

M5 Junction 10 Improvements Scheme

Environmental Statement~~Environmental Statement~~

Chapter 4 - Environmental Assessment Methodology

TR010063 - APP 6.2

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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6.2 Environmental Statement Chapter 4 - Environmental Assessment Methodology

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Contents

Chapter	Page
Document accessibility	5
4 Environmental Assessment Methodology	6
4.1 General approach	6
4.2 Environmental assessment methodology	6
4.3 Screening	7
4.4 Scoping	7
4.5 Defining the study area	8
4.6 Establishment of baseline and future conditions	8
4.7 Defining assessment years	9
4.8 Consideration of alternatives	9
4.9 Consultation	9
4.10 Identification of potential effects	10
4.11 Development of mitigation measures	14
4.12 Prediction of residual environmental effects	15
4.13 Cumulative effects assessment	15
4.14 Transboundary impacts	17
4.15 Major accidents and disasters	18
4.16 Environmental management	20
4.17 Climate change	20
4.18 Other assessments prepared	20
Tables	
Table 4-1 - Environmental sensitivity (value) of receptors	11
Table 4-2 - Magnitude of impact and typical descriptions	11
Table 4-3 - Significance Matrix	12
Table 4-4 - Significance categories and typical descriptions	12
Table 4-5 - Vulnerability to major accidents and disasters: terminology	18
Figures	
Figure 4-1 - Additive cumulative effects	16
Figure 4-2 - In-combination cumulative effects	17

Document accessibility

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4 Environmental Assessment Methodology

4.1 General approach

4.1.1 Environmental Impact Assessment (EIA) is a process for identifying the likely environmental effects (positive and negative) of proposed developments, and their significance, to inform the decision maker when considering whether to grant development consent.

4.1.2 The aim of an EIA is to ensure that the following are undertaken:

- A thorough assessment of likely effects of a proposed development on the environment.
- Consideration of mitigation measures and alternatives in light of likely environmental effects.
- Assessment of the cumulative effects of the proposed development.

4.1.3 Through this process the Scheme design includes measures to prevent, reduce or offset any significant, adverse environmental effects of the proposals, and enhance the positive impacts. The findings of the assessment are presented in this Environmental Statement (ES). The design measures have been identified through an iterative process with regular reviews and updates of the design, following discussion with the environment specialists and incorporating comments received through consultation (summarised in Section 1.7 of Chapter 1 – Introduction ([Application document TR010063 – APP 6.2](#))).

4.1.4 This chapter describes the EIA process in conformance with the requirements of the National Highway's Design Manual for Roads and Bridges (DMRB). For highways projects, DMRB is recognised as providing an appropriate methodology for the assessment of environmental effects. For some topics the DMRB methodology is supplemented by separate best practice guidance where it improves the assessment of effects. Where there is no standard guidance this is stated, together with the methodology used to undertake the assessment.

4.2 Environmental assessment methodology

4.2.1 The key stages of the EIA process for the Scheme are:

- Screening to determine the need for an EIA.
- Scoping.
- Defining the study area.
- Establishment of baseline conditions.
- Consideration of alternatives.
- Consultation.
- Impact assessment and identification.
- Defining assessment years.
- Development of mitigation measures.
- Prediction of residual environmental effects.
- Cumulative effects assessment (CEA).
- Transboundary impacts.
- Environmental management.

4.2.2 These stages are discussed in more detail in the following sections.

4.3 Screening

- 4.3.1 Screening determines if a project requires an EIA and the publication of an ES in line with the requirements of the Directive 2011/92/EU as amended by 2014/52/EU.
- 4.3.2 As described in Section 1.4 of Chapter 1 – Introduction (an Application document TR010063 – APP 6.2), the Scheme is categorised as a NSIP under the Act, and as such requires a Development Consent Order (DCO) to proceed. An EIA is required as the Scheme is Schedule 2 development that is likely to have significant effects on the environment under the EIA Regulations 2017 (paragraph 10(f) – construction of roads). The Environment Statement (ES) resulting from the EIA, has been submitted as part of the DCO application.
- 4.3.3 Therefore no further screening assessment has been undertaken for the Scheme to determine the requirement for an EIA, following the categorisation of the Scheme as a NSIP.

4.4 Scoping

- 4.4.1 Scoping will determine the environmental topics that should be ‘scoped out’ of the EIA. The appropriate level of assessment, namely whether a Simple or Detailed assessment as defined in LA 101, that should be applied to the environmental topics that are ‘scoped in’ will be set out.
- 4.4.2 An Environmental Scoping Report was published on the Planning Inspectorate (PINS) website in July 2021. A Scoping Opinion was received from PINS in August 2021 based on feedback from statutory consultation bodies. A response from Gloucestershire County Council (GCC) (Applicant) to the Scoping Opinion comments from PINS included in Appendix 1.2 (an Application document TR010063 – APP 6.15) to this ES. The following items were scoped out of the subsequent assessments undertaken:
- Assessment of heat and radiation.
 - Assessment of vibration during operation of the Scheme.
 - Effects on protected and priority plant species.
 - Effects on landscape character at a national and county level.
 - Assessment of landscape receptors beyond 1 km from the Order limits.
 - Assessment of soils of importance associated with environmentally sensitive sites and effects on soils associated with the priority habitats.
 - Assessment of geological designations.
 - Financial compensation.
 - Assessment of extreme weather events during construction. Scoped out on the basis that measures for the management of extreme weather events will be incorporated within the Environmental Management Plan (EMP).
 - Assessment of specific major accident and disaster scenarios requiring repair, maintenance or replacement works to be carried out that would lead to additional greenhouse gases (GHG) emissions beyond those anticipated in normal operation.
- 4.4.3 Detailed feedback from the statutory consultation bodies included in the Scoping Opinion from PINS has been considered as part of this Preliminary Design Stage and is addressed in the ES.

Electric and magnetic fields

- 4.4.4 Further to comments received from the UK Health Security Agency at the Statutory Consultation, the potential health impacts of the Scheme with regards to the creation of electric and magnetic fields (EMF) have been reviewed.
- 4.4.5 It is considered that as the Scheme will not create new sources of EMF that could give rise to potential health ~~impacts, and impacts and~~ does not impact any receptors from potential sources of EMF that could be hazardous to human health, then EMF should be scoped out of the assessment.

- 4.4.6 The Scheme is a highway alteration scheme, and the design does not introduce any new electricity substations, overhead power lines or underground cables into the Scheme area that were not present previously. Whilst there are 132kV overhead cables that cross the Link Road towards its southern end, these overhead cables are in place currently, and will not be altered or worked on as part of the Scheme. Information provided by the National Grid identifies 132kV as inherently compliant with the relevant exposure limits for EMFs¹. Therefore these overhead cables are considered not to cause an impact to people walking, cycling or driving along the Link Road, at a level which could be considered hazardous to human health.
- 4.4.7 The luminaires used for the road lighting for the Scheme comply with the relevant standards for exposure to EMF, namely BS EN 62479:2010², and are therefore considered as unlikely to generate levels of EMF which could be considered hazardous to human health.
- 4.4.8 EMF has therefore been scoped out of the assessment.

4.5 Defining the study area

- 4.5.1 Study areas are defined individually for each environmental topic, according to the geographic scope of the potential impacts relevant to that topic or of the information required to assess those impacts. It will also draw on guidance in DMRB where this specifies the extent of study areas. The study areas are defined within each relevant topic chapter of this ES.

4.6 Establishment of baseline and future conditions

- 4.6.1 In order to identify the effects of the Scheme on the environment, it is important to understand the environment that would be affected by the Scheme (the 'baseline conditions'). Understanding the baseline allows the prediction and measurement of changes that would be caused by the Scheme.
- 4.6.2 Consideration is given to the potential for the baseline conditions to be different from those that exist at the current time.
- 4.6.3 They are the conditions that would exist in the absence of the Scheme, and against which the changes arising from the Scheme have been assessed:
- For impacts arising from construction of the Scheme, baseline conditions are considered at the time that construction of the Scheme is expected to start. The current programme for the Scheme anticipates construction commencing in 2025. For the purposes of this EIA, the construction baseline year used is 2019 unless otherwise stated for individual topics.
 - For impacts arising from the operation of the Scheme, baseline conditions are considered at the time that the Scheme is expected to be open to traffic (without the Scheme). The current programme anticipates that the Scheme will open in 2027.
 - For impacts in a 'future year' scenario, baseline conditions are considered for the future year, 15 years after the Scheme opens to traffic, or the worst year in the first 15 years of operation. The current programme for the Scheme anticipates that 15 years after opening will be 2042.
- 4.6.4 Therefore, the identification of the baseline and future conditions involves predicting changes that are likely to happen in the intervening period, for reasons unrelated to the Scheme. This process entails taking current conditions and using readily available information such as local plans and climate change scenario data provide a description of likely changes in the local environment over an appropriate timescale that the datasets support.

¹ National Grid. EMFs.info (2022).

² BS EN 62479:2010. Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz).

- 4.6.5 Where baseline conditions are anticipated to be different from those recorded in the baseline year (2019) this is captured in the relevant topic chapters. This is based on the study area identified and methodology required for each topic chapter.
- 4.6.6 Each topic chapter provides a description of the existing situation and where relevant, a prediction of any likely changes in the absence of the Scheme for the relevant assessment year. The description of the baseline conditions identifies receptors that may be affected by the Scheme and also their 'value' or 'sensitivity' to potential change.

4.7 Defining assessment years

Scheme phases

- 4.7.1 The EIA considers effects arising from the construction and operation phases of the Scheme. Decommissioning is not relevant for the Scheme as noted in Chapter 2 – The Scheme ([Application document TR010063 – APP 6.2](#)) Section 2.9, although demolition of existing structures as part of the construction of the Scheme (for example the existing A4019 overbridge) has been considered within the ES.

Do-minimum and Do-something scenarios

- 4.7.2 The assessment of effects involves comparing a scenario with the Scheme against one without the Scheme over time. The absence and presence of the Scheme are referred to as the 'Do-Minimum' and 'Do-Something' scenarios respectively. Dependent upon the topic, the scenarios that have been assessed are:

- the baseline year (2019) used for the construction baseline.
- the opening year (2027).
- the future assessment year (2042) (or the worst year in the first 15 years of operation)³.

Do-something scenarios

- 4.7.3 As described in Section 1.1 of Chapter 1 – Introduction ([Application document TR010063 – APP 6.2](#)), the main purpose of the Scheme is to provide the key infrastructure requirements to enable the housing and economic development set out in the JCS. As this development (comprising the new housing and employment land) will not be operational in the opening year (2027) for the Scheme, then two Do-something scenarios have been assessed in the future year, addressing the impacts to air quality, noise and vibration, and water quality from the traffic arising from the Scheme with and without the development that the Scheme is intended to enable (termed the strategic development sites).

4.8 Consideration of alternatives

- 4.8.1 The ES presents the alternatives considered in the development of the preliminary design, summarising the reasoning behind the Scheme selection, as well as options considered in the design development, as required by the EIA Regulations. This outlines details of why the proposed design has been brought forward to the preliminary design stage, and why alternatives have been rejected. These details are presented in Chapter 3 (Assessment of alternatives - [Application document TR010063 - APP 6.2](#)).

4.9 Consultation

- 4.9.1 Details on the consultation undertaken to date as part of the DCO process can be found in the Consultation Report ([Application document TR010063 – APP 5.1](#)).
- 4.9.2 Consultation has been undertaken with both statutory and non-statutory bodies, together

³ DMRB LA111

with public consultation prior to submission of the DCO Application. Consultation took place at the Scoping stage and continued throughout the EIA process to inform the design, agree assessment methodology, and proposed mitigation options. A Consultation Report (Application document TR010063 – APP 5.1) has been submitted with the DCO application that sets out full details of the consultation carried out for the Scheme, the feedback received and how this has been taken into account.

4.10 Identification of potential effects

4.10.1 Schedule 4 of the EIA Regulations 2017 requires: “A description of the likely significant effects of the development on the environment resulting from, inter alia:

- the construction and existence of the development, including, where relevant, demolition works.
- the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources.
- the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste.
- the risks to human health, cultural heritage, or the environment (for example due to accidents or disasters).
- 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.
- the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change.
- the technologies and the substances used.

4.10.2 The description of the likely significant effects 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.”

4.10.3 A range of environmental topics may be affected by the Scheme. Effects may be negative or positive, temporary or permanent. They may also be described as:

- Direct or Primary Effect: caused by activities which are an integral part of the proposals resulting in a change in environmental conditions, such as construction works causing an increase in dust concentrations in the air.
- Indirect or Secondary Effects: due to activities that affect environmental conditions or the receptors, which in turn affects other aspects of the environment or receptors.
- Cumulative: comprising multiple effects from different sources within the proposals (Intra), or cumulatively with other developments (Inter), on the same receptors.
- Residual: effects that remain after the positive influence of mitigation measures are taken into account.

4.10.4 Each of these effects can persist over a period of time and can be considered as:

- Short term: effects that will last for a limited duration, for example, noise generated during construction of the Scheme.
- Long term: permanent effects from the operational activities on the Scheme.

Assessment of sensitivity of receptors

4.10.5 The sensitivity (value) of the environmental receptors assessed is described within the respective topic chapters (Chapters 5-14). As described in DMRB LA 104, the sensitivity of a receptor ranges from Very high to Negligible, as per the descriptions in Table 4-1.

Table 4-1 - Environmental sensitivity (value) of receptors

Sensitivity of receptor	Typical description
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

Assessment of magnitude of impact

4.10.6 The magnitude of impacts on the environmental receptors assessed is described within the respective topic chapters (Chapters 5-14). As described in DMRB LA 104, the magnitude of impact ranges from Major to No change, as per the descriptions in Table 4-2.

Table 4-2 - Magnitude of impact and typical descriptions

Magnitude of impact		Typical description
Major	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements
	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
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction

Assessment of significance

4.10.7 The significance of an environmental effect is typically a function of the 'value' or 'sensitivity' of the receptor and the 'magnitude' or 'scale' of the impact. Combining the environmental value of the resource or receptor with the magnitude of change produces a significance of effect category. In arriving at the significance of effect, the assessor also considers whether the effect is direct, indirect, secondary, cumulative, short, medium or long-term, permanent or temporary, positive or negative.

4.10.8 The general approach adopted is in accordance with current relevant guidance and best practice. Methods and requirements specific to each assessment topic are set out in the

relevant topic chapters (Chapters 5 to 14).

- 4.10.9 With the receptors identified and their sensitivity classified, the potential impacts of the works to these aspects, for construction and operation where appropriate, are determined and the magnitude of the impact determined.
- 4.10.10 In accordance with guidance in DMRB LA 104, for most topics the assessment undertaken combines the magnitude of the impacts and the sensitivity of the resources/receptors that could be affected in order to classify the effect (see Table 4-3) and to establish their significance (from very large to neutral). In general terms it is accepted that effects which are moderate or higher are deemed significant in assessments. General descriptors for the significance of effect are provided in Table 4-4. Some topics are assessed in a different way, as required by relevant guidance or where the topic itself does not suit this approach; where this is the case, the methodology is described in the relevant chapter.

Table 4-3 - Significance Matrix

Sensitivity of receptor	Magnitude of impact				
	Major	Moderate	Minor	Negligible	No change
Very high	Very large	Large or very large	Moderate or large	Slight	Neutral
High	Large or very large	Moderate or large	Slight or moderate	Slight	Neutral
Medium	Moderate or large	Moderate	Slight	Neutral or slight	Neutral
Low	Slight or moderate	Slight	Neutral or slight	Neutral or slight	Neutral
Negligible	Slight	Neutral or slight	Neutral or slight	Neutral	Neutral

Table Source: DMRB LA 104 Environmental assessment and monitoring Table 3.8.1

Table 4-4 - Significance categories and typical descriptions

Value	Typical descriptors
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.
Negligible	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Table Source: DMRB LA 104 Environmental assessment and monitoring Table 3.7

Dealing with uncertainty

- 4.10.11 EIA is an iterative process. At the time that the EIA is submitted, there are no aspects of design that will vary so much as to represent effectively different schemes. The EIA addresses the potential for a range of impacts resulting from any undecided parameters.
- 4.10.12 The ‘Rochdale Envelope’ approach is employed where the nature of the Proposed Development means that some details of the whole project have not been confirmed (for instance the precise dimensions of structures) when the application is submitted, and flexibility is sought to address uncertainty. Advice Note Nine recommends that the assessment should be based on a cautious ‘worst case’ approach, such that any effects

will not be worse than the stated level of significance in the ES.

- 4.10.13 The ES describes any elements of the Scheme yet to be finalised, with justification. Where flexibility is sought in the Scheme design, the maximum potential adverse impacts of the Scheme have been assessed. The ES confirms the maximum and other dimensions of the Scheme, and that any changes to the development within such parameters will not result in any likely significant impacts not previously identified and assessed.
- 4.10.14 One such element for this Scheme is embankment design. The Scheme includes a number of embankments to accommodate the four new slip roads and the two new overbridges at M5 Junction 10, and the new bridge over the River Chelt and the flood mitigation structure on the Link Road.
- 4.10.15 These embankments will have a slope angle of 1:3 and will be constructed from a combination of locally won Charmouth Mudstone Formation (from the excavation of the flood storage area) and imported fill. The exception is the embankment along the north side of the A4019 adjacent to Stanboro Lane where a steeper embankment slope (1:2 slope) has been used to reduce the land take of the embankment at this location in order to avoid an area of lowland meadow priority habitat along a section of Stanboro Lane.
- 4.10.16 If the Scheme is granted consent, the appointed Contractor will develop the detailed design for construction, and will consider how best to optimise the design to minimise unnecessary expenditure, in order to ensure efficiency is embedded in the Scheme to be taken forward. This may involve redesigning some or all of the embankments to avoid importing fill materials. For example, the following alternative designs may be considered, for some or all of the embankments, either singularly or in combination:
- Use of imported general fill to create steeper embankments with slope angle of 1:2 to 1:2.5.
 - Reinforced slopes using geogrid to create slope angles of 1:1.
 - Reinforced soil walls (green walls) to create slope angles of 1:0.4.
 - Reinforced soil walls (panel or block) or reinforced concrete walls, to create slopes up to 1:0.1.
- 4.10.17 The environmental assessment undertaken and reported in this ES has considered that in general the earth embankments with a 1:3 slope is the most likely worst case, on the basis that this design requires the greatest land take. Therefore, the environmental assessment has used this embankment design as the baseline design in determining the environmental impacts of the Scheme, in accordance with the principles of the Rochdale envelope approach.
- 4.10.18 The Contractor's consideration of alternative design solutions would include consideration of the environmental impacts compared with the assessed significance of effect reported in this ES. The Contractor would undertake an assessment of the alternatives under consideration to ensure that they are not environmentally worse than the embankment solution assessed in this ES. This is known as a NEWT ('Not Environmentally Worse Than') assessment.

Limits of deviation

- 4.10.19 Limits of Deviation (LoD) are the limits within which the DCO would authorise the Scheme to be constructed. They are included to allow for a small amount of flexibility in the exact detail of the Scheme that is taken through to construction.
- 4.10.20 Vertical and lateral LoDs have been defined in Chapter 2 - The Scheme ([Application document TR010063 – APP 6.2](#)). The environmental assessments presented within Chapters 5-15 of this ES (application documents TR010063 – APP 6.2 - 6.13) have taken into account the vertical and horizontal LoDs described.
- 4.10.21 The LoDs are also outlined within the draft DCO ([Application document TR010063 – APP 3.1](#)).

Assessment of road closures

- 4.10.22 As described in Chapter 2 ([Application document TR010063 – APP 6.2](#)) the existing

northbound on slip and southbound off slip at M5 Junction 10 will be closed for 15 months and nine months respectively, with an overlap of five months when both slip roads are closed. During this time signed diversion routes will be in place to divert the traffic seeking to join the M5 at Junction 10 and travel northbound, via the A38 and A46 to Junction 9; and for traffic southbound on the M5, and seeking to leave the M5 at Junction 10, the signed diversion will be via Junction 11, and then the A40 and A4013.

- 4.10.23 The effects of these slip road closures have been assessed in the ES using information provided from three traffic modelling scenarios in which the northbound on slip, the southbound off slip and both slip roads are closed. Not all of the traffic affected by the slip road closures is expected to follow the signed diversion routes, as people will be travelling to and from a dispersed range of locations, and may therefore take different routes when joining or exiting the M5. For example, some vehicles may leave the M5 southbound at Junction 9 rather than travelling further south to Junction 11, depending on their onward journey plans and destinations.
- 4.10.24 The traffic modelling scenarios have addressed this by closing the slip roads (in the model), and then modelling the redistribution of the traffic across the affected road network; rather than modelling the rerouting of the traffic along the signed diversion routes. The ES has assessed the effects of the redistribution of the traffic across the affected road network.

4.11 Development of mitigation measures

- 4.11.1 The environmental assessment and design incorporates mitigation measures using a hierarchical system as follows, defined in DMRB LA 104:
- avoidance and prevention: design and mitigation measures to prevent the effect (e.g. alternative design options or avoidance of environmentally sensitive sites).
 - reduction: where avoidance is not possible, then mitigation is used to lessen the magnitude or significance of effects.
 - remediation: where it is not possible to avoid or reduce a significant adverse effect, these are measures to offset the effect.
- 4.11.2 The environmental assessment and design incorporates embedded mitigation and essential mitigation. DMRB LA 104 defines embedded mitigation as 'project design principles adopted to avoid or prevent adverse environmental effects' and essential mitigation as '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.'
- 4.11.3 Embedded mitigation is reported in the project description within Chapter 2 – The Scheme ([Application document TR010063 – APP 6.2](#)) Section 2.6, and includes the measures identified in the EMP ([Application document TR010063 – APP 7.3](#)). Essential mitigation is included within the assessment. Enhancement measures, measures over and above normal mitigation, are also included within the assessment.
- 4.11.4 The Scheme will include all mitigation considered necessary to reduce effects to an acceptable level and the assessment will report on this basis.
- 4.11.5 During construction, the responsibility for further environmental mitigation and the adherence to environmentally responsible working practices will fall to the contractor. An EMP ([Application document TR010063 – APP 7.3](#)) has been prepared by the designer (Atkins) at the completion of the preliminary design, and will be refined as the Scheme progresses to construction and handover. The EMP will detail practices that the contractor is to apply on site that will demonstrate commitments to environmental management. It will detail both generic and specifically targeted practices to enable construction to be undertaken with minimal impact on the environment and will also enable monitoring requirements to be set up.

4.12 Prediction of residual environmental effects

- 4.12.1 Residual effects refer to the environmental effects predicted to remain after the application of the mitigation and enhancement measures outlined in each environmental topic.
- 4.12.2 The residual effects identified are assessed using the same system as described above (Table 4-4). Generally, residual effects considered to be moderate, large or very large are deemed significant; and those slight or negligible are deemed to be not significant, based on the described classification (Table 4-4 and professional judgement).

4.13 Cumulative effects assessment

- 4.13.1 Paragraph 5 of Schedule 4 of the EIA Regulations 2017 requires an ES to include the assessment of cumulative effects. Part (e) references the requirement to consider the cumulation of effects with other existing and/or approved projects. Therefore, the environmental effects of the Scheme have also been assessed in combination with the effects of other projects as part of the EIA process, where relevant information is available. These details are presented in Chapter 15 – Cumulative Effects Assessment ([Application document TR010063 – APP 6.13](#)).
- 4.13.2 What projects should be considered as part of a ‘cumulative’ assessment for these purposes is not defined in the EIA Directive or EIA Regulations 2017 and there is no standard approach to the assessment of cumulative effects, with different projects adopting different approaches. However, potential cumulative effects with other major developments need to be identified, as well as the assessment cumulative effects within the Scheme on a single receptor, as required by the Directive. To aid in this, the PINS Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects (August 2019) suggests the categories of developments that should be included in such cumulative assessments.
- 4.13.3 For the purposes of this Scheme, the cumulative effects assessment (CEA) explores the way in which the predicted effects of the Scheme on receptors/resources may alter when they are considered in their totality (i.e. across all topic assessments), as well as in the context of Reasonably Foreseeable Future Projects (RFFPs) that could potentially interact with the Scheme. For the purposes of this Scheme, these two strands of CEA are referred to as intra-Scheme assessment and inter-project assessment, respectively.
- 4.13.4 The CEA makes use of the following baselines for the Scheme to be considered against, making informed assumptions to categorise the likely progression of RFFPs for the purposes of consistent assessment:
- Scheme construction period (2025 to 2027) (construction baseline). RFFPs categorised as ‘undeveloped’, ‘under construction’ or ‘receptor’ during the construction period.
 - Opening year future baseline (2027): RFFPs may be categorised as ‘undeveloped’; ‘under construction’ in the same timeframe as the opening of the Scheme; or form new ‘receptors/resources’ that will be in place and operational in the same timeframe as the opening of the Scheme.
 - Operational future baseline (2042): RFFPs may be anticipated to be ‘under construction’ in the same timeframe as the future baseline; or form new ‘receptors/resources’ that will be in place and operational.
- 4.13.5 The consideration of the cumulative impacts is drawn together on the basis of receptors and/or biophysical features deemed likely to experience effects as a consequence of cumulative impacts, whether intra-Scheme or inter-project or, potentially, both. The sensitivity of a receptor or biophysical feature to cumulative impacts and the magnitude of incremental impacts (combining to become cumulative impacts) themselves determines the significance of the cumulative effect or effects.
- 4.13.6 The sections below provide a basic introduction to the way CEA has been approached and reported within the ES for the Scheme. The full proposed methodology is provided in Chapter 15 – Cumulative Effects Assessment ([Application document TR010063 – APP 6.13](#)).

Intra-Scheme assessment

- 4.13.7 Intra-Scheme impacts are defined as those arising within this Scheme and affecting specific receptors and/or biophysical resources. This requires consideration of the potential for in-combination impacts to emerge within the same specialist topic, as well as reviewing the interaction between impacts identified by each of the specialist topics undertaking assessment of the Scheme.
- 4.13.8 Within the ES, topic chapters report on individual receptors/resources predicted to experience multiple topic-specific effects and comment on their likely significance (i.e. intra-Scheme cumulative effects within a specialist topic). A separate CEA summary section is then produced to report on intra-Scheme cumulative effects that have been identified for receptors/resources predicted to experience significant effects either within a specialist topic, and/or in relation to more than one specialist topic (referred to as 'cross-topic').

Inter-project assessment

- 4.13.9 Inter-project impacts are those arising between the Scheme and other developments expected to come forward within similar timeframes. This requires consideration of the impacts of the Scheme in the context of the RFFP list that will be defined for the Scheme. The methodology in Chapter 15 – Cumulative Effects Assessment (Application document TR010063 – APP 6.13) provides further information about the production of the RFFP list.
- 4.13.10 Within the ES, the individual topic chapters identify which of the RFFPs are considered relevant to the assessment. Where inter-project cumulative effects are predicted in relation to a specialist topic, these are reported within the topic chapters, providing an indication of potential significance. A separate CEA summary section is included in each chapter, to address inter-project effects that have been identified for receptors/resources predicted to experience significant effects from the Scheme and at least one RFFP, either within a specialist topic, and/or in relation to more than one specialist topic (referred to as 'cross-topic').

Types of cumulative impacts

- 4.13.11 The CEA for the Scheme considers effects arising from additive impacts that could be caused by other past, present or reasonably foreseeable actions interacting with the Scheme; and effects arising from in-combination impacts that arise from the interaction between impacts of a Scheme on different aspects of the environment.

Cumulative impacts – additive

- 4.13.12 This is where the same impact is multiplied on the basis that it arises from more than one source. This is illustrated below (Figure 4-1):

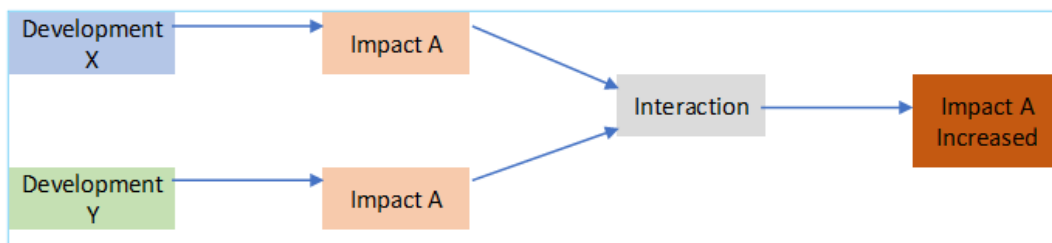


Figure 4-1 - Additive cumulative effects

- 4.13.13 This additive type of cumulative impact is most likely to arise in an assessment of inter-project effects. It has the potential to raise the level of impact above assessment or regulatory thresholds, even though each development has been designed not to.
- Example - Construction noise (impact A) of the Scheme ('development X') and the construction noise associated with an adjacent RFFP ('development Y') combines

to increase the noise impact (impact A) on a group of residential properties.

Cumulative impacts – in-combination

- 4.13.14 This is where two different impacts interact to create a third impact. These two impacts may arise within the same specialist topic area; or arise within two or more different specialist topic areas. The issue is that the third impact is more than or different from just the first two impacts occurring together. This is illustrated below:

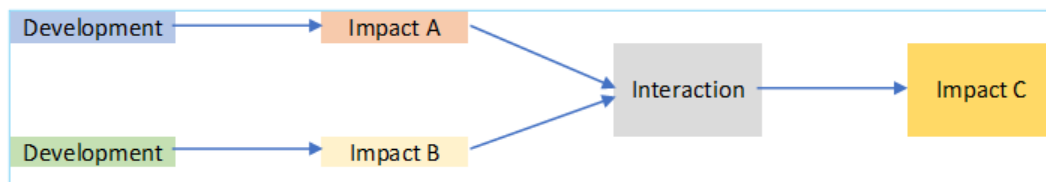


Figure 4-2 - In-combination cumulative effects

- 4.13.15 This type of in-combination impact could arise in consideration of both inter-project and intra-Scheme CEA. It is usually (but not always) the case that reporting of effects arising from in-combination impacts is easiest to understand when it is organised by receptor and/or biophysical feature, rather than within environmental topic chapters.
- Example - Construction noise (impact A) and construction dust emissions (impact B) associated with the Scheme, combine to create an amenity impact (impact C) on a group of residential properties.

4.14 Transboundary impacts

- 4.14.1 Regulation 32 of the EIA Regulations 2017 requires PINS to notify European Economic Area (EEA) States and publicise an application for development consent if it is of the view that the proposed development is likely to have significant effects on the environment of an EEA Member State, and where relevant to consult with the EEA State affected. The Scheme is approximately 250 km from France, the closest EEA State.
- 4.14.2 The study areas for the various environmental topics define the extent of effects anticipated and are described fully in Chapter 5 to 14 and are summarised below as follows:
- Air Quality: within 200 m of the works.
 - Noise and Vibration: 600 m from the carriageway of the works.
 - Biodiversity: 2 km for statutory and non-statutory designated sites and 30 km for SACs.
 - Road Drainage and the Water Environment: 1 km around the works.
 - Landscape and Visual: within the zone of visual influence of the works, i.e. areas where the Scheme can be seen from.
 - Geology and Soils: 500 m from the extent of the works.
 - Cultural Heritage: 500 m from the works or within the area considered to be the setting of the asset.
 - Materials and Waste: waste arisings within the county of Gloucestershire.
 - Population and Human Health: 500 m from the works.
- 4.14.3 The study areas cover the area where direct effects of the Scheme could be experienced as well as the area where effects on the setting of an asset might be felt, for example the setting of a listed building where the surroundings contribute to its historic value.
- 4.14.4 For some topics the effects of the Scheme will extend beyond the immediate area of the works. For example, the noise and air quality effects will be experienced in the surrounding area where there will be changes in traffic flows as a result of the Scheme. The method for establishing the extent of study areas in this situation is set out in the topic chapters (Chapter 5-13 (application documents TR010063 - APP 6.3 to 6.15)).

4.14.5 As none of these distances reach EEA Member States, no transboundary effects are anticipated for the Scheme.

4.15 Major accidents and disasters

4.15.1 In line with the requirements for major accidents and disasters outlined in the EIA Regulations 2017, the ES considers:

4.15.2 Vulnerability of the Scheme to risks of major accidents and/or disasters that are relevant to the Scheme.

- Any consequential changes in the predicted significant effects of the Scheme.
- Any measures that have been included to prevent or mitigate the significant adverse environmental effects of any identified major events.

4.15.3 In considering these elements of vulnerability, the ES has:

- Identified any 'major' events that are relevant to and can affect the Scheme. Major events include both man-made and naturally occurring events. Not all events warrant assessment and evidence is provided to support the view that they should be classified as major events.
- Where major events are identified, described the potential for any change in the assessed significance of the Scheme on relevant environmental topics in qualitative terms. The conclusions of this assessment are reported within the individual environmental topics.
- Clearly described any assumed mitigation measures, to provide an evidence base to support the conclusions and demonstrate that likely effects have been mitigated/managed to an acceptable level.

Terminology

Table 4-5 -Vulnerability to major accidents and disasters: terminology

Term	Comment
Major accident	The Control of Major Hazards Accident Regulations 2015 (COMAH 2015) define a 'major accident' as an occurrence such as a major emission, fire or explosion resulting from uncontrolled developments in the course of the operation of any establishment and leading to serious danger to human health or the environment (whether immediate or delayed) inside or outside the establishment and involving one or more dangerous substances. Further detail can be found in COMAH 2015.
Natural disaster	A naturally occurring event such as extreme weather (storm, flooding) or a ground-related hazard event (subsidence, landslide, earthquake) with the potential to cause an event or situation that meets the definition of a major accident.
Risk	The likelihood of an impact occurring combined with the effect or consequence(s) of the impact on a receptor if it does occur.
Risk event	An identified unplanned event which is considered relevant to the Scheme and has the potential to be a major accident or natural disaster subject to the identification of its potential to result in a significant adverse effect on an environmental receptor.
Serious damage	Includes loss of life, permanent injury and temporary or permanent damage to or destruction of an environmental receptor.
Vulnerability	In the context of environmental risk assessment, the term refers to the 'exposure and resilience' of the Scheme to the risk of a major accident or natural disaster.

4.15.4 A significant adverse effect is considered to mean the loss of life or permanent injury,

and/or permanent or long-lasting damage to an environmental receptor. The significance of this effect takes into account the extent, severity and duration of harm and the importance and sensitivity of the receptor.

- 4.15.5 For the purpose of this assessment, major accidents and disasters are referred to as major events, whether externally caused events that could affect the Scheme (for example, an earthquake) or events arising from within the Scheme (for example, a bridge collapse). Major events include both naturally occurring events and events arising from human activity.

Methodology

- 4.15.6 The methodology adopted for consideration of major accidents and disasters in relation to the Scheme was based on the principles of identifying factors, screening, and assessment, broadly set out in the following stages:
- Long list: A long list of possible major events was prepared. The list drew on the UK Government's Risk Register of Civil Emergencies; some events are less applicable to the UK and to the location of the Scheme. The long list is presented in Appendix 1.4 ([Application document TR010063 - APP 6.15](#)).
 - Screening exercise: The long list was reviewed giving consideration to the potential relevance to the Scheme and potential receptors, and whether there should be further consideration. The study area for relevant major events was considered to be within 1km.
 - Assessment of potential consequences: where further design mitigation would be unable to remove the potential interaction between a major event and a particular receptor or receptor group, the potential consequence for receptors is identified. Where the list highlights a potential requirement for further consideration in relation to a particular topic, this is addressed in the relevant topic chapter.

Assessment findings

- 4.15.7 The long list is provided at Appendix 1.4 ([Application document TR010063 - APP 6.15](#)).
- 4.15.8 In general, the major events fall into three categories:
- Events that could occur, and to which the Scheme may be vulnerable, or which the Scheme has the capacity to exacerbate.
 - Events that could not realistically occur, due to the type or location of the Scheme.
 - Events that could realistically occur, but for which the Scheme and associated receptors are no more vulnerable than any other development. The engineering or environmental design or the methodologies to be adopted during construction and operation will have considered such potential events and incorporated embedded mitigation through guidelines, legal requirements and industry best practice such that the Scheme is inherently as robust against such major events as any other comparable development.
- 4.15.9 The long list highlights several risks that are classed as not relevant for further consideration because the Scheme is no more at risk of effects from these risks than any other similar scheme.
- 4.15.10 In some instances, events are considered to be relevant to topics but not in themselves warrant additional consideration as major events separate to the topic considerations undertaken.
- 4.15.11 In addition, the long list highlights events several meteorological 'events' such as heatwave, heavier rainfall and extreme storms which when considered together constitute elements of the climate. Further consideration is given to climate change and its potential impact on the Scheme in Chapter 14 - Climate ([Application document TR010063 – APP 6.12](#)).
- 4.15.12 Any major events included for further consideration following the screening exercise on the long list, falling into the first category above, are considered further in the relevant topic chapter.

4.16 Environmental management

4.16.1 An EMP (1st iteration) ([Application document TR010063 – APP 7.3](#)) has been prepared by the designer (Atkins) during this DF3 stage and will be refined as the Scheme progresses from development to construction and handover. The EMP details practices that the contractor is to apply on site that demonstrate commitments to environmental management. It details both generic and specifically targeted practices to enable construction to be undertaken with minimal impact on the environment and also enable monitoring requirements to be set up. Proposals for monitoring are developed as part of the topic impact assessments in the ES. The production and implementation of the EMP through the construction stage will be secured by Requirement 3 of the draft DCO.

Monitoring

4.16.2 Where the environmental assessment reported in the ES concludes that there are significant adverse environmental effects, schemes must undertake proportionate monitoring of associated mitigation measures, in accordance with the EIA Regulations.

4.16.3 DMRB LA 101 states the purpose of monitoring is to:

- Ensure measures envisaged to avoid, prevent or reduce and, if possible, offset significant adverse effects on the environment are delivered.
- Build data on the effectiveness of design and mitigation measures thereby driving improvement in environmental performance for future projects.
- Satisfy licence / permit requirements (where applicable).
- Identify remedial action as a consequence of underperformance or failure of mitigation.

4.16.4 The monitoring measures required have been identified and developed through the design and environmental assessment process and documented in the ES.

4.16.5 Monitoring measures should be undertaken as required during construction, handover and through the operation and maintenance periods for the Scheme. These measures are documented in the EMP 1st iteration ([Application document TR010063 – APP 7.3](#)) and in the REAC ([Application document TR010063 – APP 7.4](#)).

4.16.6 The results of monitoring shall be reported through updates of the EMP during construction and handover phases.

4.17 Climate change

4.17.1 The effect of the Scheme on climate change, and the vulnerability of the Scheme to climate change, is assessed in Chapter 14 – Climate ([Application document TR010063 – APP 6.12](#)), as per the requirements of the EIA Regulations 2017.

4.17.2 Climate change is therefore considered in both the assessment of the effects of the Scheme (from greenhouse gas emissions), and in the design of embedded mitigation measures such as the drainage design and flood compensation and flood storage requirements (to manage the effects of climate change on the Scheme). The assessment of the resilience of the Scheme to climate change is assessed qualitatively, based on the future climate trends, including winter and summer temperatures and precipitation levels. The assessment of the contribution of the Scheme to climate change, through the release of greenhouse gas emissions, is made quantitatively against the legislated UK Government's carbon budgets.

4.18 Other assessments prepared

4.18.1 This section provides a summary of the assessments that have been prepared alongside the ES.

Habitat Regulations Screening

- 4.18.2 Seven European Sites were identified for consideration which met the criteria in LA 115:
- Wye Valley and Forest of Dean Bat Sites Special Area of Conservation (SAC). The closest Site of Special Scientific Interest (SSSI) component is located 21 km south-west of the Order limits.
 - Walmore Common Special Protection Area (SPA) and Ramsar. Located 17.5 km south-west of the Order limits.
 - Severn Estuary SAC, SPA and Ramsar. Located approximately 47.5 km downstream of where the River Chelt leaves the Scheme area).
 - Cotswold Beechwoods SAC (located 7.4 km south of the Order limits).
- 4.18.3 The Screening assessment (Appendix 7.13, [Application document TR010063 – APP 6.15](#)) has concluded no likely significant effects (LSE) in relation to the Wye Valley and Forest of Dean Bat Sites SAC, Walmore Common SPA/Ramsar, Severn Estuary SPA and Cotswold Beechwoods SAC as a result of the Scheme, either alone or in-combination with other plans or projects.
- 4.18.4 Survey results and desk study records indicate that European eel, Atlantic salmon, sea trout and river lamprey are present, or potentially present in the River Chelt in the vicinity of the Scheme. The screening assessment concluded that without mitigation, there is potential for LSE to occur in relation to European eel, Atlantic salmon and sea trout, qualifying features of the Severn Estuary Ramsar designation, and river lamprey, a qualifying feature of the Severn Estuary SAC and Ramsar designations.
- 4.18.5 Following a detailed assessment of the elements of the Scheme that were identified as having a LSE (within the Statement to inform an Appropriate Assessment in Appendix 7.14, [Application document TR010063 – APP 6.15](#)), it has been concluded that the potential impacts would have no adverse effects on the integrity of the Severn Estuary SAC/Ramsar.
- 4.18.6 At most, the Scheme is predicted to impact an insignificant amount of functionally linked habitat within the River Chelt, and consequently an insignificant number of individual European eel and river lamprey. Any effects would be negligible. Therefore, it is concluded that there will be no adverse effect on site integrity. Nevertheless, mitigation is proposed to address any minor residual effects.

Flood Risk Assessment

- 4.18.7 The Flood Risk Assessment (FRA) develops the understanding of flood risk to and from the Scheme in accordance with the requirements of the National Policy Statement for National Networks (NPS-NN) and National Planning Policy Framework (NPPF) (noting that these policy statements are mutually compliant).
- 4.18.8 Detailed hydraulic modelling was undertaken to provide the evidence for the FRA, considering matters of flood level, depth, extent and duration. The hydraulic modelling was reviewed and subsequently approved by the Environment Agency. The FRA produced for the Scheme is presented in Appendix 8.1 of this ES ([Application document TR010063 - APP 6.15](#)).
- 4.18.9 The FRA considers the NPPF's Sequential Test for the Scheme, justifying its location though compatibility with the degree of flood risk identified. The Scheme is classified as essential infrastructure, which permits its presence across Flood Zone 3.
- 4.18.10 Furthermore, the NPPF Exception Test was applied. The Scheme provides wider sustainability benefits to the community that outweigh flood risk as it will aid in unlocking economic potential and encourage growth and job creation (Scheme Objective 1 and the JCS)⁴, otherwise restricted by limited accessibility to the area. The Scheme will allow for improved climate change resilience in the area (Scheme Objective 4). Various assessments are contained in the ES, which includes aspects of the wider socio-economic benefits and impacts on the surrounding population and human health. The

⁴ Scheme objectives listed in Chapter 2 (application document TR010063 – APP 6.2).

site-specific flood risk assessment, supported by computational modelling, demonstrates that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Water Framework Directive Assessment

- 4.18.11 A Water Framework Directive Assessment (WFD) is a requirement for new developments and schemes to demonstrate that they will not result in a deterioration in status (or potential) of any water body or prevent the water body from meeting good status (or potential) in the future. The approach to the WFD compliance assessment undertaken for the Scheme follows the PINS advice note 18 on preparation of WFD assessments for a NSIP, and included a screening, scoping and impact assessment. The WFD assessment produced for the Scheme is presented in Appendix 8.2 of this ES ([Application document TR010063 - APP 6.15](#)).
- 4.18.12 Following the screening and scoping, three surface water bodies and two groundwater bodies were progressed to detailed impact assessment which concluded that Test A and Test B were passed for all water bodies:
- Test A: The Scheme will not cause a deterioration in any element of water body classification.
 - Test B: The Scheme will not prevent the WFD status objectives from being reached within the water body or other downstream water bodies.
- 4.18.13 Future recommendations include the continued consultation with the Environment Agency in relation to the bank protection required on the River Chelt to ensure expectations for mitigation measures are aligned.

Health Impact Assessment and Equalities Impact Assessment

- 4.18.14 The assessment of the effect of the Scheme on Population and Human Health is a requirement under the EIA Regulations 2017. Guidance from National Highways indicates that this assessment is informed by the assessments in existing topics such as Air Quality and Noise and Vibration. An Equalities Impact Assessment (EqIA) ([Application document TR010063 - APP 7.6](#)) which reports the effect of the Scheme on different social groups has been produced and reported separately to the EIA. Whilst a separate Health Impact Assessment has not been produced, the human health section of Chapter 13 - Population and Human Health ([Application document TR010063 - APP 6.11](#)) has been expanded to describe health characteristics in greater detail, including consideration of mental health data; use data analysis to identify and include relevant vulnerable groups within the health baseline; and strengthen approach to consultation and engagement process and outcomes.

5th Floor, Block 5
Shire Hall
Bearland
Gloucester
GL1 2TH

