scheme	Proposed mitigation applicable to Proposed Scheme including any apportionment	Residual cumulative effect

F.3 Preliminary long list of 'other development' for CEA

Development details									Stage 1	
ID	Application reference	Applicant or proponent	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
Projects on the Planning Inspectorate's Programme of Projects within 2km of the Proposed Scheme										
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Major Developments within 2km of the Proposed Scheme										
Bury Metropolitan Borough Council										
1	58918	Mr Brendan Kiely	Land adjacent to 15 Prestfield Road, Whitefield, Manchester, M45 6BD	Residential development (33 dwellings).	0	Approved	29/02/2016	Tier 1	All topics	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
2	63003	Mr Smith	85 Bury Old Road, Whitefield, Manchester, M45 7AY	Erection of four storey office building and residential apartments (11 dwellings).	0.05	Approved	11/06/2019	Tier 1	All topics	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
3	63378	Galliford Try Building - North West	Castlebrook High School, Parr Lane, Bury, BL9 8LP	Erection of new main school building.	0.05	Approved	15/01/2019	Tier 1	All topics	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
4	65379	Mr Stuart Smallman	Lord Clive Pub, 92 Mersey Drive, Whitefield, Manchester, M45 8LF	Demolition of existing building and construction of residential development (27 dwellings).	0.4	Approved	16/07/2020	Tier 1	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
5	62751	Mr Stuart Parks	34-36 Fountain Place & Aldi Foodstore Ltd, Higher Lane, Whitefield, Manchester, M45 7EA	Demolition of 34-36 Fountain Place and the extension of existing car park.	0.5	Approved	20/06/2018	Tier 1	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
6	60998	Peveril Securities Ltd	Park 66, Pilsworth Road, Bury, BL9 8RS	Mixed use development B1c, B2, B8, A1,D2, A3/A5.	0.8	Approved	23/11/2017	Tier 1	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
7	62220	Mr Paul Barnes	Elizabethan Public House, Ribble Drive, Whitefield, Manchester, M45 8WJ	Demolition of public house and residential development (15 dwellings).	1	Approved	09/01/2019	Tier 1	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
8	60556	Miss Miranda Steadman	Land Off Roach Bank Road, Bury, BL9 8RQ	Industrial unit for a food production facility with ancillary offices, associated parking, service yards and landscaping.	1.4	Approved	26/10/2106	Tier 1	Landscape; Biodiversity; Population and human health	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
9	63376	Mr Osman Salim	The Old School, 1 Walker Street, Radcliffe, Manchester, M26 1FH	Residential development (13 dwellings).	1.7	Approved	31/01/2019	Tier 1	Landscape; Biodiversity; Population and human health	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.

Development details									Stage 1	
ID	Application reference	Applicant or proponent	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
Manchester City Council										
10	118800/FO/2018	Premier Inn Hotels Limited	Premier Inn, Heaton Park, Middleton Road, Manchester, M8 4NB	Erection of three storey extension to existing hotel to provide 39 new bedrooms (total of 84) together with the reconfiguration of the car park, associated landscaping and ancillary services, including plant equipment.	1.8	Approved	13/04/2018	Tier 1	Landscape; Biodiversity; Population and human health	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
11	115904/VO/2017	Mr Andy Partington	Longhurst Road, Manchester, M9 8NS	Residential development (10 dwellings).	2	Approved	19/07/2017	Tier 1	Landscape; Biodiversity; Population and human health	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
Rochdale Borough Council										
12	16/01455/OUT	Mr Bill Ullathorne	Birch Industrial Estate, Whittle Lane, Heywood, OL10	Erection of 3 industrial units of B2/B8 use (with ancillary B1) including the provision of car parking and associated infrastructure including the demolition of existing commercial units.	1.6	Approved	11/10/2017	Tier 1	Landscape; Biodiversity; Population and human health	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
13	18/01041/REM	Elan Homes Ltd	Land East of Boothroyden Road, Middleton, Rochdale, M24 4RY	Residential development (67 dwellings).	1.7	Approved	11/04/2019	Tier 1	Landscape; Biodiversity; Population and human health	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
14	16/01123/FUL	Mr Nigel Smith	North Manchester Golf Club, Manchester Old Road, Middleton, M24 4PE	Erection of 65 dwellings including the demolition of the existing buildings on site, and the erection of a replacement club house (including pro-shop and function room), erection of greenkeepers store and the relocation of the existing practice area with associated engineering, drainage and landscaping together with the construction of a replacement car park.	1.8	Refused	27/03/2019	Tier 1	Landscape; Biodiversity; Population and human health	No. Application refused (to be reviewed again for potentially successful appeals).
Salford City Council										
15	20/76423/FUL	Roydon Group PLC	Units 1 To 3, Junction Business Park, Rake Lane, Clifton, Swinton, M27 8LU	Erection of building for B2 Use (general industrial) to form extension to existing recycling facility, along with ancillary office space, parking and associated works.	1.5	Approved	17/11/2020	Tier 1	Landscape; Biodiversity; Population and human health	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
16	19/72952/FUL	Mr Amar Seth	Clifton Materials Recycling Facility, Former Pilkington Tiles, Rake Lane, Salford, Clifton, M27 8LP	Change of use to a waste transfer station including physical treatment of inert and non-hazardous waste.	1.5	Approved	14/06/2019	Tier 1	Landscape; Biodiversity; Population and human health	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.

Development details									Stage 1	
ID	**Application reference**	**Applicant or proponent**	**Location**	**Description**	**Distance from project (km)**	**Application status**	**Submission / Decision date**	**Tier**	**Within ZOI?**	**Progress to Stage 2?**
17	20/75418/FUL	Mr Les Woolhouse	Clifton Green, The Green, Clifton, M27 8RH	Residential development (47 dwellings).	2	Approved	13/06/2020	Tier 1	Landscape; Biodiversity; Population and human health	Yes. This development is located within the ZOI and, due to the nature/scale of the development, should be assessed in Stage 2.
Development Allocations within 2km of the Proposed Scheme										
Bury Metropolitan Borough Council										
18	N/A	Bury Metropolitan Borough Council	Whitefield	Emerging Greater Manchester Spatial Framework (2019 Consultation Draft) GMA1.3 600 homes 64.56ha	0	N/A	N/A	Tier 3	All topics	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
19	N/A	Bury Metropolitan Borough Council	Hodder Way	Adopted Bury Unitary Development Plan (1997) H1.1.42 14 homes 13.92ha	0	N/A	N/A	Tier 3	All topics	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
20	N/A	Bury Metropolitan Borough Council	Cedar Avenue	Adopted Bury Unitary Development Plan (1997) H1.1.43 20 homes 113.36ha	0.05	N/A	N/A	Tier 3	All topics	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
21	N/A	Bury Metropolitan Borough Council	Bury New Road	Adopted Bury Unitary Development Plan (1997) S4.2.2 66.48ha	0.2	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment; Noise and vibration; Geology and soils; Air quality	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
22	N/A	Bury Metropolitan Borough Council	Prestwich Hospital	Adopted Bury Unitary Development Plan (1997) H1.1.45 120 homes 15.53ha	0.25	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment; Noise and vibration; Geology and soils	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
23	N/A	Bury Metropolitan Borough Council	Albert Road and Hazel Road	Adopted Bury Unitary Development Plan (1997) H1.1.40 55 homes 106.71ha	0.3	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment; Noise and vibration	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
24	N/A	Bury Metropolitan Borough Council	Land South of Albert Road	Adopted Bury Unitary Development Plan (1997) H1.1.41 129 homes 16.84ha	0.4	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.

Development details								Stage 1	
ID	Application reference	Applicant or proponent	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
25	N/A	Bury Metropolitan Borough Council	Albert Road	Adopted Bury Unitary Development Plan (1997) H1.1.39 24 homes 11.5ha	0.5	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
26	N/A	Bury Metropolitan Borough Council	St. Margaret's Road	Adopted Bury Unitary Development Plan (1997) H1.1.44 27 homes 14.16ha	0.6	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
27	N/A	Bury Metropolitan Borough Council	Pilsworth Industrial Estate	Adopted Bury Unitary Development Plan (1997) EC2.1.2	0.6	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
28	N/A	Bury Metropolitan Borough Council	Ribble Drive	Adopted Bury Unitary Development Plan (1997) H.1.1.38 10 homes	0.6	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
29	N/A	Bury Metropolitan Borough Council	Howard Hill and Hollins Lane	Adopted Bury Unitary Development Plan (1997) H1.1.25 15 homes 21.4ha	0.7	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
30	N/A	Bury Metropolitan Borough Council	Victoria Mill	Adopted Bury Unitary Development Plan (1997) H1.1.27 40 homes 360.7ha	0.7	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
31	N/A	Bury Metropolitan Borough Council	Land off Heys Road	Adopted Bury Unitary Development Plan (1997) H1.1.46 18 homes 28.35ha	0.7	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health; Cultural heritage; Water environment	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
32	N/A	Bury Metropolitan Borough Council	Manchester Road, Bury	Adopted Bury Unitary Development Plan (1997) H1.1.26 26 homes 0.97ha	1.3	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.

Development details								Stage 1	
ID	Application reference	Applicant or proponent	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
33	N/A	Bury Metropolitan Borough Council	Lily Hill Street	Adopted Bury Unitary Development Plan (1997) H1.1.37 26 homes 279.19ha	1.8	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
34	N/A	Bury Metropolitan Borough Council	Johnson Street	Adopted Bury Unitary Development Plan (1997) H1.1.36 75 homes 93.45ha	2	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
Bury Metropolitan Borough Council / Rochdale Borough Council										
35	N/A	Bury Metropolitan Borough Council / Rochdale Borough Council	Heywood and Pilsworth	Emerging Greater Manchester Spatial Framework (2019 Consultation Draft) GMA1.1 1,200,000 sqm employment, 1,200 homes 650.03ha	0	N/A	N/A	Tier 3	All topics	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
36	N/A	Bury Metropolitan Borough Council / Rochdale Borough Council	Simister	Emerging Greater Manchester Spatial Framework (2019 Consultation Draft) GMA1.2 2,700 homes in total 210.3ha	0	N/A	N/A	Tier 3	All topics	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
37	N/A	Bury Metropolitan Borough Council / Rochdale Borough Council	Bowlee	Emerging Greater Manchester Spatial Framework (2019 Consultation Draft) GMA1.2 2,700 homes in total 24.08ha	1.1	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
Rochdale Borough Council										
38	N/A	Rochdale Borough Council	Clifton Industrial Estate	Adopted Salford City Council UDP (2006) SL2 Area Allocation for Waste Management Development 46.37ha	1.3	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
39	N/A	Rochdale Borough Council	Birch Industrial Estate	Adopted Rochdale Borough Council Unitary Development Plan (2006) D/5(ii) Infilling at Major Existing Developed site in the Green Belt 14.2ha	1.5	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.

Development details									Stage 1	
ID	Application reference	Applicant or proponent	Location	Description	Distance from project (km)	Application status	Submission / Decision date	Tier	Within ZOI?	Progress to Stage 2?
40	N/A	Rochdale Borough Council	Birch Motorway Service Area	Adopted Rochdale Borough Council Unitary Development Plan (2006) D/5(vii) Infilling at Major Existing Developed site in the Green Belt 12.03ha	1.85	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.
41	N/A	Rochdale Borough Council	Land at Manchester Road, Hareshill Road and Pilsworth Road	Emerging Rochdale Draft Allocations Plan (2018) AL.EMP.33	2	N/A	N/A	Tier 3	Landscape; Biodiversity; Population and human health	No. It is expected that a future developer bringing forward a development in line with this allocation would carry out their own assessment of cumulative effects.

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ENVIRONMENTAL SCOPING REPORT

APPENDIX G

ARBORICULTURAL IMPACT ASSESSMENT

HE548642-JAC-EAR-SII_MLT-RP-LE-0001 | P01
02/06/21

Document Control

Project Manager:	Helen Dagg
Originator (Company):	Jacobs
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Contents

Appendix G. Arboricultural Impact Assessment

G.1 Arboricultural surveying methodology

G.1.1 The Arboricultural Impact Assessment (AIA) will be undertaken following British Standard 5837:2012 'Trees in relation to design, demolition and construction – Recommendations' (British Standards Institution, 2012) which sets out the need to assess the effects of a development on trees. The tree survey will be undertaken by Arboriculturists to record information about trees within 15m of the provisional Order Limits.

G.1.2 The purpose of the arboricultural methodology is to set out the approach, rationale and strategy for identifying and recording arboricultural features that may be lost or impacted upon by the Proposed Scheme.

G.1.3 The intention is to allow for a proportionate and appropriate survey approach to tree data collection to provide category and definition criteria, together with information to provide adequate tree protection during the construction phases in line with guidance given in British Standard 5837 2012: Trees in Relation to Design, Demolition and Construction – Recommendations.

G.1.4 The surveying methodology will use detailed desk-study data, high-resolution digital aerial photography, GIS, known ancient and veteran trees data and ecological identified tree features together with other project information available at the time of assessment. This will target resources to key areas that may need further study, including field surveys.

G.1.5 This approach is detailed in Table G.1.

G.2 Approach to arboricultural surveys

G.2.1 The arboricultural surveys will focus on capturing tree data on individual trees, tree groups, woodlands and hedgerows that are likely to be lost or impacted upon by the Proposed Scheme. In line with tree size parameters of BS5837:2012, survey scope will focus on trees with a stem diameter of 75mm and over (as measured at 1.5m above ground level). Spatial scope of surveys considers trees located within and up to 15m from the provisional Order Limits of the Proposed Scheme.

G.2.2 It is considered appropriate to group tree stems collectively when features are the same category grading/feature type and similar size/age class/stem diameter range. Features of contiguous tree cover will be grouped where practicable. This approach ensures an efficient and pragmatic approach to tree data collection as further outlined in Table G.1.

G.2.3 Existing publicly available data such as the Woodland Trust's Ancient Tree Inventory will be referenced to identify known ancient and veteran trees that may be located in or close to (15m survey boundary) the provisional Order Limits.

G.2.4 Desk study information will be used to identify where field surveys are required. This strategy will adopt the British Standard calculation for root protection areas (RPAs). A desk study will assist in locating potentially notable trees prior to site assessments as detailed in Table G.1.

G.2.5 In addition to providing information detailing preliminary RPAs, ad-hoc site visits may be undertaken to provide detailed RPA information for tree groups, hedgerows and woodlands, as well as confirm above ground constraints i.e. stocking densities, low branch formation.

G.2.6 The arboricultural survey method will also draw upon the following parallel programs of work:

- Engagement with environmental regulators, public bodies and other stakeholders
- Ongoing design development, early identification of potential mitigation measures
- Construction planning, and the draft Code of Construction Practice and Environmental Management Plan

Table G.1: Arboricultural survey elements and proposed survey methodology

Feature	Proposed approach	Best practice and details of any deviations	Justification, precedents and solutions
Desk study	A data search using the following sources: • Available web-based data, including those held by MAGIC map, and the Woodland Trust • Local authority records on Tree Preservation Orders and Conservation Areas • Historical aerial photography • Early design information/communications from the project's highways design team • Project ecology surveys on hedgerows • Baseline information from the Highways England AVIS database	N/A	Desk studies will focus field surveys on notable trees likely to be affected, and where information from other sources is not available.
Tree data collection	The survey boundary will encompass the provisional Order Limits plus an external survey boundary of 15m. The rows below set out the criteria for tree features to be included within the survey.	Consistent with best practice and BS5837: 2012	In open-ground areas the risk to tree roots from excavation activities are increased e.g. ground compaction and soil stripping. BS5837: 2012 provides a maximum root protection area of 15m for any given tree feature. The suggested protection distances from Natural England and the Forestry Commission for ancient and veteran trees will be applied for those trees verified as such (as per the Woodland Trust's Ancient Tree inventory) and identifiable on the ground.

Feature	Proposed approach	Best practice and details of any deviations	Justification, precedents and solutions
Individual trees	Individual trees are recorded individually if they represent standout features in terms of their age class, DBH or BS5837 category grading Where veteran, ancient or notable tree designation, as per the Ancient Tree Inventory, is confirmed during the survey this will be noted in the survey data. If the surveyors consider a tree to potentially fall into one of these designations but it is unverified or not identified as such, then this will also be noted within the survey data.	Consistent with best practice and BS5837: 2012	The survey strategy aims to highlight the notable individual trees that may be impacted.
Woodlands or tree groups	Where appropriate, contiguous woodlands/groups within the survey boundary will be grouped and, where appropriate, the largest measurements recorded and used for off-set calculations of RPAs from the margin of the woodland/tree group feature.	Consistent with BS5837: 2012	Applying the largest protection off set will protect all trees within the woodland area.
Hedgerows	Alignment of hedgerows will be identified on plans following arboricultural surveys but will generally not form part of the subsequent Arboricultural Impact Assessment (AIA). This is with the exception of features deemed to be of high quality which contain old coppiced or layered tree stems.	Consistent with BS5837: 2012	Identification of hedgerows and hedgerow loss will be captured as part of the project's ecology survey and assessment work.
Highways trees	Highway vegetation will generally be grouped and recorded as either forming one continuous canopy block or as sparsely planted plots.	Consistent with BS5837: 2012	It is likely that existing highway vegetation is at risk of removal and is suitable to be grouped for mitigation purposes. Note: Any notable legacy trees within groups will be surveyed as individual trees where appropriate.

G.3 Site data collection

G.3.1 This section lays out a pragmatic approach to collecting tree information whilst seeking to reduce the number of features surveyed by grouping tree features where appropriate.

G.3.2 Each individual tree, tree group, woodland or hedgerow will be given a unique reference number based on its relative location to the Proposed Scheme. Note: only hedgerows meeting criteria, as explained in Table G.1, will be given a unique reference number. This selective approach to hedgerow features is proposed on the basis that all hedgerows (including those below 75mm stem diameter) would be identified as part of the project's ecology surveys and assessment work.

G.3.3 'T', 'G', 'W' or 'H' prefixes will be used to reference individual trees, groups of trees, woodland and those hedgerows meeting the criteria referenced in Table G.1, respectively.

G.3.4 Data recorded for each tree group, woodland and hedgerow feature will provide a generic root protection offset based on the largest stem size recorded.

G.3.5 The tree surveyors will use their judgement and experience based on observed features and proposed distances to construction areas to determine the extent of the trees to be surveyed (the maximum protection radius applied within BS5837 is 15m). Fixed point information and handheld GPS devices will be used to assist surveyors. It is assumed that a full topographical survey of tree stem locations would not be available at this design stage.

G.3.6 As far as reasonably practicable, vegetation will be surveyed in groups with the largest tree measurements recorded. Information relating to the total number of trees likely to be impacted within a group or woodland will be estimated. Arboricultural surveyors will use distometers, clinometers and diameter measuring tapes for recording tree measurements. Common names will be used for tree species.

G.3.7 The following data are to be collected for features surveyed:

- Unique tree reference number and species
- Height of tree features will be measured to the nearest metre
- Stem diameter will be recorded in millimetres
- The cardinal points will be used to determine crown spread and recorded to the nearest metre
- Life stage will be recorded as young, semi-mature, early mature, mature or over-mature
- Overall condition will be based on ground based visual tree assessment techniques and will consider structural and physiological factors
- General observations and comment will detail where applicable particular tree features and significant defects such as habitat holes, storm damage fractures and prolific ivy
- Category grading and Estimated Remaining Contribution will align with criteria outline in BS5837: 2012
- Veteran and ancient trees will be recorded as such where verification of this status has been previously obtained (i.e. Ancient Tree Inventory). Trees considered as potential veteran or ancient trees (i.e. not verified or easily identifiable as such during

the survey) by the surveyors will be indicated as such within the survey data although the survey methodology does not include a specific assessment for either of these status groups.

G.4 Reporting

G.4.1 Following the completion of the tree survey the data will be used to produce an AIA report with an accompanying Tree Constraints and Assessment Plan and a Preliminary Tree Removals and Retention Plan.

G.4.2 The Tree Constraints and Assessment Plan and Preliminary Tree Removals and Retention Plan will comprise of all features included within the survey shown as follows:

- Individual trees – tree stem location based on either aerial imagery or GPS enabled device, canopy extents based on the four cardinal compass point measurements and a calculated RPA as a circular area.
- Tree groups, woodlands and hedgerows – an indicative polygon shape representing the canopy area, as per the aerial imagery used during the survey and plotted whilst in the field. The RPA buffer applied to the polygon based on the largest tree stem diameter recorded for that feature. This would be applied as either a buffer to the canopy extents or off-set with canopy spread data for the group thus reducing the RPA to extend from generic tree stem locations.

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ENVIRONMENTAL SCOPING REPORT

APPENDIX H

FIGURES

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FIGURE 1.1

Legend

- Provisional Order Limits
- District Borough Unitary Region

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P01	JUN 21	Initial Issue	LT	MS	VB	HD

Contractor: COSTAIN

Designer: Jacobs
1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

Client: highways england

Project
REGIONAL DELIVERY PARTNERSHIP
M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title
LOCATION PLAN AND
LOCAL PLANNING AUTHORITY BOUNDARIES

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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Jacobs No.	B36601F0	
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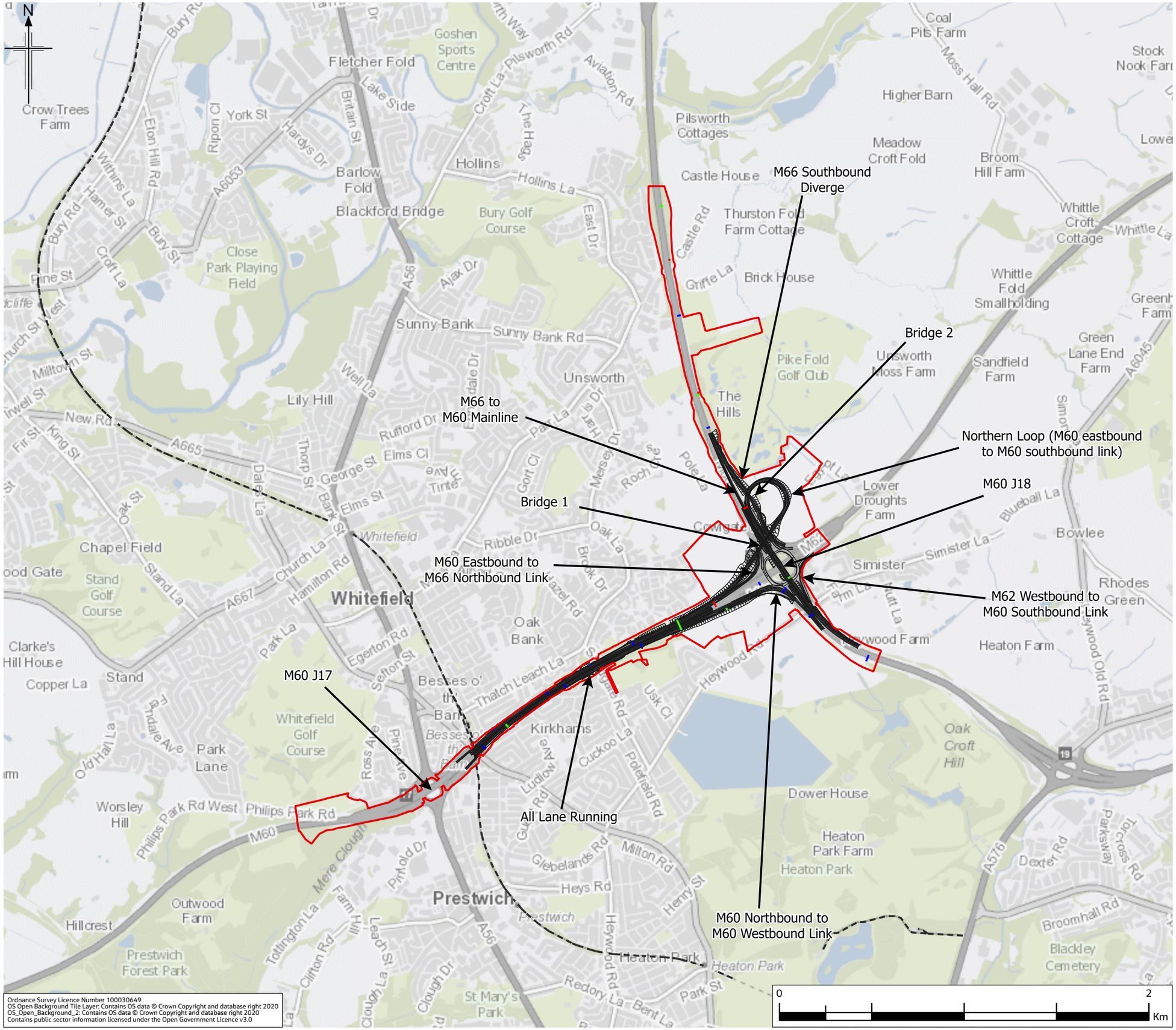
Drawing Number: HE548642-JAC-GEN-SII_MLT-SK-LE-0001

0 4 Km

FIGURE 2.1



Legend

- Combined Design
- Provisional Order Limits
- Railway Track

Gantry Locations

- Proposed New Gantries
- Proposed Removed Gantries
- Proposed Retained Gantries

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
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Contractor: COSTAIN

Designer: Jacobs
1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

Client: highways england

Project
REGIONAL DELIVERY PARTNERSHIP
M60/M62/M66 SIMISTER ISLAND INTERCHANGE

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OVERVIEW OF THE PROPOSED SCHEME

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Jacobs No.	B36601F0		
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FIGURE 6.1

Legend

- Combined Design
- Provisional Order Limits
- PCF Stage 2 Affected Road Network
- PCF Stage 2 Affected Road Network 200m Buffer

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Contractor: COSTAIN

Designer: Jacobs
1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

Client: highways england

Project
REGIONAL DELIVERY PARTNERSHIP
M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title
AIR QUALITY
AIR QUALITY ASSESSMENT STUDY AREA

Drawing Status	S4 - SUITABLE FOR STAGED APPROVAL		
Scale @ A3	1:50,000	DO NOT SCALE	
Jacobs No.	B36601F0		
Client No.	HE548642	Rev	P01

Drawing Number
HE548642-JAC-GEN-SII_MLT-SK-LE-0003

0 5 Km

FIGURE 6.2

Legend

- Combined Design
- PCF Stage 2 Affected Road Network
- TfGM Monitoring Locations
- Repurposed HE Monitoring Locations
- Local Authority Monitoring Locations
- Additional Monitoring Locations

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P01	JUN 21	Initial Issue	LT	MS	VB	HD

Contractor: COSTAIN

Designer: Jacobs
1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

Client: highways england

Project
REGIONAL DELIVERY PARTNERSHIP
M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title
AIR QUALITY
AIR QUALITY MONITORING

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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Jacobs No.	B36601F0	
Client No.	HE548642	Rev P01

Drawing Number: HE548642-JAC-GEN-SII_MLT-SK-LE-0004

0 5 Km

FIGURE 6.3

Legend

- Combined Design
- Provisional Order Limits
- PCF Stage 2 Affected Road Network
- AQMA Study Area
- Special Areas of Conservation (SAC)
- Sites of Special Scientific Interest (SSSI)
- Sites of Biological Importance
- Ancient Woodland
- Local Nature Reserves

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
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Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
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M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title
AIR QUALITY
AIR QUALITY KEY ENVIRONMENTAL CONSTRAINTS

Drawing Status	S4 - SUITABLE FOR STAGED APPROVAL		
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Jacobs No.	B36601F0		
Client No.	HE548642	Rev	P01

Drawing Number
HE548642-JAC-GEN-SII_MLT-SK-LE-0005

0 5 Km

FIGURE 6.4

Legend

- Combined Design
- Provisional Order Limits
- PCF Stage 2 Affected Road Network
- Study Area PCM Links

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Contractor

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Designer

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Drawing Title

AIR QUALITY
PCM LINKS

Drawing Status

S4 - SUITABLE FOR STAGED APPROVAL

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Jacobs No.	B36601F0	
Client No.	HE548642	Rev P01

Drawing Number

HE548642-JAC-GEN-SII_MLT-SK-LE-0006

0 5 Km

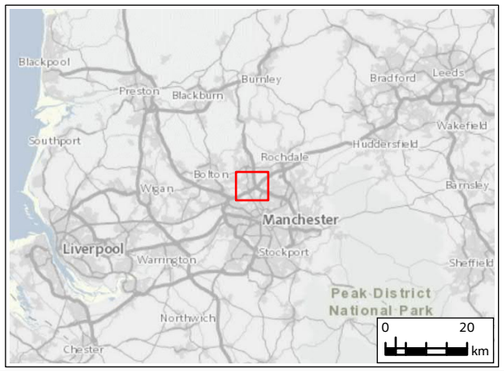
FIGURE 7.1

Legend

- Provisional Order Limits
- Provisional Order Limits 300m Buffer
- Provisional Order Limits 1km Buffer

Listed Building

- Grade I
- Grade II
- Grade II*
- Non-designated Archaeological Assets (point)
- Non-designated Historic Buildings (point)
- Non-designated Archaeological Assets (polyline)
- Non-designated Historic Buildings (region)
- Non-designated Archaeological Assets (region)
- Scheduled Monument
- Conservation Area



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Project
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Drawing Title
CULTURAL HERITAGE
CULTURAL HERITAGE ASSETS
(ARCHAEOLOGICAL REMAINS AND HISTORIC BUILDINGS)

Drawing Status	S4 - SUITABLE FOR STAGED APPROVAL		
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Jacobs No.	B36601F0		
Client No.	HE548642	Rev	P01

Drawing Number
HE548642-JAC-GEN-SII_MLT-SK-LE-0007

0 2 Km

FIGURE 7.2

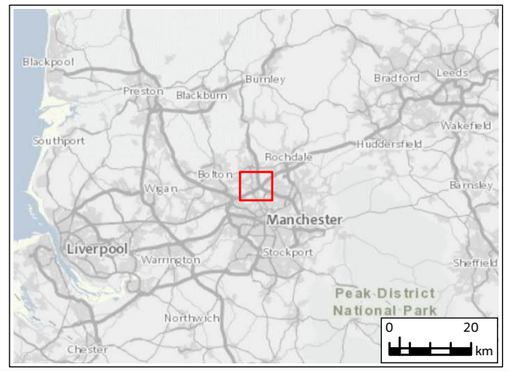
Legend

- Provisional Order Limits
- Provisional Order Limits 300m Buffer
- Provisional Order Limits 1km Buffer
- Registered Parks and Gardens

Historic Landscape Characterisation

Broad Type C

- CMC
- COM
- ENC
- EXT
- HOR
- IND
- INS
- OPR
- SET
- WAT
- WOO



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Drawing Title
CULTURAL HERITAGE
CULTURAL HERITAGE ASSETS (HISTORIC LANDSCAPES)

Drawing Status	S4 - SUITABLE FOR STAGED APPROVAL	
Scale @ A3	1:25,000	DO NOT SCALE
Jacobs No.	B36601F0	
Client No.	HE548642	Rev P01

Drawing Number
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0 2 Km

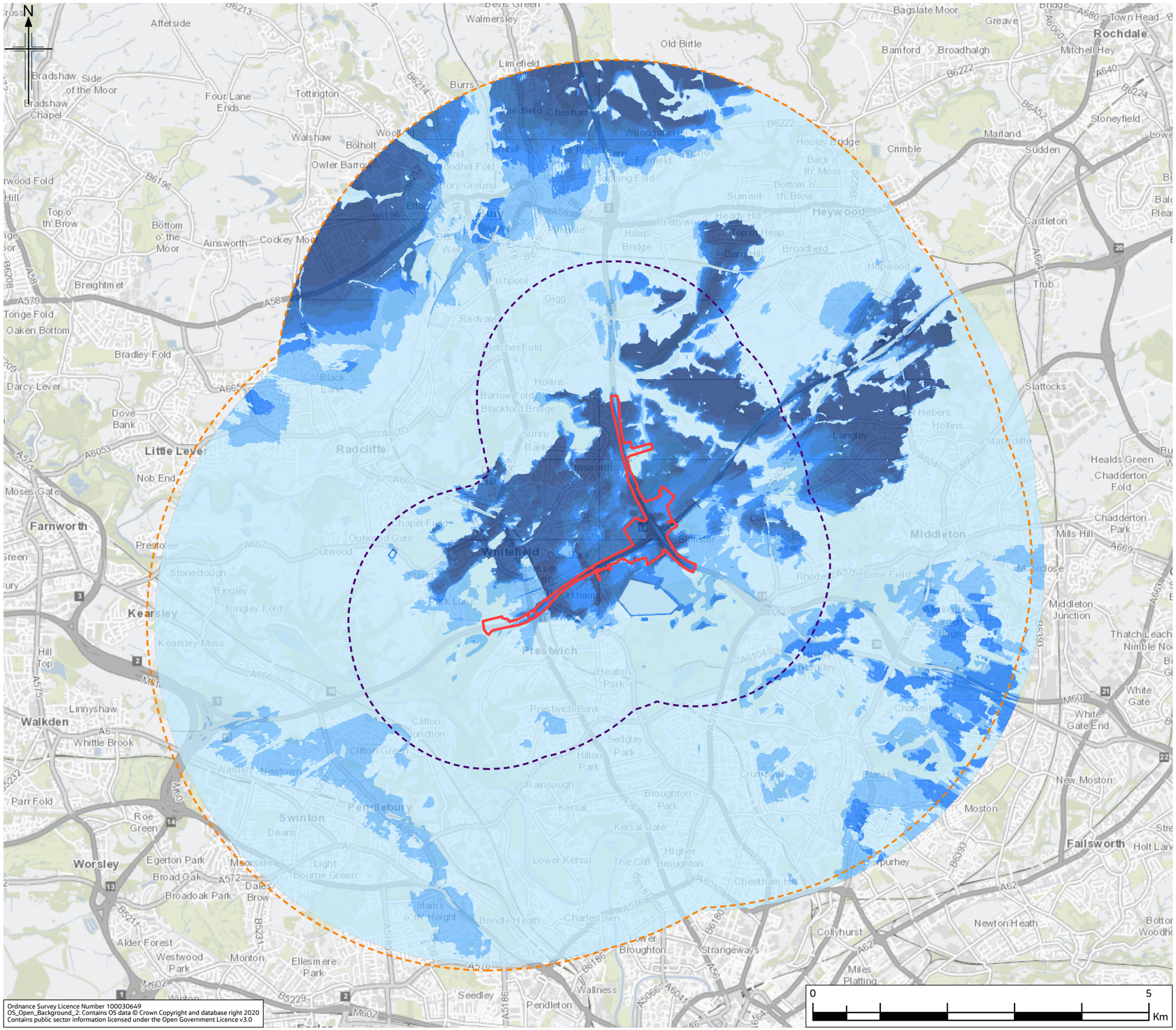

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FIGURE 8.1

Legend

- Provisional Order Limits
- Provisional Order Limits 2km Buffer
- Provisional Order Limits 5km Buffer

Zone of Theoretical Visibility

VALUE

- None Visible (number of target points visible)
- 1-25
- 26-50
- 51-75
- 76-100
- 101-125
- 126-150
- 151-175
- 176-200

Notes:
1. Representative viewpoint locations and potential photomontage locations are shown on Figure 8.4, which also includes the ZTV.
2. The ZTV illustrates the extent to which the layout is theoretically visible from within the surrounding landscape. It is based on existing terrain (i.e. 'bare earth'), and does not take account of potential screening by intervening vegetation or built form.
3. The ZTV has been modelled using digital software (Arc GIS) and a OS Terrain5 Digital Terrain Model
4. Theoretical visibility is based on the height of a HGV travelling along the Proposed Scheme (modelled at a height of 4.5m above carriageway centreline) with a viewing height of 1.7m above ground level and modelled with target points at 50m intervals along the Proposed Scheme.

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Project
REGIONAL DELIVERY PARTNERSHIP
M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title
LANDSCAPE AND VISUAL
ZONE OF THEORETICAL VISIBILITY (ZTV)

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

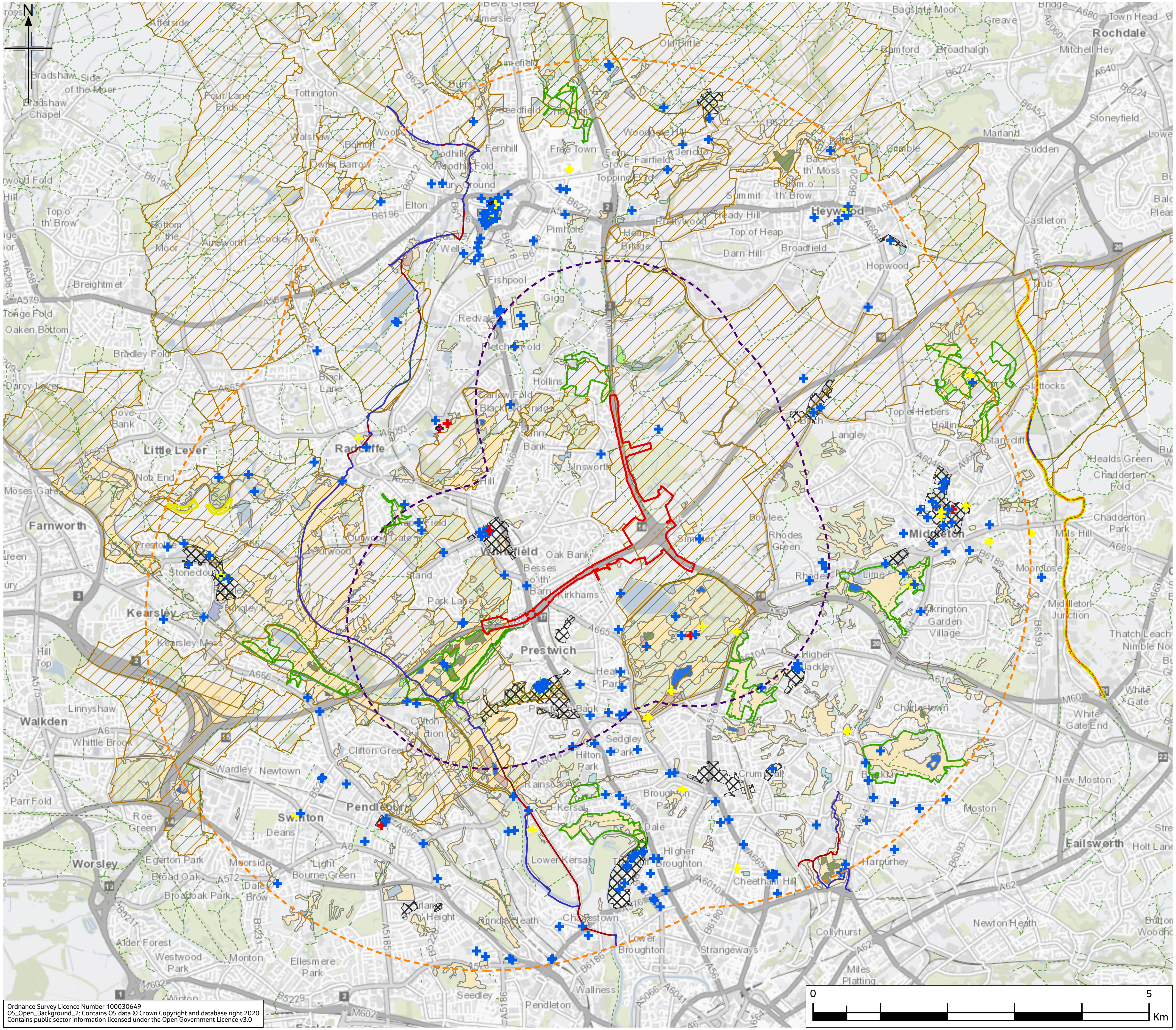
Scale @ A3	1:55,000	DO NOT SCALE
Jacobs No.	B36601F0	
Client No.	HE548642	Rev P02

Drawing Number
HE548642-JAC-GEN-SII_MLT-SK-LE-0009

FIGURE 8.2

Legend

Provisional Order Limits	Conservation Area
Provisional Order Limits 2km Buffer	Existing Significant Woodland Belts
Provisional Order Limits 5km Buffer	Assumed woodland
Listed Buildings	Bare area
Grade I	Broadleaved
Grade II	Conifer
Grade II*	Felled
Public Right of Way	Grassland
National Cycle Network	Ground prep
OnRoad	Low density
TrafficFree	Mixed mainly broadleaved
Scheduled Monuments	Mixed mainly conifer
Special Area of Conservation (SAC)	Open water
Site of Special Scientific Interest (SSSI)	Other vegetation
Local Nature Reserve	Shrub
Green Belt Boundary	Urban
	Young trees



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Drawing Title
LANDSCAPE AND VISUAL
KEY LANDSCAPE DESIGNATIONS AND FEATURES

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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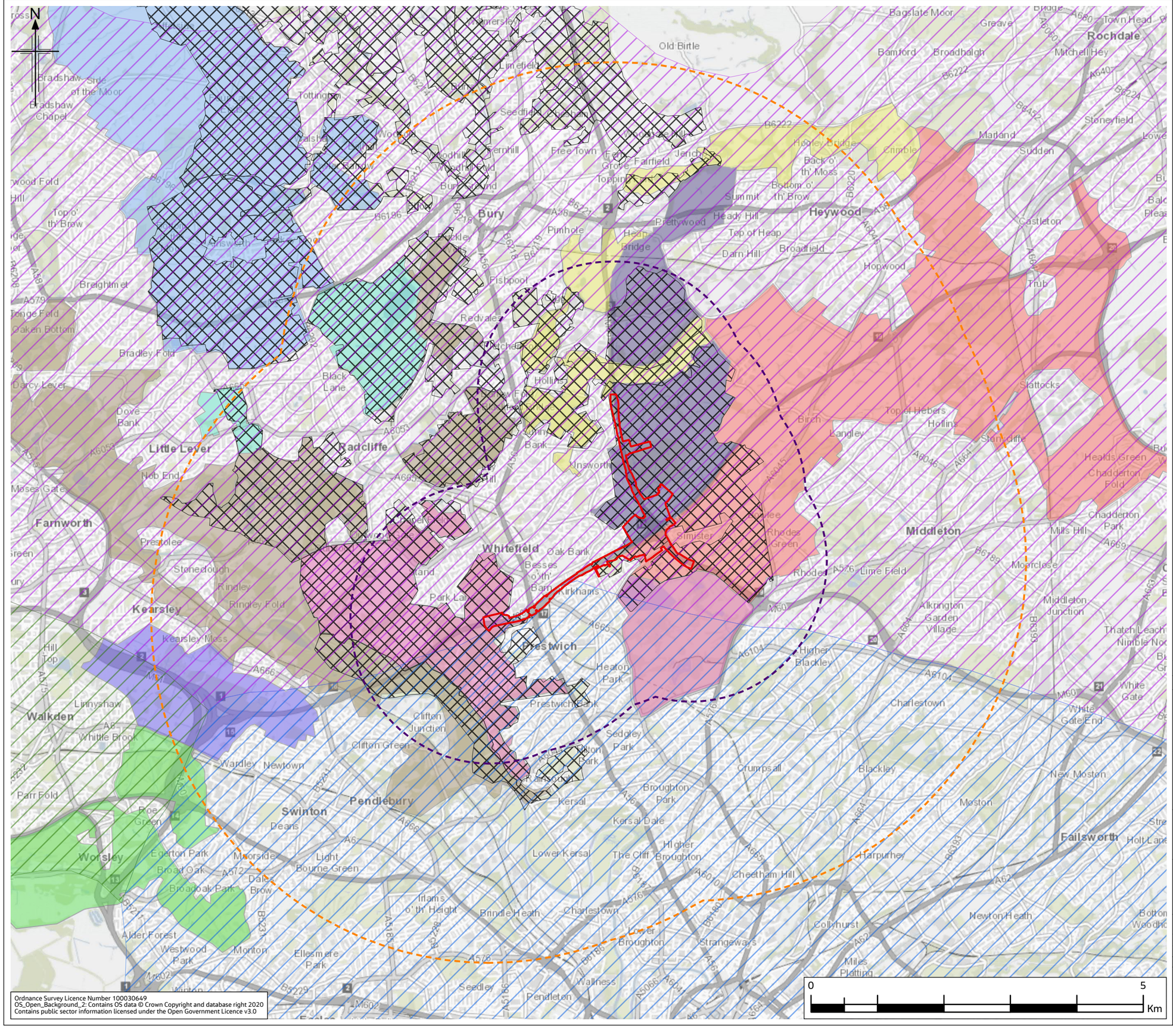
Client No.	HE548642	Rev P02

Drawing Number
HE548642-JAC-GEN-SII_MLT-SK-LE-0010

FIGURE 8.3



Legend

- Provisional Order Limits
- Provisional Order Limits 2km Buffer
- Provisional Order Limits 5km Buffer
- Landscape Character Area - Bury

National Character Areas

- Lancashire Coal Measures
- Manchester Conurbation
- Manchester Pennine Fringe

Greater Manchester Landscape Character and Sensitivity Assessment

- 16: River Irwell (south Bury) and River Croal
- 17: Clifton Moss
- 18: Worsley and Egerton
- 19: Heaton, Prestwich, Whitefield and Stand Parklands
- 20: Affetside and Ainsworth
- 21: Little Lever and Elton Reservoir
- 25: River Roch
- 26: Prettywood, Pilsworth and Unsworth Moss
- 27: Simister, Slattocks and Healds Green

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M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title
LANDSCAPE AND VISUAL
LOCAL LANDSCAPE CHARACTER AREAS

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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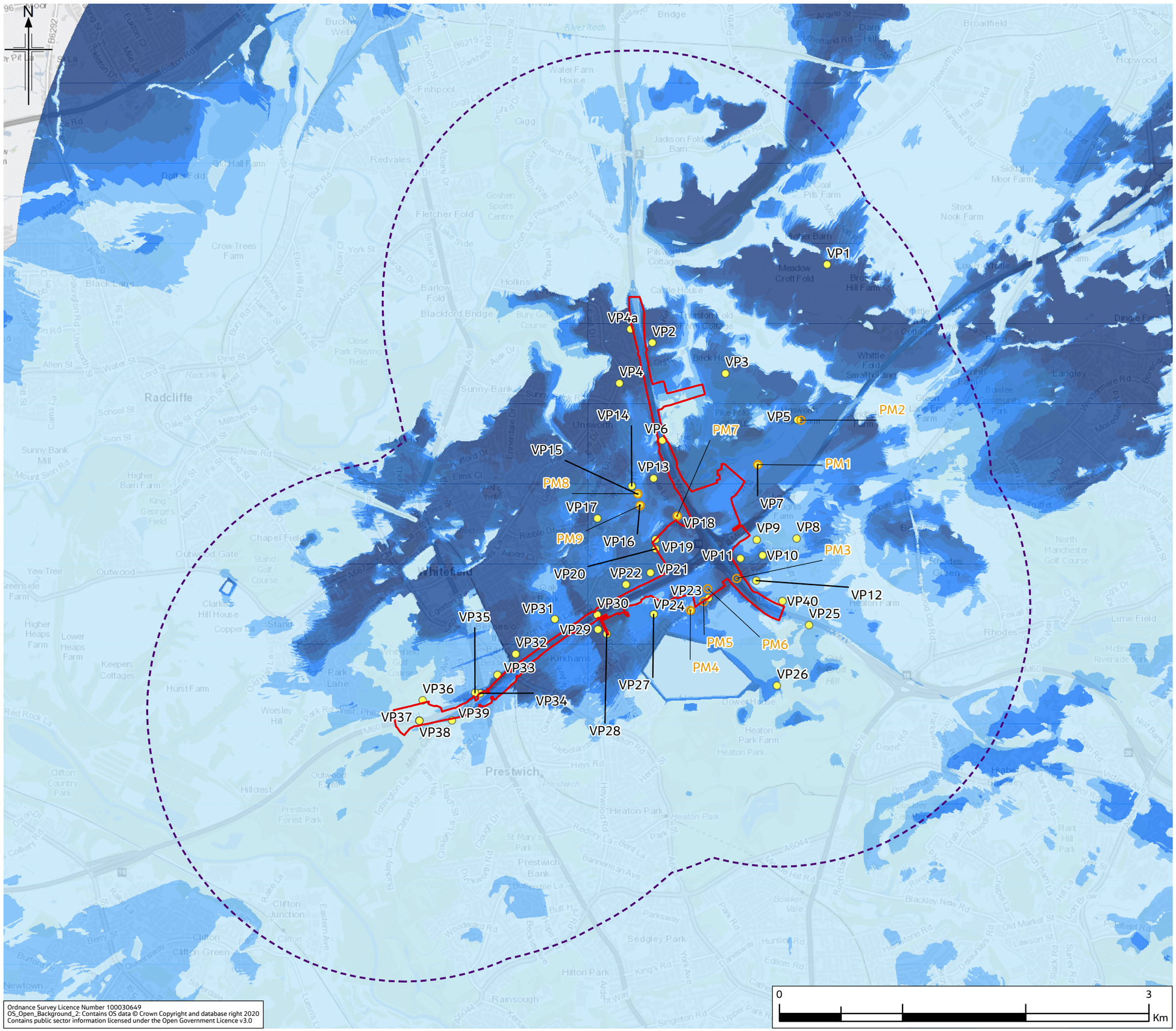
FIGURE 8.4



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Legend

- Provisional Order Limits
- Provisional Order Limits 2km Buffer
- Potential Photomontage Locations
- Representative Viewpoint Locations

Zone of Theoretical Visibility

VALUE

- None Visible (number of target points visible)
- 1-25
- 26-50
- 51-75
- 76-100
- 101-125
- 126-150
- 151-175
- 176-200

Notes:
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Drawing Title
LANDSCAPE AND VISUAL
REPRESENTATIVE VIEWPOINTS AND PHOTOMONTAGE LOCATIONS

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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Drawing Number: HE548642-JAC-GEN-SII_MLT-SK-LE-0012

FIGURE 9.1

Legend

- Provisional Order Limits
- Provisional Order Limits 2km Buffer
- PCF Stage 2 Affected Road Network
- Special Areas of Conservation (SAC)
- Sites of Special Scientific Interest (SSSI)
- Sites of Biological Importance
- Local Nature Reserves

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BIODIVERSITY
DESIGNATED SITES WITHIN 2KM

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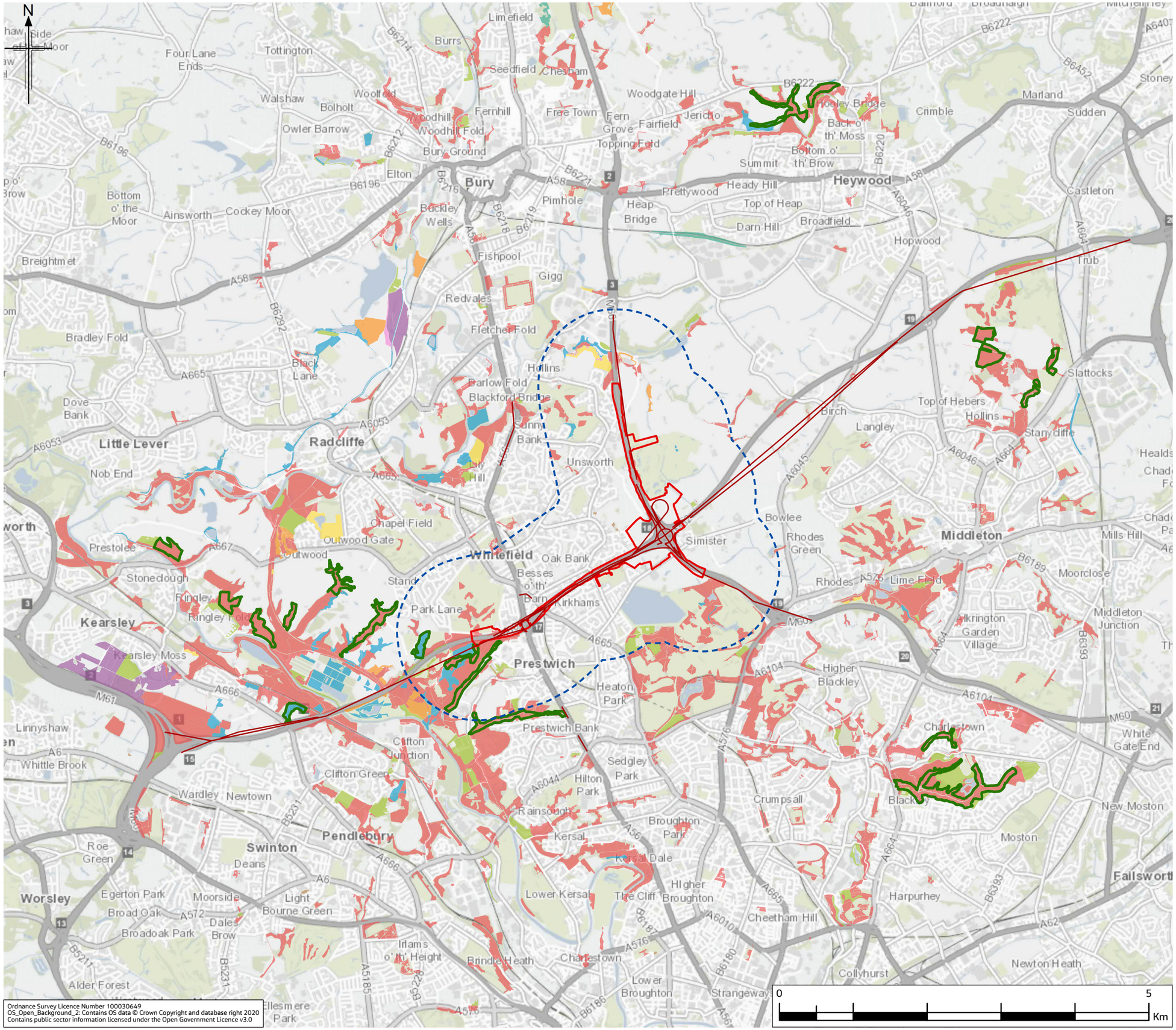
0 5 Km

FIGURE 9.2



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Legend

- Provisional Order Limits
- Provisional Order Limits 1km Buffer
- PCF Stage 2 Affected Road Network
- Ancient Woodland

Priority Habitat Inventory

- Deciduous woodland
- Lowland fens
- No main habitat but additional habitats present
- Coastal and floodplain grazing marsh
- Good quality semi-improved grassland
- Lowland dry acid grassland
- Purple moor grass and rush pastures
- Traditional orchard
- Lowland heathland

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Drawing Title
BIODIVERSITY
ANCIENT WOODLAND AND PRIORITY HABITATS WITHIN 1KM

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FIGURE 10.1

Legend

- Provisional Order Limits
- Provisional Order Limits 250m Buffer

Bedrock Geology

- Cannel Rock (South Lancashire) - Sandstone
- Chester Pebble Beds Formation - Sandstone
- Collyhurst Sandstone Formation - Sandstone
- Darwen Flags - Sandstone
- Great Arc Sandstone - Sandstone
- Helpet Edge Rock - Sandstone
- Manchester Marls Formation - Mudstone
- Milnrow Sandstone - Sandstone
- Newton Heath Sandstone - Sandstone
- Nob End Rock - Sandstone
- Old Lawrence Rock - Sandstone
- Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone
- Pennine Lower Coal Measures Formation - Sandstone
- Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone
- Pennine Middle Coal Measures Formation - Sandstone
- Pennine Upper Coal Measures Formation - Mudstone, Siltstone And Sandstone
- Rossendale Formation - Mudstone And Siltstone
- Rough Rock - Sandstone
- Trencherbone Rock - Sandstone
- Woodhead Hill Rock - Sandstone
- Worsley Delf Rock - Sandstone

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Drawing Title
GEOLOGY AND SOILS
BEDROCK GEOLOGY

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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Client No.	HE548642	

Drawing Number: HE548642-JAC-GEN-SII_MLT-SK-LE-0015

0 3 Km

FIGURE 10.2

Legend

- Provisional Order Limits
- Provisional Order Limits 250m Buffer

Superficial Geology

- Alluvium
- Glaciofluvial Deposits, Devensian
- Glaciofluvial Ice Contact Deposits, Devensian
- Glaciofluvial Sheet Deposits, Devensian
- Glaciolacustrine Deposits, Devensian
- Head
- Hummocky (Moundy) Glacial Deposits, Devensian
- Peat
- River Terrace Deposits (Undifferentiated)
- River Terrace Deposits, 1
- River Terrace Deposits, 2
- River Terrace Deposits, 3
- Till, Devensian

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Drawing Title
GEOLOGY AND SOILS
SUPERFICIAL GEOLOGY

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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Jacobs No.	B36601F0	Rev	P01
Client No.	HE548642		

Drawing Number: HE548642-JAC-GEN-SII_MLT-SK-LE-0016

0 3 Km

FIGURE 10.3

Legend

- Provisional Order Limits
- Provisional Order Limits 250m Buffer

Provisional Agricultural Land Classification (ALC)

- Grade 3
- Grade 4
- Non Agricultural
- Urban

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Drawing Title

GEOLOGY AND SOILS
AGRICULTURAL LAND CLASSIFICATION

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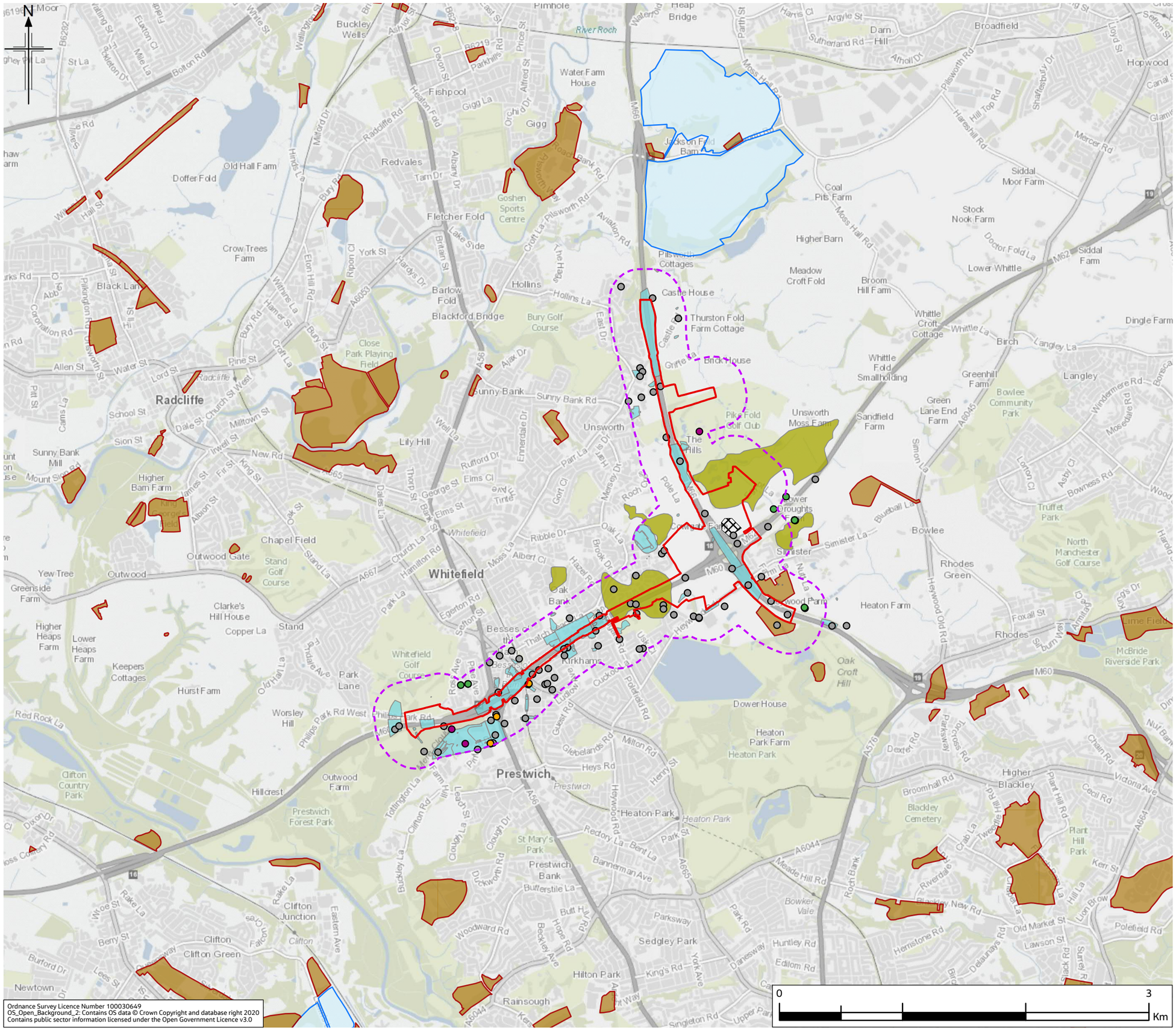
Client No.	HE548642	Rev P01

Drawing Number: HE548642-JAC-GEN-SII_MLT-SK-LE-0017

0 3 Km

FIGURE 10.4



Legend

- Provisional Order Limits
- Provisional Order Limits 250m Buffer
- Groundsure Pollution Incidents (EA NRW)
- Groundsure Licensed Pollutant Release (Part A2 B LA)
- Groundsure Licensed Discharges to Controlled Waters (EA NRW)
- Groundsure Recent Industrial Land Uses (OS)
- Soft Ground
- Historic Landfill Site
- Authorised Landfill Site
- Peat

Groundsure Historical Land Use

- Historical Energy Feature
- Historical Garages
- Historical Industrial Land Uses
- Historical Tanks

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Drawing Title
GEOLOGY AND SOILS
POTENTIAL CURRENT AND HISTORICAL CONTAMINATION SOURCES

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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Drawing Number: HE548642-JAC-GEN-SII_MLT-SK-LE-0018

FIGURE 11.1

Legend

- Combined Design
- Provisional Order Limits
- Operational Landfill Sites With Remaining Capacity by the End of 2019
- Peat

Area of Search (AoS)

- Sand

Mineral Safeguarding Areas

- Brickclay/Surface Coal
- Glaciofluvial Sand and Gravel
- Sandstone

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Project

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M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title

MATERIALS ASSETS AND WASTE
MINERAL ASSETS AND WASTE MINERAL SAFEGUARDING AREAS, MINERAL AREAS OF SEARCH, PEAT DEPOSITS AND OPERATIONAL LANDFILL SITES

Drawing Status

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Jacobs No.	B36601F0	Rev	P02
Client No.	HE548642		

Drawing Number

HE548642-JAC-GEN-SII_MLT-SK-LE-0019

0 3 Km

FIGURE 12.1

Legend

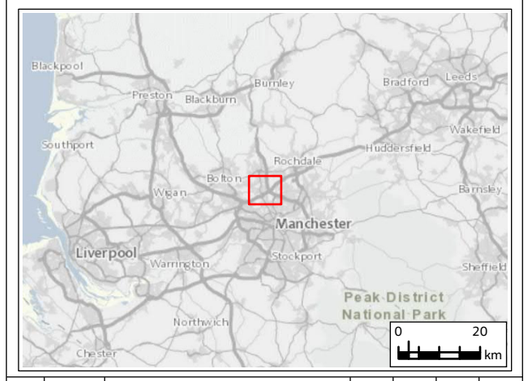
- Provisional Order Limits
- Provisional Order Limits 100m Buffer
- Provisional Order Limits 300m Buffer
- Provisional Order Limits 600m Buffer
- Residential Premises within 600m Buffer of Provisional Order Limits
- Other Buildings within 100m of Provisional Order Limits
- Other Sensitive Receptors within 600m Buffer of Provisional Order Limits

Healthcare within 600m Buffer of Provisional Order Limits

- Dentist
- General Practice Surgery / Clinic
- Professional Medical Service

Education within 600m Buffer of Provisional Order Limits

- Children's Nursery / Crèche
- Other Educational Establishment
- Preparatory / First / Primary / Infant / Junior / Middle School
- Secondary / High School
- Special Needs Establishment.
- Existing Noise Barriers
- Road Noise Action Planning Important Areas (Round 3) within 600m Buffer of Provisional Order Limits



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Contractor

COSTAIN

Designer

Jacobs

1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

Client

highways england

Project

REGIONAL DELIVERY PARTNERSHIP
M60/M62/M66 SIMISTER ISLAND INTERCHANGE

Drawing Title

NOISE AND VIBRATION
EXPECTECTED CONSTRUCTION AND OPERATIONAL NOISE AND VIBRATION STUDY AREAS AND NOISE IMPORTANT AREAS

Drawing Status

S4 - SUITABLE FOR STAGED APPROVAL

Scale @ A3	1:25,000	DO NOT SCALE
Jacobs No.	B36601F0	
Client No.	HE548642	Rev P01

Drawing Number

HE548642-JAC-GEN-SII_MLT-SK-LE-0020

0 2 Km

FIGURE 12.2

Legend
- Provisional Order Limits
- Proposed Baseline Noise Monitoring Locations

N1
N2
N3
N4
N5

0 2 Km

0 20 km

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Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

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Drawing Title
NOISE AND VIBRATION
PROPOSED BASELINE NOISE MONITORING LOCATIONS

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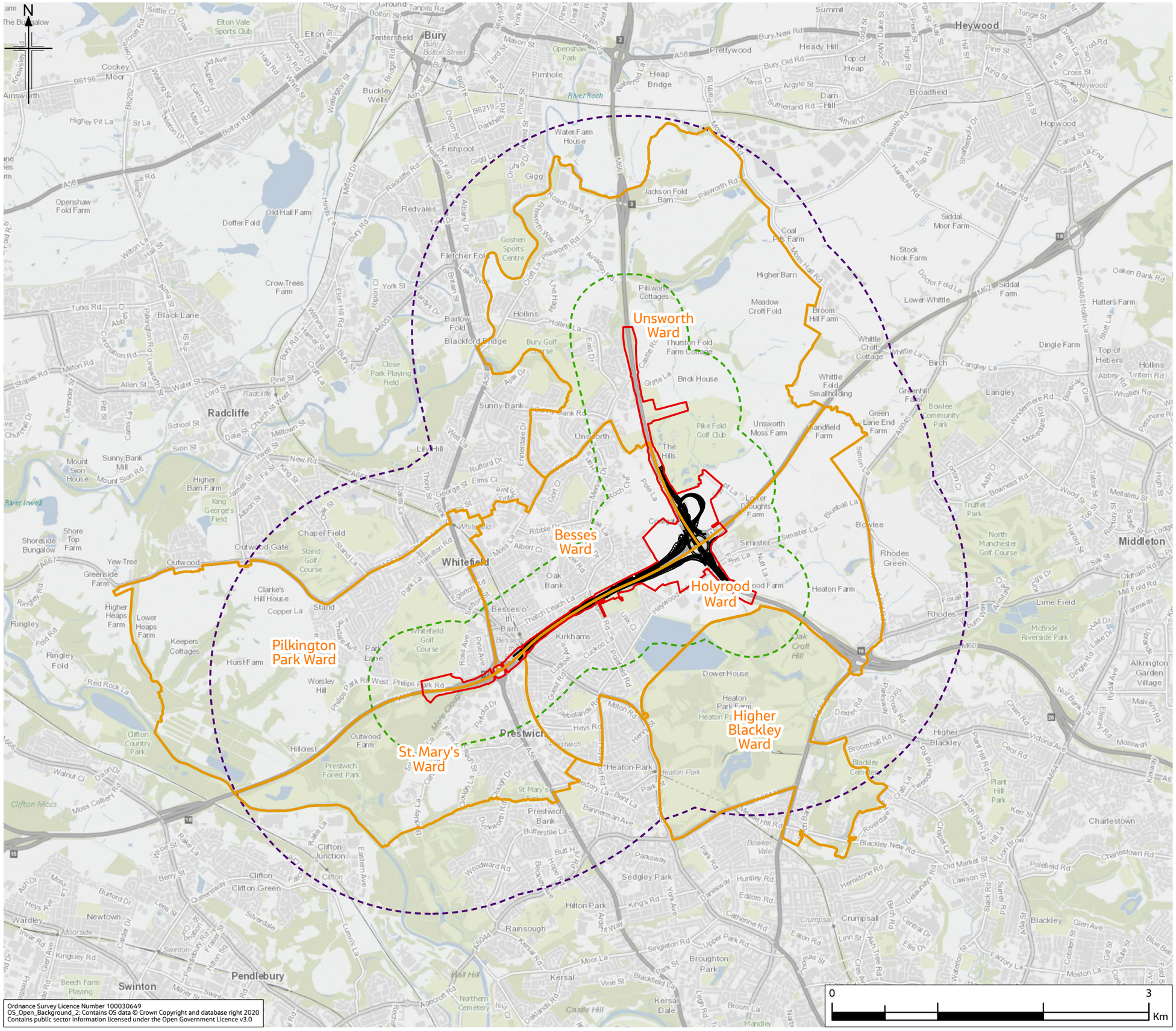
FIGURE 13.1



Legend

- Combined Design
- Provisional Order Limits
- Provisional Order Limits 500m Buffer
- Provisional Order Limits 2km Buffer
- Wards

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1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
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Drawing Title
POPULATION AND HUMAN HEALTH
CONTEXT STUDY AREA

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Drawing Number
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FIGURE 13.2

Aviation Road

Castle Road

Footpath 8WHI

Footpath 46WHI

Sandgate Road/ Footpath 18WHI

Simister Lane

Bridleway 27aPRE

Bury New Road

Park Lane

Permissive Path

Bury Old Road

Footpath 33WHI

Legend

- Combined Design
- Provisional Order Limits
- Provisional Order Limits 500m Buffer
- Provisional Order Limits 2km Buffer
- Residential Properties within Provisional Order Limits
- Public Rights of Way (PROW)

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COSTAIN

Designer

Jacobs

1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

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Drawing Title

POPULATION AND HUMAN HEALTH
LAND USE AND ACCESSIBILITY BASELINE

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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0 3 Km

FIGURE 14.1

Legend

- Provisional Order Limits
- Statutory Main River
- Groundwater Dependent Terrestrial Ecosystem (GWDTE) Study Area (250m)
- Surface water, flood risk and hydromorphology Study Area (1km)
- Groundwater Study Area (2km)

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Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

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Drawing Title
ROAD DRAINAGE AND THE WATER ENVIRONMENT
WATER ENVIRONMENT STUDY AREA

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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0 3 Km

FIGURE 14.2

Legend

- Provisional Order Limits
- Provisional Order Limits 1km Buffer

HADDMS Existing Outfall Locations (2018)

- A (Very High)
- C (Moderate)
- D (Low)
- Statutory Main River
- Watercourse Link
- WFD Water Transfer Water Bodies Cycle 2

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1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
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Drawing Title
ROAD DRAINAGE AND THE WATER ENVIRONMENT
SURFACE WATER QUALITY BASELINE

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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Jacobs No.	B36601F0	
Client No.	HE548642	Rev P01

Drawing Number: HE548642-JAC-GEN-SII_MLT-SK-LE-0025

0 3 Km

FIGURE 14.3

Legend

- Provisional Order Limits
- Provisional Order Limits 500m Buffer
- Statutory Main River
- Watercourse Link
- Ordinary Watercourse
- WFD Water Transfer Water Bodies Cycle 2

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Contractor

COSTAIN

Designer

Jacobs
1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
www.jacobs.com

Client

highways england

Project

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Drawing Title

ROAD DRAINAGE AND THE WATER ENVIRONMENT
HYDROMORPHOLOGY BASELINE

Drawing Status

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Jacobs No.	B36601F0	Rev	P02
Client No.	HE548642		

Drawing Number

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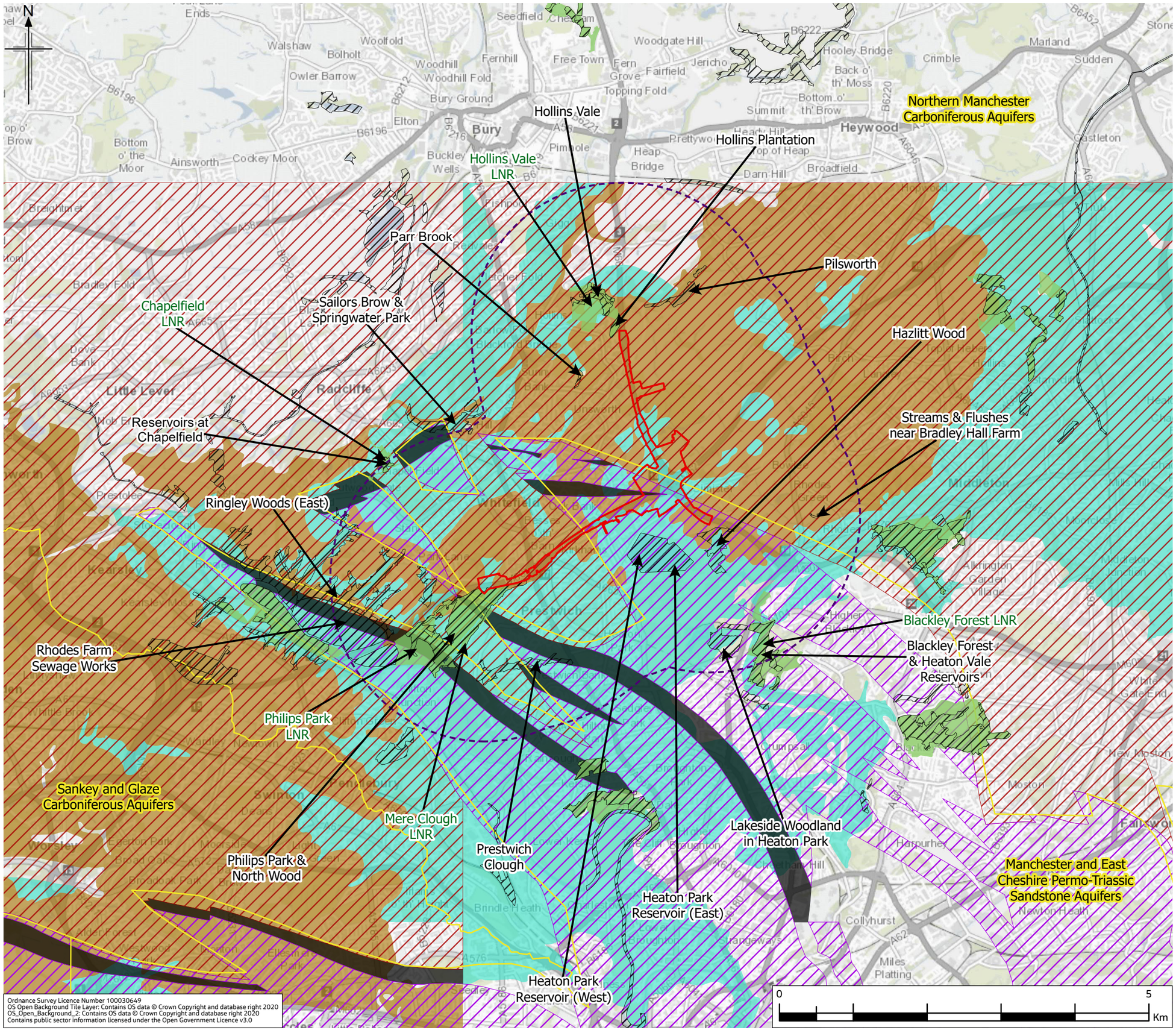
0 3 Km

FIGURE 14.4



Legend

- Provisional Order Limits
- Provisional Order Limits 2km Buffer
- Sites of Biological Importance
- Local Nature Reserve
- WFD Groundwater Bodies Cycle 2
- Principal Bedrock Aquifer
- Secondary (A) Bedrock Aquifer - Permeable Layers
- Secondary (B) Bedrock Aquifer - Lower Permeability Layers
- Secondary (A) Superficial Aquifer - Permeable Layers
- Secondary Superficial Aquifer - Undifferentiated Layers

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Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
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Drawing Title
ROAD DRAINAGE AND THE WATER ENVIRONMENT
GROUNDWATER BASELINE

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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Client No.	HE548642	Rev P01

Drawing Number: HE548642-JAC-GEN-SII_MLT-SK-LE-0027

FIGURE 14.5

Legend

- Provisional Order Limits
- Provisional Order Limits 1km Buffer
- Statutory Main River
- Watercourse Link
- Flood Zone 3
- Flood Zone 2

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1 City Walk, Leeds, LS11 9DX, UK.
Tel: +44(0)113 242 6771 Fax:+44(0)113 389 1389
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Drawing Title
ROAD DRAINAGE AND THE WATER ENVIRONMENT
FLOOD RISK BASELINE

Drawing Status: S4 - SUITABLE FOR STAGED APPROVAL

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0 3 Kilometers