

A417 Missing Link  
TR010056

6.2 Environmental Statement  
Chapter 11 Noise and Vibration

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APFP Regulation 5(2)(a)  
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(Applications: Prescribed Forms  
and Procedure) Regulations 2009**

**A417 Missing Link**

Development Consent Order 202[x]

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**6.2 Environmental Statement  
Chapter 11 Noise and Vibration**

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# 11 Noise and vibration

## 11.1 Introduction

- 11.1.1 This Environmental Statement (ES) chapter reports the potential effects from the construction and operation of the A417 Missing Link (the scheme, as detailed in ES Chapter 2 The project (Document Reference 6.2)) on noise and vibration, following the methodology set out in the Design Manual for Roads and Bridges (DMRB), *LA 111 Noise and vibration*<sup>1</sup>. Annex E/1 of this Standard provides instruction on how to take account of Government Noise policy when assessing road schemes.
- 11.1.2 This chapter details the methodology followed for the assessment, summarises the regulatory and policy framework related to noise and vibration and describes the existing environment in the area surrounding the scheme. Following this, the mitigation and the assessment of residual effects associated with the scheme are discussed, along with the limitations of the assessment. An assessment of Population and Human Health is provided in ES Chapter 12 Population and Human Health (Document Reference 6.2).
- 11.1.3 An explanation of technical terms is given in ES Appendix 11.1 Glossary of acoustic terminology (Document Reference 6.4).

## 11.2 Competent expert evidence

- 11.2.1 The Noise and vibration lead expert holds a Diploma in Acoustics and Noise Control and an MSc in Acoustics and Noise Control. They are a Member of the Institute of Acoustics. Full details are provided in ES Appendix 1.2 Competent expert evidence (Document Reference 6.4).

## 11.3 Legislative and policy framework

### Legislation

#### The Environmental Noise (England) Regulations 2006

- 11.3.1 These Environmental Noise (England) Regulations enact the requirements for Noise Action Planning to promote good health and good quality of life (wellbeing) through the effective management of noise. The latest 2018 amendment to the Regulations provides for new common noise assessment methods for five-yearly Action Plans.
- 11.3.2 Regulation 15(1)(a) of The Environmental Noise (England) Regulations 2006 is amended by The Environment (Amendment etc.) (EU Exit) Regulations 2019 which now state action plans must:
- Aim to prevent and reduce environmental noise where necessary and particularly where exposure levels can induce harmful effects on human health.
  - Aim to preserve environmental noise quality where it is good.

#### Control of Pollution Act 1974

- 11.3.3 The Control of Pollution Act gives the Local Authority powers to control construction site noise. This may include specific controls to restrict certain activities identified as causing particular problems. Conditions regarding hours of

operation will generally be specified and noise and vibration limits at certain locations may be applied in some cases. All requirements must adhere to established guidance and be consistent with best practicable means to control noise and vibration only as far as is necessary to prevent undue disturbance.

#### Land Compensation Act 1973

- 11.3.4 The Land Compensation Act Part 1 entitles property or landowners to apply for compensation if the value of their property goes down because of pollution or disturbance from the use of a new or altered road<sup>2</sup> - this includes for reasons of increased noise.

#### Noise Insulation Regulations 1975

- 11.3.5 The Noise Insulation Regulations (NIR) define the conditions under which dwellings are eligible for noise insulation to control internal noise levels. The conditions relate to the level of traffic noise at the façade, the increase in noise levels as a result of the highway, and the contribution of the new or altered project to the noise level received at the façade. In summary, noise insulation qualification criteria require that:

- The façade noise threshold of 68dB<sub>L<sub>pA10,18h</sub></sub> is met or exceeded.
- There must be a noise increase of at least 1dB(A) compared to the prevailing noise level immediately before the works to construct or improve the highway were begun.
- The noise caused by traffic on new or altered roads makes an effective contribution of at least 1dB(A).
- The property is 300m or less from the nearest point on the carriageway of a highway to which the Regulations apply.

#### **National policy**

- 11.3.6 The Government's noise policy is set out in the Noise Policy Statement for England (NPSE)<sup>3</sup>. In legislative and policy terms, noise is taken to include vibration.
- 11.3.7 Government noise policy sets three aims, which are to be met within the context of Government policy on sustainable development:
- To avoid significant adverse impacts on health and quality of life.
  - To mitigate and reduce adverse impacts on health and quality of life.
  - Where possible, contribute to the improvement of health and quality of life.
- 11.3.8 The same three aims are also reflected in:
- The National Planning Policy Framework (NPPF)<sup>4</sup>.
  - Planning Practice Guidance – Noise (PPG-Noise)<sup>5</sup>.
  - The National Policy Statement for National Networks (NPSNN)<sup>6</sup>.
- 11.3.9 PPG-Noise provides guidance on the application of Government noise policy. PPG-Noise notes that unacceptable adverse effects on health and quality of life due to noise exposure (set at a level higher than significant adverse impacts on health and quality of life) should be 'prevented'<sup>7</sup>.
- 11.3.10 Thresholds for identifying adverse effect levels in terms of Government noise policy<sup>8</sup> are not clearly defined numerically in NPSE, NPPF, PPG-Noise, or

NPSNN. The threshold values adopted for this assessment were taken from DMRB Standard for noise assessment - LA 111. These are set out in section 11.4 Assessment methodology (Assessment Criteria - Paragraph 11.4.29).

11.3.11 Particular requirements of the NPSNN in relation to noise are summarised in Table 11-1.

**Table 11-1 Relevant NPSNN policies for applicant's noise and vibration assessment**

Relevant NPSNN paragraph reference	Requirement of the NPSNN	Where in the chapter is information provided to address this policy.
5.186	NPSNN states that excessive noise can impact on the '...use and enjoyment of areas of value (such as quiet <i>places</i> ) and areas with high landscape quality'.	Section 11.10 Assessment of effects, - 'Non-residential sensitive receptors', paragraph 11.10.27 (construction) and paragraph 11.10.93 (operation).
5.187	Noise resulting from a proposed development can also have adverse impacts on wildlife and biodiversity. Noise effects of the proposed development on ecological receptors should be assessed in accordance with the Biodiversity and Geological Conservation section of this National Policy Statement (NPS).	The noise impact data from this assessment has been used in ES Chapter 8 Biodiversity (Document Reference 6.2).
5.188	NPSNN notes that the degree of noise impact will depend on the:  'proximity of the proposed development to quiet places and other areas that are particularly valued for their tranquillity, acoustic environment or landscape quality such as National Parks, the Broads or Areas of Outstanding Natural Beauty'; and  'the proximity of the proposed development to designated sites where noise may have an adverse impact on the special features of interest, protected species or other wildlife.'	Section 11.10 Assessment of effects, - 'Non-residential sensitive receptors', paragraph 11.10.27 (construction) and paragraph 11.10.93 (operation).  The effects of noise and vibration on ecological receptors have not been included in this chapter. However, the noise impact data from this assessment has been used in ES Chapter 8 Biodiversity (Document Reference 6.2).
5.189	Where a development is subject to Environmental Impact Assessment (EIA) and significant noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment, which should form part of the environment statement:  <ul style="list-style-type: none"> <li>• a description of the noise sources including likely usage in terms of number of movements, fleet mix and diurnal pattern. For any associated fixed structures, such as ventilation fans for tunnels, information about the noise sources including the</li> </ul>	Section 11.5 Assessment assumptions and limitations.

Relevant NPSNN paragraph reference	Requirement of the NPSNN	Where in the chapter is information provided to address this policy.
	<p>identification of any distinctive tonal, impulsive or low frequency characteristics of the noise. <i>[continued below]</i></p>	
	<ul style="list-style-type: none"> <li>• identification of noise sensitive premises and noise sensitive areas that may be affected.</li> </ul>	‘Value of receptor’, paragraph 11.4.3
	<ul style="list-style-type: none"> <li>• the characteristics of the existing noise environment.</li> </ul>	Section 11.7 Baseline conditions
	<ul style="list-style-type: none"> <li>• a prediction on how the noise environment will change with the proposed development: <ul style="list-style-type: none"> <li>○ in the shorter term such as during the construction period;</li> <li>○ in the longer term during the operating life of the infrastructure; and</li> <li>○ at particular times of the day, evening and night as appropriate.</li> </ul> </li> </ul>	<p>Construction: paragraph 11.10.8,</p> <p>Operation: paragraph 11.10.79, ES Appendix 11.4 Assessment Locations and Noise Prediction Results (Document Reference 6.4).</p> <p>Above sections describe day and night effects</p>
	<ul style="list-style-type: none"> <li>• an assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas.</li> </ul>	<p>Construction: paragraph 11.10.8</p> <p>Operation: 11.10.80, Table 11-23</p>
	<ul style="list-style-type: none"> <li>• measures to be employed in mitigating the effects of noise. Applicants should consider using best available techniques to reduce noise impacts.</li> </ul>	<p>Section 11.9 Design, mitigation and enhancement measures, and</p> <p>Construction: paragraph 11.10.52</p> <p>Operation: paragraph 11.10.107</p>
5.190	The potential noise impact elsewhere that is directly associated with the development, such as changes in road and rail traffic movements elsewhere on the national networks, should be considered as appropriate.	Areas within 50m of other non-scheme road links beyond 600m from new or altered scheme roads with the potential to experience short-term Basic Noise Level (BNL) change of more than 1dB(A) in the short term or 3dB(A) in the long term, paragraph 11.6.12.
5.191	Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. The prediction of road traffic noise should be based on the method described in <i>Calculation of Road Traffic</i>	‘Magnitude of impacts’, Construction: paragraph 11.4.5 Operation: paragraph 11.4.13



Relevant NPSNN paragraph reference	Requirement of the NPSNN	Where in the chapter is information provided to address this policy.
	<p><i>Noise</i>. The prediction of noise from new railways should be based on the method described in <i>Calculation of Railway Noise</i>. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies.</p>	
5.192	<p>The applicant should consult Natural England with regard to assessment of noise on designated nature conservation sites, protected landscapes, protected species or other wildlife. The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account.</p>	<p>The noise impact data from this assessment has been used in ES Chapter 8 Biodiversity (Document Reference 6.2).</p>
5.193	<p>Developments must be undertaken in accordance with statutory requirements for noise. Due regard must have been given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government's associated planning guidance on noise.</p>	<p>'Assessment of significance', paragraph 11.4.29</p>
5.194	<p>The project should demonstrate good design through optimisation of scheme layout to reduce noise emissions and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission.</p>	<p>'Operation mitigation', paragraph 11.9.6</p>
5.195	<p>The Secretary of State should not grant development consent unless satisfied that the proposals will meet, the following aims, within the context of Government policy on sustainable development:</p> <ul style="list-style-type: none"> <li>• avoid significant adverse impacts on health and quality of life from noise as a result of the new development;</li> <li>• mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and</li> <li>• contribute to improvements to health and quality of life through the effective management and control of noise, where possible.</li> </ul>	<p>Paragraph 11.10.122 and Table 11-25 Scheme compliance with Government policy.</p>

Relevant NPSNN paragraph reference	Requirement of the NPSNN	Where in the chapter is information provided to address this policy.
5.198	<p>Mitigation measures for the project should be proportionate and reasonable and may include one or more of the following:</p> <ul style="list-style-type: none"> <li>• engineering: containment of noise generated;</li> <li>• materials: use of materials that reduce noise, (for example low noise road surfacing);</li> <li>• lay-out: adequate distance between source and noise-sensitive receptors; incorporating good design to minimise noise transmission through screening by natural or purpose built barriers; and</li> <li>• administration: specifying acceptable noise limits or times of use (e.g., in the case of railway station Public Address systems).</li> </ul>	<p>Section 11.9 Design, mitigation and enhancement measures, and</p> <p>Construction: paragraph 11.10.52</p> <p>Operation: paragraph 11.10.107</p>
5.199	<p>For most national network projects, the relevant Noise Insulation Regulations will apply. These place a duty on and provide powers to the relevant authority to offer noise mitigation through improved sound insulation to dwellings, with associated ventilation to deal with both construction and operational noise. An indication of the likely eligibility for such compensation should be included in the assessment. In extreme cases, the applicant may consider it appropriate to provide noise mitigation through the compulsory acquisition of affected properties in order to gain consent for what might otherwise be unacceptable development. Where mitigation is proposed to be dealt with through compulsory acquisition, such properties would have to be included within the development consent order land in relation to which compulsory acquisition powers are being sought.</p>	<p>'Noise insulation eligibility', paragraph 11.10.114</p>
5.200	<p>Applicants should consider opportunities to address the noise issues associated with the Important Areas as identified through the noise action planning process.</p>	<p>'Noise important areas', paragraph 11.10.105</p>

## Local policy

11.3.12 Table 11-2 sets out local policy requirements and key considerations for residential communities and the Cotswolds Area of Outstanding Natural Beauty (AONB).

**Table 11-2 Local planning and environmental policies and strategies**

Local policy document	Extract relevant to noise and vibration assessment
Cotswold District Local Plan 2011 to 2031 <sup>9</sup>	<p>Policy EN15 Pollution and Contaminated Land</p> <p>‘1. Development will be permitted that will not result in unacceptable risk to public health or safety, the natural environment or the amenity of existing land uses through:</p> <p>a. pollution of the air, land, surface water, or ground water sources; and/or,</p> <p>b. generation of noise or light levels (pollution), or other disturbance such as spillage, flicker, vibration, dust or smell.’</p> <p>Clause 10.15.5 under EN15: ‘Noise should not give rise to significant adverse impacts on health and quality of life. Acceptable noise levels will vary according to the source, receptor and time, and the policy is not intended to unduly restrict existing established businesses which may need to develop.’</p>
Gloucester, Cheltenham and Tewkesbury Joint Core Strategy (JCS) 2011-2031 (December 2017) <sup>10</sup>	<p>Policy SD4: Design Requirements</p> <p>‘iii. Amenity and space;</p> <p>New development should enhance comfort, convenience and enjoyment through assessment of the opportunities for light, privacy and external space, and the avoidance or mitigation of potential disturbances, including visual intrusion, noise, smell and pollution.’</p>
Draft Tewkesbury Borough Plan 2011-2031 <sup>11</sup>	<p>Policy ENV1 Special Landscape Areas</p> <p>‘Proposals must demonstrate that they do not adversely affect the quality of the natural and built environment, its visual attractiveness, wildlife and ecology, or detract from the quiet enjoyment of the countryside.’</p>
Cotswolds Conservation Board AONB Management Plan 2018-2023 <sup>12</sup>	<p>Outcome 6 (Tranquillity):</p> <p>‘The tranquillity of the Cotswolds AONB will have been conserved and enhanced, with fewer areas being affected by noise pollution and other aural and visual disturbance.’</p> <p>Policy CE4: Tranquillity</p> <p>‘1. Proposals that are likely to impact on the tranquillity of the Cotswolds AONB should have regard to this tranquillity, by seeking to (i) avoid and (ii) reduce noise pollution and other aural and visual disturbance.</p> <p>2. Measures should be taken to enhance the tranquillity of the Cotswolds AONB by (i) removing and (ii) reducing existing sources of noise pollution and other aural and visual disturbance.’</p>

Local policy document	Extract relevant to noise and vibration assessment
	‘Policy CE4 has an emphasis on noise. This incorporates issues such as significant increases in traffic in the towns, villages and smaller settlements of the AONB, including increased traffic arising from developments outside of the AONB.’
Cotswolds AONB Position Statement (2019) on Dark Skies & Artificial Light <sup>13</sup> :	The Position Statement cites the Government’s Rural White Paper published in 2003 which observed that: “It is not just its physical features which give the countryside its unique character; there are also less tangible features such as ... dark skies and remoteness from the visible impact of civilisation.” The White Paper went on to state that: “Increased measures will be taken to promote tranquillity”. Influences on tranquillity in the countryside identified in the White Paper included light pollution.’
Cotswolds AONB Position Statement (2016) on Development in the setting of the Cotswolds AONB <sup>14</sup> :	Position Statement (2016) on Development in the setting of the Cotswolds AONB.
Cotswolds AONB Position Statement (2015) on Public Rights of Way (PRoW) <sup>15</sup> :	‘Development proposals that affect views into and out of the AONB need to be carefully assessed to ensure that they conserve and enhance the natural beauty and landscape character of the AONB.’ ‘The level of harm from any proposal does [...] have to be considered and expressed in terms of: (i) harm directly to land in the designated AONB itself which is the significant issue and (ii) [...] harm to land outside the designated AONB that is viewed in the context or backdrop of the AONB.’ Position Statement (2015) on Public Rights of Way ‘Highway Authorities have a duty to have regard to the purposes of AONB designation and all the councils have endorsed the Cotswolds AONB Management Plan.’ ‘Highway authorities also have a duty to prepare a Rights of Way Improvement Plan (ROWIP). The ROWIP, some of which are now part of the authorities’ Local Transport Plan, must consider what the current and likely future needs of the public are, and present proposals for how the authority will improve the network to meet those needs.’ ‘The public rights of way network is the main way for residents and visitors to explore and enjoy the Cotswolds and is important to the area’s economy. The Board therefore expects to see a safe, pleasant, well maintained, clearly waymarked and better-connected PRoW network available for all, making the Cotswolds AONB a place for positive, high quality experiences. An adequate network is needed for walkers, cyclists (on- and off-road), horse riders and carriage drivers.’
Cotswolds AONB Position Statement (2019) on Tranquillity (2019) <sup>16</sup>	The Position Statement makes multiple recommendations to preserve and enhance tranquillity in the Cotswolds AONB. Tranquillity is defined, in part, as ‘a state of calm and quietude’ that is ‘free from man-made noise’. Tranquillity is ‘one of the features of the Cotswolds that makes the area so outstanding that it is in the nation’s interest to safeguard it.’ The Statement notes that tranquillity is the basis for the enjoyment of other

Local policy document	Extract relevant to noise and vibration assessment
	<p>special qualities in the AONB and cites survey evidence that tranquillity ranks number 1 as the quality people value in the countryside.</p> <p>The Position Statement expands the Cotswolds AONB Management Plan 2018-202, Policy CE4 (Tranquillity), which states that proposals impacting on tranquillity should '(i) avoid and (ii) reduce noise pollution and other aural and visual disturbance', as well as enhance the tranquillity of the AONB by '(i) removing and (ii) reducing existing sources of noise pollution'.</p> <p>With regard to highway noise, the recommendation aligns closely with the Government's NPSE and associated policy documents (see paragraph 11.3.5):</p> <p>'The Board recommends that Highways England and other highways authorities should ensure that highway schemes within the Cotswolds AONB support the aims of the NPSE:</p> <ul style="list-style-type: none"> <li>• To avoid significant adverse noise effects</li> <li>• To mitigate and reduce adverse noise effects</li> <li>• To improve the noise environment where possible'</li> </ul> <p>Additionally, a recommendation is made about noise levels on minor roads since significant noise levels can be generated by higher traffic levels and/or larger, noisier vehicles such as HGVs (heavy goods vehicles):</p> <p>'The Board recommends that proposals that have the potential to affect the tranquillity of minor roads should assess baseline and anticipated noise levels on such roads.</p>

## Guidance and standards

11.3.13 Details of relevant noise and vibration guidance and standards considered as part of the assessment in this ES chapter have been provided in ES Appendix 11.5 Noise and Vibration Guidance and standards (Document Reference 6.4). The key documents referred to in this assessment are:

- Design Manual for Roads and Bridges *LA 111, Noise and Vibration, Revision 2*, (2020)
- *Calculation of Road Traffic Noise*, HMSO (1988)
- *WebTAG environmental impacts worksheets* (2019)
- BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014 *Code of practice for noise and vibration on construction and open sites*
- BS 7385-2: 1993 *Evaluation and measurement for vibration in buildings – Guide to damage levels from groundborne vibration*
- BS ISO 4866: 2010 *Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures*

## 11.4 Assessment methodology

11.4.1 The assessment methodology is outlined in this section.

11.4.2 ES Appendix 4.5 Changes to scope and methodology (Document Reference 6.4) outlines the changes in scope and methodology since the submission of the Scoping Report in May 2019.

### Value of receptor

11.4.3 In addition to residential receptors, LA 111 identifies a range of non-residential properties as noise sensitive, which should also be considered in the assessment. These include hospitals, healthcare facilities, education facilities, community facilities, designated quiet areas, international and national or statutorily designated sites, PRow and cultural heritage assets.

11.4.4 LA 111 does not specifically assign levels of sensitivity to different types of noise sensitive receptor. However, sensitivity has been considered in the assessment based on the use of the receptor, and the context of the impact (e.g. times of use of the receptor), as is common practice for noise assessment. For example, schools would have low sensitivity to noise at night when they are typically not used, or sensitivity to noise might be increased if a building is regularly used by people with hearing impairments, where speech intelligibility might be affected (as noted in paragraph 3.49 and 3.50 of LA 111). LA 111 notes that assessment criteria shall be modified where it is proportionate and merited by local circumstances.

### Magnitude of impacts

#### Construction noise

11.4.5 The noise assessment from the construction of the scheme has been determined according to LA 111 which makes reference to BS 5228–1:2009+A1:2014<sup>17</sup>. This standard provides information on the prevention and control of construction noise and includes a procedure for predicting construction noise. Calculations of noise levels at selected receptors have been based on typical noise levels for

construction processes (mainly taken from BS 5228). Calculations also take account of propagation distance, details of the intervening ground cover, and topography and screening.

- 11.4.6 The assessments have been undertaken at locations of individual receptors, or at locations that may be representative of several dwellings or other sensitive receptors. For groups of properties, receptors have been chosen which are representative of the worst-case (most exposed) location in the group of properties. Where a receptor has multiple uses the assessment has been made based on the most sensitive use.
- 11.4.7 Construction noise levels have been predicted as the logarithmic average noise level over the daytime or night-time assessment period as an  $L_{Aeq,T}^{18}$ . The predictions consider the likely variation in the working area for the period assessed. The assessment results present the range of noise levels (according to the range of construction activities) for a specified assessment location.
- 11.4.8 The predictions are presented as façade levels relating to a position one metre from the building, or as a free-field<sup>19</sup> level for sensitive receptors in open spaces such as country parks, outdoor amenity areas or some heritage assets. The assessment considers the range of typical noise levels at sensitive receptor locations, but construction noise levels would vary day-to-day.
- 11.4.9 Construction activity would mainly take place during the daytime but there would be occasional work at night during full road closures where it is required to work on, or over, a carriageway, e.g. installing or removing traffic management measures or installing the temporary Bailey bridge for access to the crusher and material stockpile compound. A night-time noise assessment has been undertaken for these activities for the closest receptors to where they would occur.
- 11.4.10 Once impacts have been determined, consideration has been given as to whether these impacts could be significant, taking into account the likely duration of the impact based on the temporal criteria for construction described in LA 111.

#### Construction vibration

- 11.4.11 Groundborne vibration during the construction of the scheme may potentially arise due to the use of compaction plant or rock-breaking machinery. Impacts at sensitive receptors would be dependent on their proximity to the works, the intensity with which the equipment is operated and the intervening ground conditions.
- 11.4.12 BS 5228–2:2009+A1:2014 provides a methodology for predicting typical levels of vibration from certain types of construction activities, based on case study data and empirical models. This has been used where appropriate to consider the likelihood that vibration from the works may exceed the thresholds for perception and disturbance.

#### Operational noise

- 11.4.13 Traffic noise level calculations were carried out according to LA 111 which makes reference to the Calculation of Road Traffic Noise (CRTN)<sup>20</sup> methodology. Noise levels were calculated across a grid of receptor positions over the study area to produce contours of noise level exposure. Additional calculations were also conducted at specific assessment locations to represent noise sensitive receptors

(e.g. residential properties). The study area is defined in LA 111 and described in paragraph 11.6.1 and shown in ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3). The noise contours shown on ES Figure 11.1 study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3) are representative of the noise levels at 4 metres above local ground level (i.e. first-floor level for a typical house, generally worst case in terms of exposure to noise from the highway).

- 11.4.14 The traffic data used in the model were those forecasted under the 'Do-Something' and 'Do-Minimum' scenarios in the opening year and those in the future assessment year (long term). In this case taken as 2026 for opening year, and 2041 for the future assessment year.
- 11.4.15 The traffic modelling approach and data verification is described in the Combined Modelling and Appraisal Report (Document Reference Volume 7.6).
- 11.4.16 For the purposes of this assessment, the  $L_{A10,18h}$  results are converted to the corresponding  $L_{Aeq}$  scale for daytime noise, i.e.  $L_{Aeq,16h}$  (see Glossary in ES Appendix 11.1 Glossary of Acoustic Terminology (Document Reference 6.4)). This provides a direct comparison with the quantitative  $L_{Aeq}$  criteria described later for assessing significance with respect to the Government's noise policy (NPSE). The  $L_{Aeq,16h}$  scale has also been adopted for traffic noise assessment as part of the Government's WebTAG<sup>21</sup> methodology for environmental impact assessment (EIA), which has been undertaken alongside the ES (Document Reference 6.2).
- 11.4.17 Baseline noise survey results and the baseline noise survey report (Appendix 11.2 Baseline noise survey results (Document Reference 6.4)) have been reviewed to provide indicative data to inform the predicted noise exposure across the study area.
- 11.4.18 The assessment has considered short-term and long-term noise impacts as described in LA 111. The long-term change (i.e. with-scheme 2041 (Do-Something) vs without-scheme 2026 (Do-Minimum)) is the likely worst-case considering traffic growth that represents the permanent effect of the scheme. The Do-Minimum 'future assessment' year (i.e. 2041) was also considered to determine whether any effects identified are as a consequence of traffic growth.
- 11.4.19 Eligibility for sound insulation measures under the NIR<sup>22</sup>, as referenced in LA 111, has been considered to identify any residential dwellings that would potentially qualify under the Regulations.

#### Operational night-time noise

- 11.4.20 The LA 111 methodology requires that night-time noise is also assessed. The  $L_{night}$  descriptor is used to represent the noise level at dwellings between the hours of 23:00 and 07:00. A procedure known as 'Method 3' from the Transport Research Laboratory (TRL) report PR/SE/451/02<sup>23</sup> was used for predicting  $L_{night}$  noise levels. Method 3 uses daily traffic flow data converting predicted daytime noise levels ( $L_{A10,18h}$ ) to night-time noise levels. This method was considered appropriate as there was nothing atypical in the proportionate traffic flow volumes for this route between daytime and night-time<sup>24</sup>.
- 11.4.21 The assessment of impact magnitude for night-time noise follows the same method as that for daytime.



## Assessment of significance

### Approach to assessment of effects – all sources and receptors

- 11.4.22 The method for identifying likely significant effects of noise and vibration from construction and operation of the scheme, as required by the EIA Regulations, is aligned with LA 111 and Government noise policy.
- 11.4.23 It follows from Government noise policy NPSE, PPG-Noise and NPSNN that thresholds should be set to define the onset of the following levels of effect:
- Significant Observed Adverse Effect Levels (SOAEL) to identify the onset of significant impacts on health and quality of life.
  - Lowest Observed Adverse Effect Levels (LOAEL) to identify the onset of adverse impact on health and quality of life.

### Significant adverse effects on health and quality of life

- 11.4.24 Where the calculated noise or vibration exceeds the relevant SOAEL threshold – criteria defined in Table 11-3 to Table 11-10, then this is assessed as a likely significant adverse effect at each receptor<sup>25</sup>. Above the SOAEL threshold, such noise levels are perceived as '*present and disruptive*' according to the assessment framework given in PPG-Noise. The NPSE states that these effects should be *avoided*.

### Adverse effects on health and quality of life

- 11.4.25 The assessment also identifies likely adverse effects where the calculated noise or vibration is less than the SOAEL but greater than the relevant LOAEL. Between these thresholds, such noise levels are perceived as '*present and intrusive*' according to the assessment framework given in PPG-Noise. The NPSE states that these effects should be *mitigated and reduced to a minimum*.
- 11.4.26 These effects may be identified in this assessment as likely significant adverse effects. This describes effects at lower noise exposures that are an adverse impact on health and quality of life and are assessed as significant in the EIA, but which are not significant in terms of Government noise policy (paragraph 11.4.23).
- 11.4.27 In this case, the basis for determining a likely significant effect is primarily the change in noise caused by the scheme, with consideration of other factors such as the existing level of noise exposure, and the noise sensitive parts of the receptor that are affected.
- 11.4.28 The LA 111 criteria used to assess the significance of effects (adverse and beneficial) for different receptor types and noise exposure levels are described under 'Assessment criteria', from paragraph 11.4.29.

### Assessment criteria

- 11.4.29 The assessment uses criteria as set out in LA 111 that responds to the requirements of:
- Government policy set out in NPSE, NPPF, NPSNN and PPG- Noise.
  - Relevant regulations, guidance and standards.
  - Best practice as set by previous relevant projects.

### Construction noise assessment criteria

- 11.4.30 Potential adverse effect thresholds in Government policy terms have been established based upon LA 111 which refers to the ABC method described in BS5228-1:2009+A1:2014. These thresholds, described in Table 11-3, have been used to establish assessment criteria for construction noise levels. The numerical thresholds for the ABC method are defined in Table 11-4. These criteria have been used to derive LOAEL and SOAEL thresholds for this assessment. Note that although BS5228-1 only sets out these thresholds as an example for residential receptors, LA 111 requires them to be used for all types of receptor.

**Table 11-3 LOAEL and SOAEL thresholds for construction noise at all receptors in terms of Government policy (from LA 111)**

Time period	LOAEL	SOAEL
Day (07:00-19:00 weekday and 07:00-13:00 Saturdays)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1 (see below)
Night (23:00-07:00)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228-1 Section E3.2 and Table E.1
Evening and weekends (time periods not covered above)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS 5228:2009 + A2014 section E3.2 and Table E.1

- 11.4.31 The threshold of potential adverse effect described in Table E.1 of BS5228-1 according to the ABC method is reproduced in Table 11-4.

**Table 11-4 Threshold of potential significant effect at dwellings according to ABC method (from Table E.1, BS 5228–1:2009 + A1:2014)**

Assessment category and threshold value period	Threshold value, dB(A)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Other: Weekday evenings (19:00 – 23:00) Saturdays (13:00 – 23:00) Sundays (07:00 – 23:00)	55	60	65

Category A: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are less than these values  
Category B: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are the same as Category A values  
Category C: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are higher than Category A values.

- 11.4.32 Using the LA 111 methodology, the construction noise impact level is determined from Table 11-5.

**Table 11-5 Magnitude of impact and construction noise descriptions (from LA 111)**

Magnitude of impact	Construction noise level
Major	Above or equal to SOAEL +5dB
Moderate	Above or equal to SOAEL and below SOAEL +5dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

11.4.33 Construction traffic BNL increases have been calculated for roads within the construction traffic study area. The magnitude of impact is then determined using Table 11-6.

**Table 11-6 Magnitude of impact for construction traffic noise (from LA 111)**

Magnitude of impact	Increase in Basic Noise Level (BNL) of closest public road used for construction traffic (dB)
Major	Greater than or equal to 5.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0

11.4.34 For diversion routes used at night, a major magnitude of impact for construction noise impact is determined at any noise sensitive receptors within the diversion route study area<sup>26</sup>.

11.4.35 From LA 111, construction noise and construction traffic noise is taken as a significant effect for all noise sensitive receptors where it is determined that a major or moderate magnitude of impact would occur for a duration exceeding:

- Ten or more days or nights in any 15 consecutive days or nights; or
- A total number of days exceeding 40 in any six consecutive months.

*Construction vibration assessment criteria*

11.4.36 BS 5228-2:2009+A1:2014<sup>27</sup>, section B2 and Table B.1, states that Peak Particle Velocity (PPV) vibration levels are considered to be an appropriate vibration parameter to be used when considering construction vibration, and the Standard provides guidance upon the 'instantaneous' human response to vibration in buildings in terms of overall vibration velocity levels (Table 11-7)<sup>28</sup>. These criteria have been used to derive LOAEL and SOAEL thresholds for this assessment.

**Table 11-7 LOAEL and SOAEL thresholds of likely effects of vibration for building occupants (from LA 111, derived from BS 5228-2:2009+A1:2014)**

Time period	LOAEL	SOAEL	Notes
All time periods	0.3mm/s PPV	1.0mm/s PPV	LOAEL is set at the lowest level at which vibration may be perceptible in residential environments. SOAEL is set where levels can be tolerated with prior warning (ref BS5228:2).

11.4.37 Using the LA 111 methodology, the construction vibration impact level is determined from Table 11-8.

**Table 11-8 Magnitude of impact and vibration level (from LA 111)**

Magnitude of impact	Construction noise level
Major	Above or equal to 10mm/s
Moderate	Above or equal to SOAEL and below 10mm/s PPV
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

11.4.38 Construction vibration is taken as a significant effect for all vibration sensitive receptors where it is determined that a major or moderate magnitude of impact would occur for a duration exceeding:

- Ten or more days or nights in any 15 consecutive days or nights; or
- A total number of days exceeding 40 in any six consecutive months.

11.4.39 Risk of damage to buildings from groundborne vibration is assessed using the criteria in Table 11-9. The criteria are derived from BS 5228 Part 2 and BS 7385, Part 2<sup>29</sup>. This ensures there is no risk of the lowest damage category ('cosmetic') being exceeded, as defined in BS ISO 4866<sup>30</sup>. However, effects in terms of even cosmetic damage to buildings would occur only for vibration exposures much higher than the lowest perceptible levels.

**Table 11-9 Vibration impact criteria for buildings (conservative criteria below which there is no risk of cosmetic damage)**

Category of building	Peak particle velocity <sup>1</sup> (mm/s)	
	Transient <sup>2</sup> vibration	Continuous <sup>3</sup> vibration
Potentially vulnerable building	6	3
Structurally sound buildings	12	6

Notes:  
<sup>1</sup> At the building foundation  
<sup>2</sup> Transient relative to building response e.g. from percussive piling  
<sup>3</sup> Continuous relative to building response e.g. from vibratory piling, vibrating rollers

#### *Operational noise assessment criteria*

11.4.40 Adverse effect levels have been set in accordance with DMRB LA 111 which references Government noise policy (including NPPF, NPSE, NPSNN, and PPG-Noise). The thresholds also relate to the guidance from the World Health Organization (WHO) Guidelines for Community Noise<sup>31</sup>, WHO Night Noise Guidelines for Europe<sup>32</sup>, WHO Environmental Noise Guidelines<sup>33</sup>, the NIR 1975, and best practice from other projects. These criteria have been used to derive LOAEL and SOAEL thresholds for this assessment as shown in Table 11-10.

**Table 11-10 Operational noise LOAELs and SOAELs for all receptors (from LA 111)**

Time period	LOAEL	SOAEL	Notes
Day (06:00-24:00)	55dB <sub>L<sub>A10,18h</sub></sub> (façade)	68dB <sub>L<sub>A10,18h</sub></sub> (façade)	The daytime LOAEL is based on the onset of moderate community annoyance, and the daytime SOAEL is based on the onset of cardiovascular health effects (ref. WHO Guidance <sup>34</sup> ) and the NIR threshold.
	50dB <sub>L<sub>Aeq,16h</sub></sub> (free-field)	63dB <sub>L<sub>Aeq,16h</sub></sub> (free-field)	

Time period	LOAEL	SOAEL	Notes
Night	40dB <sub>L<sub>Aeq,8hr</sub></sub> L <sub>night,outside</sub> (free-field)	55dB <sub>L<sub>Aeq,8hr</sub></sub> L <sub>night,outside</sub> (free-field)	The night time LOAEL is defined using the WHO Night Noise Guidelines, and the night time SOAEL is equivalent to the levels above which cardiovascular health effects become the major public health concern (ref. WHO Night Noise Guidelines).

- 11.4.41 The magnitude of the impact and effect caused by short-term and long-term change in noise levels attributable to the scheme is evaluated in accordance with Table 11-11 and Table 11-12 respectively.

**Table 11-11 Magnitude of noise impact in the short-term (from LA 111)**

Noise change [dB(A)]	Magnitude of impact in the short-term
0	No change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5.0 +	Major

**Table 11-12 Magnitude of noise impact in the long-term (from LA 111)**

Noise change [dB(A)]	Magnitude of impact in the long-term
0	No change
0.1 – 2.9	Negligible
3.0 – 4.9	Minor
5.0 – 9.9	Moderate
10.0 +	Major

- 11.4.42 The initial assessment of likely significant effect on noise sensitive buildings is determined using Table 11-13.

**Table 11-13 Initial assessment of operational noise significance (from LA 111)**

Significance	Short term magnitude of change
Significant	Major
Significant	Moderate
Not significant	Minor
Not significant	Negligible

- 11.4.43 For noise sensitive receptors where the magnitude of change in the short term is minor, moderate or major at noise sensitive buildings, Table 11-14 shall be used, together with the output of Table 11-13 to determine final significance.

**Table 11-14 Determining final operational significance on noise sensitive buildings (from LA 111)**

Assessment factor	Local circumstance	Influence on significance judgement
1	Noise level change (is the magnitude of change close to the minor to moderate boundary?)	1) Noise level changes within 1 dB of the top of the 'minor' range can indicate that it is more appropriate to determine a likely significant effect. Noise level changes within 1 dB of the bottom of a 'moderate' range can indicate that it is more appropriate to consider a change is not a likely significant effect.
2	Differing magnitude of impact in the long term and/or future year to magnitude of impact in the short term	1) Where the long term impact is predicted to be greater than the short term impact, it can be appropriate to conclude that a minor change in the short term is a likely significant effect. Where the long term impact is predicted to be less than the short term it can be appropriate to conclude that a moderate or major change in the short term is not significant.  2) A similar change in the long term and non-project noise change can indicate that the change is not due to the project and not an indication of a likely significant effect.
3	Absolute noise level with reference to LOAEL and SOAEL (by design this includes sensitivity of receptor)	1) A noise change where all do-something absolute noise levels are below SOAEL requires no modification of the initial assessment.  2) Where any do-something absolute noise levels are above the SOAEL, a noise change in the short term of 1.0dB or over results in a likely significant effect.
4	Location of noise sensitive parts of a receptor	1) If the sensitive parts of a receptor are protected from the noise source, it can be appropriate to conclude a moderate or major magnitude change in the short term and/or long term is not a likely significant effect.  2) Conversely, if the sensitive parts of the receptor are exposed to the noise source, it can be more appropriate to conclude a minor change in the short term and/or long term is a likely significant effect.  3) It is only necessary to look in detail at individual receptors in terms of this circumstance where the decision on whether the noise change gives rise to a significant environmental effect is marginal.
5	Acoustic context	1) If a project changes the acoustic character of an area, it can be appropriate to conclude a minor magnitude of change in the short term and/or long term is a likely significant effect.
6	Likely perception of change by residents	1) If the project results in obvious changes to the landscape or setting of a receptor, it is likely that noise level changes will be more acutely perceived by the noise sensitive receptors. In these cases it can be

Assessment factor	Local circumstance	Influence on significance judgement
		<p>appropriate to conclude that a minor change in the short term and/or long term is a likely significant effect.</p> <p>2) Conversely, if the project results in no obvious changes for the landscape, particularly if the road is not visible from the receptor, it can be appropriate to conclude that a moderate change in the short term and/or long term is not a likely significant effect.</p>

- 11.4.44 For residential receptors where noise impacts occur in areas below the LOAEL, there would be no noise effect in Government policy terms (Table 11-12). However, there could be noise effects in EIA terms for certain cases in very quiet, rural settings. This aligns with the requirement in LA 111 to consider ‘changes to the landscape or setting’, as referred to in the final row of Table 11-14. The absence of man-made sound is a factor (amongst other aspects of the setting) in assessing areas as having a particularly tranquil character. Tranquillity is assessed as part of ES Chapter 7 Landscape and visual effects (Document Reference 6.2). The tranquillity assessment has been used to identify any residential areas below the LOAEL considered in this assessment to have particular sensitivity in the AONB setting with regard to noise and other impacts.
- 11.4.45 The Campaign to Protect Rural England<sup>35</sup> (CPRE) defines tranquillity as follows:  
*‘The quality of calm experienced in places with mainly natural features and activities, free from disturbance from manmade ones.’*
- 11.4.46 Another definition of tranquillity is given in the Cotswolds Conservation Board Position Statement on Tranquillity<sup>36</sup>:  
*‘Tranquillity is a state of calm and quietude associated with peace, experienced in places with mainly natural features and/or historic character, free from man-made noise and other aural and visual disturbance.’*
- 11.4.47 CPRE use a ‘national relative tranquillity’ scale as a measure of the various positive and negative factors contributing to or detracting from the tranquillity character of an area. For the scheme study area, CPRE tranquillity maps have been reproduced in Figure 7.8 CPRE tranquillity mapping (Document Reference 6.3) of ES Chapter 7 Landscape and visual effects (Document Reference 6.2). These maps have been used to identify any residential receptors in the noise impact study area with relatively high tranquillity character, and any such receptors are assessed as special cases when considering noise impact below the LOAEL in any particularly sensitive settings.
- 11.4.48 Outdoor sensitive receptors in very quiet locations, such as PRoW below the LOAEL, where the existing environment is characterised by little or no appreciable man-made sound sources, may be considered rare in the national context. Hence, these outdoor amenity receptors may be assessed as special cases in the AONB.

### Stakeholder engagement

- 11.4.49 A request was made to Gloucestershire County Council, Tewkesbury District Council, and Cotswold District Council to respond to consultation on the methodology and any noise and vibration sensitivities within the study area. The



Highways England noise specialist spoke with the Environmental Health Officer (EHO) at Tewkesbury District Council to explain the assessment methods (i.e. DMRB LA 111). The EHO at Tewkesbury District Council reported that they accepted the assessment approach. A written response was also obtained from Cotswold District Council, which is the local authority area within which the larger part of the scheme would be, including the major realignment around Birdlip to the west of the proposed scheme, and Cowley and Coberley to the east. These consultation exchanges are described in the Statement of Common Ground with Joint Councils (Document Reference 7.3 Statement of Commonality).

- 11.4.50 The Cotswold District Council response noted that for construction noise and vibration, control criteria may be imposed in Prior Consent applications under the Control of Pollution Act 1974. The Development Consent Order (DCO) would secure the agreed control criteria as part of the Environmental Management Plan (EMP) (ES Appendix 2.1 EMP (Document Reference 6.4)). The contractor will seek to obtain consents from the relevant local authority under Section 61 of the Control of Pollution Act 1974.
- 11.4.51 As part of this agreement, details of construction activities will be discussed with the relevant local authorities, prior to and during the construction works. This agreement will include prediction and evaluation methods, location of sensitive receivers, the resulting noise and vibration levels, and mitigation controls.
- 11.4.52 The application for a Section 61 consent will require noise (and where appropriate vibration) assessments to be undertaken and Best Practicable Means (BPM) measures set out to manage noise associated with construction of the scheme.
- 11.4.53 The Council's requirements for construction working hours are commonly 8:00-18:00 Monday-Friday, 8:00-13:00 Saturday. Any concessions to these hours for particular activities where out-of-hours work is essential, would be controlled through the Control of Pollution Act 1974 'Prior consent' applications. Cotswold District Council noted in particular that the code of practice to be developed by the applicant for construction works should include the following considerations:
- The parking of vehicles for site operatives and visitors.
  - The loading and unloading of plant and materials.
  - The storage of plant and materials used in constructing the development.
  - The erection and maintenance of security hoarding including decorative displays.
  - Wheel washing facilities.
  - Measures to control the emission of dust and dirt during construction.
  - A scheme for recycling or disposing of waste resulting from demolition and construction works.
- 11.4.54 For operational noise assessment, Cotswold District Council noted that the DMRB highway noise assessment methodology (LA 111) would be appropriate to assess noise effects to noise sensitive receptors potentially impacted by the scheme.
- 11.4.55 The Planning Inspectorate (PINS) was consulted during the scoping stage and provided an opinion<sup>37</sup> (ES Appendix 4.1 The Planning Inspectorate Scoping Opinion (Document Reference 6.4)). PINS responses have been considered and included, where appropriate, in this chapter.
- 11.4.56 The PINS Scoping Opinion noted the requirement to comply with the relevant guidance and planning policy in relation to noise and vibration assessment. PINS



highlighted the need to consider cultural heritage assets and Special Areas of Conservation (SAC) within the AONB. Also, in combination effects with respect to 'effects to landscape and tranquillity' should be considered, and the combined effects 'to the settings of cultural heritage assets'. These requirements are included in the assessment. Table 11-1 describes national policy requirements for noise and describes where each aspect of the policy is considered in this assessment.

- 11.4.57 The required guidance and standards (as set out in DMRB LA 111) that have been used for assessment of highway noise are described in ES Appendix 11.5 Noise and Vibration Guidance and standards (Document Reference 6.4). Noise impacts at Cultural heritage assets such as Crickley Hill Camp, Crickley Hill SSSI, Emma's Grove, Beechwood Special Areas of Conservation and the Peak, have been considered as part of the assessment. Landscape and tranquillity and the combined effects of noise on setting are considered in the assessment (paragraph 11.4.44).
- 11.4.58 During the 2019 statutory consultation, comments were received from stakeholders that the 2019 Preliminary Environmental Information (PEI) report had not included noise assessment results for Cowley and Coberley, both to the east of the study area. For the ES, these areas have been fully included in the assessment and are shown on the noise contour mapping (ES Figures 11.1 - 11.4 (Document Reference 6.3)). The revised DMRB assessment methodology (LA 111) for determining the noise study area is summarised in paragraph 11.6.11.

## 11.5 Assessment assumptions and limitations

### Construction

- 11.5.1 Assumptions have been developed as to the type and number of construction plant and the intensity and duration of the construction processes for the scheme. These data have been based on the construction activities that would be required for the various stages of the scheme (excavation, earthworks and structures, among others). Data have also been used from similar highway construction works where appropriate detailed construction method data was available. This data has been reviewed with the construction logistics specialists to reflect the appropriate scale of works for each part of the scheme. This includes locations of key areas of intensive works (with regard to noise and vibration, such as piling works for structures and mitigation opportunities). The assumptions are shown in ES Appendix 11.3 Construction plant machinery (Document Reference 6.4).
- 11.5.2 The Development Consent Order (DCO) would secure the requirement, via the EMP (ES Appendix 2.1 EMP (Document Reference 6.4)) for the contractor to develop a noise and vibration management plan (NVMP) during detailed design, which would provide more detailed information on construction plant, durations and mitigation measures. However, the current construction method assumptions are considered to be representative of the scale and intensity of the works, and these are suitable for this ES.
- 11.5.3 Key assumptions and limitations of the prediction method are shown in Table 11-15, together with likely implications.

**Table 11-15 Key assumptions, limitations and implications for the construction assessment**

Assumption or limitation	Implication for assessment
<p>Working hours would be restricted to 07:30 to 18:00 Mondays to Fridays and 08:00 to 13:00 on a Saturday except for activities requiring a full carriageway closure (see Section 2.8 of this ES for further details).</p> <p>For activities outside of standard working hours, an assessment has been made for the most sensitive period for noise (night-time between 23:00 and 08:00) and separate assessments of the impacts during weekend daytimes and weekday/weekend evenings are not explicitly set out.</p>	<p>For a small increase in daytime hours up to twelve hours (07:00 to 19:00) it is unlikely that there would be additional significant effects, as the assessment undertaken uses reasonable worst-case percentage on-times for construction plant. If works extended into the more sensitive evening period, there would be an increased risk of significant effects. Section 61 consents, as described in the EMP (ES Appendix 2.1 EMP (Document Reference 6.4)) would be used to control the permitted hours of working to avoid this situation.</p> <p>For the times when night-working is required, as included in this assessment, impacts would likely be lower for the evening and weekend period and therefore the night-time assessment of impacts and effects is taken as the worst-case.</p>
<p>It has been assumed that works along the trace of the proposed scheme (e.g. cuttings, earthworks) will be undertaken by gangs working at 100m centres. For each receptor, the noise from three gangs has been summed to give the total level. A correction has been made for each gang working over a traverse length of 50m per day.</p>	<p>Noise levels affecting any individual receptor will vary throughout the day and from day to day, however, this approach is considered to best represent the method of undertaking the works.</p>
<p>BS 5228 Part 1 does not provide a method to account for the additional sound attenuation (reduction) due to intervening soft ground, in the mobile plant on a haul road calculation (Annex F, Section 2.5.2). It has been assumed that beyond 100m the excess attenuation due to soft ground would be at least 3dB (as per static BS 5228 calculation equivalent).</p>	<p>The assumption has been included to avoid large overprediction of impacts from the haul road at some distance from the scheme. Alternative methods of prediction (e.g. CRTN) would indicate larger excess soft ground attenuation at 100m and, in all prediction methods, the excess attenuation would be greater with increasing distance. This is, therefore, considered a conservative assumption.</p>

- 11.5.4 The effects of noise and vibration on ecological receptors have not been included in this chapter. However, the noise impact data from this assessment has been used in ES Chapter 8 Biodiversity (Document Reference 6.2). This is a requirement of the NPSNN. Heritage conservation assets have been included in the assessment of noise impacts, and noise is also considered as part of a wider assessment of the scheme impacts on these receptors in ES Chapter 6 Cultural heritage (Document Reference 6.2).

#### Uncertainty

- 11.5.5 The assessment has been undertaken assuming that construction works on site would start in 2023. The baseline noise condition has been determined using the operational traffic (CRTN) noise prediction model based on the expected scheme opening year traffic for 2026. Given the high flows on the A417 in this area, and the absence of other noise sources, it is unlikely that the baseline condition in 2023 would differ substantially relative to the predicted baseline (i.e. Do-minimum) noise levels in 2026.

- 11.5.6 The construction assessment is necessarily based on conservative assumptions at this stage in the design, e.g. generic plant noise levels from BS 5228–1:2009+A1:2014 combined with high assumed percentage on-times during the working day. This conservative approach may overstate the likely impacts and effects. For receptors in very close proximity to the works, when works are at their closest approach, noise levels may be temporarily higher than predicted but over the average day/week, it is expected that noise levels would be lower than predicted and this would have no effect on the conclusions of significant effect reported in this ES.
- 11.5.7 As already stated, the temporal thresholds have considered a worst-case situation for this assessment and therefore it is unlikely that impacts would worsen as a result in a programme change, however, if the rate of progression of some activities were to be much slower than assumed, then temporal thresholds may be met for more activities. It is very unlikely that this would affect any receptors that are not currently predicted to experience a significant effect from one or more activities and would be managed via the controls already set out in the EMP.
- 11.5.8 All reasonably foreseeable night-time working has been considered (see 11.10.41 to 11.10.42). An increase in duration and/or frequency of night-time working (e.g. due to unplanned or emergency conditions) could give rise to new significant effects where noise levels are elevated for periods longer than currently envisaged which could, in turn, result in an exceedance of the ten nights in 15 temporal threshold. If this possibility arose, it would be managed in close liaison with the local authority following the protocols set out in the EMP.

### **Operation**

- 11.5.9 Road traffic flows and speeds used in the assessment were provided by the scheme traffic specialists for all the assessment scenarios. The traffic forecasting is in line with the current guidance. The traffic forecasting includes the impact of any additional traffic on the highway network associated with any expected new developments in the region in the assessment years.
- 11.5.10 Lower noise surface would be laid on all new and altered roads in the scheme. The noise performance of this new road surface, described in LA 111 as the Road Surface Influence, would be a correction of -3.5dB compared with a conventional hot rolled asphalt surface. It is assumed that, lower noise surface is already laid in the Do-Minimum baseline year (2026).
- 11.5.11 The scheme design is landscape-led to reduce visual and landscape impacts to the special character of the Cotswolds AONB. Landscape earthworks proposed for the scheme are assumed as an integrated part of the permanent scheme - refer to ES Chapter 2 The project (Document Reference 6.2). These features, embedded with additional earthwork bunding specifically included for noise mitigation, would reduce wayside noise. The locations alongside the scheme are indicated in ES Figure 11.2 operational noise contour map - future assessment year (2041) (Document Reference 6.3).

### **Limits of deviation (LoD)**

- 11.5.12 The LoD have been established and are defined in Chapter 2: The project (Document Reference 6.2).

- 11.5.13 For the limits of deviation from the reference alignment, the potential changes in noise level are negligible and would not change the assessment results. Noise changes larger than this would only occur where the roadside screening (for example from bunds or barriers) would be altered relative to the highway as a result of the change in alignment. This change in screening would not occur for the proposed design, and as is common practice for highway scheme assessment, these limits of deviation would not alter the noise propagation geometries sufficiently to affect the assessment conclusions.

## 11.6 Study area

- 11.6.1 The determination of the assessment study area (as shown in ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3)) has been based on the methodology in DMRB LA 111; these requirements are described below. Following the latest DMRB, the study differs slightly from that proposed in the Scoping Report which followed the DMRB methodology at the time (i.e. Volume 11, Section 3, Part 7 Noise and Vibration, HD213/11) (please refer to ES Appendix 4.5 Changes to scope and methodology (Document Reference 6.4)). LA 111 allows for the study area to be extended where considered appropriate according to the needs of the assessment and stakeholder expectations, as described below.

### Construction

- 11.6.2 For construction noise and vibration, the study area shall include all noise sensitive receptors:
- that are potentially affected by construction noise or vibration;
  - in areas where there is a reasonable stakeholder expectation that a construction noise or vibration assessment will be undertaken.

### Noise

- 11.6.3 LA 111 notes that a study area of 300 metres from the closest construction activity is normally sufficient to encompass noise sensitive receptors, although variations in the study area can be defined for individual projects. BS 5228 (referenced within LA 111) notes that the prediction results should be treated with caution at distances greater than this.
- 11.6.4 For this assessment the study area was extended to the north to include National Star College and Crendon House and to the east to include the outskirts of Cowley in response to concerns raised by stakeholders.
- 11.6.5 LA 111 requires that a diversion route study area be defined where a project requires full carriageway closures during the night (23:00-07:00) to enable construction works to take place. LA 111 states that the study area shall include a 25 metre width from the kerb line of the diversion route.
- 11.6.6 The Traffic Management Plan (Annex B Construction Traffic Management Plan of ES Appendix 2.1 EMP (Document Reference 6.4)) sets out the planned diversions routes. One diversion route via A46-A40-B4075-A435-A436 would be used when the A417 is closed between the A46 and Air Balloon roundabout, and a diversion route via A436-A40-A429 would be used when the A417 is closed between Air Balloon roundabout and Burford Road interchange. The noise study area has been defined to include receptors within 25 metres of these routes.

- 11.6.7 LA 111 specifies that a construction traffic study area shall be defined to include a 50 metre width from the kerb line of public roads with the potential for an increase in BNL<sup>38</sup> of 1dB(A) or more as a result of the addition of construction traffic to existing traffic levels.
- 11.6.8 No increases of 1dB(A) or more are expected as a result of additional construction traffic and therefore no study area has been defined for this element.

### Vibration

- 11.6.9 LA 111 notes that a study area of 100 metres from the closest construction activity with the potential to generate vibration is normally sufficient to encompass vibration sensitive receptors. However, variations in the study area can be defined for individual projects.
- 11.6.10 Vibration impacts were calculated at the same set of receptors as for the construction noise assessment although only those within 300m of the works are presented in the report.

### **Operation**

- 11.6.11 The assessment procedure requires that an operational noise<sup>39</sup> impact study is defined to include:
- Noise sensitive receptors that are potentially affected by operational noise changes generated by the scheme, either on the route of the scheme or other roads not physically changed by the scheme.
  - Noise sensitive receptors in areas where there is a reasonable stakeholder expectation that noise assessment is undertaken<sup>40</sup>.
- 11.6.12 For most schemes the following areas are suitable, but LA 111 notes that the assessor can reduce or extend this such that it is proportionate to the risk of likely significant effects:
- The area within 600 metres of new road links or road links physically changed or bypassed by the scheme.
  - The area within 50 metres of other road links with potential to experience a short term BNL change of more than 1dB(A) in the short term or 3dB(A) in the long term, as a result of the scheme.
- 11.6.13 For this assessment the study area was extended to the east to include Cowley and Coberley in response to concerns raised by residents.

## **11.7 Baseline conditions**

### **Current baseline**

- 11.7.1 Noise or vibration sensitive locations have been identified for inclusion in the assessment across the study area (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3)). Surveys have been carried out at sufficient locations to represent noise sensitive areas alongside the scheme. The noise survey was carried out in accordance with the 'Shortened measurement procedure', described in paragraph 43 of CRTN (survey procedures and locations are described in ES Appendix 11.2 Baseline noise survey results (Document Reference 6.4)). The baseline survey

locations are shown in ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3).

- 11.7.2 It is assumed that local noise conditions would not change substantively between the survey period and the commencement of proposed works as there are no major developments of a scale that might be expected to increase or reduce local noise levels within the study area. Any additional traffic on the highway network associated with more distant developments is included in the traffic forecasts used for the assessment.
- 11.7.3 The baseline noise conditions (i.e. Do-Minimum) for the operational traffic assessment have been determined by the CRTN noise prediction model for a forecast traffic scenario of 2026. This has provided a detailed coverage of noise levels across the entire study area.
- 11.7.4 LA 111 requires that noise level calculations are carried out to compare noise changes between the Do-Minimum and Do-Something scenarios to assess the impact of the scheme.
- 11.7.5 ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3) shows the locations of the noise receptors (dwellings and other noise sensitive properties) and their proximity to the Existing A417 and the surrounding roads. The predicted traffic noise level contours for the operational baseline year (i.e. Do-Minimum 2026 for the noise assessment) are also shown so that the relative baseline noise exposures of the different sensitive receptors can be seen. Noise Important Areas<sup>41</sup> (NIA) – see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3) are shown to identify dwellings in areas of relatively high noise exposure recognised by Defra.
- 11.7.6 The following sections summarise the noise sensitive receptor locations across the scheme area in the context of baseline noise levels. The locations are described using the chainage references for the scheme alignment. The following sections should be read with reference to ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3).

### **Bentham to Air Balloon roundabout – Ch 0+000 to Ch 2+100**

- 11.7.1 At the western extent of the scheme corridor, the improved highway would follow the existing alignment along the Brockworth bypass. The study area for the noise assessment extends beyond the western end of the scheme to include dwellings in Witcombe to the south-west and a recently established housing development to the north-west near to the Bentham Country Club. There are also scattered dwellings which lie either side of the highway within approximately 50-150 metres.
- 11.7.2 Moving east from Ch 1+500 to Ch 2+100, the scheme alignment ascends towards Air Balloon roundabout. Crickley Hill Country Park lies approximately 700 metres to the west of the Air balloon roundabout where the hillside rises steeply from the highway, to a height of approximately 60 metres above the Existing A417. The Cotswold Way National Trail runs on the top of this escarpment and approximately parallel with the A417 highway.
- 11.7.3 The peak of Crickley Hill is approximately in line with Ch 1+500. At this point the Cotswold Way National Trail is located approximately 160 metres to the north-west of the A417. ES Figure 11.1 Study area, sensitive receptors and baseline

assessment noise contour map (2026) (Document Reference 6.3) shows that existing noise levels are in the range 62.5-65.0dB  $L_{Aeq,16hr}$  along this section of the footpath. As the Cotswold Way National Trail continues toward Air Balloon roundabout, it descends progressively lower and closer to the scheme. The boundary of Crickley Hill Country Park is close to the existing highway alignment. At Ch 2+000 the Cotswold Way National Trail is around 10 metres from the existing highway.

- 11.7.4 ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3) shows that existing noise levels are in the range 72.5-75.0dB  $L_{Aeq,16hr}$  along this section of the footpath. The Country Park is used by the public as an outdoor amenity destination; there are popular footpaths through the woodland and grassland areas. There are picnics areas and there is a visitor centre. The Country Park also has Site of Special Scientific Interest (SSSI)<sup>42</sup> and scheduled monument (SM) designations (Crickley Hill Camp). To the south of the highway the ground also rises steeply on approach to the roundabout with a residential property approximately 100 metres from the highway.
- 11.7.5 There are four Noise Important Areas identified on this section at residential locations close to the highway, as shown on ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3) (NIAs 3906, 3907, 3908 and 13915).

#### **Air Balloon roundabout to Cowley junction– existing alignment**

- 11.7.6 From the Air Balloon roundabout, the Existing A417 runs south to the east side of Birdlip (approximately 250 metres away) with the Cotswold Way National Trail running along the top of the escarpment with the Barrow Wake viewpoint beside the road. Just to the east of the A417 on the Gloucestershire Way long distance footpath is Emma's Grove (a scheduled monument consisting of a group of three round barrows, known collectively as Emma's Grove). There are scattered dwellings at various locations within approximately 50-150 metres from the highway between the Air Balloon and Cowley junction roundabouts. The Peak, a Neolithic enclosure and heritage asset (although not a designated SM), is north-west of Birdlip approximately 900 metres west of the Existing A417. Stockwell is approximately 400 metres north-east of the Existing A417 with a network of footpaths on either side of the highway.
- 11.7.7 There is one Noise Important Areas identified on this section at a residential location approximately 350 metres north-west of the Cowley junction, as shown on ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3) (NIA 3905).

#### **Air Balloon roundabout to Cowley junction– proposed re-alignment – Ch 2+100 to Ch 5+760**

- 11.7.8 The scheme corridor would continue east of the Air Balloon roundabout (Ch 2+150), turning south-east between Birdlip Radio Station and Rushwood Kennels and Cattery (Ch 3+000). There are a few dwellings within 200 metres of the scheme on this section. The Gloucestershire Way long distance footpath is presently aligned north-west to south-east in this locality and would be crossed by the scheme corridor (Ch 2+750). Currently, this point on the footpath is approximately 700 metres from the Existing A417 alignment, hence noise levels are between 40.0 and 45.0dB  $L_{Aeq,16hr}$  for much of this section.



- 11.7.9 Moving south-east, the scheme corridor passes approximately 300 metres north of Stockwell through open grassland with no dwellings within several hundred metres towards the point where it would reconnect with the Existing A417 at Cowley junction. Existing noise levels around the various footpaths in this area range from 42.5 to 50.0dB  $L_{Aeq,16hr}$  between Ch 3+000 and Ch 5+000, and gradually increasing to 55dB  $L_{Aeq,16hr}$  at the closest footpath to Cowley junction.
- 11.7.10 There is a Noise Important Area identified on this section of the study area at residential locations close to the highway on the A436, north-east of the scheme, as shown on ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3) (NIA 13196) – Laurel Cottage and Lychett Cottage (The Grove and Crendon House are close by but are not within the NIA area).

### Future baseline

- 11.7.11 As set out in ES Chapter 4 Environmental assessment methodology (Document Reference 6.2), the 'Do-Minimum' and 'Do-Something' scenarios have been set out, with the 'Do-Minimum' scenario representing the future baseline with minimal interventions and without new infrastructure. Potential changes to noise and vibration receptors in the future are not considered sufficient to affect the assessment, i.e. there would be no large changes to topography or large noise-screening structures. Receptor groups are unlikely to be different to those identified in the baseline text above. The exception to this is committed residential development at the west end of the study area, north and south of the Brockworth bypass which has been included in the noise model to represent the future baseline scenario. In all other respects, the future baseline would remain the same as set out in above.

## 11.8 Potential impacts

- 11.8.1 Mitigation measures incorporated in the design and construction of the scheme are reported as embedded mitigation in ES Chapter 2 The project (Document Reference 6.2) and essential mitigation in Section 11.9 Design, mitigation and enhancement measures. Prior to the implementation of mitigation, the scheme has the potential to have noise and vibration impacts during construction and operation, both beneficially and adversely.

### Construction impacts

- 11.8.2 The construction works would include a major area of earthworks cut and fill in the northern part of the scheme which is likely to be the area of most prolonged works, lasting for a total of 24 months over a 30 month period between November 2023 and April 2026. There are three areas of proposed junction works including a grade-separated junction at Shab Hill, each lasting between six and nine months. Away from the major earthworks and junctions, the new or improved carriageway works would progress more rapidly.
- 11.8.3 Noise impacts and effects are likely due to several phases of the works including cutting, major earthworks and road construction works. Short duration vibration impacts are possible where dwellings are close to earthworks compaction or rock breaking activities, depending on the particular methods used.



## Operation impacts

- 11.8.4 Operational noise adverse impacts would largely be as a result of the scheme road alignment changes, rather than as a result of future traffic growth associated with the scheme. Hence, there is potential for significant adverse changes near the proposed new sections of highway, and potential for significant beneficial effects where it is proposed to remove existing highway. The greatest adverse impacts would occur where the scheme would be much closer to nearby noise sensitive receptors than the existing highway. Where the distance between the highway and receptor is halved (or even closer), there is the potential for significant adverse effects. Minor changes in alignment, particularly where the receptors are some distance from the existing highway, would be less likely to result in impacts as the proportionate change in distance would be small. Conversely, there are locations where the scheme would be substantially further from receptors such that there is the potential for significant beneficial effects.

## 11.9 Design, mitigation and enhancement measures

### Embedded mitigation

- 11.9.1 The scheme has been designed, to avoid and prevent adverse environmental effects resulting from noise and vibration impacts through the process of design development and consideration of good design principles. Embedded mitigation measures for noise and vibration impacts are reported as part of the scheme description in ES Chapter 2 The project (Document Reference 6.2).

### Essential mitigation

#### Construction

- 11.9.2 The construction noise and vibration assessments assume that the works would be undertaken following the principles and processes set out in ES Appendix 2.1 EMP (Document Reference 6.4). The EMP includes a commitment for a Noise and Vibration Management Plan (NVMP) to be prepared. The EMP outlines that the NVMP must include the requirement to undertake noise and vibration monitoring, to ensure compliance with agreed threshold levels.
- 11.9.3 Residents would be advised of the nature and likely duration of vibratory works ahead of them taking place. For the likely worst affected properties, vibration impacts would be managed. Trials would be conducted at the start of works to establish actual vibration levels at the nearest sensitive receptors and where necessary, alternative plant or methods would be utilized e.g. more passes with compaction plant operating in 'static' mode or use of lower vibration equipment. In either case there is a trade-off between the vibration level experienced and the time taken to complete the works (i.e. potentially lower vibration impacts for a longer duration). Details will be included in the Noise and Vibration Management Plan as outlined in ES Appendix 2.1 EMP (Document Reference 6.4).
- 11.9.4 BPM is assumed as embedded mitigation to control construction noise in the form of low noise emission plant and processes (as specified in BS 5228 Annex B - Noise sources, remedies and their effectiveness).
- 11.9.5 If situations arise where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in ES Appendix 2.1 EMP (Document Reference 6.4), the main contractors may offer noise insulation to affected properties, or

ultimately, temporary re-housing; however, it is not anticipated that the latter would be required for this scheme.

### Operation

- 11.9.6 The alignment of the scheme (horizontal and vertical) has been considered as part of the design factors to minimise noise impacts. In addition, noise mitigation described in Table 11-16 is included in whole, or in part for noise screening (earth bunds, Cotswold Walls and environmental barriers). This noise screening provision was integrated into the landscape and visual mitigation design and was informed by comments from 2019 and 2020 stakeholder consultations.
- 11.9.7 To ensure that mitigation is practicable and sustainable, the provision has been subject to the following tests:
- Stakeholder engagement and consultation responses.
  - Engineering practicability.
  - Consideration of noise benefit compared to cost of the mitigation.
  - Other environmental effects potentially caused by the mitigation (for example landscape or visual effects).

**Table 11-16 Noise mitigation measures for operation of the scheme**

<b>Location (See Figure 11.2 Operational noise contour map – future assessment year (2041) (Document Reference 6.3))</b>	<b>Indicative chainage</b>	<b>Indicative screening length (m)</b>	<b>Total effective screening height relative to road level (m)</b>	<b>Description (effective screening heights relative to road, including any cutting depth)</b>
Immediately north of Shab Hill junction (along northbound carriageway)	3+050 to 2+800	250	7.2 to 8.2	Variable height (6m to 7m) earth bund with 1.2m Stone Wall
Along the B4070, from Shab Hill Farm access road to Shab Hill junction underbridge	-	225	1.2	1.2m Stone Wall
Immediately north of Shab Hill junction (along southbound carriageway)	2+920 to 3+100	180	5 to 6	Variable height (5m to 6m) earth bund only
Alongside northbound carriageway through Shab Hill junction	3+190 to 3+030	160	2.0	2m Stone Wall
B4070 to Shab Hill junction	-	230	1.2	1.2m Stone Wall
Cowley overbridge to Shab Hill junction (along northbound carriageway)	4+020 to 3+290	730	4.2 to 10.2	Variable height (3m to 9m) earth bund with 1.2m Stone Wall
Shab Hill junction – East Dumbbell roundabout to southbound onslip	-	120	3.2 to 4.2	2m to 3m earth bund with 1.2m Stone Wall
Shab Hill junction to Cowley overbridge (along southbound carriageway)	3+380 to 4+020	640	3.2 to 6.2	Variable height (2m to 5m) earth bund with 1.2m Stone Wall
Cowley bridlepath overbridge to Cowley overbridge (along northbound carriageway)	4+685 to 4+100	585	4.2 to 10.2	Variable height (3m to 9m) earth bund with 1.2m Stone Wall
Cowley overbridge to Cowley bridlepath overbridge (along southbound carriageway)	4+050 to 4+720	670	3.2 to 9.2	Variable height (2m to 8m) earth bund with 1.2m Stone Wall

Location (See Figure 11.2 Operational noise contour map – future assessment year (2041) (Document Reference 6.3))	Indicative chainage	Indicative screening length (m)	Total effective screening height relative to road level (m)	Description (effective screening heights relative to road, including any cutting depth)
Cowley Lane bridlepath to Cowley junction (along southbound carriageway)	4+775 to 5+070	295	3.2 to 9.2	Variable height (2m to 8m) earth bund with 1.2m Stone Wall
Cowley junction eastern loop	5+200 to 5+350 (eastern loop)	160	11.2 to 13.2	Variable height (10m to 12m) earth bund with 1.2m Stone Wall
NIA 3906 (Crickley Cottage) (along eastbound carriageway)	0+518 to 0+598	80	3.5	3.5m Vertical Noise Barrier (Absorptive)
NIA 3907 (Fernbank) (along eastbound carriageway)	1+345 to 1+475	130	3.5	3.5m Vertical Noise Barrier (Reflective)

- 11.9.8 The EMP (ES Appendix 2.1 EMP (Document Reference 6.4)) would ensure implementation of operational noise controls. This would include verification of the effectiveness of any installed mitigation measures against the accepted design to ensure the performance is adequate.
- 11.9.9 Noise insulation would be offered if and where future noise levels exceed the noise level trigger value of  $68\text{dB}_{\text{pA}10,18\text{hr}}$  (façade) and the other requirements referred to in the NIR 1975. Confirmation of qualification for noise insulation would be made by the responsible authority before the scheme comes into operation, based on built information in accordance with the NIR. The DCO would secure these measures as part of the EMP (ES Appendix 2.1 EMP (Document Reference 6.4)).

### Enhancement

- 11.9.10 Further to the mitigation measures integrated along the length of the scheme to reduce adverse noise effects, consideration would be given to developing enhancements during detailed design of the scheme. For example, at detailed design, there may be opportunities to extend environmental screening (e.g. Cotswold walls) in certain areas if it can be shown that this would provide beneficial enhancements with regard to noise. It is likely this would not apply to extents of noise screening described in Table 11-16 which were identified specifically as optimal noise mitigation measures, and no further noise mitigation is considered to be practicable or beneficial.
- 11.9.11 Any such enhancement would have to be shown to be sustainable in terms of material resources and other impacts based on the criteria described in paragraph 11.9.7, particularly the landscape and visual impacts of any such measures.

## 11.10 Assessment of likely significant effects

- 11.10.1 This section presents the assessment of likely significant effects for construction and operation on residential and non-residential receptors. These are assessed in terms of direct and indirect effects exceeding the SOAEL, and between the LOAEL and SOAEL. The assessment of effects takes into account the potential impacts to each receptor following the implementation of embedded and essential mitigation measures to determine the significance of the residual effects.

## Construction effects

### Noise

- 11.10.2 Construction noise effects have been calculated based on reasonable worst-case assumptions taking into account the main construction activities, haul road traffic and compound locations and the likely durations and on-times of individual plant items. The assessment was based on the information available about the programme and construction methods, as well as the assumptions summarised in section 11.5 Assessment assumptions and limitations, Table 11-15 and ES Appendix 11.3 Construction plant machinery (Document Reference 6.4).
- 11.10.3 A crusher and material stockpile compound would be sited to the west of the main cutting at approximately Ch 2+500, which would house plant for the processing of excavated material. There would be 25 dump truck movements per hour associated with 'incoming' and 'outgoing' materials at this compound. The noise contribution from the processing plant and the construction vehicles on the scheme's haul roads has been included in the predictions shown below.
- 11.10.4 A Bailey bridge will be constructed at approximate Ch 2+100 for dump trucks to access the crusher and material stockpile compound. The noise contribution from vehicles on the Bailey bridge is included in the predictions, however, there is the potential for vehicles crossing the Bailey bridge to give rise to impact or tonal noise (from interaction of tyres with low slip surface) which could result in an increased adverse perception of the noise. Additional mitigation measures will be included in the Noise and Vibration Management Plan that will be prepared as required by the EMP (ES Appendix 2.1 EMP (Document Reference 6.4)). This is likely to include installing a stone bed surface over the low slip surface which will avoid tonal noise arising from tyre interactions and ensuring that the Bailey bridge is maintained throughout the works to avoid unnecessary movement causing impact noise. The Bailey bridge will also have plywood barriers to 2m height on either side of the bridge. The Bailey bridge will be delivered and removed from site in large prefabricated sections that bolt together, taking two days to erect and two days to dismantle.
- 11.10.5 There would also be two main scheme compounds and a number of other satellite compounds mainly housing welfare facilities and offices. Details of the compounds are provided in ES Chapter 2 The project (Document Reference 6.2). The main scheme compounds would be adjacent to Cowley junction and at the northern extent of the scheme adjacent to Bentham Lane overbridge. There is likely to be some noise from construction plant within the compounds, for example, from mobile plant starting up and leaving the compound in the mornings and then returning in the evenings as well as plant maintenance and refuelling. However, these events would only occur for a short duration during the start-up and shutdown periods. There would also be noise generated by material delivery vehicles to the scheme compounds. Given the locations of the compounds, in relation to the main works, and the existing high levels of road traffic noise from the A417, it is unlikely that noise from the scheme compounds would be significant at any receptors.
- 11.10.6 Some sections of the Existing A417 between Air Balloon roundabout and Cowley roundabout would be converted into a route for walkers, cyclists and equestrians (new PRoW). Works to remove the pavement would primarily be undertaken using a road planer. Whilst the road planing is a noisy activity, works would be expected to progress along the route by at least 75 metres per day. This rate of

progress would quickly pass by the closest residential properties to the nearest section of the old carriageway (Rose Cottage, The Old Pyke House, Birdlip View, Welwyn, Hillcot, The Cottage Catchbar, Purdey House, Pheasants Keep, Hawcote House and Highclere). The worst case predicted daily noise levels may just exceed 65dB  $L_{Aeq,12hr}$  and be considered a moderate impact but would only last for a few days at most, and would then reduce quickly as the works progressed further away. This work would not exceed the duration criteria for significant effects described in the methodology (paragraph 11.4.38). These works would therefore be unlikely to give rise to significant effects at individual receptors. It is not expected that these works would be undertaken concurrently with the main works and therefore would not change the quantitative assessment presented later in this section.

- 11.10.7 The northern part of Beechwood SAC is 300m from the nearest proposed partial carriageway removal and resurfacing works on the existing B4070 (which would be of short duration as described in previous paragraph for A417 pavement removal) and one kilometre from the main works. Due to the short duration of the B4070 works and the large distance from the main works, noise or vibration significant effects would not be expected at this receptor.
- 11.10.8 In the following assessment sections the impacts and likely significant effects during daytime construction works are considered first, followed by night-time.
- 11.10.9 For the purposes of the daytime assessment, the principle construction activities have been considered and divided into the following 14 activities associated with the overall work:
- site clearance, tree and vegetation removal
  - boundary fence
  - topsoil strip
  - cutting
  - drainage
  - subbase
  - surface water channel
  - pavement and surfacing
  - earthworks (minor);
  - earthworks (major)
  - structures (including piling)
  - stone crushing
  - road planing (removal of old surface)
  - haul road traffic
- 11.10.10 Table 11-17 presents predicted construction noise levels at each receptor (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3) for receptor locations for the construction assessment). These have been predicted using the methodology described in Paragraph 11.4.5 and are compared against the assessment criteria set out in paragraph 11.4.31 derived from predicted baseline noise levels<sup>43</sup>. Where the cell text is in grey italic font, the range of predicted construction noise levels is below the predicted baseline noise level and therefore below the LOAEL for construction noise (see criterion in Table 11-3). Where the text is in bold font, the highest predicted value exceeds the ABC potential significance threshold and therefore also exceeds the SOAEL for construction noise (Table 11-3).

- 11.10.11 The receptor locations represent noise sensitive locations closest to the proposed works that would be most affected.
- 11.10.12 LA 111 requires that significance of effect be determined based on whether a moderate or major impact is likely to endure for ten or more days in any consecutive 15 days, or 40 days in a consecutive six-month period at any individual receptor. The programmed durations for each activity which are predicted to produce a moderate or major impact are included in the discussion following the table.

**Table 11-17 Daytime construction noise assessment at residential and non-residential locations**

<b>Location</b> (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3))	<b>LOAEL (baseline noise level)<sup>1</sup></b> dBL <sub>Aeq,12hr</sub>	<b>SOAEL (ABC threshold)<sup>1,3</sup></b> dBL <sub>Aeq, 12hr</sub>	<b>Range of predicted daytime construction noise levels<sup>1</sup> dBL<sub>Aeq, 10hr</sub></b> (See note 2 under table for key to text style)
R1 Holly Brae	66	70	68 - <b>75</b>
R2 Crickley Court	71	75	71 - <b>81</b>
R3 Fernbank	76	Baseline	<i>72 - 82</i>
R4 Crickley Hill Visitor Centre	55	65	59 - <b>65</b>
R5 Crickley Ridge	62	65	<b>69 - 78</b>
R6 Four Winds	66	70	<i>60 - 67</i>
R7 Air Balloon Cottages	76	Baseline	<i>69 - 81</i>
R8 Emma's Grove	60	65	<b>68 - 74</b>
R9 National Star College	55	65	56 - 60
R10 Crendon House	65	70	<i>57 - 61</i>
R11 Barrow Wake House	57	65	58 - 64
R12 Birdlip Radio Station	44	65	<b>67 - 81</b>
R13 Rushwood Kennels	46	65	64 - <b>74</b>
R14 Shab Hill Farm	42	65	61 - <b>74</b>
R15 Stockwell Farm Barn	42	65	58 - 64
R16 Chestnut Cottage	44	65	56 - 59
R17 Nothill, Cowley	39	65	53 - 55
R18 Castle Hill Cottage	77	Baseline	<i>60 - 68</i>
R19 Keepers Cottages	41	65	56 - 60

<sup>1</sup> Noise level includes correction for façade acoustic reflection (i.e. noise level at 1 metre from façade) except at R8 Emma's Grove.

<sup>2</sup> Where the cell text is grey/italic, the range of predicted noise levels are below the LOAEL. Where the text is in bold font, the highest predicted value exceeds the ABC potential significance threshold and therefore exceeds the SOAEL for construction noise (Table 11-3)

<sup>3</sup> Where the baseline noise level is above BS 5228 Category C, the baseline noise level is the SOAEL threshold.

#### Residential receptors: effects exceeding the SOAEL during the day

- 11.10.13 The ABC potential significance threshold and therefore the SOAEL threshold would be exceeded during some activities at the following assessment locations and therefore are assessed as moderate or major impacts and are potentially significant dependent on the duration of impact. The number of receptors represented by each assessment location which are expected to exceed the SOAEL are shown in brackets:

- 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)

- 11.10.14 The following paragraphs describe the impacts, starting from the north-west end of the scheme where it links into A417 Brockworth bypass and moving to the southern end where it links in with the A417 south of Cowley. As construction is a new noise source introduced into the environment, all impacts are noise increases (i.e. adverse).
- 11.10.15 The proposed scheme is split into six construction zones. For the purposes of the construction noise assessment, the duration of each activity quoted below has been taken from the construction programme and refers to the duration for that activity in the zone closest to each receptor. In some cases, where a receptor is near the boundary between two construction zones, it may result in a longer duration for the activities at that receptor. As all of the receptors quoted below are affected by a moderate or major impact for a period of at least ten days, this would not affect the significance decision at any receptor.
- 11.10.16 R1 Holly Brae (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3)) has a predicted construction noise level of up to 5dB(A) above its significant effect threshold (SOAEL) of 70dB(A). The highest impact is predicted to occur during the drainage and subbase works being undertaken concurrently, however, this major impact is only expected to last for five days. The earthworks activities, occurring over a period of 50 days, are also predicted to exceed SOAEL resulting in moderate impacts at Holly Brae and nearby Spring Orchard (see magnitude of impact criteria in Table 11-5). Moderate impacts are also likely for receptors up to around 200m from the works affecting a further four residential receptors.
- 11.10.17 Receptor R2 Crickley Court has a predicted construction noise level of up to 6dB(A) above its significant effect threshold of 75dBL<sub>Aeq,day</sub>, with the worst-case impacts arising from activities to create the cutting being undertaken over 45 days. Subbase works are also predicted to exceed significance thresholds for a period of 40 days. This is assessed as a major impact at Crickley Court, Bramble Cottage, White Towers, Crickley Hill Farm and Crickley Hill Farm Cottage. Moderate impacts are likely at receptors beyond around 200m from these works affecting an additional 12 residential receptors.
- 11.10.18 Receptor R3 Fernbank has a predicted construction noise level up to 6dB(A) above its significant effect threshold of 76dBL<sub>Aeq,day</sub>, with the worst-case impacts arising from the subbase works being undertaken over a period of 40 days. Other activities exceeding SOAEL are site clearance (25 days), topsoil strip (20 days), cutting activities (45 days), earthworks activities (150 days) and drainage works (20 days). A major impact is assessed at Fernbank, The Willows (three dwellings), Grove Lodge, Half Acre, The Spinney, Haroldstone House and Haroldstone Lodge. Moderate impacts are likely at receptors beyond around 200m from these works, affecting an additional seven residential properties.



- 11.10.19 Receptor R5 Crickley Ridge has a predicted construction noise level of up to 12dB(A) above its significant effect threshold of 65dBL<sub>Aeq,day</sub>. The worst-case impacts at this receptor are predicted to arise from cutting activities which are likely to affect the receptor for 100 days. Site clearance (15 days), topsoil strip (12 days), drainage works (5 days), subbase works (10 days) and structures work (80 days) are also predicted to exceed SOAEL. This is assessed as a major impact.
- 11.10.20 Receptor R7 representing Nos.1 and 2 Air Balloon Cottages, is situated at approximately 15 metres from the new section of the Cold Slad connection to the proposed A436 roundabout and approximately 40 metres from the A417 mainline works. Its significance threshold of 76dBL<sub>Aeq,day</sub> is predicted to be exceeded by 5dB(A), with the highest impacts arising from the mainline cutting activities lasting for 100 days. High noise levels arising from activities being undertaken on the Cold Slad connection road are likely to be of shorter duration than those being undertaken on the A417 mainline. This is assessed as a major impact at Air Balloon Cottages (two dwellings).
- 11.10.21 The residential receptor represented by R13 Rushwood Kennels has a threshold for significant effects of 65dBL<sub>Aeq,day</sub>. The highest impacts at R13 are predicted to exceed the threshold by 9dB(A) and arise predominantly due to the activities for the construction of the new A436 alignment and new access road over a period of 350 days, together with concurrent cutting work further north over a period of 220 days and the adjacent construction of Shab Hill junction over a period of 230 days. Subbase works (30 days) are also predicted to exceed SOAEL. This is assessed as a major impact at this receptor.
- 11.10.22 Receptor R14, Shab Hill Farm is predicted to experience noise levels up to 9dB(A) above its significance threshold of 65dBL<sub>Aeq,day</sub>. The highest impact is predicted to occur during the drainage, subbase and surface water channel works being undertaken concurrently on the proposed B4070 link road for a period of 120 days. Other activities giving rise to impacts in excess of SOAEL are site clearance (10 days), topsoil strip (8 days) and cutting (220 days). This is assessed as a major impact at two residential receptors.
- 11.10.23 The predicted noise levels are above the SOAEL for longer than ten days in a consecutive 15 days for all receptors described in paragraphs 11.10.16 to 11.10.22 which is an indication of a temporary significant adverse effect above the SOAEL.

Residential receptors: direct effects between LOAEL and SOAEL

- 11.10.24 This section describes effects at lower noise exposures. The construction noise levels are predicted to exceed the LOAEL (existing ambient noise level) in some months, but not exceed the SOAEL at the following receptors:
- R6 Four Winds
  - R9 National Star College
  - R11 Barrow Wake House
  - R15 Stockwell Farm Barn and Cottages (8 dwellings)
  - R16 Chestnut Cottage (also Cottage Barn, Hill Barn and Cuckoopen Barn Farm)
  - R17 Nothill (representing the village of Cowley)
  - R19 Keepers Cottages (2 dwellings)



- 11.10.25 The construction noise levels at these receptors are below the SOAEL and therefore are assessed as minor impacts and not significant based on the LA 111 methodology.

Residential receptors: indirect effects

- 11.10.26 There are no indirect noise effects resulting from construction activities on the works sites. However, there is the potential for indirect effects (i.e. not directly from construction noise emissions from the scheme) as a result of diverted traffic during night-time road closures and this is considered starting at paragraph 11.10.48. No indirect effects are expected from construction traffic using public highways and this is dealt with in 11.10.40.

Non-residential receptors: direct effects above SOAEL

- 11.10.27 Receptor R1 is representative of St Peter's Church, Witcombe which is within 200m of the construction works and therefore a moderate impact is determined at this receptor (see paragraph 11.10.16 for further detail).
- 11.10.28 Receptor R4, Crickley Hill Visitor Centre, is some 325 metres from the works at the nearest point. The predicted highest monthly construction noise level is 65dB<sub>L<sub>Aeq, day</sub></sub>, as a result of activities to create the cutting, in combination with noise from the haul road. This is equal to the SOAEL and is therefore assessed as a moderate impact at this receptor. Neither of these activities in isolation would give rise to a moderate impact, however, there is the potential for the combined effect to last for 45 days and therefore this is assessed as a temporary significant adverse effect above the SOAEL.
- 11.10.29 Receptor R8 representing Emma's Grove (scheduled monument) is assessed as subject to a major noise impact affecting the scheduled monument. Predicted noise levels are up to 9dB(A) above the SOAEL due to activities to create the cutting, lasting for a period of 20 days. The assessment of whether the predicted noise impact on this cultural heritage resource would give rise to, or would contribute to, a likely significant effect, is reported in ES Chapter 6 Cultural Heritage (Document Reference 6.2).
- 11.10.30 Receptor R12 Birdlip Radio Station is located some 100 metres from the mainline works but is only 25 metres from the proposed Shab Hill junction slip roads. The highest impacts would occur during the earthworks (cut and fill) preparation for the construction of Shab Hill junction when noise levels would exceed the significance threshold by 15dB(A) for a period of 220 days. Other activities predicted to produce noise levels exceeding the threshold are site clearance (10 days), topsoil strip (8 days), drainage (40 days), subbase (30 days), surface water channel (30 days), pavement (30 days) and the construction of Shab Hill junction (230 days). This is assessed as a major impact at this receptor. It is understood that office accommodation is likely to be the most sensitive use (i.e. not acoustic studio uses). Given the noise level of the construction works and the estimated noise ingress, the likely effect at this receptor is assessed as a direct temporary significant adverse effect above the SOAEL.
- 11.10.31 Receptor R13 is discussed in detail in paragraph 11.10.21 under residential receptors. It also represents Rushwood Kennels and Cattery and the closest point on the Gloucestershire Way long distance footpath which are discussed below.

- 11.10.32 Rushwood Kennels and Cattery would be subject to construction noise affecting employees and other users of the facility for the durations as set out in paragraph 11.10.21. This is assessed as a major impact and consequently, a direct temporary significant adverse effect above the SOAEL.
- 11.10.33 Receptor R13 represents the closest point on the Gloucestershire Way long distance footpath (link ACY3<sup>44</sup> as shown on ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3)) at approximately 30 metres from the works on the proposed local access road and 85 metres from the proposed A436 works. Up to around 400 metres away from the construction works, the impacts would be above SOAEL (65dB<sub>L<sub>Aeq,day</sub></sub>) and therefore a major or moderate impact is determined for a 400 metre section of the Gloucestershire Way long distance footpath in link ACY3, reducing to a minor impact beyond this. The major/moderate impact area of the footpath is assessed as being a direct temporary significant adverse effect on the P<sub>RoW</sub> for link ACY3.
- 11.10.34 Similar temporary noise effects are likely to occur for other sections of footpath within approximately 400 metres of major excavation works. This would not apply at these distances for locations currently dominated by noise from major roads.
- 11.10.35 Significant adverse effects above the SOAEL are predicted at all receptors described in paragraphs 11.10.27 to 11.10.34.

Non-residential receptors: direct effects between LOAEL and SOAEL

- 11.10.36 Receptor R9, National Star College (also assessed as a residential receptor – paragraph 11.10.24), has buildings at around 480 metres from the construction works at the closest point. The predicted highest monthly construction noise level is up to 60dB<sub>L<sub>Aeq,day</sub></sub> at the closest buildings, as a result of a combination of activities along with the contribution from the construction haul road traffic. This is below the SOAEL but above the LOAEL for this receptor during some months. Relative to the ambient noise level of 55dB<sub>L<sub>Aeq,day</sub></sub> this is assessed as a minor impact and a not significant effect based on the LA 111 methodology. However, National Star College is an educational facility for young people with complex disabilities and therefore is considered especially sensitive to noise. With windows closed, internal noise levels within teaching spaces are likely to be acceptable throughout the construction period (dependent on glazing specification), although with windows open for ventilation there is more potential for disturbance.
- 11.10.37 The predicted highest construction noise level exceeds the ambient traffic noise at the closest building by 5dB. It is likely that other local noise sources, such as outdoor recreation or grass cutting, may currently exceed the ambient noise levels by similar margins at times throughout a typical day. However, given the noise sensitivity of certain parts of the College, mitigation measures to minimise construction noise impacts would be applied where it is agreed to be appropriate. The requirement for this will be based on an on-going review with the College to identify the most sensitive spaces such as teaching or therapy rooms. The predicted construction noise levels at those particular facades will be considered relative to existing noise sources in order to review, with the College, the potential for disturbance from construction work.
- 11.10.38 For sensitive rooms, where it is agreed to be appropriate, mechanical ventilation would be provided if not already fitted, such that windows can be closed if

construction noise is intrusive. With this mitigation in place, it is considered that internal noise would be adequately controlled during periods of the worst case construction noise. Further detail on the approach to determining these mitigation requirements and associated commitments is given in the ES Appendix 2.1 EMP (Document Reference 6.4).

#### Non-residential receptors: indirect effects

11.10.39 There are no indirect effects associated with the construction activities.

#### Construction traffic noise

11.10.40 During the most intensive construction period, it is expected that 85 trucks per day would visit the scheme to transport material to and from site (170 one-way trips). These trucks would access the scheme via the A417 to the north and south. Existing flows on these sections of road are around 35000 vehicles per day including approximately 3500 heavy vehicles. The addition of 170 two-way trips onto the existing road network would therefore result in a negligible increase (<1dB(A)) in overall noise level and hence noise on haul routes away from scheme is assessed as being not significant. The use of haul roads on the scheme is covered within the assessment described above.

#### Night-time noise

11.10.41 It is currently expected that night road closures would only be required for installing and removing the temporary Bailey bridge at Ch 2+100 and traffic management measures at tie-in junctions. The total number of working nights is currently expected to be fewer than 35 throughout the 42-month construction period. Works undertaken during these nights would be divided between Crickley Hill, Air Balloon roundabout, Shab Hill junction and Cowley junction.

11.10.42 For the purposes of the night-time noise assessment, the following construction activities have been considered:

- Installation and removal of the Bailey bridge.
- Traffic management works at A417 Crickley Hill.
- Traffic management works at Air Balloon and A436 roundabout.
- Traffic management works at Shab Hill junction.
- Traffic management works at Cowley junction.

11.10.43 Table 11-18 identifies the night-time LOAEL and SOAEL thresholds as set out in DMRB LA 111. Only residential facilities are considered for the night-time assessment.

**Table 11-18 Night-time construction noise assessment at residential locations**

Location (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3))	LOAEL (baseline noise level) <sup>1</sup> dBL <sub>Aeq,8hr</sub>	SOAEL (ABC threshold) <sup>1,3</sup> dBL <sub>Aeq,8hr</sub>	Range of predicted night-time construction noise levels <sup>1,2</sup> dBL <sub>Aeq, 8hr</sub> (See note 2 under table for key to text style)
R1 Holly Brae	57	Baseline	<30 - 42
R2 Crickley Court	62	Baseline	<30 - <b>65</b>
R3 Fernbank	66	Baseline	<30 - <b>69</b>
R5 Crickley Ridge	54	55	<30 - <b>65</b>

Location (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3))	LOAEL (baseline noise level) <sup>1</sup> dBL <sub>Aeq,8hr</sub>	SOAEL (ABC threshold) <sup>1,3</sup> dBL <sub>Aeq,8hr</sub>	Range of predicted night-time construction noise levels <sup>1,2</sup> dBL <sub>Aeq, 8hr</sub> (See note 2 under table for key to text style)
R6 Four Winds	58	Baseline	<30 - 51
R7 Air Balloon Cottages	67	Baseline	<30 - 66
R9 National Star College	48	55	<30 - 42
R10 Crendon House	56	Baseline	<30 - 42
R11 Barrow Wake House	49	55	<30 - 48
R13 Rushwood Kennels	39	45	<b>31 - 58</b>
R14 Shab Hill Farm	36	45	<b>31 - 53</b>
R15 Stockwell Farm Barn	36	45	30 - 39
R16 Chestnut Cottage	38	45	<30 - 35
R17 Nothill, Cowley	33	45	<30 - 33
R18 Castle Hill Cottage	67	Baseline	<30 - 55
R19 Keepers Cottages	35	45	<30 - 40

<sup>1</sup> Noise level includes correction for façade acoustic reflection (i.e. noise level at 1 metre from façade).

<sup>2</sup> Where the cell text is grey/italic, the range of predicted noise levels are below the LOAEL. Where the text is in bold font, the highest predicted value exceeds the ABC potential significance threshold and therefore exceeds the SOAEL for construction noise (see Table 11-3).

<sup>3</sup> Where the baseline noise level is above BS 5228 Category C, the baseline noise level is the SOAEL threshold.

### Residential receptors: effects exceeding the SOAEL at night

11.10.44 The ABC night-time potential significance thresholds and therefore the SOAEL would be exceeded during some nights at the following receptors. The number of receptors represented by each location which are expected to exceed the SOAEL are shown in brackets:

- R2 Crickley Court (17)
- R3 Fernbank (16)
- R5 Crickley Ridge
- R13 Rushwood Kennels
- R14 Shab Hill Farm (2)

11.10.45 Impacts at R5, R13 and R14 are major and impacts at R2 and R3 are moderate, however, night works would not occur for ten nights or more in 15 consecutive night period nor for 40 nights affecting one location in a six-month period and therefore these impacts are assessed as not significant.

11.10.46 In addition, there would be minor noise impacts at R15, R17 and R19. These impacts are assessed as not significant.

### Summary of significant construction effects

11.10.47 Table 11-19 summarises the significant effects for receptors in the study area for the construction assessment. The representative assessment locations with significant effects are presented together with the number of additional receptors in the surrounding area with identical effects.

**Table 11-19 Significant construction noise effects**

<b>Significantly affected receptors in locality</b>	<b>Conclusion of significance assessment</b>	<b>Representative assessment location</b>	<b>Justification of significance conclusion</b>
Six dwellings and one place of worship in Witcombe (Field View Lane and Dog Lane).	Significant adverse	R1. Holly Brae, Crickley Hill, Witcombe, GL3 4UF	Moderate impact, temporary adverse effect in the daytime – significant in the daytime.  No night-time impact.
17 dwellings in Witcombe (Dog Lane)	Significant adverse	R2. Crickley Court, Crickley Hill, Witcombe, GL3 4UF	Moderate to major impact, temporary adverse effect in the daytime – significant in the daytime.  Moderate impact, temporary adverse effect in the night-time, not exceeding LA 111 duration threshold.
16 dwellings on Crickley Hill	Significant adverse	R3. Fernbank, Crickley Hill, Witcombe, Gloucester, GL3 4UQ	Moderate to major impact, temporary adverse effect in the daytime – significant in the daytime.  Moderate impact, temporary adverse effect in the night-time, not exceeding LA 111 duration threshold – not significant at night.
Crickley Hill Visitor Centre (one non-residential)	Significant adverse	R4. Crickley Hill Visitor Centre	Moderate impact, temporary adverse effect in the daytime – significant in the daytime only.
Crickley Ridge (one dwelling)	Significant adverse	R5. Crickley Ridge, Crickley Hill, GL4 8JY	Major impact, temporary adverse effect in the daytime – significant in the daytime.  Major impact, temporary adverse effect in the night-time, not exceeding LA 111 duration threshold – not significant at night.
Two dwellings at Air Balloon Cottages	Significant adverse	R7 Air Balloon Cottages, Crickley Hill, GL4 8JY	Major impact, temporary adverse effect in the daytime – significant in the daytime.  No night-time impact.
Birdlip Radio Station (one non-residential)	Significant adverse	R12. Birdlip Radio Station	Major impact, temporary adverse effect in the daytime only – significant in the daytime only.
One dwelling and Rushwood Kennels and Cattery	Significant adverse	R13. Rushwood Kennels, Shab Hill, GL4 8JX	Major impact, temporary adverse effect in the daytime – significant in the daytime.  Major impact, temporary adverse effect in the night-time, not exceeding LA 111 duration threshold – not significant at night.

Significantly affected receptors in locality	Conclusion of significance assessment	Representative assessment location	Justification of significance conclusion
Public rights of way (non-residential)	Significant adverse	R13. Footpaths within around 400m of major excavation works away from existing major roads.	Major/moderate impact (distance dependent), temporary adverse effect in the daytime – significant in the daytime only.
Two dwellings at Shab Hill	Significant adverse	R14. Shab Hill Farm, Shab Hill, GL4 8JX	Major impact, temporary adverse effect in the daytime – significant in the daytime..  Major impact, temporary adverse effect in the night-time, not exceeding LA 111 duration threshold – not significant at night.
<b>Summary of effects in study area</b>			
Significant Adverse: 45 dwellings and six non-residential receptors (also representing other footpaths within approximately 400m of major excavation works).			

### Diversion routes

- 11.10.48 LA 111 states that any receptor within 25 metres of a diversion route used at night would be subject to a major noise impact. Where this major noise impact would exceed ten or more nights in any consecutive 15 nights, or 40 nights in any six consecutive months, this would be considered to be an indirect temporary likely significant effect.
- 11.10.49 The Traffic Management Plan (Annex B Construction Traffic Management Plan of ES Appendix 2.1 EMP (Document Reference 6.4)) sets out that one weekend closure and 29 individual weeknight closures of the main carriageway are anticipated over the 33 month construction period, during the installation and removal of traffic management measures and the temporary Bailey bridge. One diversion route via A46-A40-B4075-A435-A436 would be used when the A417 is closed between the A46 and Air Balloon roundabout, and a diversion route via A436-A40-A429 would be used when the A417 is closed between Air Balloon roundabout and Burford Road interchange (these routes are shown in the Traffic Management Plan referred to above). Each of these would affect a different set of receptors.
- 11.10.50 Table 11-20 shows the localities that traffic diversions at night would pass through together with the residential property count within 25 metres of the route (according to the LA 111 method).

**Table 11-20 Diversion route residential impacts**

Town or Locality	Number of Residential Properties
Andoversford	
<i>Foxcote</i>	1
<i>Garricks Head</i>	2
<i>Other</i>	1
Baunton	1

Town or Locality	Number of Residential Properties
Birdlip <i>Crickley Hill</i>	1
Chedworth <i>Fosse Cross</i> <i>Fossebridge</i>	2 4
Cheltenham <i>Badgeworth</i> <i>Bentham</i> <i>Charlton Kings</i> <i>Shurdington</i> <i>Up Hatherley</i> <i>Other</i>	5 1 236 141 32 660
Cirencester	2
Coberley	2
Coln St Dennis	5
Compton Abdale	1
Dowdeswell	1
Hazleton	1
Northleach	16
Seven Springs	1
Shipton Oliffe	6
Ullenwood	8
Yanworth	1
<b>Total</b>	<b>1131</b>

11.10.51 A total of 1131 properties are within 25 metres of a diversion route and would experience a major impact during night-time closures when traffic is diverted past their properties. However, as the traffic management plan sets out that the closures would be limited to short-term periods, e.g. two to five nights in each case, totalling fewer than 35 nights split across the two diversion routes; the ten nights in any 15 consecutive nights, or 40 nights in any six consecutive months criteria would not be exceeded and hence this is determined as being not significant.

#### Specific mitigation

11.10.52 The potential for mitigation has been discussed in Section 11.9 Design, mitigation and enhancement measures. Due to the linear nature and large area of the cutting and earthworks, specific mitigation to avoid significant effects in the form of noise barriers is unlikely to be practicable or effective. Several of the worst affected receptors are situated on higher ground than the construction works area resulting in it being impractical to build tall enough barriers to break line of sight with the works which is required for barriers to be effective. As the distance from the works increases, the absorption provided by sound travelling over soft ground is likely to outweigh any potential benefits that would be achieved with noise barriers.

- 11.10.53 There may be opportunities to use temporary noise barriers when conditions permit, such as works being close to receptors and at grade, or higher than the receptor such that noise barriers would be effective.
- 11.10.54 The following paragraphs describe the type of specific mitigation that could be included but is not currently committed.
- 11.10.55 The mitigation effects of 2.4 metre high barriers have been calculated at Fernbank and Air Balloon Cottages. The height of temporary noise barriers would be limited by engineering practicability (e.g. at Air Balloon Cottages there are services in the pavement that would need diverting to construct taller noise barriers).
- 11.10.56 At Fernbank, a barrier could provide up to 8dB reduction at ground floor and 2dB reduction at first floor during earthworks activities at the existing road height. As the earthworks become taller, the screening effect of the barrier would gradually diminish and become negligible.
- 11.10.57 At Air Balloon Cottages, during works on the immediately adjacent Cold Slad Lane connection, a 2.4 metre high barrier, installed on the existing road edge (higher than ground level), would provide a reduction of up to 10dB for ground floor rooms and up to 5dB for first floor rooms. Reductions in noise from the cutting and road construction works on the mainline would be limited to around 4dB at ground floor and negligible at first floor and therefore the barrier would be most effective during the short-term high noise levels from the closest activities. These measures have not been included in the assessment as there needs to be agreement about installation and practicability and although they may minimise impacts, in the short to medium term, they would not change the assessment result.
- 11.10.58 Due to the isolated nature of most of the significantly affected receptors and the duration of the potential effects, noise insulation at individual properties may be the most cost effective and technically effective solution. A policy for assessing and determining eligibility for individual property noise insulation is described in ES Appendix 2.1 EMP (Document Reference 6.4) in Section 4 Consents and permissions.
- 11.10.59 At National Star College, noise mitigation measures would include provision of mechanical ventilation so that windows could be closed if necessary to achieve appropriate noise levels for sensitive spaces. Consideration has been given to incorporating noise barriers along the edge of the closest works, however, due to the large distance (over 400m) to the nearest buildings on the scheme, over intervening soft ground, the screening benefit provided by barriers would be negligible.
- 11.10.60 Further mitigation detail is included, where relevant, in ES Appendix 2.1 EMP (Document Reference 6.4). The EMP includes details of the monitoring regime and stakeholder communication strategy.
- 11.10.61 Although there would be major impacts from diversion routes at night, these are not assessed as significant given the duration of these events. Furthermore, additional mitigation is not considered practicable in this case due to issues of noise barriers severing access to properties on existing residential roads, the long lengths of barrier that would be required and the impact of the works to install the barriers would be likely to exceed the impact of the noise from the diverted traffic. Similarly, provision of lower noise surface, even if it were effective for the speeds



of the roads in question, would likely exceed the short-term impact of the diversions.

### Vibration

- 11.10.62 Groundborne vibration resulting from the construction of the scheme has been considered. The greatest sources of vibration would arise from the use of vibratory compaction plant during earthwork and road pavement construction activities and these activities have been assessed quantitatively below.
- 11.10.63 It is expected that given the ground conditions, most excavation of cuttings can be achieved using ripping techniques. As the cutting depth increases (greater than 6 metres), the possibility that limited rock breaking methods may be required will increase. Although there may be occasional perceptible vibration from these activities, it is expected that levels will not regularly exceed SOAEL thresholds and will be short-lived. It is therefore unlikely that any rock breaking will give rise to significant effects.
- 11.10.64 Piling works would be required, to construct structures including Gloucestershire Way crossing, Shab Hill junction, Cowley overbridge and Stockwell overbridge. All piling activities are expected to be undertaken using a rotary bored cast in-situ method. This piling method generates low vibration levels even at close proximity to the piling rig and as such the potential for adverse vibration effects would be low. Therefore, it is assessed that using this piling method would be unlikely to generate significant vibration effects.
- 11.10.65 Removal of redundant sections of the Existing A417 carriageway, would be undertaken using a road planer, however, hand-held pneumatic breakers would be used for removal of kerbs and other items. The use of this type of plant is not expected to result in high levels of groundborne vibration at the closest residential properties and durations of working in close proximity to individual receptors would be short. As such, this would not result in a significant effect.
- 11.10.66 Underground horizontal drainage pipes would need to be installed at regular intervals along part of the Crickley Hill Escarpment. These drainage pipes will not be installed any closer than 10 metres either side of the Fernbank residential property. It is not expected that these drilling operations would last for more than one day per pipe installation. The vibration levels generated from this work are not expected to exceed the SOAEL. Given the nature and distance of these works, this may be audible at times as 'groundborne' noise inside Fernbank during the closest drainage installation either side of this property. However, as this work would be for only a very short duration (approximately two days for both of the closest drainage installations), this would not result in a significant effect.
- 11.10.67 There are two particular construction stages where specific plant activities would potentially give rise to high vibration levels: road pavement surfacing and earthworks, when it is expected that the majority of fill material required along the scheme alignment would require compaction using large vibratory compactors.
- 11.10.68 The potential vibration effects of the compaction activities have been considered (according to LA 111) with reference to BS 5228-2 (see Table 11-7) for human response, and BS 7385-2 to quantify the potential for risk of cosmetic damage to buildings (see Table 11-9). Human response predictions have been made at first floor level, as a worst-case, taking into account the vibration amplification which could occur higher up the building. Potential building damage predictions are

made at the base of the building for comparison with the criteria set out in Table 11-9.

- 11.10.69 Table 11-21 shows the predicted construction vibration levels, in terms of PPV at first floor level of the nearest sensitive receptors for assessment against the human response criteria and Table 11-22 shows the construction vibration levels, in terms of PPV predicted at the base of the nearest sensitive receptors in order to assess the potential for building damage.
- 11.10.70 The PPVs shown are representative of the instantaneous worst-case vibration predicted on occasions for a period of time during the closest approach of the works to each sensitive receptor. Actual vibration levels will be dependent on ground conditions, coupling between the ground and the structure and resonances within the receptor building. The receptors for the vibration assessment have been limited to those construction receptors which are within 300m of the vibratory activities. All vibration effects would be negligible beyond this distance.

**Table 11-21 Unmitigated construction vibration levels for human annoyance assessment (buildings only – worst-case predictions at first floor)**

Loc. ID	Receptor description (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3))	Peak Particle Velocity (PPV, mm/s)	
		Earthworks	Road pavement surfacing <sup>1</sup>
R1	Holly Brae	2.2	2.2
R2	Crickley Court	5.5	5.5
R3	Fernbank	>10	>10
R5	Crickley Ridge	4.6	2.4
R6	Four Winds	0.4	0.3
R7	Air Balloon Cottages	8.2	>10
R12	Birdlip Radio Station*	5.3	2.7
R13	Rushwood Kennels	1.8	1.6
R14	Shab Hill Farm	0.5	1.0
R18	Castle Hill Cottage	0.5	0.4

<sup>1</sup> Predicted road pavement and earthworks vibration levels vary at some receptors dependent on distance to the works.

\*Non-residential single storey receptor assessed at ground-floor.

**Table 11-22 Unmitigated construction vibration levels for building damage assessment (predicted at base of building/structure)**

Loc. ID	Receptor description (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3))	Peak Particle Velocity (PPV, mm/s)	
		Earthworks	Road pavement surfacing <sup>1</sup>
R1	Holly Brae	0.6	1.0

Loc. ID	Receptor description (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3))	Peak Particle Velocity (PPV, mm/s)	
		Earthworks	Road pavement surfacing <sup>1</sup>
R2	Crickley Court	1.4	1.0
R3	Fernbank	3.6	4.0
R5	Crickley Ridge	1.2	1.0
R6	Four Winds	0.1	0.0
R7	Air Balloon Cottages	2.1	9.0
R8	Emma's Grove	0.2	0.0
R12	Birdlip Radio Station	2.7	1.0
R13	Rushwood Kennels	0.5	0.0
R14	Shab Hill Farm	0.1	0.0
R18	Castle Hill Cottage	0.1	0.0

<sup>1</sup> Predicted road pavement and earthworks vibration levels vary at some receptors dependent on distance to the works.

### *Human Annoyance*

- 11.10.71 The vibration levels predicted at first floor, would result in several receptors exceeding the SOAEL for human response to vibration, due to either earthworks or pavement works. The number of receptors represented by each assessment location which are expected to exceed the SOAEL are shown in brackets:
- R1 Holly Brae (3)
  - R2 Crickley Court (4)
  - R3 Fernbank (8)
  - R5 Crickley Ridge
  - R7 Air Balloon Cottages (2)
  - R12 Birdlip Radio Station
  - R13 Rushwood Kennels
  - R14 Shab Hill Farm (2)
- 11.10.72 Without mitigation, vibration levels in excess of 10mm/s are predicted to be possible at upper floors (where the highest levels within the property would be expected) of R3 Fernbank (other nearby receptors would also be affected) and R7 Air Balloon Cottages. These levels would not be acceptable for any but the shortest period of time and are assessed as a major adverse impact.
- 11.10.73 At the remaining receptors, vibration levels are predicted to potentially exceed 1mm/s but be less than 10mm/s. These levels are above SOAEL and therefore a moderate adverse impact is predicted during pavement and/or earthworks at these receptors.
- 11.10.74 Residents would be advised of the nature and likely duration of vibratory works ahead of them taking place. For the likely worst affected properties, vibration impacts would be managed as appropriate using methods as described in section 11.9.

- 11.10.75 The general construction processes proposed for the main scheme alignment, where the use of intensive vibration generating plant has been identified, would largely follow a linear progression along the scheme route. The duration of the SOAEL exceedances is therefore estimated to be of short duration i.e. less than ten days, hence these impacts are assessed as not significant.

#### *Building Damage*

- 11.10.76 In terms of potential building damage, Air Balloon Cottages (nos. 1 and 2) are predicted to be at risk of being exposed to vibration levels in excess of 6mm/s (below which the risk of damage tends to zero for continuous vibration).
- 11.10.77 To avoid these vibration levels occurring, trials would be conducted at the start of works to establish actual vibration levels at the nearest sensitive receptors and where necessary, alternative plant or methods would be utilized (see section 11.9). Details will be included in the Noise and Vibration Management Plan as outlined in ES Appendix 2.1 EMP (Document Reference 6.4).

#### **Operation effects**

- 11.10.78 Table 11-23 summarises the assessment of the significant effects for daytime and night-time resulting from the operational scheme in the short term and long term. All the assessment results assume that the mitigation measures described in Table 11-16 as well as the lower noise road surface are incorporated into the design.
- 11.10.79 The following noise contour figures should be referred to alongside the noise assessment text in this section. ES Figure 11.2 Operational noise contour map – future assessment year (2041) (Document Reference 6.3) shows the long-term noise level contours. ES Figure 11.3 Operational noise difference contour map future assessment year (2041) (Document Reference 6.3) shows the noise difference contours (i.e. the changes in noise) resulting from the operational scheme between the baseline and the future year (2041). The noise contours shown on these figures are representative of the noise levels at four metres above local ground level. ES Appendix 11.4 Assessment locations and noise prediction results (Document Reference 6.4) provides tabulated noise level results.

#### Assessment of significant effects

- 11.10.80 Table 11-23 summarises residential areas alongside the scheme where significant effects have been assessed. Tables 1-3 and 1-4 of ES Appendix 11.4 Assessment locations and noise prediction results (Document Reference 6.4), give a comparison of the numbers of receptors subject to decreases and increases in the minor, moderate and major bands (Appendix 11.4).
- 11.10.81 The text following Table 11-23 describes further detail on the types of effect as well as effects on non-residential locations (e.g. PRow in the AONB), and in NIAs. The assessment is based upon the change in noise caused by the scheme, with consideration of other factors relating to the context of the impact such as the level of noise exposure and relative short-term and long-term impacts (see Table 11-14 for other assessment factors).

**Table 11-23 Significance of operational noise effects (residential)**

<b>Receptor</b>	<b>Conclusion of significance assessment</b>	<b>Direct or indirect effect</b>	<b>Magnitude of impact and justification of significance conclusion</b> <i>(See operational criteria in Table 11-10 to Table 11-14, for thresholds and other criteria considered in determining significance. Additional explanation is given in the paragraphs following this table)</i>
1-4 Witcombe Court, Badgeworth, Tewkesbury, GL3 4UA	Significant Beneficial	Direct	Moderate impact in the short term, beneficial effect
Witcombe Court, Badgeworth, Tewkesbury, GL3 4UA	Significant Beneficial	Direct	Moderate impact in the short term, beneficial effect
Crickley Court, Crickley Hill, Witcombe, Gloucester, GL3 4UF	Significant Beneficial	Direct	Moderate impact in the short term, beneficial effect
White Towers, Dog Lane, Witcombe, Cheltenham, GL3 4UG	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Barn, Hill Farm, Witcombe, Gloucester, GL3 4SL	Significant Beneficial	Indirect	Moderate impact in the short term, beneficial effect
Knapp Cottage, Birdlip Hill, Witcombe, Gloucester, GL3 4SL	Significant Beneficial	Indirect	Moderate impact in the short term, beneficial effect
Knapp Lodge, Birdlip Hill, Witcombe, Gloucester, GL3 4SL	Significant Beneficial	Indirect	Moderate impact in the short term, beneficial effect
The Dower House, Birdlip Hill, Witcombe, Gloucester, GL3 4SL	Significant Beneficial	Indirect	Moderate impact in the short term, beneficial effect
Knapp House, Witcombe, Gloucester, GL3 4SJ	Significant Beneficial	Indirect	Moderate impact in the short term, beneficial effect
The Knapp, Witcombe, Gloucester, GL3 4SL	Significant Beneficial	Indirect	Moderate impact in the short term, beneficial effect
Crickley Hall, Crickley Hill, Witcombe, Gloucester, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Yew Tree Cottage, Crickley Hill, Witcombe, Gloucester, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Highridge, Birdlip, Gloucester, GL4 8JN	Significant Beneficial	Indirect	Moderate impact in the short term, beneficial effect

Receptor	Conclusion of significance assessment	Direct or indirect effect	<b>Magnitude of impact and justification of significance conclusion</b>  <i>(See operational criteria in Table 11-10 to Table 11-14, for thresholds and other criteria considered in determining significance. Additional explanation is given in the paragraphs following this table)</i>
1-3 Crickley Cottages, Crickley Hill, Badgeworth, Cheltenham, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Crickley Lodge Cottages, 2 Badgeworth, Cheltenham, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Ridge Cottage, Stroud Road, Birdlip, Gloucester, GL4 8JN	Significant Beneficial	Indirect	Moderate impact in the short term, beneficial effect
Black Horse Ridge, Stroud Road, Birdlip, Gloucester, GL4 8JN	Significant Beneficial	Indirect	Moderate impact in the short term, beneficial effect
Tophers Cottage, Crickley Hill, Badgeworth, Cheltenham, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Ivy Lodge, GL4 8JH	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Haroldstone Lodge, Badgeworth, Cheltenham, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Corner Cottage, GL4 8JH	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Staff House, Corner Cottage, GL4 8JH	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Haroldstone House, Crickley Hill, Badgeworth, Cheltenham, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Mockingbird House, GL4 8JH	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Berrywood House, GL4 8JH	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)

Receptor	Conclusion of significance assessment	Direct or indirect effect	<b>Magnitude of impact and justification of significance conclusion</b>  <i>(See operational criteria in Table 11-10 to Table 11-14, for thresholds and other criteria considered in determining significance. Additional explanation is given in the paragraphs following this table)</i>
Hawthorn House, GL4 8JH	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Willow House, GL4 8JH	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Chestnut House, GL4 8JH	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Cedarwood House, GL4 8JH	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
6 Ridgeway Close, GL4 8BN	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Devon House, GL4 8JH	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Skyfall House, GL4 8JH	Significant Beneficial	Direct	Moderate impact in the short term decreasing to minor impact in the long term, beneficial effect
Buckingham House, GL4 8JH	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Applegarth, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Ermin Cottage, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
The Nest, Birdlip Farm, GL4 8JH	Significant Beneficial	Direct	Moderate impact in the short term, beneficial effect
Michaelmas House, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Cotswold Cottage, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Birdlip Farm Barn, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect



<b>Receptor</b>	<b>Conclusion of significance assessment</b>	<b>Direct or indirect effect</b>	<b>Magnitude of impact and justification of significance conclusion</b> <i>(See operational criteria in Table 11-10 to Table 11-14, for thresholds and other criteria considered in determining significance. Additional explanation is given in the paragraphs following this table)</i>
Flat Willows, Witcombe, Gloucester, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
The Willows, Crickley Hill, Witcombe, Gloucester, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
The Flat, The Willows, Witcombe, Gloucester, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
The Willows, Badgeworth, Cheltenham, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Top Flat, The Willows, Badgeworth, Cheltenham, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Ground Floor, The Willows, Badgeworth, Cheltenham, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
The Spinney, Crickley Hill, Badgeworth, Cheltenham, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Birdlip House, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Haroldstone Lodge, Crickley Hill, Witcombe, Gloucester, GL3 4UQ	Significant Adverse	Direct	Moderate impact in the short term decreasing to minor impact in the long term, adverse effect
Kellands Farm, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Springfield Bungalow, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Clare Cottage, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
April Cottage, GL4 8JH	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect



<b>Receptor</b>	<b>Conclusion of significance assessment</b>	<b>Direct or indirect effect</b>	<b>Magnitude of impact and justification of significance conclusion</b> <i>(See operational criteria in Table 11-10 to Table 11-14, for thresholds and other criteria considered in determining significance. Additional explanation is given in the paragraphs following this table)</i>
Half Acre, Crickley Hill, Witcombe, Gloucester, GL3 4UQ	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Halfacres, Badgeworth, Cheltenham, GL3 4UQ	Significant Beneficial	Direct	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Fernbank, Crickley Hill, Witcombe, Gloucester, GL3 4UQ	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact, beneficial effect
Welwyn, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Hillcot, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
The Old Pyke House, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Birdlip View, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Rose Cottage, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
The Cottage Catchbar, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Crickley Ridge, Crickley Hill, GL4 8JY	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Purdey House, Hawcote Hill, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Pheasants Keep, Hawcote Hill, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Hawcote House, Hawcote Hill, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect

Receptor	Conclusion of significance assessment	Direct or indirect effect	<b>Magnitude of impact and justification of significance conclusion</b>  <i>(See operational criteria in Table 11-10 to Table 11-14, for thresholds and other criteria considered in determining significance. Additional explanation is given in the paragraphs following this table)</i>
Four Winds, 1 Shab Hill, GL4 8JX	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
1-2 Air Balloon Cottages, Crickley Hill, GL4 8JY	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Highclere, Cirencester Road, GL4 8JL	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Barrow Wake House, Shab Hill, GL4 8JX	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Shab Hill Barn, Shab Hill, GL4 8JX	Significant Adverse	Direct	Major impact in the short term and long term, adverse effect
Shab Hill Farm, Shab Hill, GL4 8JX	Significant Adverse	Direct	Major impact in the short term and long term, Adverse effect
The Rise, Stockwell, GL4 8JZ	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Rushwood Kennels, Shab Hill, GL4 8JX	Significant Adverse	Direct	Major impact in the short term and long term, Adverse effect
Crendon House, GL53 9QX	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
The Grove, GL53 9QX	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Mosella Cottage, GL53 9QX	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
The Muzzards, The Common, GL4 8LB	Significant Beneficial	Direct	Major impact in the short term decreasing to moderate impact in the long term, beneficial effect
Laurel Cottage, GL53 9QX	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Lychett Cottage, GL53 9QX	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Leaside, Nettleton, GL4 8LA	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect

Receptor	Conclusion of significance assessment	Direct or indirect effect	Magnitude of impact and justification of significance conclusion <i>(See operational criteria in Table 11-10 to Table 11-14, for thresholds and other criteria considered in determining significance. Additional explanation is given in the paragraphs following this table)</i>
Woodside, Nettleton, GL4 8LA	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Castle Hill Cottage, Nettleton, GL4 8LA	Significant Beneficial	Direct	Major impact in the short term and long term, beneficial effect
Old Ullenwood Lodge, GL53 9QX	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
1-2 Oxford Cottages, GL53 9QX	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
Pixwold, Cockleford, GL53 9NW	Significant Beneficial	Indirect	Minor impact in the short term, beneficial effect (see Table 11-14, assessment factor 3.2)
<p><b>Summary of effects in study area within 600m of scheme:</b>            Significant Adverse above the SOAEL: 0 dwellings            Significant Beneficial above the SOAEL: 34 dwellings            Significant Adverse (between LOAEL and SOAEL): 21 dwellings            Significant Beneficial (between LOAEL and SOAEL): 37 dwellings            Not Significant: 314 dwellings            Negligible effects above SOAEL: 3 dwellings</p>			

*Residential receptors: direct effects exceeding the SOAEL*

- 11.10.82 There are four dwellings currently exceeding the SOAEL where noise reductions would occur as a result of the scheme (as shown in the noise difference contours – ES Figure 11.3 Operational noise difference contour map future assessment year (2041) (Document Reference 6.3)). These are Crickley Court, Fernbank, Halfacres and Half Acre.
- 11.10.83 For a further 15 dwellings, noise exposure would fall below the SOAEL threshold with the scheme in operation. All the above noise reductions would be greater than 1dB(A) in the opening year (i.e. short term). Because the baseline noise level would be above the SOAEL, this level of reduction to below the SOAEL threshold is assessed as a direct permanent likely significant beneficial effect for these 19 dwellings. This is based on the LA 111 assessment of significance criteria described in Table 11-14 (assessment factor 3.2).
- 11.10.84 For three dwellings that would already exceed the SOAEL in the baseline year in the absence of the scheme, there would be negligible noise change with the scheme in the opening year (i.e. short term). This describes a change of less than 1dB, and hence no adverse or beneficial effect. These are The Lodge, Gillsland Cottage and Cottage on Ridge.

*Residential receptors: indirect effects exceeding the SOAEL*

- 11.10.85 For ten dwellings that would already exceed the SOAEL in the baseline year in the absence of the scheme, there would be noise reductions as a result of the scheme. These indirect effects would be as a result of changes in road traffic noise associated with non-scheme roads. For five dwellings, Pixwold, The Knapp, Knapp House, Devon Cottage and The Dower House, noise exposure would fall below the SOAEL with the scheme in operation. All the above noise reductions would be greater than 1dB(A) in the opening year (short term), and because the baseline noise level would be above the SOAEL, these reductions at 15 dwellings are assessed as indirect permanent likely significant beneficial effects.

*Residential receptors: direct effects between LOAEL and SOAEL*

- 11.10.86 There are 21 dwellings with a moderate or major level of adverse impact predicted with the scheme in the opening year (i.e. short term). These would be subject to direct permanent likely significant adverse effects as identified in Table 11-23. Specific mitigation has been included in the scheme design. However, it is not practicable to avoid all significant effects where the locations or elevations of the dwellings relative to the scheme would mean that roadside noise screening would not be effective for these properties. Most of these are scattered properties on the north side of the Brockworth bypass, setback 150m to 250m from the highway and elevated high above road level. The remainder are around the proposed Shab Hill junction area and screened as far as is practicable by the bunding and stone walls included in the proposed scheme design at that location.
- 11.10.87 There are 31 dwellings subject to direct permanent likely significant beneficial effects between the LOAEL and SOAEL as a result of the scheme. The level of beneficial impact would be major or moderate for all these dwellings in the opening year (short term). These beneficial effects are shown in Table 11-23 and are generally located around the Birdlip area near to the section of highway that would be removed under the scheme proposals.

*Residential receptors: indirect effects between LOAEL and SOAEL*

- 11.10.88 There are six dwellings (Barn (Hill Farm), High Ridge, Knapp Cottage, Knapp Lodge, Ridge Cottage and Blackhorse Ridge) predicted to be subject to moderate beneficial noise reductions in the opening year (short term). These are assessed as indirect permanent likely significant beneficial effects. This would be as a result of changes in road traffic noise associated with non-scheme roads.

*Residential receptors: effects below LOAEL*

- 11.10.89 LA 111 requires that noise impacts are considered for all levels of noise exposure, although noise levels below the LOAEL would not be assessed as adverse effects in policy terms (refer to Table 11-10).
- 11.10.90 Residential properties, with noise levels below the LOAEL may be potentially assessed as particularly sensitive settings as identified in the tranquillity assessment (ES Chapter 7 Landscape and visual effects (Document Reference 6.2)). The methodology for assessing noise impacts in areas below the LOAEL is described in paragraphs 11.4.44 to 11.4.48.
- 11.10.91 There are 205 residential properties within the study area that would be subject to noise levels below the LOAEL with the scheme in the baseline year. Most (153) of these properties would be subject to a reduction in noise levels as a result of the

scheme (minor to major beneficial impact range) in the opening year (i.e. short term). For those properties subject to increases in noise in the opening year, eight would be greater than a minor impact. Although these eight properties are in areas below the LOAEL and there would be no noise effect in Government policy terms, further consideration is given to these impacts in relation to the tranquillity of their location.

- 11.10.92 Referring to the national relative tranquillity mapping (ES Figure 7.8 CPRE tranquillity mapping (Document Reference 6.3)), none of these properties is located in a particularly sensitive, high tranquillity area. Therefore, no significant noise effects, either beneficial or adverse, have been determined as special cases (defined in paragraph 11.4.47) for residential properties below the LOAEL.

*Non-residential sensitive receptors: effects*

- Birdlip area

- 11.10.93 Several non-residential receptors in Birdlip would be subject to noise reductions as a result of the removal of the Existing A417 close to the village - as can be seen from ES Figure 11.3 Operational noise difference contour map future assessment year (2041) (Document Reference 6.3). These are, Birdlip Primary School subject to a major beneficial impact in the opening year (i.e. short term), and Birdlip Village Hall (also major beneficial impact in the opening year). These are subject to noise reductions which are assessed as direct permanent likely significant beneficial effects.

- 11.10.94 Birdlip Church (St Marys) would be subject to a major beneficial impact in the short term. However, noise levels are below the LOAEL hence this beneficial impact is assessed as not significant.

- Crickley Hill Country Park area and National Star College

- 11.10.95 Around Ch 1+600 towards the Air Balloon roundabout, the new highway alignment would move slightly southwards from its existing position. Between Ch 1+200 and Ch 2+100, within 100 metres from the scheme, parts of Crickley Hill Country Park at the bottom of the hill would be subject to noise reductions of between 5 and 10dB(A) as shown in ES Figure 11.4 Operational noise difference contour map (at 1.5 metres height) future assessment year (2041) (Document Reference 6.3). This would be a major beneficial impact in the opening year.

- 11.10.96 'The Scrubbs' area and footpaths on the escarpment rising up to Crickley Hill Country Park would be subject to negligible changes in traffic noise exposure in this outdoor amenity area. Towards the top of the escarpment, there would be some areas of noise reduction (minor impact). Crickley Hill Country Park is part of the Crickley Hill and Barrow Wake SSSI. Crickley Hill Camp at the top of the hill is a scheduled monument. As well as cultural heritage assets, Crickley Hill includes popular footpaths within the areas described above, including the Gloucestershire Way long distance footpath, Cotswold Way National Trail, and Gustav Holst Way. The magnitude and spatial extent of the noise reductions across this designated site is assessed as not significant.

- 11.10.97 The National Star College would be subject to noise increases of 1.5dB (minor impact) in the opening year, which is assessed as a not significant effect.

- Removed highway - Barrow Wake area

- 11.10.98 South of the Air Balloon roundabout, the removal of the existing highway would result in noise reductions of between 5 and 10dB(A) approximately 100 metres either side of the removed highway (including Emma's Grove scheduled monument). The Cotswold Way National Trail, on the section of the footpath between Air Balloon roundabout and Barrow Wake view point (shown on ES Figure 11.4 Operational noise difference contour map (at 1.5 metres height) future assessment year (2041) (Document Reference 6.3)), would be subject to noise reductions of between 5 and 10dB(A) or more. These noise reductions, for the Cotswold Way National Trail itself where it is close to the alignment of the removed road are assessed as a direct permanent likely significant beneficial effect. Further west, The Peak (Neolithic enclosure, heritage asset) would be subject to a noise reduction of less than a 1dB(A) (negligible).
- Removed highway – east of Birdlip
- 11.10.99 Further south, the section of footpath from just north of Birdlip, running east across the removed road (ACY43<sup>45</sup> – see footpath codes in ES Figure 11.4 Operational noise difference contour map (at 1.5 metres height) future assessment year (2041) (Document Reference 6.3)) and turning south to Parson's Pitch (ACY10) (800 metres in length) would be subject to noise reductions of between 5 and 10dB(A) or more. These noise reductions for this section of the footpath are assessed as a direct permanent likely significant beneficial effect.
- Removed highway – southeast of Birdlip
- 11.10.100 South of Birdlip, footpaths in the following areas would be subject to noise reductions of between 1 and over 10dB(A) in the opening year (short term): Beechwoods SSSI (BBR13), Hawcote Hill (ACY17), Birtlan Grove (BBR14), Brimpsfield SSSI (BBR15). Given the proportions of these footpaths that are beneficially affected, these noise reductions are assessed as a direct permanent likely significant beneficial effect. The exception to this in this area, is the smaller noise reduction at the footpath at Hawcote Copse (BBR12) which is assessed as not significant.
- Proposed new alignment - Air Balloon roundabout to Shab Hill
- 11.10.101 To the south-east of the Air Balloon roundabout, the new alignment would result in noise increases around the scheme. The noise mitigation design around this new alignment (see ES Figure 11.4 Operational noise difference contour map (at 1.5 metres height) future assessment year (2041) (Document Reference 6.3)) would reduce, as far as reasonably practicable, noise levels to the surrounding footpaths and other noise sensitive receptors.
- 11.10.102 Noise impacts in the area of the new alignment would affect the Gloucestershire Way crossing this area of land. The baseline noise levels for this part of the footpath range from 60dB<sub>L<sub>Aeq,16hr</sub></sub> or above close to the east side of the existing alignment (see ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document Reference 6.3)); and as quiet as 40dB<sub>L<sub>Aeq,16hr</sub></sub> (below LOAEL) in the lower-lying area of the proposed scheme corridor furthest from existing roads. This quieter section of the footpath has a relatively low baseline noise level within the AONB and given the magnitude of impact and the proportion of the footpath affected by perceptible noise increases, this is assessed as a direct permanent likely significant adverse effect. This relates to the section of the Gloucestershire Way long distance footpath<sup>46</sup>

between the Air Balloon roundabout and Coberley to the east, specifically on footpath links: ACO16, ACY3, ACO3 and ACO18. The adjoining footpath ACO15 would also be similarly affected. ACO17, to the north of ACO3 would be affected by perceptible change for only a small proportion of its length and the effect is assessed as not significant on this link.

- Stockwell area

- 11.10.103 Further south, footpath ACY44 (see ES Figure 11.4 Operational noise difference contour map (at 1.5 metres height) future assessment year (2041) (Document Reference 6.3)) on the east side of Barrow Wake runs south-east to join with the lane just north of Stockwell. At the Stockwell end of this footpath link, the easternmost 250 metre section would be affected by perceptible noise increases of more than 3dB(A). However, the north-western kilometre of this footpath link would be subject to smaller noise increases or reductions. Given the relatively small length of this footpath adversely affected as a proportion of the whole link, this is assessed as not significant.
- 11.10.104 On the east side of the lane through Stockwell, two footpaths (ACY26 and ACY22) connect to a lane approximately one kilometre to the south-east. The northernmost of these footpaths (ACY26) would align closely with the scheme along most of the length of this link and would therefore be subject to noise increases of approximately 5-10dB(A). The southernmost footpath (ACY22) would be adversely affected for a relatively short proportion of its length. A third footpath in this area (section ACY36 and ACY27) runs from the lane at a point just north of Stockwell towards Green Hatch Farm to the north-east where it re-joins the same lane. This footpath would cross the scheme and noise levels would be increased by 3dB(A) or more along the whole length of this link. These sections of the footpath have a relatively low baseline noise level within the AONB and given the magnitude of impact and the proportion of the footpaths affected by perceptible noise increases, these are assessed as direct permanent likely significant adverse effects. This relates to footpath links ACY26, ACY36 and ACY27.

#### *Noise important areas (NIAs)*

- 11.10.105 There are six NIAs that lie within the A417 study area. However, NIA 3908 (Woodside House) would be removed as part of the scheme proposals. All these areas represent properties which are currently exposed to noise levels above the SOAEL. These receptors have already been reported in paragraph 11.10.82 but are described here specifically as beneficial effects at NIAs. Of these, NIA 13915 (No.1 and 2 Air Balloon Cottages), NIA 3905 (Castle Hill Cottage) and NIA 13196 (Laurel Cottage and Lychett Cottage) would be subject to direct permanent likely significant beneficial effects.
- 11.10.106 With the proposed mitigation (noise screening – see Table 11-16), NIA 3906 (Crickley Court) and NIA 3907 (Fernbank) would be subject to direct permanent likely significant beneficial effects.

#### *Mitigation*

- 11.10.107 Operational embedded and essential mitigation measures included in the scheme design are discussed in section 11.9: Design, mitigation and enhancement measures, and listed in Table 11-16. The locations of noise mitigation measures are also shown in ES Figure 11.4 Operational noise difference contour map (at 1.5 metres height) future assessment year (2041) (Document Reference 6.3).

This mitigation (mainly earth bunding) would be effective in avoiding or reducing the extent of significant noise effects around the new alignment. This is also a cost-effective solution, as the spoil can be transferred from the excavation works to elsewhere on the scheme during scheme construction, notably from the deep cutting section to where the bunds are to be constructed. It would also avoid the sustainability and cost implications of moving material off-site.

- 11.10.108 As detailed in paragraph 11.10.100, a number of PRoW to the south of Birdlip would realise beneficial noise impacts. These benefits are as a direct result of the A417 scheme design (which re-aligns the noise source further away from these PRoW).
- 11.10.109 Effects of the new alignment close to PRoW would be reduced as a result of the noise bunding incorporated into the scheme design from around the proposed Shab Hill junction to Cowley junction, on both sides of the highway. This is most effective for sections of PRoW close to the scheme, but the attenuating effect reduces with greater distance from the bunding.
- 11.10.110 Apart from the visual mitigation of the scheme provided by this noise bunding, the requirement for noise screening as part of bunding design was expressed by stakeholders during consultation events and written submissions, especially for residents to the east of the proposed scheme towards Cowley and Coberley. Hence it is expected that benefits would be perceived by stakeholders in relation to the combined visual and noise mitigation (the likelihood of perceived benefit is a mitigation criterion in LA 111). The mitigation design also responds to the requirements of the NPSNN to recognise that excessive noise can impact on the ‘...use and enjoyment of areas of value (such as quiet places) and areas with high landscape quality’, such as an AONB (refer to Table 11-1, NPSNN para 5.186).
- 11.10.111 To the north of the proposed Shab Hill junction, the highway is screened from the surroundings by being in cutting, hence there is no benefit to further noise mitigation bunding on this section through to the Air Balloon roundabout (see ES Figure 11.4 Operational noise difference contour map (at 1.5 metres height) future assessment year (2041) (Document Reference 6.3)). Although the cutting would provide substantial noise screening to the surrounding area, there are no residential receptors in this region.
- 11.10.112 On the western part of the scheme (Brockworth bypass) the proposed environmental barriers are located in Noise Important Areas (NIAs) to avoid impacts in residential locations designated as currently being subject to relatively high traffic noise exposures. The proposed noise mitigation at these locations addresses the requirement in the Defra Noise Action Plan: ‘Roads (Environmental Noise (England) Regulations 2006, published 2 July 2019)’ to identify proposed actions that would meet the vision and aims set out in the Government’s policy on noise. The Regulations require that Action Plans should “*apply in particular to the most important areas as established by the strategic noise maps (Regulation 15 (1)(e))*”. The benefits of the noise mitigation at the NIAs is described in paragraph 11.10.105.
- 11.10.113 In this same area, on the north side of the Brockworth bypass, there are predicted noise increases further from the highway up the escarpment which would affect a number of residential properties identified in Table 11-23. These noise changes are shown in ES Figure 11.3 Operational noise difference contour map future assessment year (2041) (Document Reference 6.3)). The receptors here are generally scattered properties, setback 150m to 300m from the highway, which



are positioned high above the levels of the bypass. At these heights above road level and at these distances, roadside screening would be ineffective at providing any further attenuation relative to the existing topography.

*Noise insulation eligibility*

11.10.114 There are three dwellings that would exceed the criteria to be eligible for noise insulation under the NIR. LA 111 (Annex E/2) requires that potential noise insulation eligibility is considered as part of the assessment. These are Crickley Hill Farm, Crickley Hill Farm Cottage and The Spinney.

*Non-scheme road links beyond 600m from the scheme where noise levels change by 1dB(A) in the short term or 3dB(A) in the long term*

11.10.115 LA 111 requires consideration of impacts on noise sensitive receptors alongside non-scheme road links not covered by the main study area within 600m of new or altered road links. For these other road links, the calculations of noise level change are carried out within 50 metres of these non-scheme road links where there is a possibility of change of  $1\text{dBL}_{A10,18\text{hr}}$  or more in the short-term, or  $3\text{dBL}_{A10,18\text{hr}}$  in the long-term. The assessment is based upon the change in noise caused by the scheme, with consideration of other factors described in LA 111 relating to the context of the impact such as the level of noise exposure, the location of sensitive parts of the receptor, and relative short term and long term impacts (see Table 11-14).

11.10.116 There are 30 road links in the short-term that meet the  $1\text{dBL}_{A10,18\text{hr}}$  change threshold (either decreases or increases). Two of these 30 road links also meet the  $3\text{dBL}_{A10,18\text{hr}}$  long-term change threshold. LA 111 requires noise sensitive receptors within 50 metres of these road links to be reported. In the short-term, there are 83 noise sensitive properties within 50 metres of the road links with a noise decrease which has a moderate impact and an indirect permanent likely significant beneficial effect. In the short-term, there are 17 noise sensitive properties where noise levels are predicted to exceed the SOAEL with a noise increase of minor impact, and these are therefore assessed as an indirect permanent significant adverse indirect effect above the SOAEL. Table 11-24 summarises these results.

11.10.117 These significant adverse effects relate to minor increases (just over 1dB) at individual, scattered dwellings which are very close to the road and hence façade noise levels are high (above SOAEL). It is not considered practicable to mitigate these effects by installing noise barriers or bunds this close to the road or the property facades, or to apply other potential mitigation measures such as lower noise surface which is less effective on lower speed roads.

11.10.118 The provisions of the NIR would not apply directly to these properties as eligibility relates to dwellings not more than 300 metres from the new or altered scheme. Also, depending on the type of glazing already installed, which is often of a higher acoustic performance where dwellings are very close to busy roads, a noise insulation package may not provide any further noise attenuation.

11.10.119 Although these properties are well beyond 300m from the proposed scheme, where the acoustic performance of existing glazing is found to be less than that in the standard NIR mitigation for sensitive rooms, then noise insulation would be offered. This does not alter the assessment of significant adverse effects at these

receptors. NIR eligibility is described in the ES Appendix 2.1 EMP (Document Reference 6.4).

- 11.10.120 Discussions are ongoing with interested parties regarding possible measures to mitigate the significant effects identified to properties at Stratton and Leckhampton Hill. Potential solutions have been presented by Highways England to the local highway authority, Gloucestershire County Council (GCC), and discussed at an initial stage, to help identify possible further mitigation measures.

**Table 11-24 Noise changes at properties beyond 600m from the scheme within 50 metres of other non-scheme roads**

Road	Noise increase or decrease	Number of noise sensitive receptors within 50m of the road link	Assessment
Gloucester Road, passes south-west of the village of Stratton	Increase	87	There is a short-term noise increase of around 1dB(A) on the Gloucester road link, near to Stratton (minor impact). In the long-term the noise increase is around 1dB(A). (68 receptors not significant and 12 significant adverse indirect effect - (see Table 11-14, assessment factor 3.2).
London Road, near to Corinium Gate, north Cirencester	Increase	9	There is a short-term noise increase of around 1dB(A) on the London Road north bound slip road of the A429/A417 roundabout. In the long-term, the noise increase is less than 2dB(A) (not significant).
Slad Road, Lansdown, Stroud	Increase	370	There is a short-term noise increase of approximately 1dB(A) on the Slad Road link in the Lansdown area of Stroud (minor impact). In the long-term, the noise increase is less than 2dB(A) (not significant).
Slad Road, north Slad	Increase	60	There is a short-term noise increase of around 1dB(A) on the Slad Road link in the north of Slad (minor impact). In the long-term, the noise increase is less than 2dB(A) (not significant).
Road passing through the village of Elkstone	Decrease	22	In the short-term, there is a decrease of approximately 3dB(A) (moderate impact). In the long-term, the noise decrease is approximately 4dB(A) (significant beneficial indirect effect).
High Cross Road in Bubb's Hill	Decrease	2	In the short-term, there is a decrease below 2dB(A). In the long-term, the noise decrease is approximately 2dB(A)

Road	Noise increase or decrease	Number of noise sensitive receptors within 50m of the road link	Assessment
			(not significant).
A435, south of the village of Colesbourne, near to Marsden Manor Road	Decrease	10	In the short-term, there is a decrease of approximately 1dB(A) (minor impact). In the long-term, the noise decrease is negligible (not significant).
Cirencester Road, Ermin Way and Birdlip Hill	Decrease	61	In the short-term, there is a decrease of approximately 3-5dB(A) (moderate impact). In the long-term, the noise decrease is approximately 3-5dB(A) (significant beneficial indirect effect).
Painswick Road, Shurdington Road	Decrease	5	In the short-term, there is a decrease of approximately 1dB(A) (minor impact). In the long-term, the noise decrease is below 1dB(A) (not significant).
South of Leckhampton Hill	Increase	15	There is a short-term noise increase of around 1dB(A) (minor impact). In the long-term, the noise increase is 2dB(A) (not significant).
Leckhampton Hill	Increase	52	There is a short-term noise increase of around 1dB(A) (minor impact). In the long-term the noise increase is below 2dB(A). (47 receptors not significant and 5 significant adverse indirect effect - see Table 11-14, assessment factor 3.2).
A436 and A435 pass through Seven Springs	Decrease	6	In the short-term, there is a decrease of approximately 1-2 dB(A) (minor impact). In the long-term, the noise decrease is 2dB(A) or below (not significant).
A435 (Cirencester Road) between the west of Charlton Kings and Seven	Decrease	250	In the short term, there is a decrease of approximately 2 dB(A) (minor impact). In the long-term, the noise decrease is below 2 dB(A) (not significant).
North of Leckhampton Road	Increase	95	There is a short-term noise increase below 2dB(A) (minor impact). In the long-term, the noise increase is around 2dB(A) (not significant).
Old Bath Road in the village of Pilley	Increase	196	There is a short-term noise increase below 2dB(A) (minor impact). In the long-term, the noise increase is around 2dB(A)

Road	Noise increase or decrease	Number of noise sensitive receptors within 50m of the road link	Assessment
			(not significant).
A436, east of the village Kilkenny and north of the village Foxcote	Decrease	3	In the short-term, there is a decrease of just over 1dB(A) (minor impact). In the long-term, the noise decrease is less than 1dB(A) (not significant).

11.10.121 The section of concrete-surfaced road on the A417/A419 over 10 kilometres south of the scheme<sup>47</sup> was included in the above analysis of traffic changes associated with the scheme. For this concrete section of road, the short-term noise change would be less than 0.5dB(A), and just over 0.5dB(A) in the long-term (hence not meeting the criteria to be included in the above table). This is assessed as a not significant change based on LA 111 assessment criteria.

11.10.122 The Government policy objectives (see paragraph 11.3.7) are also defined in the England National Application Annex to LA 111. In accordance with the assessment requirements, the scheme's compliance against these objectives is set out in Table 11-25.

**Table 11-25 Scheme compliance with Government policy**

Government policy objective (NPSNN)	Compliance with policy requirements
<p><b>Aim 1:</b> Avoid significant adverse impacts on health and quality of life from noise as a result of the new development. (NPSE describes this aim in relation to impacts above the SOAEL)</p>	<p>Significant adverse impacts from construction noise and vibration would be avoided through construction BPM mitigation, and noise insulation where established thresholds are exceeded. These controls would follow the principles and processes set out in ES Appendix 2.1 EMP (Document Reference 6.4).</p> <p>Some residual significant adverse effects are reported in this assessment for construction noise, despite the proposed mitigation measures – however all appropriate measures have been applied in these cases as far as it is practicable and sustainable to do so (see paragraphs 11.10.52- 11.10.61). Further mitigation, as far as is practicable and sustainable, would be detailed in the NVMP that will be prepared as required by the EMP (ES Appendix 2.1 (Document Reference 6.4)) following dialogue with local authorities.</p> <p>For operational noise, there are 17 properties where significant adverse effects above the SOAEL are predicted to occur alongside non-scheme road links beyond 600m of new or altered roads. Screening and other potential mitigation measures have been investigated in these cases but are not considered sufficiently effective to practicably and sustainably avoid the impact. Noise insulation measures will be offered where appropriate (see paragraph 11.10.119). This does not alter the assessment of significant adverse effects at these receptors. Further to this, discussions are ongoing</p>

Government policy objective (NPSNN)	Compliance with policy requirements
	with GCC and interested parties regarding possible solutions to mitigate the significant effects identified. For all other properties, effects above the SOAEL have been avoided by scheme mitigation design. This includes scheme alignment, lower noise road surface and noise screening, incorporating noise barriers alongside specific residential properties.
<p><b>Aim 2:</b> Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development. (NPSE describes this aim in relation to impacts between the LOAEL and SOAEL)</p>	<p>Adverse impacts from construction noise and vibration would be mitigated and minimised through construction BPM mitigation. These controls would follow the principles and processes set out in ES Appendix 2.1 EMP (Document Reference 6.4).</p> <p>Adverse impacts from operational noise would be minimised by scheme alignment, and mitigation including lower noise road surface and noise screening.</p> <p>Some residual significant adverse effects for operational noise between the LOAEL and SOAEL are reported in this assessment despite the proposed mitigation measures. However, all appropriate measures have been applied in these cases as far as it is practicable and sustainable to do so to mitigate and minimise these effects.</p>
<p><b>Aim 3:</b> Contribute to improvements to health and quality of life through the effective management and control of noise, where possible. (Applies to all noise levels)</p>	<p>Noise mitigation measures described above have been incorporated to reduce noise levels. Beneficial effects would occur at communities and outdoor amenity areas in some locations as result of the scheme. Noise levels would also be reduced at properties in the Noise Important Areas (see paragraphs 11.10.105-11.10.106).</p>

## 11.11 Monitoring

- 11.11.1 The requirements of LA 111 (Section 4) regarding monitoring and evaluation shall be followed.
- 11.11.2 The prediction and assessment methodologies set out in section 11.4 Assessment methodology of this chapter would be used to support the verification of the effectiveness of any mitigation measures<sup>48</sup>. Monitoring of the effectiveness would be carried out as part of Highways England's Project Evaluation procedures, which evaluates how highway schemes are delivered and would highlight any issues with meeting the accepted design.
- 11.11.3 Where access is required onto private land for monitoring purposes, prior consultation would be undertaken with the occupier and appropriate arrangements would be made to enable the monitoring to be undertaken.
- 11.11.4 Highways England has a duty under Regulation 6 of the NIR to assess noise levels following the opening of the scheme to traffic. The purpose of this is to establish the buildings previously not identified as qualifying for an original offer of carrying out or making a grant in respect of carrying out noise insulation work, which may have become eligible by increased traffic flow. Assessments would be carried out in accordance with the obligations set out in the NIR.

## Construction

- 11.11.5 For construction works, monitoring includes one or more specified approaches described in LA 111, including verification that adequate mitigation measures are in place, measurement of noise and/or vibration (see ES Appendix 2.1 EMP (Document Reference 6.4)), and verifying adequate working procedures to ensure adverse effects are no worse than set out in this ES.

## Operation

- 11.11.6 For operation, monitoring measures should include ensuring mitigation measures incorporated into the scheme design are included (or equivalent performance is achieved with any alternative design). Also, the specifications of any noise mitigation measures should be verified to meet the design specifications. Verification of the effectiveness of any mitigation measures against the accepted design. This would be carried out as part of Highways England's Project Evaluation procedures (see ES Appendix 2.1 EMP (Document Reference 6.4)).

## 11.12 Summary

- 11.12.1 Construction and operational traffic noise have been assessed in terms of Government Policy (for dwellings potentially exceeding the SOAEL), and EIA significance (between the LOAEL and SOAEL). These different types of effect are explained in paragraph 11.4.22.

### Construction assessment

- 11.12.2 Construction noise and vibration has been assessed from the available construction information at the time of preparation of the ES. The assessment assumes that the works would be undertaken following the principles, controls and processes set out in ES Appendix 2.1 EMP (Document Reference 6.4).
- 11.12.3 The principal activities considered with the potential to cause noise and vibration effects are cutting and earthworks, structures and road construction works. Other activities such as surfacing or removal of Existing A417 pavement may cause temporary high impacts but would be of short duration adjacent to any individual receptors.
- 11.12.4 Night-time activities would be strictly limited to those activities that could not be completed without road closures. Primarily this would be installing and removing traffic management at junction tie-ins.

### Significant effects

- 11.12.5 All reasonably practicable embedded and essential mitigation measures have been considered within the assessment but no allowance has been made for these measures within the assessment as their practicability needs to be assessed further at the detailed design stage. It is likely that noise impacts and effects can be further reduced through the control measures set out in the EMP.
- 11.12.6 Direct temporary likely significant adverse construction noise effects have been assessed at 45 residential properties during the daytime only (see Table 11-19). These are direct effects above the SOAEL threshold, as described in Government Policy. The properties are represented by the following receptors (all construction assessment locations are shown in ES Figure 11.1 Study area, sensitive receptors and baseline assessment noise contour map (2026) (Document

Reference 6.3)). The number of receptors represented by each assessment location which are expected to exceed the SOAEL are shown in brackets:

- 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)

11.12.7 Likely daytime noise impacts are also assessed as direct temporary significant adverse effects at a number of non-residential receptors, represented by the following receptor locations:

- R1 St Peter's Church
- R4 Crickley Hill Visitor Centre
- Receptor R12 Birdlip Radio Station
- Receptor R13 Rushwood Kennels and Cattery
- PRow within approximately 400 metres of major excavation works.

#### Non-significant effects

11.12.8 Night-time activities are predicted to give rise to minor, moderate or major adverse impacts at residential properties for fewer than 35 nights spread throughout the 42-month construction period and are therefore considered to be not significant. The results are shown in Table 11-18.

11.12.9 Construction traffic using off-site haul routes is predicted to give rise to negligible noise increases on the A417 or other major roads leading to or from the scheme to the north and south of the scheme.

11.12.10 Diversion routes used at night would cause temporary major impacts at over 1,000 residential properties. However, diversions at night would be expected to be used for fewer than 35 nights, divided between two diversion routes and therefore would not constitute a significant effect.

11.12.11 It is likely that construction vibration levels generated by road surfacing activities at receptor locations close to the scheme would result in moderate and major adverse impacts above the SOAEL for human annoyance. However, the duration of these impacts is estimated to be less than ten days, hence these effects are assessed as not significant based on the LA 111 assessment criteria (paragraph 11.4.38). With appropriate mitigation, such as using compaction plant in 'static' mode or lower vibration plant, building damage thresholds would not be exceeded at any receptors.

#### **Operational assessment**

11.12.12 Embedded and essential mitigation has been included in the scheme design to avoid significant adverse noise effects, and to reduce adverse noise effects from the scheme as far as is practicable and sustainable to do so.

11.12.13 Daytime and night-time traffic noise levels within the study area (see ES Figures 11.1-11.4 (Document Reference 6.3) have been predicted and the assessed conclusions are described below.



### Residential receptors exceeding the SOAEL

- 11.12.14 There are four dwellings currently exceeding the SOAEL where noise reductions would occur as a result of the scheme (as shown in the noise difference contours – ES Figure 11.3 Operational noise difference contour map future assessment year (2041) (Document Reference 6.3)). These are Crickley Court, Fernbank, Halfacres and Half Acre. For a further 15 dwellings, noise exposure would fall below the SOAEL with the scheme in operation.
- 11.12.15 All the above noise reductions would be greater than 1dB(A) in the opening year (i.e. short term), and because the baseline noise level would be above the SOAEL, this level of reduction is assessed as a direct permanent likely significant beneficial effect for these dwellings.
- 11.12.16 Indirect noise reductions would occur at ten dwellings that would already exceed the SOAEL in the baseline year in the absence of the scheme. These indirect effects would be as a result of changes in road traffic noise associated with non-scheme roads. For five dwellings, Pixwold, The Knapp, Knapp House, Devon Cottage and The Dower House, noise exposure would fall below the SOAEL with the scheme in operation. All the above noise reductions would be greater than 1dB(A) in the opening year (short term), and because the baseline noise level would be above the SOAEL, these reductions are assessed as indirect permanent likely significant beneficial effects.
- 11.12.17 LA 111 requires consideration of impacts on noise sensitive receptors alongside non-scheme road links not covered by the main study area within 600m of new or altered road links. There are 30 road links that meet the  $1\text{dB}_{\text{LA}10,18\text{hr}}$  short-term or  $3\text{dB}_{\text{LA}10,18\text{hr}}$  long-term change threshold. LA 111 requires noise sensitive receptors within 50 metres of these non-scheme road links to be reported. In the short term, there are 83 noise sensitive properties which have a significant beneficial indirect effect (moderate impact), and 17 noise sensitive properties which have a significant adverse indirect effect (minor impact). These significant adverse effects relate to minor noise increases (just over 1dB) at individual, scattered dwellings very close to the road and hence façade noise levels are above SOAEL. However, it is not considered practicable to mitigate these effects by installing noise barriers (as the property facades are very close to the road), or to apply other potential mitigation measures in these cases. Noise insulation measures will be offered where appropriate for these properties (see paragraph 11.10.119). Further to this, discussions are ongoing with GCC and interested parties regarding possible solutions to mitigate the significant effects identified.

### Residential receptors between LOAEL and SOAEL

- 11.12.18 There are 21 dwellings between the LOAEL and SOAEL with a moderate or major level of adverse impact predicted with the scheme in the opening year (i.e. short term). These would be subject to direct permanent likely significant adverse effects. Specific mitigation has been included in the scheme design. However, it is not practicable to avoid all significant effects. Most of these are scattered properties on the north side of the Brockworth bypass, setback 150m to 250m from the highway and elevated high above road level. The remainder are around the proposed Shab Hill junction area and screened as far as is practicable by the bunding and stone walls included in the proposed scheme design at that location.
- 11.12.19 There are 31 dwellings that would be subject to direct permanent likely significant beneficial effects between the LOAEL and SOAEL. The level of beneficial impact



would be major or moderate for all these dwellings in the opening year (short term). These beneficial effects are generally located around the Birdlip area near to the section of highway that would be removed under the scheme proposals.

- 11.12.20 Further beneficial impacts would occur as a result of changes in road traffic noise associated with non-scheme roads. These would occur at six dwellings (Barn (Hill Farm), High Ridge, Knapp Cottage, Knapp Lodge, Ridge Cottage and Blackhorse Ridge) predicted to be subject to moderate beneficial noise reductions in the opening year (short term). These are assessed as indirect permanent likely significant beneficial effects.

#### Noise Important Areas (NIAs)

- 11.12.21 There are six NIAs that lie within the A417 study area. However, NIA 3908 (Woodside House) would be removed as part of the scheme proposals. All these areas represent properties which are currently exposed to noise levels above the SOAEL. These receptors have already been reported in paragraph 11.12.14 but are described here specifically as beneficial effects at NIAs. Of these, NIA 13915 (No.1 and 2 Air Balloon Cottages), NIA 3905 (Castle Hill Cottage) and NIA 13196 (Laurel Cottage and Lychett Cottage) would be subject to direct permanent likely significant beneficial effects.
- 11.12.22 With the proposed mitigation (noise screening – see Table 11-16), NIA 3906 (Crickley Court) and NIA 3907 (Fernbank) would be subject to direct permanent likely significant beneficial effects.

#### Non-residential receptors

- 11.12.23 Several non-residential receptors in Birdlip would be subject to noise reductions as a result of the removal of the Existing A417 close to the village. These are, Birdlip Primary School subject to a major beneficial impact in the opening year (i.e. short term), and Birdlip Village Hall (also a major beneficial impact in the opening year). These are subject to noise reductions which are assessed as direct permanent likely significant beneficial effects.
- 11.12.24 At Crickley Hill Country Park, 'The Scrubbs' area and footpaths on the escarpment rising up to the Country Park would be subject to negligible changes in traffic noise exposure. Between Ch 1+600 and Ch 2+100, within 100 metres from the scheme, parts of the Country Park at the bottom of the hill would be subject to noise reductions of between 3 and 10dB(A). The magnitude and spatial extent of the noise reductions across the County Park (designated site - SSSI, SAM) and footpaths here is assessed as not significant.
- 11.12.25 The National Star College would be subject to noise increases of 1.5dB (minor impact) in the opening year, which is assessed as a not significant effect.
- 11.12.26 South of the Air Balloon roundabout, the removal of the existing highway would result in noise reductions in this area and along the Cotswold Way National Trail. The section of the footpath between Air Balloon roundabout and Barrow Wake view point car park (where it joins the new link roundabout with the re-aligned B4070) would be subject to a direct likely significant beneficial effect. Further south, the section of footpath from just north of Birdlip, running east across the removed road and turning south to Parson's Pitch would also be subject to a direct permanent likely significant beneficial effect.

- 11.12.27 To the south-east of the Air Balloon roundabout, the new alignment would result in noise increases around the scheme. The noise increase is assessed as a direct permanent likely significant adverse effect on the section of the Gloucestershire Way long distance footpath between the Air Balloon roundabout and Coberley to the east. This is considered in this assessment to be a special case given the relatively low baseline noise levels of this section of the long-distance footpath within the AONB.
- 11.12.28 On the east side of the lane through Stockwell there are three footpaths connected to the lane (immediately north of Stockwell). All these footpath links run for approximately one kilometre to the east. These footpath links are assessed as special cases in this part of the AONB where baseline noise levels are low. These are assessed as being subject to a direct permanent likely significant adverse effect.

### **Compliance against the three aims of Government policy (NPSNN)**

- 11.12.29 Compliance with Government policy objectives (defined in the England National Application Annex to LA 111) has been achieved by means of mitigation measures. This includes scheme alignment, lower noise road surface and noise screening. The mitigation would result in noise reductions at residential communities, outdoor amenity areas and Noise Important Areas. Where significant adverse effects would remain, all appropriate measures have been applied as far as it is practicable and sustainable to do so to avoid, mitigate and reduce these effects.

## End Notes & References

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- <sup>1</sup> Highways England, Transport Scotland, Welsh Government, and Department for Infrastructure Northern Ireland, “Design Manual for Roads and Bridges LA 111, Noise and Vibration, Revision 0, TSO,” 2019
- <sup>2</sup> UK Government, “*Compensation when a road affects your property’s value*,” 2019. [Online]. Available: <https://www.gov.uk/compensation-road-property-value>. [Accessed: 18-Nov-2019]
- <sup>3</sup> Department for Environment Food & Rural Affairs, “Noise Policy Statement for England (NPSE),” 2010.
- <sup>4</sup> Ministry of Housing Communities and Local Government, “National Planning Policy Framework,” 2019
- <sup>5</sup> Ministry of Housing Communities and Local Government, “Planning Practice Guidance – Noise,” 2014 (updated 2019). [Online]. Available: <https://www.gov.uk/guidance/noise--2>. [Accessed: 19-Nov-2019]
- <sup>6</sup> Department for Transport, “National Policy Statement for National Networks,” London, 2014.
- <sup>7</sup> PPG-N defines an unacceptable adverse effect as ‘present and very disruptive’, with outcomes described as ‘Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory’.
- <sup>8</sup> i.e. adverse effects, significant adverse effects and unacceptable adverse effects on health and quality of life.
- <sup>9</sup> Cotswold District Council, “The Cotswold District Local Plan (2011-2031),” Cirencester, 2018 <https://www.cotswold.gov.uk/planning-and-building/planning-policy/local-plan-2011-to-2031/> (assessed date)
- <sup>10</sup> Gloucester City Council, Cheltenham Borough Council, and Tewkesbury Borough Council, “Joint Core Strategy 2011-2031,” no. November, 2017 <https://www.gloucester.gov.uk/media/4486/dp001-adopted-jcs-december-2017.pdf> (assessed date)
- <sup>11</sup> Tewkesbury Borough Council, “Pre-submission Tewkesbury Borough Plan,” 2019 <https://www.tewkesbury.gov.uk/pre-submission-tewkesbury-borough-plan> (assessed date)
- <sup>12</sup> Cotswolds Conservation Board, “Cotswolds AONB Management Plan 2018- 2023,” 2018 <https://www.cotswoldsaonb.org.uk/planning/cotswolds-aonb-management-plan/> (assessed date)
- <sup>13</sup> Cotswolds Conservation Board, “Cotswolds AONB Position Statement Dark Skies and Artificial Light,” 2019. <https://www.cotswoldsaonb.org.uk/wp-content/uploads/2019/03/Cotswolds-Dark-Skies-Artificial-Light-Position-Statement.pdf> (assessed date)
- <sup>14</sup> Cotswolds Conservation Board, “Development in the setting of the Cotswolds AONB,” 2016 <https://www.cotswoldsaonb.org.uk/wp-content/uploads/2017/08/setting-position-statement-2016-adopted-with-minor-changes-30616-1.pdf> (assessed date)
- <sup>15</sup> Cotswolds Conservation Board, “Cotswolds AONB Public Rights of Way Position Statement,” 2015 <https://www.cotswoldsaonb.org.uk/wp-content/uploads/2017/08/public-rights-of-way.pdf> (assessed date)
- <sup>16</sup> Cotswolds Conservation Board, “Cotswolds AONB Tranquillity Position Statement,” 2019 <https://www.cotswoldsaonb.org.uk/wp-content/uploads/2019/06/Tranquillity-Position-Statement-FINAL-June-2019.pdf> (assessed date)
- <sup>17</sup> BS5228-1:2009+A1:2014, *Code of practice for noise and vibration control on construction and open sites – Noise*, 2014
- <sup>18</sup> The equivalent continuous sound level ( $L_{Aeq,T}$ ) is the level of a notional steady sound, which at a given position and over a defined period of time (T), would have the same A-weighted acoustic energy as the fluctuating noise.
- <sup>19</sup> Free Field: An external sound field in which no significant sound reflections occur (apart from the ground).
- <sup>20</sup> Department of Transport and Welsh Office, “Calculation of Road Traffic Noise”, 1988.
- <sup>21</sup> Department for Transport, WebTAG, July 2020 <https://www.gov.uk/government/publications/tag-environmental-impacts-worksheets> (assessed date)

<sup>22</sup> Noise Insulation Regulations, 1975.

<sup>23</sup> Abbott, PG & Nelson PM (2002), PR/SE/451/02, Converting the UK traffic noise index  $L_{A10,18h}$  to EU noise indices for noise mapping, TRL

<sup>24</sup> Appendix A2 of LA 111 notes that TRL Method 3 provides reliable results for most UK roads. Exceptions to this can include roads where the proportion of night-time traffic to daytime traffic is atypical

<sup>25</sup> Any beneficial effects would also be identified due to noise reductions.

<sup>26</sup> Defined in paragraph 11.6.5

<sup>27</sup> BS5228-2:2009+A1:2014, *Code of practice for noise and vibration control on construction and open sites – Vibration*, 2014

<sup>28</sup> BS 5228-2 notes in Table B.1: 'The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.' Consideration has been given to other guidance with regard to time varying exposure where appropriate – the BS 6472 guidance makes use of the 'Vibration Dose Value' metric (VDV).

<sup>29</sup> BSI, BS 7385: *Evaluation and measurement for vibration in buildings – Guide to damage levels from groundborne vibration* 1993.

<sup>30</sup> BSI, BS ISO 4866:2010 *Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures* 2010

<sup>31</sup> World Health Organization, "Guidelines for community noise," 1999.

<sup>32</sup> World Health Organization, "Night Noise Guidelines For Europe," Copenhagen, 2009

<sup>33</sup> World Health Organization, "Environmental Noise Guidelines for the European Region", 2018

<sup>34</sup> World Health Organization Guidelines for Community Noise (1999). The WHO Environmental Noise Guidelines for the European Region (2018) recommend traffic noise levels below 53dB<sub>L<sub>den</sub></sub> (i.e. day/evening/night) and 45dB<sub>L<sub>night</sub></sub> to avoid adverse health effects. It should be noted that the thresholds for lowest observed adverse effect level (LOAEL) for this assessment are set at lower noise exposures (i.e. more sensitive criteria) to represent the onset of adverse health effects associated with traffic noise.

<sup>35</sup> Campaign to Protect Rural England (CPRE) Saving Tranquil Places: How to Protect and Promote a Vital Asset. 2006

<sup>36</sup> Cotswolds Conservation Board, "Cotswolds AONB Tranquility Position Statement," 2019

<sup>37</sup> The Planning Inspectorate, "Scoping Opinion: Proposed A417 Missing Link," 2019.

<sup>38</sup> BNL: the 'Basic Noise Level' at a reference distance of 10 meter from the nearside carriageway edge, as defined in CRTN.

<sup>39</sup> LA 111 Paragraph 1.4 notes that: '*Operational vibration is scoped out of the assessment methodology as a maintained road surface will be free of irregularities as part of scheme design and under general maintenance, so operational vibration will not have the potential to lead to significant adverse effects.*'

<sup>40</sup> Based on the comments received from stakeholders during the 2019 statutory consultation, the areas of Cowley and Coberley have been fully included in the noise study area and assessment.

<sup>41</sup> UK Government, "Noise Action Planning Important Areas Round 2 England," 2019. [Online]. Available: <https://data.gov.uk/dataset/fc786717-3756-4fd1-9c7d-c082331e40e4/noise-action-planning-important-areas-round-2-england>. [Accessed: 19-Nov-2019]

<sup>42</sup> SSSI ('Site of Special Scientific Interest').

<sup>43</sup> For the purposes of the construction noise assessment, baseline noise levels have been predicted specifically for the façade facing the works as a result of existing road traffic noise sources. These are inclusive of a 3dB façade reflection correction and may differ from the noise levels reported in Appendix 11.4 which are applicable to the operational noise assessment.

<sup>44</sup> GCC PRoW reference number.

<sup>45</sup> GCC PRoW reference number.

<sup>46</sup> The Gloucestershire Way long distance footpath would be realigned at the western end of this section described in paragraph 11.10.102. The assessment takes this realignment into account.

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<sup>47</sup> The potential for impacts has been raised during consultation for this section of road by local residents (i.e. *The campaign to have the concrete section of the A419/A417 resurfaced*).

<sup>48</sup> Refer to: Table 11-16 Noise mitigation measures for operation of the scheme