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6.2 Environmental Statement
Chapter 15 Assessment of
Cumulative Effects

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and Procedure) Regulations 2009**

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6.2 Environmental Statement

Chapter 15 Assessment of Cumulative Effects

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Table of Contents

	Pages
15 Assessment of cumulative effects	2
15.1 Introduction	2
15.2 Legislative context	2
15.3 Cumulative assessment methodology	2
15.4 Assessment of combined effects	9
15.5 Assessment of cumulative effects	9
15.6 Monitoring	22
15.7 Summary	23
End Notes & References	24

Table of Tables

Table 15-1	Stages of cumulative effects assessment (CEA)	3
Table 15-2	Project tiering to assign certainty for the purpose of CEA (as provided in Table 2 within Advice note 17)	4
Table 15-3	Criteria for shortlisting 'other development'	7
Table 15-4	Zol extents for assessment of potential cumulative impacts	8
Table 15-5	Combined effects as assessed and reported in environmental factor assessment chapters of the ES	9
Table 15-6	Significant effects and key receptors for environmental factors	10
Table 15-7	Short listed 'other developments' with the potential to result in cumulative impacts (for assessment in the CEA)	16

15 Assessment of cumulative effects

15.1 Introduction

- 15.1.1 Cumulative effects are those that arise as a result of impacts from more than one project, or element of a single project, combining to have an effect on a receptor, or group of receptors, that may be larger than if the effect were considered separately.
- 15.1.2 The Design Manual for Roads and Bridges (DMRB) *LA 104 Environmental assessment and monitoring* states that environmental assessments shall assess cumulative effects.
- 15.1.3 This Environmental Statement (ES) chapter details the legislative context and methodology for the assessment of combined and cumulative effects. It presents the findings of the combined and cumulative effects assessments, and where required, goes on to identify any design, mitigation and enhancement measures, and any ongoing monitoring requirements.

15.2 Legislative context

- 15.2.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) set out in paragraph 5 of Schedule 4 that an ES should include:

“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”.

- 15.2.2 The requirement to consider cumulative effects is also outlined in planning policy. The National Policy Statement for National Networks, paragraph 4.3 states 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 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 measures to avoid, reduce or compensate for any adverse impacts”.*

15.3 Cumulative assessment methodology

- 15.3.1 There is currently no standard methodology for cumulative effects assessment (CEA) and combined effects assessment although there is a range of guidance available. The following standards and guidance have been taken into consideration during the preparation of the ES:
- DMRB *LA 104 Environmental assessment and monitoring* (section 3.19 – 3.22), which sets out a high-level methodology for assessing cumulative effects on highways projects¹; and
 - Planning Inspectorate (PINS) *Advice note 17 Cumulative Effects Assessment*, which sets out a methodology, relevant to nationally significant infrastructure projects (NSIP)².

15.3.2 Consistent with the distinction between combined effects and cumulative effects, as defined within DMRB *LA 104 Environmental assessment and monitoring*, and outlined in section 15.1 Introduction, the assessment is split in to two sections:

- **Combined effects assessment:** a single project (for example, numerous different effects impacting a single receptor) comprising an assessment of the combined impact of a number of different impacts from the scheme upon a single resource/receptor, which are individually assessed, and findings reported within each environmental factor chapter of this ES; and
- **Cumulative effects assessment:** different projects (together with the project being assessed) comprising an assessment of cumulative impacts of a number of different projects within the vicinity, in combination with the environmental impact of the scheme on a single resource/receptor.

15.3.3 The methodology for each of these assessments is described separately below.

Combined effects assessment

15.3.4 Combined effects from the action of a number of different impacts upon a single resource/receptor are considered within the environmental factor chapters of the ES. The combined effects are summarised in section 15.4 Assessment of combined effects.

Cumulative effects assessment

15.3.5 *PINS Advice note 17* provides a systematic approach to cumulative effects assessment which can be split into four distinct phases explained in Table 15-1. Paragraph 2.5 of the guidance notes that the recommended process focusses on cumulative effects with 'other existing development and/or approved development'.

Table 15-1 Stages of cumulative effects assessment (CEA)

CEA stage	Activity
Stage 1: Establish the Zone of Influence (Zol) of the scheme and identify long list of 'other developments'	<ul style="list-style-type: none"> • Identify the Zol for each of the environmental factors covered by the ES. • Identify a long list of other developments in the vicinity of the scheme which may have cumulative effects. • Undertake desktop review of available environmental information for identified cumulative developments.
Stage 2: Identify short list of 'other developments'	<ul style="list-style-type: none"> • Identify which of the identified other developments from Stage 1 has the potential to give rise to significant cumulative effects by virtue of overlaps in temporal scope, due to the scale and nature of the 'other development'/receiving environment; or any other relevant factors.
Stage 3: Information gathering	<ul style="list-style-type: none"> • Information related to the shortlisted cumulative developments is gathered and reviewed.
Stage 4: Assessment	<ul style="list-style-type: none"> • CEA of shortlisted cumulative development is undertaken. Each individual 'other development' is reviewed in turn to identify whether there is potential for significant cumulative effects. • Mitigation measures are identified.

Stage 1 establish the NSIP's zone of influence and long list of 'other development'

Establishing the zone of influence


15.3.6 The zone of influence (Zol) refers to the spatial area over which an effect from a project is likely to be experienced. The Zol for the scheme varies for each

environmental factor and is set out in the study area for each environmental factor assessment, shown in ES Figure 15.1 Cumulative zone of influence (Document Reference 6.3).

Establishing the long list of ‘other developments’

15.3.7 *Advice note 17* recommends that a wide range of future projects is included within the CEA which can be tiered (from Tier 1 – 3) according to how far advanced the development is within the planning system and to the level of detail that is likely to be available for each tier. The tiers are set out in Table 15-2.

Table 15-2 Project tiering to assign certainty for the purpose of CEA (as provided in Table 2 within Advice note 17)

Tier 1	<ul style="list-style-type: none"> • projects under construction³; • permitted application(s) but not yet implemented; and • submitted application(s) but not yet determined⁴. 	<p>Decreasing level of detail likely to be available.</p> 
Tier 2	<ul style="list-style-type: none"> • Projects on the Planning Inspectorate’s Programme of Projects where a scoping report has been submitted⁵. 	
Tier 3	<ul style="list-style-type: none"> • Projects on the Planning Inspectorate’s Programme of Projects where a scoping report has not been submitted⁶; • Identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited⁷; and • 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. 	

15.3.8 The less information that is available for the future projects (for example environmental impacts predicted and project definition), the less likely that the CEA would be able to make any robust assessment in relation to these projects. Reasonable steps have been taken to review publicly available information when conducting the CEA.

15.3.9 Whilst projects that are Tier 2 and Tier 3, as defined by PINS guidance, are included within this assessment, it is considered that there is limited value in assessing developments for which there is no environmental assessment information available as it would be more challenging to identify environmental effects arising from those projects. Moreover, it would be challenging to determine the timeframe (temporal scope) within which effects arising from these developments are likely to occur.

15.3.10 In accordance with the methodology outlined in DMRB LA 104 *Environmental assessment and monitoring* (section 3.21.2), the assessment of cumulative effects with other developments for the scheme reports on:

- “roads projects which have been confirmed for delivery over a similar timeframe⁸;
- other development projects with valid planning permissions or consent orders, and for which EIA is a requirement; and
- proposals in adopted development plans with a clear identified programme for delivery”.

15.3.11 Relevant ‘other developments’, as listed above, have been identified through a combination of consultation with the relevant planning authorities and directly

from published sources⁹. Relevant planning authorities within 5 kilometres of the scheme (the greatest Zol) were included as follows, as shown on ES Figure 15.1 Cumulative zone of influence (Document Reference 6.3):

- The Planning Inspectorate¹⁰;
 - consented NSIPs within 5 kilometres of the scheme;
- The Department for Transport (DfT);
 - approved Transport and Works Act Order (TWAO) applications¹¹ within 5 kilometres of the scheme;
- Gloucestershire County Council;
 - permitted applications (EIA development only) within 5 kilometres of the scheme;
 - site allocations within adopted planning policy within 5 kilometres of the scheme:
 - Minerals Local Plan for Gloucestershire (2018 - 2032) (adopted March 2020);
 - Gloucestershire Waste Core Strategy (adopted 2012);
 - Waste Local Plan 2002-2012 Saved Policies (adopted 2004);
 - Gloucestershire's Local Transport Plan, 2015-2031 (adopted 2016, updated 2017). Note at the time of undertaking the EIA, the LTP was undergoing a further review, with public consultation having concluded in March 2020 and adoption due by early 2021. The latest adopted version (2017 version) was therefore used to identify cumulative developments;
- Cotswold District Council;
 - permitted applications (EIA development only) within 5 kilometres of the scheme;
 - site allocations within adopted planning policy (within 5 kilometres of the scheme):
 - Local Plan 2011 – 2031 (adopted August 2018);
 - made neighbourhood plans (no made plans within 5 kilometres of scheme);
- Tewkesbury Borough Council;
 - permitted applications (EIA development only) within 5 kilometres of the scheme;
 - site allocations within adopted planning policy within 5 kilometres of the scheme:
 - Saved Policies of the Tewkesbury Borough Local Plan to 2011 (adopted 2006);
 - The Pre-Submission Tewkesbury Borough Plan 2011 – 2031 (October 2019), submitted for examination on 18 May 2020. Note: at the time of undertaking the EIA, the Plan was not adopted. Therefore, any Plan allocations are not included in the cumulative baseline;
 - Gloucester City Council, Tewkesbury Borough Council and Cheltenham Borough Council Joint Core Strategy 2011-2031 (adopted 2017);

- made neighbourhood plans: Churchdown and Innsworth neighbourhood plan (made 30 June 2020) is within 5 kilometres of the scheme;
- Gloucester City Council;
 - permitted applications (EIA development only) within 5 kilometres of the scheme;
 - site allocations within adopted planning policy within 5 kilometres of the scheme:
 - Gloucester City Council, Tewkesbury Borough Council and Cheltenham Borough Council Joint Core Strategy 2011-2031 (adopted 2017);
 - Gloucester Local Plan (1983) – saved policies;
 - Second Stage Deposit City of Gloucester Local Plan (2002);
 - Gloucester City Plan (2016-2031) (pre-submission draft (2019)).
Note: at the time of undertaking the EIA, the Plan had been submitted to PINS for examination (18 November 2020) however was not adopted. Therefore, any plan allocations were not included in the cumulative baseline;
 - made neighbourhood plans: no made plans within 5 kilometres of scheme;
- Cheltenham Borough Council;
 - permitted applications (EIA development only) within 5 kilometres of the scheme;
 - site allocations within adopted planning policy within 5 kilometres of the scheme:
 - Local Plan Second Review 2006 (adopted 2006) (saved policies);
 - The Cheltenham Plan (adopted July 2020);
 - Gloucester City Council, Tewkesbury Borough Council and Cheltenham Borough Council Joint Core Strategy 2011-2031 (adopted 2017);
 - made neighbourhood plans: no made plans within 5 kilometres of scheme;
- Stroud District Council;
 - permitted applications (EIA development only) within 5 kilometres of the scheme;
 - site allocations within adopted planning policy within 5 kilometres of the scheme:
 - Stroud District Local Plan (adopted November 2015); and
 - made neighbourhood plans: no made plans within 5 kilometres of scheme.

Stage 2 identify shortlist of 'other development' for CEA

- 15.3.12 The 'long list' of other developments identified under Stage 1 has been subject to further threshold and criteria to identify a proportionate list of developments for assessment within the CEA.
- 15.3.13 The threshold and criteria considered in shortlisting a development is outlined in Table 15-3. Criteria has come from PINS guidance within *Advice note 17* and the EIA Regulations 2017.

Table 15-3 Criteria for shortlisting ‘other development’

Threshold	Description
The temporal scope of ‘other development’ potential for interaction.	Consideration of relative construction, operation and decommissioning programmes of the ‘other development’ identified in the Zol with the scheme programme, to establish whether there is overlap, or similar temporal scope for construction and operation phases, and any potential for interaction.
The scale and nature of ‘other development’	Consideration of whether the scale and nature of the developments identified in the Zol are likely to interact with the scheme and to result in a cumulative effect.
Any other relevant factors	<p>Nature and/or capacity of the receiving environment that would make a significant cumulative effect with ‘other development’. The sensitivity of the receiving environment includes whether the sites are within:</p> <ul style="list-style-type: none"> • Wetlands, riparian areas, river mouths • Coastal zones and the marine environment • Mountain and forest areas • Nature reserves and parks • European sites and other areas classified or protected under national legislation • Areas in which there has already been a failure to meet the environmental quality standards, laid down in Union legislation and relevant to the project, or in which it is considered that there is such a failure • Densely populated areas • Landscapes and sites of historical, cultural or archaeological significance.

15.3.14 Professional judgement has been applied to ‘other developments’ that exceed the thresholds but do not give rise to discernible effects. Where relevant, the reasons for excluding any ‘other development’ from further consideration is outlined in ES Appendix 15.1 Consideration of cumulative effects (Document Reference 6.4).

Stage 3 information gathering

15.3.15 In line with *Advice note 17*, the following information on the ‘other developments’ has been compiled from publicly available information as outlined under ‘Stage 1’ above (section 15.3.11):

- *“proposed design and location information;*
- *proposed programme of construction, operation and decommissioning; and*
- *environmental assessments that set out baseline data and effects arising from the ‘other existing development and/or approved development’”.*

Stage 4 assessment

15.3.16 The assessment of significance of the cumulative effects is determined in accordance with the significance assessment as detailed within ES Chapter 4 Environmental assessment methodology (Document Reference 6.2).

15.3.17 For the purposes of the CEA, the value of a resource and magnitude of impact is determined according to the criteria set within the preceding chapters of this ES: ES Chapters 5-14 (Document Reference 6.2). The significance of effect is then carried forward from preceding chapters to identify the significance of cumulative effects with other developments.

- 15.3.18 The significance criteria for cumulative effects has been derived from guidance set out within DMRB *LA 104 Environmental assessment and monitoring*. This is set out in Table 4.3 of ES Chapter 4 Environmental assessment methodology (Document Reference 6.2) and is used in the assessment of effects in section 15.5 Assessment of cumulative effects.
- 15.3.19 Where significant cumulative effects beyond those identified as residual significant effects from the scheme in isolation are identified, an assessment of the need for additional mitigation (further to that already set out in the preceding ES chapters: Chapters 5-14 (Document Reference 6.2)) is undertaken.
- 15.3.20 The assessment of cumulative effects varies depending on each environmental factor's individual assessment criteria and thresholds for significant effects.

Zone of influence

- 15.3.21 Table 15-4 explains the rationale for the Zol extent for potential cumulative impacts with other developments used by each environmental factor. These individual Zols were subsequently combined to define an overall Zol representing the search area within which other development has been identified, as shown on ES Figure 15.1 Cumulative zone of influence (Document Reference 6.3). The Zol for Air quality (from the affected road network), Biodiversity (for impacts on Bats) and Materials and waste has been limited to 5 kilometres due to the study area for those factors encompassing areas much greater than would be feasible to identify other development. Climate impacts (i.e. those as a consequence of global heating) are observable at a national/global scale. Climate has therefore been scoped out of the cumulative effects assessment in combination with other local/regional developments).

Table 15-4 Zol extents for assessment of potential cumulative impacts

Environmental factor	Zone of Influence
Air quality	Up to 200m from the Development Consent Order (DCO) boundary (for construction dust) and up to 200m from the affected road network (ARN) once operational. (Note that other development for inclusion within the CEA is only identified out to 5km from the scheme)
Cultural heritage	Up to 1km from the DCO boundary.
Landscape and visual effects	Up to 3km from the DCO boundary.
Biodiversity	Study areas vary by ecological features, generally up to 2km ¹² from the DCO boundary (Bats, 30km).
Geology and soils	Up to 500m from the DCO boundary.
Material assets and waste	Includes the whole of Gloucestershire county (though other development for inclusion within the CEA is only identified out to 5km from the DCO boundary).
Noise and vibration	Up to 600m from the DCO boundary.
Population and human health	Up to 500m from the DCO boundary.
Road drainage and the water environment	Up to 1km from the DCO boundary.

15.4 Assessment of combined effects

15.4.1 Table 15-5 provides a summary of the potential combined effects which have been identified as part of the assessments reported within the relevant environmental factor chapters of the ES:

- ES Chapter 6 Cultural heritage (Document Reference 6.2)
- ES Chapter 7 Landscape and visual effects (Document Reference 6.2)
- ES Chapter 8 Biodiversity (Document Reference 6.2)
- ES Chapter 12 Population and human health (Document Reference 6.2)
- ES Chapter 13 Road drainage and the water environment (Document Reference 6.2)
- and ES Chapter 14 Climate (Document Reference 6.2)

15.4.2 These are considered likely to affect a single resource or receptor. These in-combination assessments are summarised in and reported in Table 15-6 of this chapter.

Table 15-5 Combined effects as assessed and reported in environmental factor assessment chapters of the ES

Environmental factor and scope of combined effects assessed within ES chapter
ES Chapter 6 Cultural heritage (Document Reference 6.2) considers effects from different sources on heritage assets, such as visual impacts during construction and noise impacts during operation.
ES Chapter 7 Landscape and visual effects (Document Reference 6.2) considers effects on landscape and visual receptors from different sources such as ecological and noise effects during construction and operation.
ES Chapter 8 Biodiversity (Document Reference 6.2) considers the combined ecological effects on single receptors of a number of individual environmental impacts such as area of land required, disturbance due to noise, changes in air quality and airborne dust deposition, surface run-off and pollution events and cumulative loss of certain habitat types.
ES Chapter 12 Population and human health (Document Reference 6.2) considers the conclusions of other environmental factors such as changes in traffic, severance, air quality, landscape, visual and noise impacts in the assessment of amenity impacts to community assets such as residential property, recreation infrastructure and existing businesses. The human health assessment also considers a wide range of environmental factors such as air quality, noise and visual amenity in assessing impacts on health determinants
ES Chapter 13 Road drainage and the water environment (Document Reference 6.2) considers combined effects such as the accumulation of impacts on water resources and receptors such as rivers and aquifers, which when considered together constitute a greater impact.
ES Chapter 14 Climate (Document Reference 6.2) considers the in-combination climate change impacts of the scheme where the focus is on those effects of the scheme identified by an environmental factor that are also affected by climate change. The findings of the assessment are presented in ES Appendix 14.3 In-combination climate change impact assessment (Document Reference 6.4).

15.5 Assessment of cumulative effects

15.5.1 Table 15-6 provides a summary of the significant effects of the scheme (as assessed within each ES chapter) and sensitive receptors identified as potentially affected by the other developments. The long-list and of other developments is provided within ES Appendix 15.1 Consideration of cumulative effects (Document Reference 6.4). The short-list is provided below in Table 15-7.

Table 15-6 Significant effects and key receptors for environmental factors

Environmental factor	Summary of significant effects (as reported in ES chapters 5-14 (Document Reference 6.2))	Key receptors identified as being potentially affected by 'other developments'
Air quality	<p>Construction</p> <ul style="list-style-type: none"> No likely significant effects <p>Operation</p> <ul style="list-style-type: none"> No likely significant effects. 	<p>People living and working within the study and construction area (i.e. 200m from the DCO boundary) and once operational, 200m from the ARN. European designated ecological sites.</p>
Cultural heritage	<p>Construction</p> <ul style="list-style-type: none"> Permanent adverse significant effect on Shab Hill Barn Grade II Listed Building resulting from the scheme altering the setting of the resource. Permanent adverse significant effect on Emma's Grove scheduled monument resulting from the scheme altering the setting of the resource. <p>Operation</p> <ul style="list-style-type: none"> Permanent adverse significant effect on Shab Hill Barn Grade II Listed Building due to increased traffic noise compared to the existing situation. 	<p>N/A - no 'other development' identified within one km of the scheme.</p>
Landscape and visual effects	<p>Construction</p> <ul style="list-style-type: none"> Temporary adverse significant effects on landscape character types (LCT) that are directly affected by the scheme, including: LCT 2 Escarpment; LCT 7 High Wold; and LCT 8 High Wold Valleys. Temporary adverse significant effects experienced by residents of Nettleton Bottom, Shab Hill, Stockwell, visitors to Crickley Hill Country Park, Barrow Wake, Great Witcombe Roman Villa, Leckhampton Hill and users of the Public Rights of Way (PRoW) network, including the Cotswold Way National Trail, Gloucestershire Way long distance footpath and local footpaths, bridleways and byways. <p>Operation</p> <ul style="list-style-type: none"> Permanent adverse significant effects on LCT that would be directly affected by the scheme, including: LCT 2 Escarpment (year 1 and year 15); LCT 7 High Wold (year 1 and year 15); and LCT 8 High wold Valleys (year 1). Combination of permanent adverse and neutral effects experienced by residents of Shab Hill (adverse at year 1), Stockwell (adverse at year 1), visitors to Crickley Hill Country Park (adverse at year 1 and year 15), Barrow Wake (adverse at year 1 and neutral at year 15), Great Witcombe Roman Villa (adverse at year 1) and users of the 	<p>Landscape receptors:</p> <ul style="list-style-type: none"> LCT 2 Escarpment LCT 7 High Wold LCT 8 High Wold Valleys <p>Visual receptors:</p> <ul style="list-style-type: none"> Recreational receptors: <ul style="list-style-type: none"> Cotswold Way National Trail users Gloucestershire Way long distance footpath Users of local PRoW and Byways Tourism receptors: <ul style="list-style-type: none"> Crickley Hill Country Park Great Witcombe Roman villa Barrow Wake

Environmental factor	Summary of significant effects (as reported in ES chapters 5-14 (Document Reference 6.2))	Key receptors identified as being potentially affected by 'other developments'
	PRoW network, including the Cotswold Way National Trail (adverse at year 1 and year 15), Gloucestershire Way long distance footpath (adverse at year 1) and local footpaths, bridleway and byways (adverse at year 1).	
Biodiversity	<p>Construction</p> <ul style="list-style-type: none"> • Adverse significant effect on the Barrow Wake unit of the Crickley Hill and Barrow Wake Site of Special Scientific Interest (SSSI) due to losses of 1,400m² (0.14ha) calcareous grassland and wooded habitat. • Beneficial significant effect on the Barrow Wake unit of the Crickley Hill and Barrow Wake Site of Special Scientific Interest (SSSI) due to the conversion of hardstanding of the existing A417 within the SSSI to calcareous grassland. • Adverse significant effect on veteran trees due to the loss of three veteran trees. • Adverse significant effect on semi-natural broadleaved woodland priority habitat and scattered trees through loss of 17.21 ha of woodland along verges and embankments and loss and severance of woodland at Emma's Grove and Shab Hill. • Beneficial significant effect on semi-natural broadleaved woodland priority habitat due to planting approximately 24.65ha of new woodland resulting in a gain of 7.44 ha of woodland once established. • Adverse significant effect on important and species-rich hedgerow priority habitat through habitat loss of approximately 3.5km of hedgerow. • Beneficial significant effect on species-rich hedgerow habitat due to planting approximately 9km of new native species-rich hedgerow resulting in a gain of 5.5km of hedgerow habitat once established. • Adverse significant effect on species-rich neutral grassland priority habitat due to habitat loss. • Beneficial significant effect on calcareous grassland priority habitat across the scheme due to approximately 75ha of habitat creation, a gain of approximately 72.5ha of calcareous grassland habitat. • Adverse significant effect on a petrifying spring with tufa formation through loss of Annex 1 habitat at the tributary of Norman's Brook. • Beneficial significant effect on petrifying spring with tufa formation through restoration of other existing Annex 1 habitat. • Adverse significant effect on bat assemblages, which include Annex II species, due to temporary impacts of loss and fragmentation of foraging and commuting features. 	<p>Designated sites – Crickley Hill and Barrow Wake SSSI.</p> <p>Non-statutory designated sites.</p> <p>Ancient woodland and veteran trees.</p> <p>Semi-natural broadleaf woodland.</p> <p>Species-rich and important hedgerows.</p> <p>Species-rich calcareous grasslands.</p> <p>Semi-improved neutral grassland.</p> <p>Bat assemblages including Annex II species (roosts, foraging and commuting habitat)</p> <p>Badgers</p> <p>Breeding birds and Wintering birds</p> <p>Barn Owl populations including loss and fragmentation of foraging habitat</p> <p>Great Crested Newts</p> <p>Reptiles populations</p> <p>Otter</p> <p>Terrestrial Invertebrate assemblages including Roman Snail</p> <p>Aquatic Macroinvertebrates</p> <p>Fish</p>

Environmental factor	Summary of significant effects (as reported in ES chapters 5-14 (Document Reference 6.2))	Key receptors identified as being potentially affected by 'other developments'
	<ul style="list-style-type: none"> • Adverse significant effect on barn owl through loss and fragmentation of foraging habitat. <p>Operation</p> <ul style="list-style-type: none"> • Adverse significant effect on Ullen Wood Local Wildlife Site (LWS) and ancient woodland due to increase in nitrogen deposition from vehicle emissions. • Adverse significant effect on a veteran tree due to increase in nitrogen deposition from vehicle emissions. • Adverse significant effect on barn owl through increased risk of mortality and injury through traffic collisions due to severance of habitat. 	
Geology and soils	<p>Construction</p> <ul style="list-style-type: none"> • Permanent adverse significant effect on Agricultural Land Classification (ALC) Grade 3a best and most versatile agricultural land. • Permanent adverse significant effect on ALC Grade 3b agricultural land. <p>Operation</p> <ul style="list-style-type: none"> • No likely significant effects. 	N/A – no 'other development' identified within 500m of the scheme.
Material assets and waste	<p>Construction</p> <ul style="list-style-type: none"> • No likely significant effects. <p>Operation</p> <ul style="list-style-type: none"> • No likely significant effects. 	Capacity of waste management infrastructure in the county, although estimated waste arisings from the scheme are not considered significant.
Noise and vibration	<p>Construction</p> <p><u>Residential:</u></p> <ul style="list-style-type: none"> • Temporary adverse significant noise effects from construction activities for 45 residential properties: <ul style="list-style-type: none"> ○ R1 Holly Brae (6) ○ R2 Crickley Court (17) ○ R3 Fernbank (16) ○ R5 Crickley Ridge ○ R7 Air Balloon Cottages (2) ○ R13 Rushwood Kennels ○ R14 Shab Hill Farm (2) 	N/A – no 'other development' identified within 600m of the scheme, and no other large development identified as being constructed in the same construction period.

Environmental factor	Summary of significant effects (as reported in ES chapters 5-14 (Document Reference 6.2))	Key receptors identified as being potentially affected by 'other developments'
	<p><u>Non-residential:</u></p> <ul style="list-style-type: none"> • Temporary adverse significant noise effects from construction activities at non-residential locations: <ul style="list-style-type: none"> ○ R1 St Peter's Church ○ R4 Crickley Hill Visitor Centre ○ R12 Birdlip Radio Station ○ R13 Rushwood Kennels and Cattery ○ PRow within approximately 400 metres of major excavation works <p>Operation</p> <p><u>Residential:</u></p> <ul style="list-style-type: none"> • Direct permanent beneficial significant noise effects have been identified at 19 residential properties currently exceeding the SOAEL. • Direct permanent beneficial significant noise effects have been identified at 31 residential properties between the LOAEL and SOAEL. • Indirect permanent beneficial significant noise effects have been identified at 15 residential properties exceeding the SOAEL. • Indirect permanent beneficial significant noise effects have been identified at six residential properties between the LOAEL and SOAEL. • Direct permanent adverse significant noise effects have been identified at 21 residential properties between the LOAEL and SOAEL. • Indirect permanent beneficial significant noise effects have been identified 600m or more beyond new or altered road links at 83 residential properties between the LOAEL and SOAEL. • Indirect permanent adverse significant noise effects have been identified 600m or more beyond new or altered road links at 17 residential properties exceeding the SOAEL. <p><u>Non-residential:</u></p> <ul style="list-style-type: none"> • Direct permanent beneficial significant effects at several non-residential receptors in Birdlip, including the Primary School and the Village Hall. 	

Environmental factor	Summary of significant effects (as reported in ES chapters 5-14 (Document Reference 6.2))	Key receptors identified as being potentially affected by 'other developments'
	<ul style="list-style-type: none"> • Direct permanent beneficial significant effects on part of the Cotswold Way National Trail, along the re-purposed section of the A417 running between Emma's Grove and Barrow Wake view point. • Direct permanent significant adverse effects on part of the Gloucestershire Way long distance footpath between the Air Balloon roundabout and Coberley to the east. • Direct permanent significant adverse effects on footpath links running for approximately one kilometre to the east from Stockwell. 	
Population and human health^{13*}	<p>Construction</p> <ul style="list-style-type: none"> • Permanent adverse significant effects on two businesses (Air Balloon Public House and Crickley Hill Tractors) and three residential properties on Crickley Hill (Woodside House, Pinewood and Crickley Ridge). • Temporary adverse significant effects at National Star College and on users of Crickley Hill Country Park. • Permanent adverse significant effect on one Agricultural Holding, Shab Hill Farm. • All health outcomes are neutral. <p>Operation</p> <ul style="list-style-type: none"> • Permanent beneficial significant effect on the Cotswold Way National Trail. • Permanent beneficial significant effect on walking, cycling and horse riding / PRow. • Positive and neutral health outcomes. 	N/A – no 'other development' identified within 500m of the scheme.
Road drainage and the water environment	<p>Construction</p> <ul style="list-style-type: none"> • Temporary adverse significant effect on hydromorphology due to the removal of the tributary of Norman's Brook during the construction phase. <p>Operation</p> <ul style="list-style-type: none"> • No likely significant effects 	Surface water within the tributary of Norman's Brook catchment. Groundwater - Secondary (undifferentiated aquifer)

Identification of other developments to be assessed

- 15.5.2 For each identified 'other development', consideration has been made as to the likelihood that any impacts from the other development could occur at the same time as the scheme or affect similar receptors or resources. ES Appendix 15.1 Consideration of cumulative effects (Document Reference 6.4) presents the list of other developments identified along with justification for those screened out of the assessment.
- 15.5.3 The long list of developments is given in ES Appendix 15.1 Consideration of cumulative effects (Document Reference 6.4). The number of developments to be considered within each environmental factor has been condensed between stage 1 and stage 2 assessments using the criteria listed in Table 15-3.
- 15.5.4 Table 15-7 provides the shortlist of development projects used for this CEA and ES Figure 15.2 Cumulative developments (Document Reference 6.3) shows the location of each development in relation to the scheme.

Table 15-7 Short listed 'other developments' with the potential to result in cumulative impacts (for assessment in the CEA)

Application reference and local planning authority	Approximate distance from scheme and location	Proposal	Proposed programme of construction, operation and decommissioning	Relevant environmental factor (development is within respective Zol)
12/01256/OUT (and related approved reserved matters applications: 18/00109/APP (Phase 3, Land at Perrybrook – 225 dwellings), 18/00410/APP, 18/00864/APP (Phases 2 & 5, Land at Perrybrook – 240 dwellings), 19/00537/APP (Phase 1, Land at Perrybrook-135 dwellings), 20/00328/NMA, 20/00305/NMA) (Tewkesbury Borough Council)	1.1km Land at Perrybrook to the North of Brockworth and to the South of the A417 Brockworth	Outline application (EIA) for a mixed-use development of up to 1,500 dwellings, including extra care housing, community facilities including A1, A2, A3, A4 and A5 local retail shops (totalling 2,500m ²), B1/B8 employment uses (totalling 22,000m ²), D1 health facilities and formal and informal public open space (including means of access). The reserved matters applications provide additional detail about the development.	Development of the site appears to have not yet commenced based on aerial imagery. Tewkesbury Borough Council confirmed that the development was recorded as not started in April 2019.	Biodiversity 2km, Bats 30km Landscape and visual 3km Material assets and waste 5km
14/00838/FUL (Tewkesbury Borough Council)	2.5km Land to the West of Farm Lane, Shurdington	Full application (EIA) for residential development comprising 377 dwellings, including access and associated infrastructure.	The ES indicates that the development would be constructed in three phases: phase 1 2015-2018, phase 2 2018-2019 and phase 3 2019-2020.	Biodiversity (bats only - 30km) Landscape and visual 3km Material assets and waste 5km
BR1 - Brockworth and Hucclecote Housing Allocation (site allocation within Tewkesbury Borough	3.1km Brockworth	Land is allocated to the south and west of the Gloucester Business Park for approximately 1,400 dwellings (29ha net) as shown on the proposals map. Within this area and the adjoining land identified by Stroud District Council for	(1,400 dwellings between 2001-2011), however the policy was retained in 2009. Site appears to be partially but not fully built out based on aerial imagery. Related	Biodiversity (bats only - 30km) Material assets and waste 5km

Application reference and local planning authority	Approximate distance from scheme and location	Proposal	Proposed programme of construction, operation and decommissioning	Relevant environmental factor (development is within respective Zol)
<p>Local Plan to 2011 Saved Policies)</p> <p>(Tewkesbury Borough Council)</p>		<p>development, the borough council will support proposals for a comprehensive scheme which:</p> <ul style="list-style-type: none"> • Integrates with existing and proposed business uses. • Includes a new local centre and community and recreational facilities. • Makes provision for local educational requirements. • Addresses traffic issues in the context of the existing and proposed highway network. • Provides for/contributes to enhanced pedestrian, cycle and public transport facilities within the site and to and from Gloucester, Cheltenham, Brockworth and Hucclecote. • Respects the high quality landscape setting and introduces planting both within and on the edge of the development consisting of native broadleaved species. • Safeguards the Hucclecote meadows site of special scientific interest and its sustainable management. <p>Note: This site allocation includes a number of permitted applications, including 17/01002/APP (development of 71 residential dwellings), 16/00292/APP (development of 113 residential dwellings) and 15/01274/APP (development of 214 residential dwellings).</p>	<p>planning applications within the site allocation (17/01002/APP, 16/00292/APP, 15/01274/APP) were recorded as 'complete' or 'under construction' in May-June 2019 by Tewkesbury Borough Council.</p>	
<p>BR2 - Gloucester Business Park (site allocation within Tewkesbury Borough</p>	<p>2.5km</p> <p>Gloucester Business Park (Brockworth/Hucclecote)</p>	<p>Land at Gloucester business park (Brockworth/Hucclecote) is allocated for employment use as shown on the proposals map. New buildings, or the redevelopment or change of use of existing buildings or sites, must</p>	<p>Site appears to be partially but not fully built out based on aerial imagery. There is a planning application pending within the site allocation</p>	<p>Biodiversity (bats only - 30km)</p> <p>Landscape and visual 3km</p>

Application reference and local planning authority	Approximate distance from scheme and location	Proposal	Proposed programme of construction, operation and decommissioning	Relevant environmental factor (development is within respective Zol)
Local Plan to 2011 Saved Policies) (Tewkesbury Borough Council)		be within business (class b1), general industrial (class b2) or warehousing (class b8) use. Note: This site allocation includes a number of permitted applications including 11/01155/FUL (Proposed Class B1, B2 and B8 Business/industrial use) and related applications.	(Tewkesbury Borough Council 15/01378/OUT Development of up to 106 dwellings) at the time of writing.	Material assets and waste 5km
BR3 - Brockworth/Hucclecote District Centre (site allocation within Tewkesbury Borough Local Plan to 2011 Saved Policies) (Tewkesbury Borough Council)	2.8km Land at plot 5,000, Gloucester Business Park, adjacent to Ermin Street/Hucclecote Road	Land at plot 5,000, Gloucester Business Park, adjacent to Ermin Street/Hucclecote Road as shown on the proposals map is allocated for a mixed use district centre incorporating a foodstore of a minimum of 3,250sqm net sales area subject to retail assessment, a number of unit shops with a total gross floorspace of about 2,375sq m providing a range of other convenience and comparison goods and services, leisure uses not including a cinema, community uses, a hotel, and business and residential uses. Detailed proposals for the development of the site shall include measures to encourage the use of non-car modes, including bus interchange, and shall facilitate the safe movement of pedestrians and cyclists between the adjacent employment and residential areas and the district centre.	185 dwellings between 2001-2011, however the policy was retained in 2009. Site appears to be partially but not fully built out based on aerial imagery. There is planning consent for part of this allocated site (Tewkesbury Borough Council 18/01239/FUL, Erection of 166 new homes).	Biodiversity (bats only - 30km) Landscape and visual 3km Material assets and waste 5km
Policy H2 – site allocation MD4 within the adopted Cheltenham Local Plan. (Cheltenham Borough Council)	3.1km Leckhampton	Site allocation for approximately 350 dwellings and a secondary school (21ha). • Approximately 350 dwellings on land north of Kidnappers Lane • Provision of a secondary of school with six forms of entry on land to the south of Kidnappers Lane.	Note: Planning permission for the secondary school within the site was granted on 14 May 2020: Application 19/0058/CHR3MJ - Construction of a new 6 forms of entry secondary school building, with a new all-weather pitch, sports playing fields, a multi-use	Biodiversity (bats only - 30km) Material assets and waste 5km

Application reference and local planning authority	Approximate distance from scheme and location	Proposal	Proposed programme of construction, operation and decommissioning	Relevant environmental factor (development is within respective Zol)
			<p>games area, onsite parking and other associated works (Land Between Farm Lane/Kidnappers Lane Cheltenham Gloucestershire).</p> <p>At the time of undertaking the assessment there is a pending application for the erection of 360 dwellings on the allocated site H2-MD4 but this has not triggered EIA (20/01788/FUL)</p>	

Significance of cumulative effects

15.5.5 Cumulative effects have been identified by considering whether:

- there would be any change in magnitude of the significant effects from the scheme, as identified within the environmental factor assessments, taking into consideration any impacts from the other developments. *For example, a moderate adverse significant effect becoming a large adverse significant effect; or*
- the impacts of the scheme on key receptors potentially affected by 'other developments', as identified in Table 15-6, in combination with any impacts of the other developments would trigger a significant effect where the impacts of the scheme in isolation would not, *i.e. a non-significant effect becoming a significant effect.*

15.5.6 Where available, the relevant ESs for each development have been assessed.

Air quality

15.5.7 Cumulative effects of the resultant traffic changes from the scheme and other cumulative developments are incorporated into the assessment in ES Chapter 5 Air quality (Document Reference 6.2) and are therefore not assessed further. No other development is planned within the Zol for the air quality dust assessment during construction and none are to be constructed in the same time period, therefore there are no expected cumulative effects.

Cultural heritage

15.5.8 No other development is present within the Zol for Cultural heritage, and therefore no cumulative effects are expected on heritage assets.

Landscape and visual effects

15.5.9 Allocated sites BR2 and BR3 and the consented mixed-use development 12/01256/OUT have the potential to give rise to cumulative landscape and visual effects. The cumulative effect of these projects with the A417 Missing Link scheme would lead to an increase in the urbanising effect of Brockworth on the visual amenity of landscape character type 2 (LCT 2) (Escarpment) and landscape character area 2D (LCA 2D) (Coopers Hill to Winchcombe) and views along the escarpment as experienced by recreational users of the Cotswold Way National Trail and tourists to Crickley Hill Country Park, Barrow Wake and Great Witcombe Roman Villa.

15.5.10 It is important to note that the urbanising presence of Brockworth and Gloucester are already present in the landscape and in views from the escarpment. These receptors would experience a slight increase in the presence of built form. This cumulative effect on the character of the landscape and views would be temporary, slight adverse and not significant.

15.5.11 The consented residential development 14/00838/FUL is located to the north of the scheme. The allocation site would not have a visual connection to any of affected landscape or visual receptors of the scheme due to landform.

15.5.12 There are no significant landscape or visual cumulative effects predicted as a result of the scheme in combination with the other development assessed.

Biodiversity

12/01256/OUT (mixed-use development)

- 15.5.13 The mixed-use development 12/01256/OUT is outside the footprint of the A417 Missing Link scheme and is situated approximately 1 kilometre away from the DCO boundary. The environmental assessment for the mixed-use development 12/01256/OUT concluded that the proposed development would result in the loss of species-poor habitats of limited intrinsic value and that the mitigation measures set out would ensure any significant ecological impacts were avoided or mitigated, while the enhancements proposed would deliver significant and long-lasting benefits for wildlife in the area. The assessment concludes that many of the ecological receptors would be positively impacted due to habitat enhancements as part of the development.
- 15.5.14 Ecological receptors considered to be negatively impacted as a result of the mixed-use development 12/01256/OUT have been fully considered and would not result in any change to the effects reported within ES Chapter 8 Biodiversity (Document Reference 6.2).
- 15.5.15 An Appropriate Assessment¹⁴ for the Cotswolds Beechwoods Special Area of Conservation (SAC) completed as part of the assessment for the mixed-use development 12/01256/OUT concluded that there would be no significant effects to the Cotswold Beechwoods SAC.
- 15.5.16 The mixed-use development 12/01256/OUT assessment concludes that it would provide net gains and contribute to maintaining the favourable conservation status of the local bat populations and therefore there is not deemed to be any significant cumulative effects on foraging and commuting or roosting bats.

Developments 12/01256/OUT, 14/00838/FUL, BR1, BR2 and BR3

- 15.5.17 Developments 12/01256/OUT, 14/00838/FUL, BR1, BR2 and BR3 fall within 5 kilometres of the A417 scheme, and within 30 kilometres of the Wye Valley and Forest of Dean Bat Sites SAC. Habitats Regulations Assessment (HRA) screening for the A417 scheme (Document Reference 6.5 Habitats Regulations Assessment: Screening Report) concluded that there are no likely significant effects on the bat SAC either alone or in combination with other developments. NE have reviewed the report and confirmed that they agree with its conclusions. Therefore, there are not deemed to be any significant cumulative effects on the Wye Valley and Forest of Dean SAC.
- 15.5.18 As a result, cumulative effects on biodiversity are not anticipated, and there would be no change to the significant effects reported in ES Chapter 8 Biodiversity (Document Reference 6.2).

Geology and soils

- 15.5.19 No other development is present within the ZOI for Geology and soils and therefore no cumulative effects are expected on relevant receptors.

Material assets and waste

- 15.5.20 There may be additional impacts upon material use and waste in combination with the other developments, including additional impacts on waste management infrastructure where construction periods coincide.
- Mixed-use development 12/01256/OUT at Perrybrook, North Brockworth: Section 4.8 of the Waste Minimisation Statement¹⁵ (November 2012) for this

development states that the tonnage of construction waste is unknown at the outline permission stage, therefore there is insufficient information to quantify this potential effect.

- Residential development 14/00838/FUL on land to the west of Farm Lane, Shurdington: Construction waste from this development is estimated to be approximately 3,393 tonnes. From Environment Agency¹⁶ data, the remaining landfill capacity in Gloucestershire at the end of 2018 was 4,114,753m³, therefore, the volume of waste is unlikely to cause a significant cumulative effect.
- It has not been possible to locate information regarding likely quantities of waste in relation to the following site allocations: CR1 - Brockworth and Hucclecote Housing Allocation; BR2 - Gloucester Business Park; BR3 - Brockworth/Hucclecote District Centre; and Policy H2 MD4 Leckhampton. Therefore, there is insufficient information to quantify these potential effects.

15.5.21 As a result, cumulative effects on waste management infrastructure are therefore not anticipated, and there would be no change to the significant effects reported in ES Chapter 10 Material assets and waste (Document Reference 6.2).

Noise and vibration

15.5.22 No other development is present within the Zol for noise and vibration, and none are to be constructed in the same time period, therefore no cumulative effects are expected on relevant receptors. Furthermore, cumulative effects of the resultant traffic changes from the scheme and other cumulative developments are incorporated into the assessment in ES Chapter 11 Noise and vibration (Document Reference 6.2).

Population and human health

15.5.23 No other development is present within the Zol for population and human health, and therefore no cumulative effects are expected on relevant receptors.

15.5.24 Employment opportunities could be maximised across identified development projects through collaboration between colleges, local authorities and employers within the local market. Should skills shortages exist in the housing sector for example, the scheme could provide an opportunity to provide training in these skills areas for local people, seeking to leave a legacy benefit.

Road drainage and the water environment

15.5.25 The environmental assessment for mixed-use development 12/01256/OUT concluded negligible effects on hydrology, hydrogeology and water quality as a result of the development during construction and operation following mitigation measures. No significant effects are anticipated within the Horsbere Brook or the Secondary (undifferentiated aquifer) from the A417 Missing Link scheme, within which the 12/01256/OUT development is located, with the nearest infrastructure related to the scheme greater than 1 kilometre away within the catchment.

15.5.26 As a result, cumulative effects on the water environment are therefore not anticipated, and there would be no change to the significant effects reported in ES Chapter 13 Road drainage and the water environment (Document Reference 6.2).

15.6 Monitoring

15.6.1 The assessment of cumulative effects confirms that no mitigation above the measures identified and proposed within the ES and stated in ES Appendix 2.1 Environmental Management Plan (EMP) (Document Reference 6.4) is necessary.

On that basis, there are no adverse cumulative residual significant effects identified and no additional monitoring is required.

15.7 Summary

- 15.7.1 In line with DMRB *LA 104 Environmental assessment and monitoring*, cumulative effects have been assessed based on the conclusions of individual environmental factor assessments.
- 15.7.2 In summary, there are no significant cumulative effects anticipated which would result in any new or materially different significant effects to those identified in each environmental factor chapter of the ES (ES chapters 5-14, Document Reference 6.2). No mitigation measures further to those set out in the individual environmental factor chapters (ES Chapters 5-14, Document Reference 6.2) and ES Appendix 2.1 Environmental Management Plan (Document Reference 6.4) are required.

End Notes & References

¹ Highways England (2019) Design Manual for Roads and Bridges (DMRB) LA 104 *Environmental assessment and monitoring*. Available online:

<http://www.standardsforhighways.co.uk/ha/standards/dmr/vol11/section2/la104.pdf>

² The Planning Inspectorate (August 2019) Cumulative Effects Assessment, Advice note seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects: <https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf>

³ Projects consented within the five-year period which are expected to be have been constructed before the planned start of construction of the scheme (in 2023) are considered as part of both the construction and operational assessment within the environmental factor chapters of the ES. These developments have not therefore been included in the shortlisted developments for assessment in the CEA.

⁴ Applications which are still to be determined at the time of undertaking the assessment are not shortlisted for assessment in the CEA due to uncertainty and limited detailed information available.

⁵ Note: No projects of this type have been identified within 5 kilometres of the scheme

⁶ Note: No projects of this type have been identified within 5 kilometres of the scheme

⁷ Note: In line with the DMRB methodology, only adopted planning policy has been included in the CEA.

⁸ Roads projects are limited to those which require planning permission or development consent and does not include maintenance of the existing road network, which is typically carried out under permitted development rights.

⁹ Publicly available published sources such as planning applications on local authority websites, published local authority plans, data published on the Planning Inspectorate website and Transport and Works Act (TWA) applications published by the Department for Transport.

¹⁰ Planning Inspectorate, National Infrastructure Planning. Available online at:

<https://infrastructure.planninginspectorate.gov.uk/>

¹¹ Department for Transport, Transport and Works Act (TWA) applications and decisions: Available online at: <https://www.gov.uk/government/collections/twa-inspector-reports-and-decision-letters#2020-twa-decisions-and-applications>

¹² with the exception of Special Areas for Conservation (SAC) for bat populations and Internationally designated nature conservation sites, which are both up to 30 kilometres from the scheme.

¹³ NOTE: In accordance with the methodology set out in ES Chapter 12 Population and human health (Document Reference 6.2), health outcomes are not assigned a significance and are therefore not reported in this table. The human health assessment only allows for adverse or beneficial effects, rather than significance.

¹⁴ An Appropriate Assessment (AA) is required under the Conservation of Habitats and Species Regulations 2017 (as amended) if a proposed plan or project is considered likely to have a significant effect on a protected habitats site (either individually or in combination with other plans or projects).

¹⁵ Waste Minimisation Statement (November 2012) available on the Documents page for application 12/01256/OUT on the Tewkesbury Borough Council Planning portal online:

<https://publicaccess.tewkesbury.gov.uk/online-applications/applicationDetails.do?activeTab=documents&keyVal=MFJ9HVQD0AJ00>

¹⁶ Environment Agency. Remaining landfill capacity: England as at end 2018

<https://www.gov.uk/government/publications/environment-agency-conditional-licence/environment-agency-conditional-licence>