A66 Northern Trans-Pennine Project
TR010062

3.2 Environmental Statement
Chapter 12 Noise and Vibration

APFP Regulations 5(2)(a)

Planning Act 2008

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

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3.2 ENVIRONMENTAL STATEMENT CHAPTER 12 NOISE AND VIBRATION

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12 Noise and Vibration

12.1 Introduction

12.1.1 This chapter sets out the findings of the assessment of the likely significant noise and vibration effects of the construction and operation of the Project, following the methodology set out in the *Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration (DMRB LA 111)*, 2020)[1] and any other relevant guidance. It details the methodology followed, summarises the legislation and policy framework relevant to the noise and vibration assessment and describes the existing environment in the area surrounding the Project. It then considers the design, mitigation and residual effects of the Project, including taking account of relevant characteristics of the future baseline environment. Any key assumptions and limitations applicable to the assessment are also identified.

12.1.2 Any noise and vibration effects (both adverse and beneficial) predicted to be significant are identified in section 12.10: Assessment of likely significant effects of this chapter with further detail presented in Appendix 12.4: Operational Assessment Results. Effects identified in the course of the assessment but not predicted to be significant are presented in Appendix 12.5: Non-significant Effects (Application Document 3.4).

12.1.3 The noise and vibration assessment is supported by a number of figures (Application Document 3.3) and Technical Appendices (Application Document 3.4) as listed on the contents page.

12.1.4 Noise and vibration related aspects are also considered within Chapter 6: Biodiversity, Chapter 10: Landscape and Visual and Chapter 13: Population and Human Health.

12.1.5 This Environmental Impact Assessment (EIA) has been undertaken by competent experts with the relevant and appropriate experience in their respective topics. The lead author of this chapter has the following relevant credentials:

- Diploma in Acoustics and Noise Control and an MSc in Acoustics and Noise Control
- Chartered Engineer
- Member of the Institute of Acoustics
- 21 years' experience in professional practice

12.2 Key assessment parameters

12.2.1 The following key assessment parameters have been used in order to enable flexibility in the assessment and to ensure that a reasonable worst case has been assessed.

[1] Highways England (now National Highways) (2020) Design Manual for Roads and Bridges LA 111 Noise and Vibration

Table 12-1: Key assessment parameters

Key Assessment Parameters
• The assessment of construction noise and vibration has been undertaken based upon the construction information available at the time of writing. The key assumptions are presented in Appendix 12.1: Baseline Noise Survey Results and Appendix 12.2: Construction Assessment Assumptions (Application Document 3.4). • The assessment of operational noise has been undertaken based upon the information included in section 12.4: Assessment Methodology. Operational vibration has been scoped out of this assessment. • Noise modelling is based on indicative design which is assumed to be a realistic and reasonable worst-case scenario. The impacts of Limits of Deviation (LoD) upon noise modelling are presented in paragraph 12.5.7.

12.3 Legislation

12.3.1 The following key legislation is applicable to the noise and vibration assessment:

- The Environmental Noise (England) Regulations 2006 *(as amended):* This Directive requires member states to generate strategic noise maps and noise action plans intended to enable the derivation of a common assessment method by which exposure to environmental noise may be determined and, subsequently, reduced through Noise Important Areas (NIAs)
- Control of Pollution Act 1974 *(as amended)*: Sets out procedures for those undertaking works to obtain 'Prior Consent' for construction works within agreed noise limits
- Noise Insulation Regulations 1975: Provides Highway authorities with a duty to provide a grant towards the installation of noise insulation measures or with powers to undertake such works, as appropriate; these apply to dwellings affected by noise from new or altered roads
- Environmental Protection Act 1990 *(as amended)*: Under Part III, local authorities have a duty to investigate noise complaints from premises (land and buildings) and vehicles, machinery or equipment in the street. It does not apply to road traffic noise but may be applicable to some construction activities

National level policy

Noise Policy Statement for England (NPSE)

12.3.2 The Government's noise policy is set out in the *Noise Policy Statement for England (NPSE)* (Department for Environment, Food and Rural Affairs, 2010)[2]. In legislative and policy terms, noise is taken to include vibration.

12.3.3 The NPSE sets three noise policy aims, which are to be met through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

[2] Department for Environment, Food and Rural Affairs (2010) Noise Policy Statement for England Explanatory Note

- To avoid significant adverse impacts on health and quality of life.
- To mitigate and minimise adverse impacts on health and quality of life.
- Where possible, contribute to the improvement of health and quality of life.

National Policy Statement for National Networks

12.3.4 The primary basis for the Secretary of State deciding whether or not to grant a Development Consent Order (DCO) for the Project is the *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014)[3].

12.3.5 Table 12-2: Relevant *NPSNN* policies identifies the *NPSNN* policies relevant to the noise and vibration assessment and a reference to where in this Environmental Statement (ES) information is provided to address each policy.

Table 12-2: Relevant *NPSNN* policies

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
5.186	*NPSNN* states that excessive noise can have wide-ranging impacts on the quality of human life and health (e.g. owing to annoyance or sleep disturbance), use and enjoyment of areas of value (such as quiet places) and areas with high landscape quality'. The Government's policy is set out in the Noise Policy Statement for England. It promotes good health and good quality of life through effective noise management.'	An assessment of likely significant effects from construction noise and vibration and operational noise has been undertaken and is presented within this ES.	The noise results from this assessment have been used in Chapter 10: Landscape and Visual and Chapter 13: Population and Human Health.
5.187	NPSNN requires that noise effects of the proposed development on ecological receptors should be assessed in accordance with the Biodiversity and Geological Conservation section of the NPSNN.	An assessment of noise and vibration effects on ecological receptors has been assessed in accordance with Biodiversity and Geological Conservation section of the NPSNN.	The noise results from this assessment are presented in Appendix 12.6 Noise (Application Document 3.4) and Vibration Results at Ecology Receptors and have been used in Chapter 6: Biodiversity. The location of the ecology receptors is shown in Figure 12.8: Noise

[3] Department for Transport (2014) National Policy Statement for National Networks (NPSNN)

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
			and Vibration Assessment - Location of Ecology Receptors (Application Document 3.3).
5.188	Factors that will determine the likely noise impact include: • Construction noise and the inherent operational noise from the proposed development and its characteristics. • The proximity of the proposed development to noise sensitive premises (including residential properties, schools, and hospitals) and noise sensitive areas (including certain parks and open spaces). • 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,	An assessment of likely significant effects from construction and operational noise has been undertaken and is presented within the ES. This includes the identification of residential and non-residential receptors, noise sensitive areas and designated areas.	Details of the receptors included within this assessment are provided in section 1212.4: Assessment Methodology and any potential noise impacts (after embedded mitigation) are provided in section 1212.10: Assessment of likely significant effects. The assessment of noise sensitive areas (including open spaces and public rights of way) are provided in Chapter 13: Population and Human Health. The effects of noise and vibration on ecological receptors has not been included within this chapter. The results from this assessment are shown in Appendix 12.6: Noise and Vibration Results at Ecology Receptors (Application Document 3.4) and have been used in Chapter 6: Biodiversity. Figure 12.8: Noise and Vibration Assessment

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
	protected species, or other wildlife.		- Location of Ecology Receptors shows the location of the ecology receptors (Application Document 3.3).
5.189	Where significant noise impacts are likely to arise from the proposed development, the following should be included in the noise assessment, which should form part of the environment statement: • 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 identification of any distinctive tonal, impulsive or low frequency characteristics of the noise.	There are no relevant plant associated with the operational Project and traffic noise sources are addressed within the calculation of road traffic noise. A description of the noise and vibration sources associated with construction of the Project are provided in this ES.	Details of the operational noise sources are provided in section 12.4 and Table 12-15: Modelling parameters. For construction noise and vibration sources, these are presented in Appendix 12.2: Construction Assessment Assumptions (Application Document 3.4).
	• Identification of noise sensitive premises and noise sensitive areas that may be affected	Noise sensitive receptors have been identified throughout the study area and have been used to inform the assessment of likely significant effects from construction and operational noise.	Details of the Project study area are shown in Figure 12.1: Operational Noise Study Area (Application Document 3.3) and is discussed in section 12.6: Study area. Construction noise sensitive receptors are identified in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
			Operational noise sensitive receptors predicted to experience significant effects are presented in Appendix 12.4: Operational Assessment Results (Application Document 3.4). An overview of all other operational noise sensitive receptors assessed is in Appendix 12.5: Non-significant Effects (Application Document 3.4).
	• Characteristics of the existing noise environment	Baseline noise surveys were undertaken to inform the understanding of the existing noise environment.	Existing noise environment is detailed within section 12.7: Baseline conditions and Appendix 12.1: Baseline Noise Survey Results (Application Document 3.4).
	A prediction on how the noise environment will change with the proposed development: • in the short-term such as during the construction period; • In the longer term during the operating life of the infrastructure; • At particular times of the day, evening and night as appropriate	An assessment of likely significant effects from operational noise has been undertaken and is presented within the ES. This includes an assessment of both the short term and long term.	All construction and operational noise changes are presented in section 12.10: Assessment of likely significant effects. The assessment approach and methodology is presented within section 12.4: Assessment methodology
	• An assessment of the effect of predicted changes in the noise environment on any noise sensitive	All construction and operational noise changes are presented in section 12.10: Assessment of	The assessment approach and methodology are presented within section 13.4:

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
	premises and noise sensitive areas	likely significant effects	Assessment methodology.
	• Measures to be employed in mitigating the effects of noise, including using best available techniques to reduce noise impacts.	Noise mitigation options have been considered as part of this chapter.	Details of noise mitigation are provided in section 12 9: Essential mitigation and enhancement measures.
	The nature and extent of the noise assessment should be proportional to the likely noise impact	All construction and operational noise changes are presented in section 12.10: Assessment of likely significant effects. The assessment has been undertaken in a proportional manner to the likely noise impact.	The assessment approach and methodology are presented within section 12.4: Assessment methodology.
5.190	The potential noise impact elsewhere that is directly associated with the development, such as changes in road movements elsewhere on the national networks, should be considered as appropriate.	Following *DMRB LA 111,* road links with potential to experience a short-term BNL change of more than 1dB(A) as a result of the Project have been included within the study area.	Details of potential noise impacts are provided in section 12.6: Study area.
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 Calculation of Road Traffic Noise. …. 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.	The relevant standards have been included and have informed the relevant assessments.	Details provided within section 12.4: Assessment methodology.

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
5.192	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.	Consultation with Natural England has been undertaken and presented in Chapter 6: Biodiversity.	Chapter 6: Biodiversity includes an assessment of the effects of noise and vibration on ecological receptors based on the results presented in Appendix 12.6 Noise and Vibration Results at Ecology Receptors (Application Document 3.3). The locations of the ecological receptors are shown in Figure 12.8 Noise and Vibration Assessment - Location of Ecology Receptors (Application Document 3.4)
5.193	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.	Assessments have been conducted in accordance with NPSE, NPPF, NPSNN and related policy and guidance documents.	Details of Government policies and guidance used in this assessment are provided in section 12.4: Assessment methodologies.
5.194	The project should demonstrate good design through optimisation of scheme layout to reduce noise emissions and, where practicable, the use of landscaping, bunds or noise barriers to reduce noise transmission.	The Project scheme objectives encapsulate the design approach, which for Environment are to minimise adverse impacts on the environment and where practicable optimise environmental improvement opportunities. Good design is considered in the chapter and demonstrated in the	Chapter 2: The Project provides the overarching design approach of the Project. Chapter 4: EIA Methodology sets out the Project design, mitigation and enhancement measures. Noise and vibration design aspects are considered within section 12.8: Potential impacts and additional design measures

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
		consideration of embedded, essential and enhancement mitigation and measures.	within section 12.9: Essential mitigation and enhancement measures.
5.195	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: • avoid significant adverse impacts on health and quality of life from noise as a result of the new development; • mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and • contribute to improvements to health and quality of life through the effective management and control of noise, where possible.	Assessments have been conducted in accordance with NPSE and related policy and guidance documents. The project meets the aims so development consent should be granted.	Government policy is considered throughout the chapter and is shown to meet the stated aims at Table 12-46: Scheme compliance with Government Policy.
5.198	Mitigation measures for the project should be proportionate and reasonable and may include one or more of the following: • engineering: containment of noise generated; • materials: use of materials that reduce noise, (for example low noise road surfacing); • lay-out: adequate distance between	Good design is considered in the chapter and demonstrated in the consideration of embedded, essential and enhancement mitigation and measures. Measures include Best Practicable Means during construction and low-noise surfacing, alignment, landscaping bunds	Chapter 4: EIA Methodology sets out the Project design, mitigation and enhancement measures. Construction and operation noise and vibration design aspects are considered within section 12.8: Potential impacts and additional design measures within section 12.9:

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
	source and noise-sensitive receptors; incorporating good design to minimise noise transmission through screening by natural or purpose built barriers; and • administration: specifying acceptable noise limits or times of use (e.g., in the case of railway station Public Address systems).	and cuttings for operation.	Essential mitigation and enhancement measures.
5.199	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.	An assessment of likely significant effects from operational noise has been undertaken and from these results, properties eligible for noise insulation have been identified.	Noise insulation is considered in section 12.9: Essential mitigation and enhancement measures with likely eligible properties identified at paragraph 12.10.33.

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
5.200	Applicants should consider opportunities to address the noise issues associated with Important Areas as identified through the noise action planning process.	NIAs are considered throughout the chapter as part of good design.	NIAs are considered and assessed within section 12.10: Assessment of likely significant effects.

National Planning Policy Framework

12.3.6 The *National Planning Policy Framework (NPPF)* (Ministry of Housing, Communities & Local Government, 2021)[4] originally published in March 2012 and most recently updated in July 2021, sets out the government's planning policies for England and provides a framework within which locally prepared plans can be produced and applications for planning permission can be assessed. The *NPPF* states the NSIPs should be "*determined in accordance with the decision making framework in the Planning Act 2008 (as amended) and relevant national policy statements for major infrastructure, as well as any other matters that are relevant (which may include the National Planning Policy Framework).”*

Regional and local level policy

12.3.7 Other regional and local level policies have been considered as part of the noise and vibration assessment where these have informed the identification of receptors and resources and their sensitivity; the assessment methodology; the potential for likely significant environmental effects; and required mitigation. These policies include:

- *Cumbria County Council Development Plan* (Cumbria County Council, 2017)[5] Policy DC3
- *Eden District Council Local Plan, 2014-2028* (Eden District County Council, 2018)[6] Policy ENV6 and ENV9
- *County Durham Plan* (Durham County Council, 2020)[7] Policy 31
- *Richmondshire Local Plan 2012-2028 Core Strategy* (Richmondshire District Council, 2014)[8] Policy CP4

Table 12-3: Regional and local level policies

Policy document	Policy wording	Applicant response	Where addressed?
Cumbria County Council Development Plan	Policy DC3 Noise states “*it is recognised that some temporary activities, including soil stripping, construction and removal of soil*	An assessment has been carried out to predict the construction	Section 12.10: Assessment of likely significant effects.

[4] Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework
[5] Cumbria County Council (2017) Cumbria Minerals and Waste Local Plan 2015-2040
[6] Eden District County Council (2018) Eden Local Plan 2014-3032
[7] County Durham Plan Adopted Version (2020) Durham County Council
[8] Richmondshire District Council (2014) Local Plan

Policy document	Policy wording	Applicant response	Where addressed?
	storage and baffle mounds, aspects of road construction and maintenance, often bring longer-term environmental benefits. For such activities, increased temporary weekday daytime noise level limits should not exceed 70dB(A) $L_{Aeq\ 1\ hour}$ (free field) for periods up to eight weeks in a year at specified noise sensitive properties. Operators will be expected to make every effort to deliver temporary works at a lower level of noise impact".	noise levels during each construction phase.	
Eden District Council Local Plan 2014-2028	Policy ENV6 – "*The development proposed will not have an unacceptable impact on the amenity of local residents and can demonstrate that there is sufficient mitigation measures to minimise the impact of noise, smell or other nuisance or pollutants likely to affect nearby occupiers and neighbouring land uses.*"	An assessment has been carried out to predict the construction and operational noise levels (after embedded mitigation) to determine any potential impact and assess likely significant effects to nearby receptors.	Section 12.10: Assessment of likely significant effects.
	Policy ENV9 – "*Development proposals for developments likely to experience noise, light, dust, odour or vibration from road, rail or air, or other sources must be supported by an adequate assessment to assess risks and their acceptability, and to ensure that appropriate mitigation is put in place to ensure occupiers are not adversely affected. Assessments should consider both the likely level of exposure at the time of application and any increase that might be reasonably expected in the foreseeable future."* *"Development proposals for development likely to cause noise, light, dust, odour or vibration sources must be supported by an adequate assessment to assess*	An assessment has been carried out to predict the construction and operational noise levels (after embedded mitigation) to determine any potential impact and assess likely significant effects to nearby receptors.	Section 12.10: Assessment of likely significant effects.

Policy document	Policy wording	Applicant response	Where addressed?
	risks and their acceptability, and to ensure that appropriate mitigation is put in place to ensure existing noise sensitive premisses are not adversely affected"		
County Durham Plan	Policy 31 – "*Developments which has the potential to lead to, or be affected by, unacceptable levels of air quality, inappropriate odours, noise and vibration or other sources of pollution, either individually or cumulatively, will not be permitted including where any identified mitigation cannot reduce the impact on the environment, amenity of people or human health to an acceptable level"* *"Noise pollution is noise created by man-made sources which, if excessive can cause disturbance or annoyance and negatively affect wildlife and sensitive areas including areas known for their tranquillity. It often occurs as a result of industrial operations, transportation or roads. Good planning should aim to prevent the adverse effects of noise from being unacceptable, as sated in NPPF."* *"It will be necessary to determine the impact of noise producing sources on prevailing ambient background level and achievement of the World Health Organisations recommended maximum noise levels in residential areas. Developments*	An assessment has been carried out to predict the construction and operational noise levels (after embedded mitigation) to determine any potential impact and assess likely significant effects to nearby receptors.	Section 12.10: Assessment of likely significant effects.
Richmondshire Local Plan 2012-2028 Core Strategy	Policy CP4: Supporting sites for development – "*Consider the effect of the local environmental quality including noise and air quality on the health and wellbeing of travellers resulting from existing neighbouring and future proposed development uses*."	An assessment has been carried out to predict the construction and operational noise levels (after embedded mitigation) to determine any potential impact and assess likely	Section 12.10: Assessment of likely significant effects.

Policy document	Policy wording	Applicant response	Where addressed?
		significant effects to nearby receptors.	

Other relevant policy and guidance

12.3.8 In addition to compliance with the *NPSNN* and *NPPF*, other relevant policies have been considered as part of the noise and vibration assessment, and this assessment has been compiled in accordance with relevant standards and guidance. The standards and guidance which relate to the assessment are:

- *British Standard (BS) 5228-1:2009+A1:2014 Code of practice for noise and vibration on construction and open sites. Part 1 - Noise (BS 5228-1)* (British Standard, 2014)[9]
- *British Standard (BS) 5228-2:2009+A1:2014 Code of practice for noise and vibration on construction and open sites. Part 2 - Vibration (BS 5228-2)* (British Standard, 2014)[10]
- *British Standard (BS) 7385-2 Evaluation and measurement for vibration in buildings – Guide to damage levels from ground borne vibration (BS 7385-2)* (British Standard, 1993)[11]
- *British Standard (BS) International Standards Organisation (ISO) 4866 Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures (BS ISO 4866) (British Standards, 2010)*[12]
- Campaign to Protect Rural England (CPRE) Saving Tranquil Places: How to Protect and Promote a Vital Asset (Campaign to Protect Rural England, 2006)13
- Transport Research Laboratory (TRL) *Converting the UK traffic noise level* $L_{A10,18h}$ *to EU noise indices for noise mapping* (Transport Research Laboratory, 2002)[14]
- World Health Organization (WHO)- *Night Noise Guidelines for Europe* (World Health Organization, 2009)[15] and *Guidelines for community noise (World Health Organization*, 1999)[16]

[9] British Standard (2014a) Code of practice for noise and vibration control on construction and open sites. Part 1 - Noise
[10] British Standard (2014b) Code of practice for noise and vibration control on construction and open sites. Part 2 - Vibration
[11] British Standards (1993) Evaluation and measurement for vibration in buildings – Guide to damage levels from ground borne vibration
[12] British Standards (2010) 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
[13] Campaign to Protect Rural England (2006) Saving Tranquil Places: How to Protect and Promote a Vital Asset
[14] Transport Research Laboratory (2002) Converting the UK traffic noise level $L_{A10,18h}$ to EU noise indices for noise mapping
[15] World Health Organization (2009) Night Noise Guidelines for Europe
[16] World Health Organization (1999) Guidelines for community noise

- *Design Manual for Roads and Bridges (DMRB) LA 111 Noise and vibration (DMRB LA 111)* (Highways England (now National Highways), 2020)[17]
- *Calculation of Road Traffic Noise (CRTN) 1988* (Department for Transport, 1988) [18]

12.4 Assessment methodology

12.4.1 The methodology for the noise and vibration assessment follows the guidance set out within *DMRB LA 111*.

Value of receptor

12.4.2 In addition to residential receptors, *DMRB 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, Environmental Noise Directive (END) quiet areas or potential END quiet areas, international and national or statutorily designated sites, public rights of way (PRoW) and cultural heritage assets. An assessment of PRoW is provided in Chapter 13: Population and Human Health and an assessment of cultural heritage assets is provided in Chapter 8: Cultural Heritage.

12.4.3 *DMRB LA 111* does not specifically assign levels of sensitivity to different types of noise sensitive receptors. However, sensitivity has been considered in the assessment based on the use of the receptors and the context of the impact. For example, schools have a low sensitivity to noise at night when they are not typically used. Conversely, sensitivity to noise might be increased if a building is regularly used by people with hearing impairments, where speech intelligibility might be affected (as discussed in paragraph 3.49 and 3.50 of *DMRB LA 111).*

Assessment

12.4.4 The method for identifying likely significant effects of noise and vibration from construction and operation of the Project, within an identified study area (as defined within section 12.6: Study Area), is aligned with *DMRB LA 111* and Government noise policy.

12.4.5 It follows from Government noise policy *NPSE* 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 Level (LOAEL) to identify the onset of adverse impacts on health and quality of life.

12.4.6 Where the predicted noise or vibration level exceeds the relevant SOAEL threshold criteria, there is potential for a significant adverse effect. The *NPSE* states that these effects should be avoided.

[17] Highways England (now National Highways) (2020) Design Manual for Roads and Bridges LA 111 Noise and vibration
[18] Department for Transport (1988) Calculation of Road Traffic Noise

12.4.7 Where the predicted noise or vibration level is less than the SOAEL but greater than the relevant LOAEL, there is potential for a significant adverse effect. The *NPSE* states that these effects should be mitigated and reduced to a minimum.

12.4.8 Noise levels between the LOAEL and SOAEL could be considered to be significant adverse effects within the ES, however, they are not deemed to be significant in terms of Government noise policy (i.e. *NPSE*). In these situations, the change in noise caused by the Project will be the main factor when deciding if a significant effect is likely. Other factors such as the existing level of noise exposure and the noise sensitive parts of the receptor that are affected should be considered.

12.4.9 The *DMRB LA 111* criteria used to assess the significance of effects (both adverse and beneficial) for different receptor types and noise exposure levels are described under 'Noise Criteria', from paragraph 12.4.10 onwards for construction noise and vibration and paragraph 12.4.28 onwards for operational noise.

Construction noise

12.4.10 Construction noise will be predicted and assessed in accordance with *DMRB LA 111* by following the methodology defined in *BS 5228-1*. *BS 5228-1* provides guidance on predicting and measuring construction noise and assessing its impact on the environment.

12.4.11 When assessing the temporary effects of construction noise, the sensitivity of a particular receptor depends on the existing noise levels in the study area. Noise from construction works is expected to be more intrusive in a relatively quiet area with low background noise levels compared to a noisy area with already high background noise levels. For the latter, construction noise would not be as easily perceived.

12.4.12 Table 12-4: Construction time period – LOAEL and SOAEL is based on Table E.1 in Annex E of *BS 5228-1*, which presents the threshold levels based on the 'ABC method' for evaluating the potential significant effects of construction noise based on the existing noise level. The ABC method involves the comparison of the existing, pre-construction ambient noise level with noise level arising from construction works on site alone.

12.4.13 The calculations of construction noise levels were assessed for the following phases. Details of the construction plant items including noise level are presented in Appendix 12.2: Construction Assessment Assumptions (Application Document 3.4).

- Phase 1 Demolition
- Phase 2 Road construction
  - 2a - boundary fence
  - 2b - topsoil strip
  - 2c - drainage (v-ditch)
  - 2d - earthworks
  - 2e - capping/subbase
  - 2f - pavement/surfacing
  - 2g - road marking

    - 2h - variable road sign (VRS)
    - 2i - removal of current road
    - 2j - surface water channels
    - 2k - drainage
- Phase 3 Structures
    - 3a - excavation (hard standing)
    - 3b - stone delivery
    - 3c - concreting
    - 3d - sheet piling
    - 3e - continuous flight auger (CFA)
- Phase 4 compound
    - 4a - site clearance & trees
    - 4b - boundary fence
    - 4c- topsoil
    - 4d - excavation
    - 4e - drainage
    - 4f - subbase
    - 4g - pavement/surfacing
    - 4h - operation and haul roads

12.4.14 In addition, to these phases, an additional assessment has been undertaken to calculate the noise emissions arising from offsite construction traffic movements, in accordance with BS *5228-1*. Details of the construction traffic modelling, including the definition of construction scenarios assessed in this chapter i.e. scenario C and scenario D, are presented in Chapter 11: Construction impact assessment of the Transport Assessment (Application Document 3.7).

12.4.15 LOAEL and SOAEL for all noise sensitive receptors were established in accordance with Table 12-4: Construction time period – LOAEL and SOAEL. Ambient noise levels (which define the LOAEL) at the relevant facades for each receptor within 300m (in line with *DMRB LA 111*) have been determined based on predicted 2019 baseline traffic noise levels of the noise model described in section 12.4.40 and informed by baseline survey level data.

Table 12-4: Construction time period – LOAEL and SOAEL

Time Period	LOAEL	SOAEL
Daytime weekday (07:00-19:00); and Saturdays (07:00-13:00)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per *BS 5228-1* Section E3.2 and Table E.1 *BS 5228-1*
Evening's weekday (19:00-23:00); Saturdays (13:00-23:00); and Sundays (07:00-23:00)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per *BS 5228-1* Section E3.2 and Table E.1 *BS 5228-1*
Night-time (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 *BS 5228-1*

12.4.16 The threshold of potential adverse effect described in Table E.1 of *BS 5228-1* according to the ABC method is reproduced in Table 12-5:

Threshold of potential significant effect at dwellings according to ABC method (source: *BS 5228-1*), i.e. receptors with low existing ambient noise levels (Category A) have a lower threshold than those with higher existing ambient noise levels (Category C). Table 12-5: Threshold of potential significant effect at dwellings according to ABC method (source: *BS 5228-1*) can be used as follows: for the appropriate period (night, evening/weekends or day), the ambient noise level is determined and rounded to the nearest 5dB. This is then compared with the site noise level. If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. Consideration is given to other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect.

Table 12-5: Threshold of potential significant effect at dwellings according to ABC method (source: *BS 5228-1*)

Assessment category 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 evening (19:00-23:00) Saturdays (13:00 - 23:00) Sundays (07:00-23:00)	55	60	65

12.4.17 In accordance with *DMRB LA 111* the magnitude of impact of construction noise is determined using Table 12-6: Construction noise impact magnitudes.

Table 12-6: Construction noise impact magnitudes

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

12.4.18 The magnitude of impact of construction traffic noise is determined using Table 12-7: Construction Basic Noise Level (BNL) impact magnitudes. The BNL is calculated using the principles defined in the *Calculation of Road Traffic Noise (CRTN) 1988* (Department for Transport, 1988)[19], as required by *DMRB LA 111* and *NPSNN*.

Table 12-7: Construction Basic Noise Level (BNL) impact magnitudes

Magnitude of impact	Increase in 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

[19] Department for Transport (1988) Calculation of Road Traffic Noise

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

12.4.19 As defined in *DMRB LA 111*, for diversion routes used at night, a major magnitude of impact for construction noise is determined to be the case at any noise sensitive receptor within the diversion route study area.

12.4.20 In accordance with *DMRB LA 111* construction noise and construction traffic noise is considered a significant effect when it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

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

Construction vibration

12.4.21 Construction vibration has been predicted and assessed in accordance with *DMRB LA 111*, which draws upon the guidance in *BS 5228-2* that provides guidance on predicting and measuring construction vibration and assessing its impact on the environment.

12.4.22 *BS 5228-2* states that Peak Particle Velocity (PPV) is an appropriate parameter to be used when considering the impacts on humans and the risk to buildings due to construction vibration. The guidance on human response to vibration in buildings in terms of overall vibration velocity levels is detailed in Table 12-8: LOAEL and SOAEL thresholds of likely effects of vibration for building occupants (source: *BS 5228-2*). These criteria have been used to derive LOAEL and SOAEL thresholds for this assessment. Effects on ecological receptors are assessed within Chapter 6: Biodiversity based on the vibration results shown in Appendix 12.6: Noise and Vibration Results at Ecology Receptors (Application Document 3.4). The locations of ecological receptors included in this assessment are shown in Figure 12.8 Noise and Vibration Assessment - Location of Ecology Receptors.

12.4.23 An assessment of construction traffic vibration has not been undertaken. This is because the PPV from construction traffic vehicles would not be different from the PPV caused by any other similar vehicles that could legally use the route and therefore no significant effect would arise.

Table 12-8: LOAEL and SOAEL thresholds of likely effects of vibration for building occupants (source: *BS 5228-2*)

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.

12.4.24 In accordance with *DMRB LA 111* the magnitude of impact at sensitive receptors is determined in accordance with the threshold summaries in Table 12-9: Construction vibration impact magnitude.

Table 12-9: Construction vibration impact magnitude

Magnitude of impact	Increase in BNL of closest public road used for construction traffic (dB)
Major	Above or equal to 10 mm/s Peak Particle Velocity (PPV)
Moderate	Above or equal to SOAEL and below 10 mm/s PPV
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

12.4.25 Construction vibration is considered a significant effect when it is determined that a major or moderate magnitude of impact will 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.

12.4.26 Risk of damage to buildings from ground borne vibration is assessed using the criteria in Table 12-10: Vibration impact criteria for buildings. The criteria are derived from *BS 5228-2* and *BS 7385-2 Evaluation and measurement for vibration in buildings – Guide to damage levels from ground borne vibration (BS 7385-2)* (British Standards, 1993)[20]. This ensures there is no risk of the lowest damage category (cosmetic) being exceeded, as defined in *BS International Standards Organisation (ISO) 4866 Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures (BS ISO 4866) (British Standards, 2010)*[21], which defines the following categories:

- Cosmetic: the formation of hairline cracks on drywall surfaces or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction.
- Minor: the formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks.
- Major: the damage to structural elements of the structure, cracks in support columns, loosening of joints, splaying of masonry cracks, etc.

12.4.27 *BS7385-2* states that minor damage is possible at PPV of twice the criteria for cosmetic damage and major damage may occur at four times those levels. Effects in terms of even cosmetic damage to buildings would occur only for vibration exposures much higher than the lowest perceptible levels.

Table 12-10: Vibration impact criteria for buildings

Category of building	PPV (mm/s)[1]	
	Transient vibration[2]	Continuous vibration[3]
Potentially vulnerable building[4]	6	3

[20] British Standards (1993) Evaluation and measurement for vibration in buildings – Guide to damage levels from ground borne vibration
[21] British Standards (2010) 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

Category of building	PPV (mm/s)[1]	
	Transient vibration[2]	Continuous vibration[3]
Structurally sound buildings[4]	12	6

Notes:

1 At the building foundation

2 Transient relative to building response - from percussive piling

3 Continuous relative to building response - from vibratory piling, vibrating rollers

4 BS ISO 4866 (BS 2010) - Evaluation and measurement for vibration in buildings, provides guidance for the measurement of vibrations and evaluation of their effects on buildings including classifications.

Operation

Noise criteria

12.4.28 In accordance with NPSNN, traffic noise is assessed in terms of change of noise level and absolute noise level (see paragraph 12.4.29, paragraph 12.4.30 and Table 12-11: Operational noise LOAELs and SOAELs). Noise level change is determined through the calculation of noise levels at each individual noise sensitive receptor. Where the noise sensitive receptor is a building, the façade used to calculate noise change is chosen as:

- The façade with the greatest magnitude of noise change
- Where the greatest magnitude of noise change is equal on more than one façade, the façade experiencing the greatest magnitude of noise change and highest Do-Something noise level in both the opening and future year.

12.4.29 Regarding absolute operational noise levels, the effect level categories adopted in *DMRB LA 111* for the daytime and night-time LOAEL and SOAEL are set out for all noise sensitive receptors in Table 12-11: Operational noise LOAELs and SOAELs. The SOAEL and LOAEL defined within *DMRB LA 111* are considered to be appropriate given that the main noise source within study area is likely to be road traffic noise.

12.4.30 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 (according to WHO *Guidelines for Community Noise* and the noise insulation threshold). The night-time LOAEL is defined using the WHO *Night Noise Guidelines for Europe* and the night-time SOAEL is equivalent to the levels above which cardiovascular health effects become a major health concern according to the WHO *Guidelines for Community Noise*.

Table 12-11: Operational noise LOAELs and SOAELs

Time Period	LOAEL	SOAEL
Day	55dB $L_{A10,18hr}$ (façade) 50dB $L_{Aeq,16hr}$ (free-field)	68dB $L_{A10,18hr}$ (façade) 63dB $L_{Aeq,16hr}$ (free-field)
Night	40dB $L_{night,\ outside}$ (free-field)	55dB $L_{night,\ outside}$ (free-field)

Notes:

Façade - sound level that is determined 1 metre (m) in front of a window or door in a façade.

Time Period	LOAEL	SOAEL
Free-field - The sound level which is measured or calculated, 3.5m from reflecting surfaces (as per *BS 8233:2014 Guidance on sound insulation and noise reduction for buildings*[22]), without any reflections from nearby surfaces except the ground.		

12.4.31 In accordance with *DMRB LA 111,* the assessment considers noise levels with the Project (referred to as Do-Something) and without the Project (referred to as Do-Minimum) in an opening year (short-term) and a future year (long-term). The magnitude of change in the short-term and long-term noise levels attributable to the Project is evaluated in accordance with Table 12-12: Operational magnitude of change.

Table 12-12: Operational magnitude of change

Magnitude	Short-term noise change (dB $L_{A10,18h}$ or L_{night})	Long-term noise change (dB $L_{A10,18h}$ or L_{night})
Major	Greater than or equal to 5.0	Greater than or equal to 10.0
Moderate	3.0 to 4.9	5.0 to 9.9
Minor	1.0 to 2.9	3.0 to 4.9
Negligible	Less than 1.0	Less than 3.0

12.4.32 The initial assessment of likely significant effects at noise sensitive receptors is defined according to Table 12-13: Operational noise significance of change.

Table 12-13: Operational noise significance of change

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

12.4.33 Where the magnitude of change in the short-term is negligible, it can be concluded that the operational noise arising from the Project will not give rise to a likely significant effect.

12.4.34 For noise sensitive receptors where the magnitude of change in the short-term is moderate or major, Table 12-12: Operational magnitude of change will be used together with the output of Table 12-13: Operational noise significance of change to determine final significance.

12.4.35 Where the magnitude of change is minor or above in the short-term, other factors including absolute noise level, differing magnitude of change in the long-term, location of receptor, acoustic context and local attitude are then considered to determine the final operational significance effect as described in Table 12-14: Determining final operational significance on noise sensitive receptors (from *DMRB LA 111*).

[22] British Standards (2014) BS 8233:2014 Guidance on sound insulation and noise reduction for buildings

Table 12-14: Determining final operational significance on noise sensitive receptors (from *DMRB LA 111*)

Local circumstance	Influence on significance judgement
Noise level change (is the magnitude of change close to the minor/moderate boundary?)	1) Noise level changes within 1dB of the top of the 'minor' range can indicate that it is more appropriate to determine a likely significance effect. Noise level changes within 1dB of the bottom of a 'moderate' range can indicate that it is more appropriate to consider a change is not a likely significant effect.
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.
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 1dB or over results in a likely significant effect.
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) An example of this would be where no windows of sensitive rooms face the road, and outdoor spaces are protected from the road by buildings. 3) 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. 4) An example of this would be when a house has many windows of sensitive rooms and outdoor spaces facing the road. 5) It will only be 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.
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.
Likely perception of change by residents	1) If the Project results in obvious changes to the landscape or setting or a receptor, it is likely that noise level change will be more acutely perceived by the noise sensitive receptors. In these cases, it can be appropriate to conclude that a minor change in the short-term and/or long-term is a likely significant effect. 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.

12.4.36 Where the predicted noise levels are below the LOAEL there would be no noise effect in terms of Government policy. However, there could be noise effects in EIA terms for certain cases i.e. very rural settings where the ambient levels are very quiet. Therefore, *DMRB LA 111* requires the assessment to consider 'changes to the landscape or setting' as described in Table 12-14: Determining final operational significance on noise sensitive receptors (from *DMRB LA 111*). The absence of artificial sound is a factor (amongst other aspects of the setting) in assessing areas as having a particularly tranquil character. The tranquillity assessment presented within section 12.10: Assessment of likely significant effects has been used to identify any residential areas below the LOAEL considered in this assessment to have any particular sensitivity, including in the Area of Outstanding Natural Beauty (AONB) setting with regard to noise and other impacts.

12.4.37 The Campaign to Protect Rural England (CPRE) (Campaign to Protect Rural England, 2006)[23] defines tranquillity as *"The quality of calm experienced in places with mainly natural features and activities, free from disturbance from manmade ones"*. 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. The national relative tranquillity mapping has been reproduced in Figure 10.7 (Application Document 3.3) as part of Chapter 10: Landscape and Visual, 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 impacts below the LOAEL in any particularly sensitive settings.

12.4.38 Outdoor sensitive receptors in very quiet locations, such as PRoW where the noise level is below the LOAEL and the environment is characterised by little or no appreciable man-made sound, are considered rare in the national context. Hence, these outdoor amenity receptors in the AONB have been assessed as special cases. An assessment of impacts on PRoW is provided in Chapter 13: Population and Human Health.

Noise model

12.4.39 The purpose of this assessment is to assess road traffic noise in relation to sensitive receptors including dwellings and community facilities. Consideration of noise sensitive non-residential receptors, as described in *DMRB LA 111*, is also given as part of the noise assessment including educational establishments, hospitals, places of worship and PRoW.

12.4.40 For the prediction of road traffic noise, *DMRB LA 111* and *NPSNN* suggest using the methodology described in the technical memorandum CRTN. The proprietary software, NoiseMap 5 Server Edition, was used to predict traffic noise levels for the opening year (2029) and future year (2044), for both the existing layout (Do-Minimum) and project layout (Do-Something).

[23] Campaign to Protect Rural England (2006) Saving Tranquil Places: How to Protect and Promote a Vital Asset

The parameters used in the model are set out in Table 12-15: Modelling parameters.

Table 12-15: Modelling parameters

Parameter	Source	Details
Calculation method	CRTN method, as modified by Appendix A *DMRB LA 111*	BNL Calculations CRTN Modifications Speed pivoting process
Calculation engine	NoiseMap 5 Server Edition	CRTN package
Horizontal distances (horizontal alignment)	Engineering team	Civil engineering models for each scheme provided by the engineering team
Engineering civils (vertical alignment)	Engineering team	Civil engineering models for each scheme provided by engineering team
Ground levels (Digital Terrain Model)	OS Mastermap topography	Digital Terrain Model
Building heights	Ordnance Survey (OS)	Provided as part of OS Mastermap dataset
Addresses	Address Base Premium	Version received in January 2022
Receptor position	Noise model	For receptors with an associated building: 1m from facade and height depending on building height. For outdoor receptors: 1.5m above ground
Absorbent ground	Ordnance Survey (OS)	Soft ground except for areas of hard ground e.g. water, car parks
Road surface type	Engineering team	National Highways roads assumed to have low noise surface (noise level surface correction of -3.5dB). Non-National Highways roads assumed to be hot rolled asphalt (noise level surface correction of -0.5dB). Noise level corrections applied as per DMRB.
Traffic data	Transport planners	Opening year: 2029 Future year: 2044

12.4.41 The traffic data comprises 18-hour annual average weekday traffic (AAWT, 18h) flows for 2029 and 2044, traffic speed (pivoted speed as per *DMRB LA 111*) and percentage heavy good vehicles (HGVs). Full details of the traffic data used within this assessment are provided in the Transport Assessment (Application Document 3.7) and in Appendix 2.1 Traffic Modelling Data (Application Document 3.2).

12.4.42 Noise levels were calculated within the study area to produce contours of noise level exposure. Traffic noise levels were also calculated at each noise sensitive receptor within the Project study area. The noise contours

shown in Figure 12.2: Opening Year Do-Minimum Noise Level to Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) illustrate the noise levels at 4m above ground level (i.e. first floor level for a typical house which has been assumed to provide a worst-case scenario in terms of exposure to noise from the Project, i.e. greater angle of view and exposure to incident road traffic noise, rather than at ground level where there is likely to be greater screening of incident traffic noise).

12.4.43 Noise monitoring (presented in section 12.7: Baseline Conditions and Appendix 12.1: Baseline Noise Survey Results (Application Document 3.4)) has been used to inform the validation of the baseline model as per the guidance of *DMRB LA 111.*

12.4.44 The results discussed in section 12.10: Assessment of likely significant effects are based on a design including embedded mitigation (e.g. low-noise surface, alignment, landscaping bunds and cuttings). Essential and enhancement mitigation are presented in section 12.9: Essential mitigation and enhancement measures. The definitions of mitigation measures are identified in Chapter 4: EIA Methodology.

12.4.45 The feasibility of proposed noise mitigation measures was established through an appraisal process which considered engineering and environmental constraints, as well as a cost-benefit assessment which considers the degree of attenuation, cost of the mitigation measure and any other potential impacts arising from additional mitigation.

Assessment scenarios

12.4.46 The assessment considers noise levels with the Project (referred to as Do-Something) and without the Project (referred to as Do-Minimum) in an opening year (short-term) and a future year (long-term).

12.4.47 The assessment scenarios are defined as:

- Do-Minimum – opening year (2029) and future year (2044)
- Do-Something – opening year (2029) and future year (2044).

12.4.48 The traffic model which informs this noise assessment incorporates the impact upon the road network of future committed developments. Details of such developments are included within the traffic model uncertainty log and summarised in Table 5-1: Information Sources for Developments, of the Transport Assessment (Application Document 3.7) within section 5 Strategic Forecast Model Development. The full list of all development sites in the uncertainty log is shown in Appendix A – Development Uncertainty Log of this document. Noise impacts at committed developments are assessed separately in section 12.10: Assessment of likely significant effects, in Chapter 15: Cumulative Effects and in Appendix 15.1: Consideration of Cumulative Effects and Appendix 15.2: Cumulative Assessment (Application Document 3.4).

12.4.49 In accordance with *DMRB LA 111* the following comparisons were made between scenarios in the Project opening year and the future year to determine the impact of the Project in the short-term and the long-term:

- Do-Minimum scenario in the opening year against Do-Something scenario in the opening year (short-term Do-Something)
- Do-Minimum scenario in the opening year against Do-Something scenario in the future assessment year (long-term Do-Something)
- Do-Minimum scenario in the opening year against the Do-Minimum scenario in the future assessment year (long-term Do-Minimum).

12.4.50 *DMRB LA 111* also requires that night-time noise is assessed using the L_{night} descriptor to represent the noise level between the hours of 23:00 and 07:00. Method 3 from the Transport Research Laboratory (TRL) *Converting the UK traffic noise level $L_{A10,18h}$ to EU noise indices for noise mapping* (Transport Research Laboratory, 2002)[24] report PR/SE/451/02 was used to predict the L_{night} noise levels. Method 3 uses the predicted daytime noise level ($L_{A10,18h}$) as a basis for predicting the night-time noise levels. This was deemed to be proportionate and the appropriate method as there was nothing atypical in terms of traffic flow volumes between daytime and night-time for this route. [25]

Scoping

12.4.51 Table 12-16: Summary of scoping opinion and response sets out the key points from the Planning Inspectorate Scoping Opinion relevant to the noise and vibration assessment. The full Scoping Opinion is provided in Appendix 4.1 (Application Document 3.4), which includes responses from relevant local authorities and other stakeholders.

12.4.52 Where assessment has been undertaken in accordance with the Scoping Opinion, the wording of each point raised with a response and reference to the relevant ES section is provided. Where further discussion and/or an alternative approach has been agreed with the relevant stakeholders and the Planning Inspectorate, an explanation is provided.

Table 12-16: Summary of scoping opinion and response

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
Planning Inspectorate	The Affected Road Network (ARN) must be clearly identified.	ARN is a term used in Chapter 5: Air Quality. The noise and vibration assessment defines a study area.	Details are provided in section 12.6: Study area and Figure 12.1: Operational Noise Study Area (Application Document 3.3)
Planning Inspectorate	Agreement that operational vibration can be scoped out of assessment as road	This is noted and has been scoped out. No further action required.	Details provided in section 12.5: Assumptions and Limitations.

[24] Transport Research Laboratory (2002) Converting the UK traffic noise level $L_{A10,18h}$ to EU noise indices for noise mapping
[25] DMRB LA 111 notes in its Appendix A2 that the TRL Method 3 provides reliable results for most UK roads. Exceptions to this may include roads where the proportion of night-time traffic to daytime is atypical which can occur on roads serving facilities that operate 24hr per day, for example airports or ports. This is not the case for the Project.

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
	surface will be free of irregularities.		
Planning Inspectorate	Where professional judgement is used, a methodology for identifying and selecting sensitive receptors should be provided.	The study area and inclusion of receptor types were based on the guidance provided within *DMRB LA 111*, therefore no additional professional judgement was made.	N/A
Planning Inspectorate, Cumbria County Council, Eden District Council and Durham County Council	Details of how NIAs are going to be assessed should be provided and how noise levels can be reduced within NIAs should be detailed and explored where possible. NIA should be identified using the latest Round 3 mapping information	Details on the assessment of NIAs and their locations are provided.	Details are provided in section 12.7: Baseline conditions and Figure 12.1: Operational Noise Study Area (Application Document 3.3). An assessment is provided within section 12.10: Assessment of likely significant effects
Planning Inspectorate	Clear distinctions should be made between what are “enhancement” measures and what are mitigation measures necessary to avoid, minimise or offset potentially significant effect.	This is noted and has been addressed. Details on the essential mitigation and enhancement measures which have been considered and implemented as part of the design are provided.	Details are provided in section12.9: Essential mitigation and enhancement measures.
Planning Inspectorate, Durham County Council and Cumbria County Council and Eden District Council	Details of proposed BPM and mitigation measures during the construction phase should be included and confirmation should be made that noise mitigation measures will be installed at the earliest available opportunity during the construction phase.	Construction mitigation measures implement Best Practicable Means (BPM) methods. The Project will ensure mitigation measures are installed at the earliest opportunity.	Details of mitigation methods are provided in the Environmental Management Plan (EMP) (Application Document 2.7)
Planning Inspectorate, Cumbria County Council, Eden District	Traffic data provided by the transport consultant should be	This is noted and has been addressed. Details of the construction traffic	Details of the traffic data used for the assessment and their

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
Council and Durham County Council	interpretated correctly within the noise model. The methodology for assessing construction traffic impacts should consider any changes to traffic flows, speed and percentage of heavy vehicles and not just traffic flows.	noise assessment and the off-site construction traffic flows, speed and percentage of heavy vehicles are provided.	interpretation are provided in section 12.4: Appendix 12.3: Construction Assessment Results (Application Document 3.4). The study area has been identified based on the BNL and is discussed in section 12.6: Study Area
Planning Inspectorate	Details of what LOAEL and SOAEL level is being set for the construction noise and vibration assessment and how the SOAEL value has been determined.	LOAEL and SOAEL for construction noise and vibration are established in line with *DMRB LA 111*. The LOAEL Ambient noise levels (which define the LOAEL) at the relevant facades for each receptor within 300m of construction activities (in line with *DMRB LA 111*) have been determined based on predicted 2022 baseline traffic noise levels of the noise model and informed by baseline survey level data. The LOAEL and SOAEL for vibration have been established with reference to *BS 5228-2*.	Section 12.4: Assessment methodology.
Planning Inspectorate, Cumbria County Council and Eden District Council	Details of how the traffic model will be validated.	This is noted and has been addressed.	Traffic model validation details are provided in section 12.4.41 (under Operation section of the 1.4 Assessment methodology) and in section 12.7.6 (under section 12.7 Baseline Conditions.

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
Cumbria County Council and Eden District Council, Durham County Council	Information relating to working methods and plant/equipment requirements should be provided.	Construction information has been generated based on the preliminary design and worst-case assumptions regarding construction methodologies. The assumptions that have informed the assessment are provided.	Construction noise and vibration assessment provided in section 12.10: Assessment of likely significant effects. Details of construction assumptions are provided in ES Appendix 12.2: Construction Assessment Assumptions (Application Document 3.4).
Environment Agency	The potential impacts of construction vibration on fish arising from piling near a watercourse should be identified and assessed.	A construction vibration assessment has been undertaken and includes the specific concerns raised by the Environment Agency with respect to fish eggs / redds.	Construction vibration assessment detailed in section 12.10: Assessment of likely significant effects. Vibration impacts associated with fish eggs / redds are presented in Chapter 6: Biodiversity based on the vibration results shown in Appendix 12.6: Noise and Vibration Results at Ecology Receptors (Application Document 3.4). The locations of ecological receptors included in this assessment are shown in Figure 12.8: Noise and Vibration Assessment - Location of Ecology Receptors (Application Document 3.3).
Durham County Council and East and West Layton and Carkin Parish	The study area should capture all likely significant effects associated with the scheme and include East and West Layton.	This is noted and has been addressed. East and West Layton are included within the study area.	Section 12.6 and Figure 12.1: Operational Noise Study Area (Application Document 3.3).

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
Cumbria County Council and Eden District Council	Justification should be provided as to why the construction study is along the preferred route only.	The study area for construction noise and vibration has been set following the guidelines provided with *DMRB LA 111* and covers all routes and construction compounds.	Details of the construction study area are provided in section 12.6: Study Area.
East and West Layton, Carkin Parish, Cumbria County Council and Eden District Council	Consideration of induced and increased traffic should be made and not just current levels.	The traffic noise assessment has considered induced and increased traffic. As per *DMRB LA 111*, an assessment of both the short-term and long-term noise levels has been undertaken based on future year baseline traffic noise levels.	Consideration to the traffic changes resulting from the operation of the Project are presented in section 12.4 Assessment methodology under the Operation section. The study area, which is defined based on where traffic is predicted to be subject to changes (increase or decrease), is presented in section 12.6. Results are provided in section 12.10: Assessment of likely significant effects.
East and West Layton and Carkin Parish	Details of mitigated noise levels via planting and sound barriers.	Assessment results for operational noise presented in this chapter include identified embedded mitigation measures. Essential mitigation has not been included in the operational noise results they are subject to liaison with stakeholders.	Assessment results provided in section 12.10: Assessment of likely significant effects. Mitigation measures for operation of the scheme detailed in section 12.9: Essential mitigation and enhancement measures
East and West Layton and Carkin Parish	Consideration should be made to cuttings and placing of junctions in these cuttings.	The use of cuttings has been included as part of the design and to maximise the embedded mitigation.	Details of design are described in Chapter 2: The Project and Chapter 4: EIA Methodology.

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
East and West Layton and Carkin Parish	Consideration should not be limited to individual dwellings. Assessment of villages as a whole in terms of amenity should also be provided.	This is noted and has been addressed. The assessment follows the guidance provided within *DMRB LA 111*. However, Table 12-44: Summary of significant effects (construction) and Table 12-45: Summary of significant effects (operation) provide a summary of significant effects which have been grouped in terms of settlements.	Section 12.10: Assessment of likely significant effects.
Cumbria County Council, Eden District Council and Durham County Council	Location of monitoring locations, survey methodology, reason for location and duration of survey should be provided. Surveys should be undertaken at an appropriate time to ensure noise levels and traffic flows represent "normal" traffic conditions if possible.	This is noted and has been addressed. Details of the baseline noise survey are provided.	Details of the noise surveys are provided in Appendix 12.1: Baseline Noise Survey Results (Application Document 3.4) and section : Baseline conditions. A summary of these monitoring locations is also provided within Table 12-18: Summary of baseline survey locations.
Durham County Council	Clear statements of how the Project achieves the three main aims of NPSE and NPSNN.	This is noted and has been addressed.	Details are provided in Table 12-46: Scheme compliance with Government Policy
Durham County Council, Cumbria County Council and Eden District Council	Consultation on the proposed mitigation measured included within the Noise and Vibration Management Plan (NVMP) is welcomed before its submission.	The NVMP will be prepared by the Principal Contractors and will be consulted in line with the process set out in the EMP. The mitigation that is required to be included in the NVMP and an essay plan of the NVMP is provided in the EMP submitted with the DCO application.	EMP is prepared and submitted with DCO application (Application Document 2.7)

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
Natural England	Those seeking relative tranquillity should be included as noise sensitive receptors. For example, the users of the AONB should be considered rather than the AONB itself.	This is noted and has been addressed. Assessment of tranquillity is provided.	Tranquillity is discussed in section 12.4: Assessment methodology. An assessment of tranquillity is provided in section 12.10: Assessment of likely significant effects. Further assessment of Tranquillity is provided in Chapter 10: Landscape and Visual Effects and Chapter 13: Population and Human Health
Cumbria County Council and Eden District Council	Clarification of which *DMRB LA 111* is being followed.	*DMRB LA 111* version 2 - issued May 2020	*N/A*
Cumbria County Council and Eden District Council	Details how the Project will *"optimise environmental improvement opportunities*"	One example of this is where the Project passes around the north of Kirkby Thore, where it will be in cutting with an additional height of embankment on top of that in order to visually screen the road and to reduce noise impacts to the village of Kirkby Thore. These embankments will be graded out to allow them to fit better into the surrounding landscape and enable them to be returned to agriculture following construction.	Chapter 2: The Project provides the overarching design approach of the Project. Chapter 4: EIA Methodology sets out the Project design, mitigation and enhancement measures. Noise and vibration design aspects are considered within section 12.8: Potential impacts and additional design measures within section 12.9: Essential mitigation and enhancement measures.
Cumbria County Council and Eden District Council	The sensitivity (or value) of receptor should be provided.	There are different types of noise sensitive receptors considered in the assessment, which in addition to residential receptors, are a range of non-residential properties, including	Details have been included as part of section 12.4: Assessment methodology.

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
		hospitals, healthcare facilities, education facilities, community facilities, Environmental Noise Directive (END) quiet areas or potential END quiet areas, international and national or statutorily designated sites, public rights of way (PRoW) and cultural heritage assets. Sensitivity has been considered in the assessment based on the use of the receptors and the context of the impact.	
Cumbria County Council and Eden District Council	Detail on how construction noise and vibration levels will be predicted and then assessed to determine significance. Including how construction vibration for road traffic using diversion routes will be assessed.	Construction information was provided by the Project team buildability advisors, which was used as the basis of the construction noise and vibration assessment. The methodology has been set following the guidelines provided within *DMRB LA 111.* A vibration assessment has not been undertaken as it is not expected that a significant change in traffic vibration would occur.	Details of construction assumptions are provided in Appendix 12.2: Construction Assessment Assumptions (Application Document 3.4). Details are provided in section 12.4: Assessment methodology.
Cumbria County Council and Eden District Council	Details of how the assessment will determine that *"appropriate mitigation is put in place to ensure existing noise sensitive premises are not adversely affected"*	This is noted and has been addressed.	Details are provided in section 12.8: Potential impacts within the mitigation section.

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
Cumbria County Council and Eden District Council	Details of the acoustician(s) preparing the chapter should be provided.	This is noted and has been addressed	The credentials of the lead author are provided (as is relevant for the purpose of the assessment) in section 12.1: Introduction.
Cumbria County Council and Eden District Council	Details on how significant effects will be determined and mitigated and how the Project will be compliant with national planning policy and local planning policy.	This is noted and has been addressed	This is discussed in section 12.10: Assessment of likely significant effects and Table 12-46: Scheme compliance with Government Policy.

Consultation

12.4.53 Table 12-17: Summary of key consultation comments received sets out a summary the key consultation comments relevant to the noise and vibration assessment.

12.4.54 In addition to the comments provided below, Richmondshire District Council has been consulted through online discussion. Eden District Council was also contacted to discuss any comments or concerns they may have. However, no response was received prior to submitting the ES. Cumbria County Council was contacted and directed the discussion to the local councils.

Table 12-17: Summary of key consultation comments received

Consultee/ respondent	Comment	Applicant response	Where addressed?
Eden District Council and Cumbria County Council	Consultation with Natural England to discuss the assessment of noise and vibration on designated nature conservation sites.	Consultation with Natural England has been undertaken as part of the statutory consultation process.	Detail of consultation with Natural England is presented in Chapter 6: Biodiversity. Chapter 6 includes an assessment of the effects of noise and vibration on ecological receptors based on the results presented in Appendix 12.6: Noise and Vibration Results at Ecology Receptors (Application Document 3.4). The locations of the ecological receptors

Consultee/ respondent	Comment	Applicant response	Where addressed?
			are shown in Figure 12.8: Noise and Vibration Assessment - Location of Ecology Receptors (Application Document 3.3).
Eden District Council and Cumbria County Council	The ES should identify the location and details of NIAs within the operational noise study area.	Each NIA location within the operational noise study area is identified and detailed.	Details are provided within section 12.7: Baseline conditions and Figure 12.1 Study Area, NIAs, and Survey Monitoring Locations (Application Document 3.3).
Eden District Council and Cumbria County Council	The baseline noise levels used to define the construction LOAEL should be presented.	LOAEL and SOAEL for construction noise and vibration are established in line with *DMRB LA 111*. The ambient noise levels (which define the LOAEL) at the relevant facades for each receptor within 300m of construction activities (in line with *DMRB LA 111)* have been determined based on predicted 2022 baseline traffic noise levels of the noise model and informed by baseline survey level data.	Appendix 12.1: Baseline Noise Survey Results (Application Document 3.4) and section 12.4: Assessment methodology.
Eden District Council and Cumbria County Council	Details of the committed developments and how they are included in the assessment scenarios. Consideration should be given to whether committed developments could mask impacts associated with the Project.	The impact on the overall traffic flows due to the committed developments have been included in all scenarios as it has been assumed they will proceed with or without the Project.	The predicted noise impact on committed developments has been provided in section 12.10: Assessment of likely significant effects. Information relating to committed developments impacting traffic flows are provided in paragraph 12.4.48. Noise impacts at committed

Consultee/ respondent	Comment	Applicant response	Where addressed?
			developments are assessed separately in section 12.10: Assessment of likely significant effects, in Chapter 15: Cumulative Effects and in Appendix 15.1: Consideration of Cumulative Effects and Appendix 15.2: Cumulative Assessment (Application Document 3.4).
Eden District Council	The Do-Minimum future year compared against the Do-Minimum opening year, should be modelled and assessed.	This is noted and has been addressed.	Details are provided in Appendix 12.4: Operational Assessment Results and Appendix 12.5: Non-significant Effects (Application Document 3.4).
Eden District Council	Details of whether the motorway or non-motorway equations have been used from the TRL report.	The calculation of night-time noise is predicted using non-motorway for the majority of the roads within the study area. The motorway equation was used for the A1(M) and M6.	Details provided in section 12.4: Assessment methodology.
Eden District Council	Clarification is sought that the methodology for determining significance is the same for any non-building receptors (for example the AONB or public rights or way). An assessment of the potential impacts of noise and vibration should be presented.	The method to determine significance is the same regardless of the receptor (i.e. residential or non-residential) as per *DMRB LA 111*.	Details of how significant is determined is provided in section 12.4: Assessment methodology. This is discussed in section 12.10: Assessment of likely significant effects and in Chapter 10: Landscape and Visual and Chapter 13: Population and Human Health.

Consultee/ respondent	Comment	Applicant response	Where addressed?
Eden District Council and Cumbria County Council, Richmondshire District Council and North Yorkshire County Council	Study area should be sufficient to encompass all sensitive receptors which may experience significant effects.	This is noted and has been addressed. Details of the study area and how it has been defined in accordance with *DMRB LA 111* are provided.	Section 12.6: Study area and Figure 12.1: Operational Noise Study Area (Application Document 3.3). A list of all sensitive receptors that are predicted to experience significant effects is provided in Appendix 12.4: Operational Assessment Results (Application Document 3.4). Likely effects not predicted to be significant are presented in Appendix 12.5: Non-significant Effects (Application Document 3.4).
Eden District Council and Cumbria County Council	Details of noise monitoring locations and the reason for each monitoring location/ duration of the survey period should be provided and discussed with EDC in advance of the noise survey being undertaken.	The Project has tried to accommodate these comments even though received after the surveys were completed but has not yet had a response from Eden District Council.	Full details of monitoring locations are provided within Appendix 12.1: Baseline Noise Survey Results (Application Document 3.4).
Eden District Council, Cumbria County Council	Details on how the second aim of the NPSE will be assessed and achieved.	This is noted and has been addressed.	This is discussed in section 12.10: Assessment of likely significant effects.
Eden District Council and Cumbria County Council	Details of how “appropriate mitigation is put in place to ensure existing noise sensitive premises are not adversely affected” should be provided.	Appropriate sustainable mitigation measures have been considered in the forms of embedded, essential and enhancement mitigation and measures. Measures include Best Practicable Means	Chapter 4: EIA Methodology sets out the Project design, mitigation and enhancement measures. Construction and operation noise and vibration design aspects are considered within

Consultee/ respondent	Comment	Applicant response	Where addressed?
		during construction and low-noise surfacing, alignment, landscaping bunds and cuttings for operation.	section 12.8: Potential impacts and additional design measures within section 12.12: essential mitigation and enhancement measurements.
Eden District Council and Cumbria County Council	Details of how significant effects are determined should be provided.	Details of how significant effects are determined in line with *DMRB LA111* for construction noise and vibration and operation noise.	Details of the establishment of significant effects are presented within section : Assessment methodology.
Eden District Council	Comments made in relation to the limitations of the traffic data should be considered for the results in the ES.	Road traffic flows (including the proportion of heavy vehicles) and speeds used in the assessment were provided by the Project traffic specialists for all the assessment scenarios. The traffic forecasting includes any additional traffic on the highway network associated with any expected new developments in the region in the assessment years.	Details of the noise model are provided in section 12.4: Assessment methodology. Limitations and assumptions are presented in section 12.5.
Eden District Council	The noise and vibration chapter should be prepared by a suitably qualified acoustician.	This is noted and has been addressed. Details of the lead author's credentials showing they are a competent expert are provided	Section 12.1: Introduction.
Eden District Council and Cumbria County Council	National Highways should consider all opportunities to minimise any increases and to seek enhancements.	One example of this is where the Project passes around the north of Kirkby Thore, where it will be in cutting with an additional height of embankment on top of that in order to visually screen the road and to	Chapter 2: The Project provides the overarching design approach of the Project. Chapter 4: EIA Methodology sets out the Project design, mitigation and enhancement measures.

Consultee/ respondent	Comment	Applicant response	Where addressed?
		reduce noise impacts to the village of Kirkby Thore. These embankments will be graded out to allow them to fit better into the surrounding landscape and enable them to be returned to agriculture following construction.	Noise and vibration design aspects are considered within section 12.8: Potential impacts and additional design measures within section 12.9: essential mitigation and enhancement measurements
Eden District Council and Cumbria County Council	A construction road traffic assessment methodology should be completed.	This is noted and has been addressed. Full details on the assessment methodology are provided	Section 12.4: Assessment methodology.
Eden District Council and Cumbria County Council	Details of mitigation and enhancements is required. The inclusion of BPM and commitment to mitigation measures during the construction phase, should be included in the NVMP.	This is noted and has been addressed. Full details on mitigation and enhancement measures are provided. The EMP sets out Best Practicable Means (BPM) approach.	Section 12.9: essential mitigation and enhancement measurements. Details on methodology are provide in section 12.4: Assessment methodology. EMP (Application Document 2.7)
Eden District Council	Details on how the noise and vibration assessment will take the Project objective to *"optimise environmental improvement opportunities"* should be provided.	This is noted and has been addressed.	Details are provided in section 12.9: essential mitigation and enhancement measurements.
Eden District Council and Cumbria County Council	Mitigation measures should minimise the adverse impact on sensitive receptors in Kirkby Thore and consultation should be undertaken with EDC. Acoustic mitigation should be complimentary to the landscape and biodiversity.	Mitigation measures have been explored in detail with detailed calculation of several mitigation measures and, where appropriate, value for money calculations. The Project has tried to accommodate these comments but has not yet had a response	The evolution of the scheme design is described in Chapter 3: Assessment of Alternatives. Mitigation information is presented in section 12.9: Essential mitigation and enhancement measures.

Consultee/ respondent	Comment	Applicant response	Where addressed?
		from Eden District Council.	
Eden District Council and Cumbria County Council	Consideration should be given to Kirkby Thore Primary School and whether appropriate internal ambient noise levels can still be achieved in classrooms with windows open.	Predicted noise levels at the school are consistent with requirements of Building Bulletin 93 (2015), Acoustic design of schools: performance standards. Predicted noise levels at outdoor teaching spaces and in classrooms (assuming windows partially open) would meet BB93 criteria. Eden District Council has been contacted to discuss but such discussions have not taken place at the time of writing.	The noise levels at Kirkby Thore Primary School are provided in Appendix 12.4: Operational Assessment Results (Application Document 3.4) and an assessment is provided in section: 12.10 Assessment of likely significant effects.
Richmondshire District Council and North Yorkshire County Council	Construction traffic using diversionary routes during night-time hours should be assessed. The study area should be sufficient to consider sensitive properties at a greater distance where appropriate.	The 25 metre radius is recommended within *DMRB LA 111*.	Details of the diversion route assessment are provided in section: Assessment of likely significant effects.
Richmondshire District Council and North Yorkshire County Council	Any forecasts based on traffic speed, flow, and percentage HGV which could all lead to an increase in noise	This is noted and has been addressed. The predicted noise impacts of the Project reflect changes in traffic speed, flow and percentage HGV.	Section 12.10: Assessment of likely significant effects.

Consultee/ respondent	Comment	Applicant response	Where addressed?
	levels along the route must be addressed.	These are provided and assessed.	
Richmondshire District Council and North Yorkshire County Council	RDC would like to be involved in the preliminary discussions surrounding the methodology of this assessment and the identification of vibration-sensitive receptors.	An online meeting with Richmondshire District Council was held to discuss the assessment methodology.	N/A

In-combination climate change impact assessment

12.4.55 An in-combination climate change assessment (ICCI) (section 12.10.172 to 12.10.176) has been conducted to assess likely changes to the significance of effects when considering the combined impact of the Project in a future changed climate on noise and vibration sensitive receptors in the surrounding environment. The assessment considers whether climate change could impact the likelihood and magnitude of the effects of the project on noise and vibration sensitive receptors, or affect the susceptibility, vulnerability, value or importance of the receptors themselves. The assessment has been based on the latest UK Climate Change Projections and considers a range of climatic hazards including rising temperatures, higher and lower rainfall, and the increased frequency and magnitude of extreme events such as heat waves and flooding.

12.4.56 UKCP18 projections suggest that changes to the climate by the 2020s (construction period) are unlikely to have a significant impact on this effect.

12.5 Assumptions and limitations

Construction

12.5.1 Assumptions have been developed based on the preliminary design for the Project as to the type and number of construction plant and the methods and duration of the construction processes for the Project. This data has been based on the construction activities that will be required for the various stages of the Project (for example, earthworks and structures). Data has also been used from similar highway construction works where appropriate detailed construction method data was available. This data has been reviewed by construction advisors to reflect appropriate scale of works for each scheme. This includes locations of key areas of works (with regard to noise and vibration, such as piling works for structures). The assumptions are shown in Appendix 12.2: Construction Assessment Assumptions (Application Document 3.4).

12.5.2 The DCO will secure the requirement, via the EMP, for the Principal Contractors to develop a NVMP during detailed design, which will provide more detailed information on construction plant, durations and mitigation

measures. However, the current construction method assumptions are considered representative of the type and scale of the works.

Operation

12.5.3 NoiseMap 5 was used to calculate the traffic noise levels at all residential properties within the relevant study areas.

12.5.4 Road traffic flows (including the proportion of heavy vehicles) and speeds used in the assessment were provided by the Project traffic specialists for all the assessment scenarios. The traffic forecasting includes any additional traffic on the highway network associated with any expected new developments in the region in the assessment years.

12.5.5 In liaison with the Project pavement engineers, principal A-roads and motorways have been modelled with a low noise surface for both the Do-Minimum and Do-Something scenario. Two sections of the existing A66 (between Appleby-in-Westmoreland to Brough and Bowes Bypass) have been assumed to be Hot Rolled Asphalt for durability reasons: Slapestone Bridge to before the Maiden Castle Roman Fortlet and second from the end of Roman Road (course of) to about Rowtonbridge Sike. All other existing roads and slip roads have been assumed to be Hot Rolled Asphalt.

12.5.6 As stated in *DMRB LA 111* and agreed by the Planning Inspectorate (Table 12-16: Summary of scoping opinion and response), operational vibration has been scoped out of assessment as the road surface will be free of irregularities as part of project design and general maintenance. Therefore, only an operational noise assessment has been undertaken.

Limits of Deviation

12.5.7 Limits of Deviation (LoD) have been established and are defined in Chapter 2: The Project, to allow flexibility for the final detailed design to respond to information about local conditions that will be better understood after consent has been granted (e.g. ground investigation and detailed topographical information).

12.5.8 The modelled predictions, which follow the methodologies presented in *DMRB LA 111* and *CRTN*, are representative of a typical scenario as opposed to an overly cautious worst-case scenario with the distance from the road minimised. This is considered to be an appropriate overall assessment scenario.

12.5.9 A high-level sensitivity test using a geospatial based[26] approach has been undertaken to determine whether the LoD have the potential to change the conclusion of likely significant effects identified in section 12.10. Generally, within the LoD of the reference alignment (i.e. the modelled Project alignment) the potential noise level changes will be negligible and will not change the assessment outcome for receptors located at a large distance from the Project relative to the change in alignment.

[26] High-level sensitivity test consists of an analysis of distance between receptors and A66 new dualling centrelines arising from the use of the full extent of the LoD. The analysis estimates the change in noise levels resulting from moving the centrelines horizontally and the process is undertaken using Geographical Information Systems (GIS).

12.5.10 Where maximum possible changes in the alignment (within the LoD) would change the distance between any receptors and the road by a distance similar to the current distance of the receptor from the road, or where the LoD are greater than the standard LoD, then changes of the alignment within the LoD would have a larger impact. For receptors brought closer to the alignment, these impacts could result in additional likely significant effects at receptors that are close to the assessment criteria (as per section 12.4) for a likely significant effect. Conversely, moving the road alignment further from such receptors could obviate a predicted likely significant effect. The receptors for which the conclusion of significance may change from being not significant to adverse significant effect as a result of the LoD being invoked are presented in the relevant subsections of section 12.10 Assessment of likely significant effects.

12.5.11 For the schemes where the vertical LoD are greater than those identified as the standard LoD, it is noted that whilst the vertical deviation could vary significantly, the noise mitigation relative to the roads would be adapted accordingly as required in the EMP (Application Document 2.7) and the Project Design Principles (Application Document 5.1). This is the case for mitigation in the northern part of the Temple Sowerby to Appleby scheme (north of Kirkby Thore), where mitigation in the form of earth bunds, would be adapted to ensure screening of the new roads to sensitive receptors is maintained.

12.6 Study area

12.6.1 The study area has been determined using the guidance provided within *DMRB LA 111*. The section below presents the methodology followed to determine the construction noise and vibration study area and the operational noise study area.

Construction

12.6.2 *DMRB LA 111* guidance states that a construction study area should be of sufficient size to consider all noise sensitive receptors:

- That have the potential to be affected by any construction noise or vibration activity
- That are located in an area where there is a reasonable stakeholder expectation that a construction noise and vibration assessment will be undertaken

12.6.3 *DMRB LA 111* notes that a study area of 300m from the closest construction activities, is sufficient to encompass construction noise sensitive receptors. Similarly, for vibration, a study area of 100m from the closest construction activities is sufficient. Receptors located beyond these distances are unlikely to be significantly impacted by construction noise and vibration.

12.6.4 As required by *DMRB LA 111* a diversion route study area of 25m from the kerb line of all diversion routes will be adopted where the Project requires full carriageway closures during the night-time period (23:00-07:00) to enable construction works to take place.

12.6.5 As required by *DMRB LA 111* a construction traffic noise study area has been defined to include a 50m width from the kerb line of existing public roads with the potential for an increase in BNL of 1dB(A) or more as a result of the addition of construction traffic to existing traffic levels.

Operational

12.6.6 *DMRB LA 111* guidance states that an operational noise study area should be defined to include:

- All noise sensitive receptors that are potentially affected by operational noise changes generated by the Project, either on the route of the Project or other roads not physically changed by the Project
- Noise sensitive receptors that are located in an area where there is a reasonable stakeholder expectation that an operational noise assessment will be undertaken

12.6.7 Following *DMRB LA 111* the operational study area is defined as the area within 600m of the centrelines of the new, bypassed or altered roads and 50m of the centrelines of other road links with potential to experience a short-term BNL change of more than 1dB(A) as a result of the Project.

12.6.8 The study area has been extended to include the settlement of East Layton in response to responses received during statutory consultation.

12.6.9 The study areas for this assessment are shown in Figure 12.1: Operational Noise Study Area (Application Document 3.3).

12.7 Baseline conditions

Routewide

12.7.1 The main settlement areas within the route corridor for the Project are: Penrith, Temple Sowerby, Kirkby Thore, Crackenthorpe, Appleby-in-Westmorland, Warcop, Brough, Bowes, Barnard Castle, West Layton, East Layton, Scotch Corner and Middleton Tyas.

12.7.2 This section considers the whole study area, where in total, 5,926 residential and 468 non-residential receptors have been identified.

12.7.3 Noise Important Areas (NIAs) are locations in England where the top 1% of the population that are affected by the highest noise levels are located. NIAs are based on the results of the strategic noise mapping undertaken by Department for Environment, Food and Rural Affairs (Defra), under the terms of the Environmental Noise (England) Regulations 2006. NIAs are assessed as sensitive receptors or groups of receptors in their own right, therefore each NIA has been assessed in terms of noise change and whether the Project presents an opportunity for enhancement.

12.7.4 The following NIAs have been identified adjacent to the existing A66 within the study area which are the responsibility of National Highways (Defra, 2019b)[27] (Refer to Figure 12.1: Operational Noise Study Area):

[27] DEFRA, 2019b, Noise Action Planning Important Areas Round 3 England

- Defra Important Area, 10283, National Highways
- Defra Important Area, 10284, National Highways
- Defra Important Area, 10285, National Highways
- Defra Important Area, 6763, National Highways
- Defra Important Area, 12113, National Highways
- Defra Important Area, 10128, National Highways
- Defra Important Area, 10438, National Highways
- Defra Important Area, 13930, National Highways
- Defra Important Area, 10230, National Highways
- Defra Important Area, 10437, National Highways
- Defra Important Area, 10127, National Highways.

12.7.5 Defra Noise Important Area, 10285 has been identified within Cumbria County Council and is also the responsibility of Cumbria County Council.

12.7.6 Baseline noise surveys were undertaken in June 2021 at several locations across the proposed route of the Project. Whilst surveying was conducted during the Covid-19 pandemic, surveying was not conducted during periods of national or local lock-down. Measured noise levels are believed to be representative of normal conditions as traffic flows on the major trunk roads were close to pre-Covid-19 levels. Survey results were used to help validate the acoustic road noise model used for the predictive noise calculations as per *DMRB LA 111* section 3.45 – 3.48.

12.7.7 A combination of 24-hour unattended noise monitoring and measurements made in accordance with the 'Shortened measurement procedure' defined in CRTN were undertaken as part of the baseline surveys. Surveys were undertaken at representative locations where staff could safely work and landowner access permission was granted. Full details of the surveys are provided in Appendix 12.1: Baseline Noise Survey Results (Application Document 3.4) and measurement locations are shown on Figure 12.1: Operational Noise Study Area (Application Document 3.3).

Table 12-18: Summary of baseline survey locations

Relevant Scheme	ID	Address	Location	Survey Type
M6 Junction 40 to Kemplay Bank	1	4 Eamont Terrace	NY 50544 28697	24h
	2	Skirsgill Lodge	NY 50816 28811	CRTN
	3	35 Clifford Road	NY 51822 29046	24h
	4	11 Carleton Hall Gardens	NY 51804 29034	CRTN
Penrith to Temple Sowerby	5	School House	NY 57488 28924	24h
	6	Whinfell Park Cottages	NY 55891 28800	CRTN
Temple Sowerby to Appleby	7	Castrigg Lane	NY 67411 22403	24h
	8	48 Sanderson Croft	NY 64122 25987	24h
	9	12 Long Marten Road	NY 68089 21334	24h
	10	Crackenthorpe Junction	NY 66246 21978	CRTN
	11	Bridge Hotel	NY 63534 25331	CRTN
	12	Comrie Lea	NY 61590 26602	CRTN

Relevant Scheme	ID	Address	Location	Survey Type
Appleby to Brough	13	Walkmill	NY 74964 16384	24h
	14	Wheatsheaf Farm	NY 74480 16642	CRTN
	15	Near Croft Cottage off A66	NY 78644 14902	CRTN
Bowes By-pass	16	Kilmond View	NY 99313 13634	24h
	17	Unicorn Inn	NY 99505 13560	CRTN
Stephen Bank to Carkin Moor	18	The Laurels	NZ 14219 09875	24h
	19	Foxhall Inn	NZ 14745 09151	CRTN
	20	Foxwell Farm	NZ 14981 09059	CRTN

12.7.8 A summary of the baseline results is provided in Table 12-19: Summary of Average Measured Noise Levels.

Table 12-19: Summary of Average Measured Noise Levels

Relevant Scheme	ID	Address	Average Measured Noise Levels (dB)		
			$L_{A10,18h}$	$L_{Aeq,16h}$	$L_{night,outside}$
M6 Junction 40 to Kemplay Bank	1	4 Eamont Terrace	76.4	74.4	65.0
	2	Skirsgill Lodge	79.0	77.0	67.3
	3	35 Clifford Road	57.5	55.5	48.0
	4	Carleton Hall	63.0	61.0	52.9
Penrith to Temple Sowerby	5	School House	62.7	60.7	52.7
	6	Whinfell Park Cottages	61.6	59.6	51.7
Temple Sowerby to Appleby	7	Castrigg Lane	42.1	40.1	34.1
	8	48 Sanderson Croft	38.9	36.9	31.2
	9	12 Long Marten Road	53.9	51.9	44.7
	10	Crackenthorpe Junction	77.9	75.9	66.3
	11	Bridge Hotel	79.3	77.3	67.6
	12	Comrie Lea	59.3	57.3	49.6
Appleby to Brough Temple	13	Walkmill 1	59.8	57.8	50.1
	14	Wheatsheaf Farm	79.0	77.0	67.3
	15	Near Croft Cottage off A66	75.0	73.0	63.7
Bowes By-pass	16	Kilmond View	59.9	57.9	50.1
	17	Unicorn Inn	52.2	50.2	43.2
Stephen Bank to Carkin Moor	18	The Laurels	45.1	43.1	36.8
	19	Foxhall Inn	75.2	73.2	63.9
	20	Foxwell Farm	68.0	66.0	57.4

M6 Junction 40 to Kemplay Bank

12.7.9 This scheme is located to the south of the town of Penrith within the Eden District Council. Land to the east, south and west is predominantly rural with a number of commercial and residential receptors located near the A66. The majority of receptors are located to the north of the scheme within the town of Penrith. Closest residential receptors are located near to Clifford Road. In total there are 2172 residential and 157 non-residential receptors identified within this scheme.

12.7.10 There are a number of main roads in the area surrounding this scheme. These include M6, A66, A529, A686 and A6.

12.7.11 There are four NIAs located within 600m of this scheme NIA 10284, 10283, 10285 and 6763.

Penrith to Temple Sowerby

12.7.12 This scheme is located to the east of the town of Penrith within the Eden District Council. It extends for approximately 5km through a largely rural area. There are a number of scattered residential, commercial and community receptors located near the A66. In total there are 46 residential and 4 non-residential receptors identified within this scheme.

12.7.13 The A66 is the main road in the vicinity of this scheme area with a number of local roads which are accessed from the A66.

12.7.14 There are no NIAs located within 600m of this scheme.

Temple Sowerby to Appleby

12.7.15 This scheme begins to the west of the Roman Road and then bypasses north of the village of Kirkby Thore within the Eden District Council. It extends for approximately 7.5km through a predominantly rural area with the exception of the village of Kirkby Thore and the village of Crackenthorpe. Appleby-in-Westmorland is located to the south-east of the end of the scheme. In total there are 693 residential and 22 non-residential receptors identified within this scheme

12.7.16 The A66 is the main road in the vicinity of this scheme area with a number of local roads which are accessed from the A66. There is also a British Gypsum and other industrial sites to the north of Kirkby Thore.

12.7.17 There is one NIA located within 600m of this scheme; NIA 12113. NIA 12113 is located to the south-west of Kirkby Thore on the existing A66.

Appleby-in-Westmorland to Brough

12.7.18 The scheme is located within the Eden District Council. The area immediately surrounding this section is rural. It extends for approximately 8km. There are a number of scattered residential, commercial and community receptors located near the A66. The villages of Warcop and Brough are located within the study area. In total there are 485 residential and 35 non-residential receptors identified.

12.7.19 The North Pennines AONB is located to the north, east and south-east of this scheme. The scheme encroaches on the south-western boundary of the North Pennines AONB by approximately 200m.

12.7.20 There is one NIA located within 600m of this scheme; NIA 10128. NIA 10128 is located on the existing A66, north of Warcop Training Centre.

Bowes Bypass

12.7.21 This scheme is located to the north of the village of Bowes in the Eden District Council. The surrounding area is predominantly rural with a number of scattered residential and community receptors. The scheme extends for approximately 3km. In total there are 147 residential and 15 non-residential receptors identified within this scheme.

12.7.22 The North Pennines AONB is located to the west and south of this scheme. The scheme is located on the south-eastern boundary of the North Pennines AONB but encroaches less than 20m on the AONB.

12.7.23 There are no NIAs located within 600m of this scheme.

Cross Lanes to Rokeby

12.7.24 This scheme is located within the Durham County Council. The surrounding area is predominantly rural with a number of scattered residential and community receptors. The scheme extends for 3km. The community of Barnard Castle is located north of the scheme via the B6277 road. In total there are 49 residential and 5 non-residential receptors identified within this scheme.

12.7.25 There are no NIAs located within 600m of this scheme.

Stephen Bank to Carkin Moor

12.7.26 This scheme is located within Richmondshire Council and extends for approximately 6.5km. The area immediately surrounding this section is predominantly rural. There are a number of scattered residential and community receptors located near the A66 and also West Leyton. East Leyton is not located within 600m of this scheme, however, the study area has been extended to include this settlement in response to the consultation feedback. In total there are 91 residential and 6 non-residential receptors identified within this scheme.

12.7.27 There is one NIA located within 600m of this scheme – NIA 10437. NIA 10437 is located the existing A66, north of Ravensworth.

A1(M) Junction 53 Scotch Corner

12.7.28 This scheme is located to the west of Middleton Tyas within the Richmondshire Council area. There are a number of commercial and residential community receptors near Scotch Corner. In total there are 58 residential and 6 non-residential receptors identified within this scheme

12.7.29 There are no NIAs located within 600m of this scheme.

Future baseline

12.7.30 The in-combination climate change assessment has used a future climate baseline that is based on representative concentration pathway 8.5 (RCP 8.5) of the UK climate change 2018 projections (UKCP18). This future climate baseline is presented in Chapter 7 Climate (Application Number 3.2).

12.7.31 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. Potential impacts arising from operation of the Project upon future receptors / committed developments, are assessed in section 12.10: Assessment of Likely Significant Effects below.

12.7.32 As part of the next round of Environmental Noise (England) Regulations noise mapping (which is likely to be published in 2023), the list and location of NIAs may be altered and updated depending on the outcome of this assessment. However, as it stands these NIAs are still considered to represent the current top 1% of the population that are affected by the highest noise levels in England.

12.8 Potential impacts

12.8.1 Based on the Project design and associated construction activities, the Project has the potential to cause noise and vibration impacts during both construction and operation.

12.8.2 The design of the Project, including any embedded mitigation measures that have been incorporated, are described in Chapter 4: Environmental Assessment Methodology. Any key aspects of the design and embedded mitigation are also referenced in this section where they are directly applicable to the noise and vibration assessment.

12.8.3 Potential impacts of the Project are described in this section prior to the implementation of the essential mitigation described below. The residual effects of the Project, taking into account this essential mitigation (where not subject to liaison with stakeholders), are then described in section 12.10: Assessment of likely significant effects.

Construction

Design and embedded mitigation

12.8.4 The scheme has been designed to avoid and minimise potential adverse noise and vibration effects through the process of design development and consideration of good design principles. All design and embedded mitigation measures for noise and vibration impacts are reported within Chapter 4: Environmental Assessment Methodology.

12.8.5 An EMP has been prepared at this stage and included in the DCO application (Application Document 2.7). The EMP contains a Noise and Vibration Management Plan (Annex B5), which includes relevant noise

criteria, proposed surveys and a range of best practice measures associated with mitigating potential noise and vibration impacts.

12.8.6 The potential attenuation of noise from construction activities through the localised use of temporary site hoardings or noise barriers has not been included in the assessment of construction noise in order to represent a worst-case scenario. BS 5228 advises that noise barriers can provide a reduction in noise levels of 5dB when the top of the plant is just visible over the noise barrier, and 10dB when the plant is completely screened from a receptor. The effectiveness of a noise barrier depends upon its length, effective height, position relative to the noise source and to the receptors, and the material from which it is constructed.

12.8.7 The core working hours for the Project are weekdays 07:30-18:00 and Saturday 07:30-13:00. There may be a requirement to undertake occasional works on evenings/weekends/night although these works are currently unknown and would be subject to a separate Section 61 application (refer to section 12.9: Essential Mitigation and Enhancement Measures). This will be determined by the contractors once appointed and agreed by the relevant local councils through the final EMP(s) and NVMP.

12.8.8 As stated in the NVMP (Annex B5 of the EMP, Application Document 2.7), during the construction, appropriate mechanisms to communicate with local residents will be set up to highlight potential periods of disruption for both noise and vibration (for example web-based, newsletters, newspapers, radio announcements etc.). This will include the appointment of the CRM responsible for leading engagement with potentially affected communities. An information web-page will be provided and kept up-to-date on the National Highways website to reflect construction and community liaison requirements. It is envisaged that the web-page will provide up-to-date information on the progress of the construction works, areas affected by construction, mitigation in place to reduce adverse effects, information regarding planned construction works (including any proposed works outside normal hours, diversion routes etc.) and works recently completed. The communication strategy will minimise the likelihood of complaints. Residents will be provided with a point of contact for the CRM for any queries or complaints. In addition, the National Highways Customer Contact Centre (NHCCC) will also be available to deal with queries from the public. This includes an information line staffed by National Highways 24/7. A complaint management system will be in place, in line with systems used by National Highways on other major infrastructure projects. Any noise and vibration complaints will be investigated, and appropriate action taken as required. The complainant will be provided with a response outlining the results of the investigation and any action taken.

12.8.9 Surveys will include physical measurements and observational checks/audits. The contractors will undertake, and report noise and vibration surveys as is necessary to ensure and demonstrate compliance with all noise and vibration commitments and the requirements of the final EMP and NVMP (Application Document 2.7).

12.8.10 The survey and compliance assurance process is set out in the EMP which will be secured by the DCO.

12.8.11 All survey locations will be detailed within the final EMP(s).

Essential mitigation

12.8.12 Regular onsite observation surveys and checks/audits will be undertaken to ensure that BPM are being employed at all times. The site reviews will be logged, and any remedial actions recorded. Such checks will include:

- compliance with hours of working
- presence of mitigation measures
- compliance with agreed working methods
- compliance with any specific requirements of the final EMP(s).

Potential Impacts before essential mitigation and enhancement

12.8.13 The main construction activities that are expected to take place are site clearance, earthworks, demolition, construction of structures (overbridge, underbridge, culverts and retaining walls) and road construction.

12.8.14 The construction of the scheme has the potential for temporary noise impacts at the closest receptors to the works. The potential for temporary construction vibration impacts is dependent on the need for construction activities which are a potentially significant source of vibration, such as vibratory rollers/compactors and piling rigs.

12.8.15 Construction traffic can have a temporary impact on sensitive receptors located along existing roads. The potential for such impacts is dependent on the volume and route of construction traffic.

12.8.16 During construction, it may be occasionally necessary to divert traffic off the A66 to allow works to be undertaken. *DMRB LA 111* states that any receptor within 25m of a diversion route at night would be subject to a major noise impact. Where this major noise impact would exceed 10 or more nights in any consecutive 15 nights or 40 nights in any six consecutive months, this would be considered to cause a potential temporary significant effect.

12.8.17 Compound sites have been carefully chosen to minimise noise impacts on surrounding sensitive receptors. The first stage of construction for the compound sites will be to construct a boundary fence which surrounds the compound site. This will assist in the attenuation of noise. The indicative location of construction compounds are shown in Figure 2.3: Indicative Construction Areas (Sheets 1 to 8) (Application Document 3.3).

Operation

Design and embedded mitigation

12.8.18 The Project has been designed to avoid and minimise potential adverse noise and vibration effects through the process of design development and consideration of good design principles. All design and embedded mitigation measures for noise and vibration impacts, e.g. the road alignment, cuttings, low noise road surfacing and landscaped earthworks to

mitigate visual impact and reduce noise, are reported within Chapter 4: Environmental Assessment Methodology.

Potential Impacts before essential mitigation and enhancement

12.8.19 The operation of the Project has the potential to result in both beneficial and
adverse permanent impacts associated with road traffic noise. The Project moves the road closer to some receptors and further away from others as shown in Figure 12.1: Operational Noise Study Area (Application Document 3.3).

12.8.20 The magnitude of the operational traffic noise impact at a receptor is dependent on a range of factors including the traffic flow, composition, speed, road surface, ground topography, the presence of intervening buildings/structures and the distance to the road.

12.8.21 Traffic noise reduction measures have been incorporated into the design of the Project by means of the vertical and horizontal alignment and through the proposed use of a low noise surfacing, which results in lower levels of noise generation than a standard Hot Rolled Asphalt surface. The need for further measures, such as noise barriers, has been determined in conjunction with other environmental disciplines, to avoid secondary impacts (including, for example, upon landscape and visual) and discussed in section 12.9: Essential mitigation and enhancement measures.

12.9 Essential mitigation and enhancement measures

Construction

Essential mitigation

12.9.1 It has been assumed for the purpose of the assessment that all construction works will be undertaken in accordance with the principles and processes set out within the EMP (Application Document 2.7). Within the EMP there is a commitment for a NVMP to be prepared which will include the requirement to undertake noise and vibration monitoring, to ensure compliance with the agreed threshold levels. An expanded essay plan is provided, which sets out what needs to be included in the NVMP (Annex B5 of the EMP, Application Document 2.7).

12.9.2 Residents will be advised of the nature and likely duration of vibratory works ahead of them taking place and as agreed with the local authority through a Section 61 consent.

12.9.3 Trials will be conducted at the start of works to establish actual vibration levels at the nearest sensitive receptors and where necessary, alternative plant or methods will be used, e.g. compaction plant operating in ‘static’ mode (i.e. without the vibratory mechanism operating) 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 NVMP.

12.9.4 BPM is assumed as essential mitigation that will be implemented to control construction noise, including in the use of low noise emission plant and processes (as specified in *BS 5228-1* Annex B - Noise sources, remedies and their effectiveness). The Principal Contractor will be required to undertake any construction works in line with the principles outlined within the EMP and NVMP (Application Document 2.7) and will be subject to a Section 61 consent from the relevant Local Authority. Additional mitigation may be achieved by developing a construction programme that considers the duration of exposure as well as the noise level at potentially affected receptors. For example, it may be possible to provide periods of respite in between phases of the noisier works. Additionally, there may be a useful trade-off between the noise level experienced and the time taken to complete the works (i.e. potentially lowering the noise levels but for a longer duration) which could minimise the potential for significant effects to occur.

12.9.5 If situations arise where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the EMP and the NVMP, the Principal Contractor(s) may offer noise insulation to affected properties or ultimately, temporary re-housing.

Operation

Essential mitigation

12.9.6 Where a likely significant effect has been identified (section 12.10: Assessment of likely significant effects), an assessment of the viability of providing additional mitigation measures has been undertaken where appropriate. In line with *DMRB LA 111* the following have been considered when determining if additional mitigation should be implemented:

- Engineering practicality i.e. safety considerations and engineering constraints
- Value for money i.e. comparison of the monetised noise benefit of the measure against the cost for installing and maintaining the measure
- Other environmental effects potentially created by the proposed mitigation (e.g. landscape or visual effects).

12.9.7 The additional environmental noise mitigation measures which are assessed to be practicable and sustainable based on the above are presented in Table 12-20: Noise mitigation measures for operation of the scheme, and are described in the relevant scheme assessment sections (section 12.10 Assessment of likely significant effects, under schemes M6 Junction 40 to Kemplay Bank, Appleby to Brough and Cross Lanes to Rokeby).

12.9.8 The process has identified the use of certain barriers / earth bunds as a sustainable mitigation measure where essential mitigation is required. The DCO will secure these barriers (subject to caveats, as explained below) as part of the EMP (Application Document 2.7) and it will ensure that all noise controls are implemented, including the verification of the effectiveness of any installed mitigation measures against the accepted design to ensure the performance is as predicted. A summary of the essential mitigation,

which complies with the considerations listed above, is provided in Table 12-20: Noise mitigation measures for operation of the scheme. The location of these mitigation measures are presented in Figure 2.8.1: Environmental Mitigation (Application Number 2.8).

Table 12-20: Noise mitigation measures for operation of the scheme

Ref	Location	Indicative Chainages	Indicative screening length (m)	Approximate height relative to road level (m)	Description
52	One residential receptor at Skirsgill Lodge, Redhills Lane, Redhills CA11 0DT - West of the main roundabout	9300.000-9350.000	35	2-4	Reflective fence type barrier. Provision of barrier subject to consultation with relevant stakeholders, including the resident(s) in question, given it impacts one residential receptor only and has other potential impacts.
86	One residential receptor at North Bitts Farm, Cross Lanes, Barnard Castle, DL12 9SN - west of the new Cross Lanes junction	59520.000 - 59580.000	56	2-4	Reflective fence type barrier. Provision of barrier subject to consultation with relevant stakeholders, including the resident(s) in question, given it impacts one residential receptor only and has other potential impacts.
14	Approximately 52 residential properties on Pembroke Close and Lady Anne Drive, Brough, CA17 4BS Just after the end of S06	Outside RLB - east of 48038.000	235	2-3	Reflective fence type barrier. Barrier will be located on existing National Highways land outside of the Order limits and delivered through existing powers.
33-58	242 residential and 9 non-residential properties in Kirkby Thore	Approximately 30600.000 - 32750.000	Approximately 2500 as per drawing reference HE565627-	As per drawing	Earthworks Embedded into the design due to its

Ref	Location	Indicative Chainages	Indicative screening length (m)	Approximate height relative to road level (m)	Description
	(north end of the village)		AMY-HAC-S0405-DR-CH-301102 and HE565627-AMY-HAC-S0405-DR-CH-301100 (DCO Package number 5.18)		nature i.e. earthworks (combination of cutting and earth bund). This mitigation measure is included in references to 'embedded mitigation' throughout this chapter

12.9.9 Noise insulation will be offered if and where future noise levels exceed the trigger level of 68dB $L_{A10,18hour\ (façade)}$ (i.e. above a SOAEL) and the other requirements referred to in the Noise Insulation Regulations (NIR) 1975 guidelines. Confirmation of receptors which are eligible for noise insulation will be made by the responsible authority (National Highways) before the Project comes into operation, based on built information in accordance with NIR. The DCO will secure these measures as part of the EMP (Application Document 2.7), where deemed necessary having regard to the existing statutory framework.

12.9.10 The NIR noise insulation criteria require that:

- The façade noise threshold of 68dB$L_{A10,18hour\ (façade)}$ 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 (as part of the Project) 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.

Enhancement

12.9.11 Further to the mitigation integrated within the Project design, consideration will be given to developing enhancements during detailed design of the Project.

12.9.12 Any such enhancements will have to be shown to be sustainable in terms of material resources and other impacts including any engineering and environmental constraints, as well as a cost-benefit assessment which considers the degree of attenuation, cost of the mitigation measure and any other potential impacts arising from these enhancements.

12.10 Assessment of likely significant effects

12.10.1 This section identifies the likely noise and vibration effects of the Project that are predicted to be significant with further detail presented in Appendix 12.3: Construction Assessment Results and Appendix 12.4: Operational Assessment Results (Application Document 3.4). Likely effects not predicted to be significant are presented in Appendix 12.5: Non-significant Effects (Application Document 3.4). The conclusion of significance is based upon the worst-case of the daytime and night-time impacts. All the assessment results assume that the embedded mitigation measures described in this report (e.g. low-noise surface, alignment, landscaping bunds and cuttings) and in Chapter 4: Environmental Assessment Methodology have been incorporated into the design (this includes Ref 33-58 in Table 12-20: Noise mitigation measures for operation of the scheme).

12.10.2 Essential mitigation measures are presented in Table 12-20: Noise mitigation measures for operation of the scheme, and are described in the relevant scheme assessment sections (section 12.10 Assessment of likely significant effects, under schemes M6 Junction 40 to Kemplay Bank, Appleby to Brough and Cross Lanes to Rokeby).

12.10.3 The following results should be referred to alongside Appendix 12.3: Construction Assessment Results (Application Document 3.4) for the construction noise and vibration assessment and the operational noise contour figures provided in Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) and the results provided in Appendix 12.4: Operational Assessment Results and Appendix 12.5: Non-significant Effects (Application Document 3.4).

12.10.4 The results are presented firstly as a routewide assessment for the Project which provides the results for the full study area as defined in section 12.6: Study area.

12.10.5 Following the routewide assessment, which includes those areas between schemes, a scheme-by-scheme assessment has been completed where all sensitive residential and non-residential receptors (within the study area identified in section 12.6: Study area) are presented.

12.10.6 As per section 12.4: Assessment methodology other sensitive receptors include educational establishments, hospitals, places of worship and PRoW. The assessment of PRoW is provided in Chapter 13: Population and Human Health.

12.10.1 The assessment of likely cumulative effects is provided in Chapter 15: Cumulative Effects.

Routewide

Construction noise

12.10.2 Noise levels during construction have been calculated for each phase of the construction programme, for the core working hours of the Project weekdays (07:30 – 18:00) and Saturday (07:30 – 13:00). The predicted noise levels for each phase are in Appendix 12.3: Construction

Assessment Results (Application Document 3.4). It should be noted that only the receptors predicted to experience noise levels above the SOAEL (prior to BPM being adopted) are detailed within this appendix.

12.10.3 There is a total of 1,442 residential and non-residential receptors within the routewide noise construction study area. The number of receptors predicted to exceed the LOAEL and/or SOAEL, prior to BPM being adopted, is summarised in Table 12-21: Summary of construction assessment (without BPM).

Table 12-21: Summary of construction assessment (without BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		1248	181	13
Phase 2 - road construction	Boundary fence	858	571	13
	Topsoil strip	136	1111	195
	Drainage - v ditch	1087	348	7
	Earthworks	59	577	806
	Capping/subbase	60	866	516
	Pavement/surfacing	188	1107	147
	Road marking	1272	168	2
	VRS	989	450	3
	Removal of current road	279	1083	80
	Surface water channel	680	741	21
	Drainage	869	533	40
Phase 3 - structures	Excavation - hard standing	1440	2	0
	Stone delivery	1418	24	0
	Concreting	654	779	9
	Sheet pilling	1201	239	2
	CFA piling	1190	252	0
Phase 4 - Compound	Site clearance	512	835	95
	Boundary fence	1234	203	5
	Topsoil strip	949	445	48
	Excavation	1012	387	43
	Drainage	1077	330	35
	Subbase	1013	386	43
	Pavement/surfacing	1071	337	34
	Operation and haul roads	1155	266	21

12.10.4 The greatest potential for construction noise levels to exceed the SOAEL is during Phase 2: Road Construction as shown in Table 12-21: Summary of construction assessment (without BPM). Although the construction noise

levels may exceed the SOAEL during phase 1 (demolition), phase 3 (structures) and phase 4 (compound), the majority of receptors within the study area will experience construction noise levels below the SOAEL. Details of receptors predicted to experience noise levels above the SOAEL (without BPM) are provided in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.5 As discussed in section 12.4: Assessment methodology, a construction significant effect is likely if the predicted noise levels are above the SOAEL and are experienced for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months. As the programme of works and duration of each activity cannot currently be finalised, construction impacts have been assessed as significant effects when construction is at its busiest and closest to receptors. Nevertheless, BPM will be used to minimise the potential for significant effects to occur. Details of BPM are provided within the EMP and NVMP (Application Document 2.7), which states that BPM will be used to minimise the potential for significant effects to occur. The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management.

12.10.6 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it is estimated that the construction noise levels could generally be reduced by 5dB or possibly more in some situations. The number of receptors predicted to exceed the LOAEL and/or SOAEL, allowing for a reduction of 5dB through use of BPM, is summarised in Table 12-22: Summary of construction assessment (with BPM).

Table 12-22: Summary of construction assessment (with BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		1248	181	13
Phase 2 - road construction	Boundary fence	1237	203	2
	Topsoil strip	349	1046	47
	Drainage - v ditch	1313	128	1
	Earthworks	153	1000	289
	Capping/subbase	164	1104	174
	Pavement/surfacing	410	998	34
	Road marking	1385	57	0
	VRS	1390	51	1
	Removal of current road	613	809	20
	Surface water channel	1194	239	9
	Drainage	1034	396	12
	Excavation - hard standing	1442	0	0

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 3 - structures	Stone delivery	1440	2	0
	Concreting	1066	372	4
	Sheet pilling	1417	24	1
	CFA piling	1384	58	0
Phase 4 - Compound	Site clearance	912	480	50
	Boundary fence	1234	208	0
	Topsoil strip	1198	229	15
	Excavation	1209	224	9
	Drainage	1233	204	5
	Subbase	1209	224	9
	Pavement/surfacing	1230	208	4
	Operation and haul roads	1269	172	1

12.10.7 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it remains possible that construction noise levels will exceed the SOAEL during each of the construction phases at a number of receptors, however, the total number of receptors likely to experience noise levels greater than the SOAEL has reduced. Where the construction noise level is predicted to be greater than the SOAEL, further mitigation measures will be utilised (where practicable) in the form of the construction program to minimise the possibility that receptors are not exposed to noise levels greater than the SOAEL for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months.

12.10.8 The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management. Within this application, a detailed construction assessment will be undertaken using the most up to date construction information to enable further noise and vibration predictions to be completed in line with the latest working method(s) and construction program.

Construction traffic

12.10.9 Additional traffic would be generated on the existing nearby road network by the construction works and therefore road traffic noise levels may increase during construction. The noise increase has the potential to adversely impact receptors which are located in close proximity to the affected roads. This section assesses noise changes as a result of an increase in traffic due to construction traffic on the existing road network. The construction traffic assessed within this section is associated with delivery of construction materials, construction material movement (e.g.

soil which could be reused), construction material unsuitable for further use and material being taken away to landfill.

12.10.10 In line with *DMRB LA 111*, an assessment of off-site construction traffic has been undertaken by comparing the Basic Noise Level (BNL) without construction traffic in the Do-Minimum construction year 2024 and the BNL with construction traffic in the Do-Minimum construction year 2024. The construction traffic has been assessed by using the monthly average construction traffic movements estimated for the busiest construction year. This is considered a reasonable worst-case scenario. In addition, peak construction traffic movements during the busiest construction month are assessed and presented in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.11 There are seven construction scenarios for which traffic modelling is undertaken to derive the impacts on road users. The two scenarios which generate the largest number of construction traffic movements upon the existing road network have been used for this assessment: scenario C and scenario D.

12.10.12 The list of roads for which the BNL is predicted to increase by 1dB(A) or more, due to construction traffic, is presented in section D of Appendix 12.3: Construction Assessment Results (Application Document 3.4), Table 23: Offsite Traffic - Scenario C and Table 24: Offsite Traffic. These roads are referred to as the construction traffic affected roads[28]. The table in the appendix shows the detailed results of the assessment for the two construction scenarios, along with the relevant details of the assessed road, its Do-Minimum flows, the estimated increase in construction traffic, the resulting BNL change and the magnitude of impact as defined in *DMRB LA 111.*

12.10.13 Where the BNL change results in a minor or negligible impact, by reference to *DMRB LA 111* it is concluded that impacts are unlikely to result in significant effects. For road links where the BNL change results in a moderate or major impact, it is concluded there is an indication of a temporary likely significant effect and further analysis is required.

12.10.14 As shown in Table 23: Offsite Traffic - Scenario C of Appendix 12.3: Construction Assessment Results (Application Document 3.4), the assessment concluded that receptors located within 50m of construction traffic affected roads 28 with a moderate or major impact, are not predicted to experience significant effects. The rationale for the assessment is presented in the tables and is summarised as follows:

- Road links reference 80345_95031, 95136_90125, 93911_90123, 95137_93911: The noise increase is only 0.1-0.5dB over threshold. The increase is marginal and by reference to LA111, effects are assessed as not significant

[28] Construction traffic affected roads are those for which the increase in traffic flows due to construction traffic, trigger a change in BNL of 1dB or more, when comparing Do-Minimum Construction Year 2024 scenario against Do-Minimum with construction traffic Construction Year 2024 scenario.

- Road links reference 95028_95029, 95031_95032, 95029_80347, 95137_93910: The road link represents a relatively small roads e.g. slip roads, with no receptors within 50m. As such, effects are assessed as not significant
- Road links reference 95714_95713: The road link is a relatively small road link that represents entrance to the Penrith Industrial Estate (by Myers Beck). There are no sensitive receptors within 50m and therefore effects are assessed as not significant.

12.10.15 It is noted that there may be instances during the busiest construction period where noise from existing roads may increase due to large volume of construction traffic, however, these are temporary and would decrease as the Project progresses.

Diversion routes

12.10.16 *DMRB LA 111 s*tates that any receptor within 25m of a diversion route at night would be subject to a major noise impact. Where this major noise impact would exceed 10 or more nights in any consecutive 15 nights or 40 nights in any six consecutive months, this would be considered to likely cause a temporary significant effect.

12.10.17 At this stage, the diversion routes (indicated in Figure 12.9: Possible Diversion Routes (Application Document 3.3)) are yet to be discussed with each local authority and relevant stakeholders. The selection of diversion routes will be conducted in line with the EMP and respective NVMP (Application Document 2.7) and Construction Traffic Management Plan (CTMP) (Application Document 2.7). For this assessment, as a worst-case scenario, the assessment of diversion routes is undertaken on indicative potential routes within and around the Project. The total number of receptors within 25m of each diversion route option is provided in Table 12-23: Diversion route residential and non-residential impacts.

Table 12-23: Diversion route residential and non-residential impacts

Diversion Route	Number of residential receptors	Number of non-residential receptors
S01 M6 J40 to Penrith along A592	123	46
S01 M6 J40 Northbound to Kitchen Hill returning to Kemplay Bank along A6	358	145
S01 Redhills to Penrith along Mile Lane and B5288	142	3
S02 Eamont Bridge to Brougham along A6 and B6262	55	27
S02 Kemplay Bank to Cliburn along A6 and Curwen Bank	68	3
S02 Kemplay Bank to Whinfell North along A686 and B6412	123	5
S02 Pategill to Kemplay Bank along Carleton Road and A686	82	0
S03 Current A66 for Center Parcs	2	1

Diversion Route	Number of residential receptors	Number of non-residential receptors
S03 Around Whinfell along B6412	7	0
S04 S05 Current A66 for Kirkby Thore - Crackenthorpe	22	2
S04 S05 M6 J40 to J38 to A66 via Kirkby Stephen	258	70
S06 Current A66 for Warcop	5	1
S07 Bowes to Barnard Castle along A67	140	31
S07 Current A66 Bowes Bypass	1	0
S07 S08 Barnard Castle to Darlington along A688 and A68	449	160
S08 Current A66 for Rokeby	0	1
S09 Current A66 Stephen Bank to Carkin Moor and East Layton	5	0
S11 Scotch Corner	15	0

12.10.18 A number of properties are within 25m of a potential diversion route and are likely to experience a major impact during night-time closures when traffic is diverted past their property. At this stage, the detail and duration of these diversion routes are unknown, though it is expected that diversions are only likely to be required for limited activities, such as amendments to traffic management layouts, tie-in works where offline routes tie back into the main A66, movement of abnormal loads and installation of major structures online. These are unlikely to be for significant durations, however as the durations and number of nights are not known currently, as a worst-case scenario it is concluded that the receptors identified in Table 12-23: Diversion route residential and non-residential impacts above are likely to be subject to a temporary significant adverse effect. As presented in the NVMP and the CTMP, the actual diversion routes will be determined by the Principal Contractor in consultation with the relevant local authorities in advance of any required closures.

12.10.19 Specific mitigation measures for diversion routes will be developed when detail becomes available in line with EMP and respective NVMP (Application Document 2.7). Mitigation measures include the use of more than one diversion route for different closures, to reduce the exposure of individual noise sensitive receptors. Noise insulation to residents along the diversion routes may also be implemented as another mitigation measure if long durations are anticipated to be required.

Vibration

12.10.20 The activities with the potential to generate significant vibration are: road construction (earthworks, capping/subbase and pavement) for which vibratory rollers/compactors would be required; and sheet pilling, assumed to be installed by vibratory driving. Continuous flight auger (CFA) piling is

also to be used to construct some of the structures. Vibration from CFA is minimal and therefore has not been considered further.

12.10.21 Vibration levels have been calculated in accordance with the procedures and using source data in BS 5228-2 Table E.1. Details of the assumptions associated with these calculations are shown in Appendix 12.2: Construction Assessment Assumptions (Application Document 3.4). For assessing risk of building damage, the vibration on the ground or at the base of the building is used; for risk of disturbance to people, a worst case first floor level has been calculated.

12.10.22 Predicted maximum PPV levels for distance bands up to 100m are shown in Table 12-24: Predicted maximum PPV levels from vibration generating activities.

Table 12-24: Predicted maximum PPV levels from vibration generating activities

Distance (m)	Maximum PPV (mms^{-1})					
	Vibratory piling		Vibratory roller/compactor - steady state		Vibratory roller/compactor - start-up/run-down	
	Ground	First floor	Ground	First floor	Ground	First floor
10	2.4	9.6	3.9	>10.0	5.6	>10.0
20	0.9	3.6	1.6	6.4	2.6	>10.0
30	0.5	2.1	0.9	3.6	1.6	6.3
40	0.3	1.4	0.6	2.4	1.1	4.4
50	0.3	1.0	0.4	1.8	0.8	3.4
60	0.2	0.8	0.3	1.4	0.7	2.7
70	0.2	0.6	0.3	1.1	0.6	2.2
80	0.1	0.5	0.2	0.9	0.5	1.9
90	0.1	0.4	0.2	0.8	0.4	1.6
100	0.1	0.4	0.2	0.6	0.4	1.4

Human receptors

12.10.23 For human receptors, LOAEL is defined as PPV of $0.3mms^{-1}$, this being the point at which construction vibration is likely to become perceptible. The SOAEL is defined as a PPV of $1.0mms^{-1}$, this being the level at which construction vibration can be tolerated with prior warning.

12.10.24 There is a risk that the SOAEL could be exceeded at first floor level in buildings up to and beyond 100m during start-up and run-down of vibratory roller/compactor. During steady state use, a vibratory roller/compactor could cause vibration exceeding the SOAEL at up to 70m at first floor level and up to 50m at first floor for vibratory piling.

12.10.25 Without mitigation, likely significant effects are therefore predicted at various distances across the study area from these types of activities depending on the activity and building height.

Building damage

12.10.26 For building damage risk assessment for continuous vibration, which is relevant to vibratory piling and compaction, a criterion of 6mms^{-1} PPV on the ground/base of a building is used. No exceedances are predicted at ground floor.

Operation

12.10.27 This section considers the whole study area (as defined in section 12.6: Study area), where in total, 5,926 residential and 468 non-residential receptors have been identified within the study area and are included in this assessment.

12.10.28 The following describes the predicted effects on residential and non-residential receptors due to changes in traffic noise caused by the Project. The noise contour figures should be referred to alongside the noise assessment text in this section (Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3)).

12.10.29 The predicted noise levels include the effects of embedded mitigation (e.g. low-noise surface, alignment, landscaping bunds and cuttings).

12.10.30 Table 12-25: Short-term Do-Something magnitude of change presents the predicted noise changes in terms of magnitude of change bands for the short-term (opening year) Do-Something assessment.

Table 12-25: Short-term Do-Something magnitude of change

Change in noise level (dB $L_{A10,18hr}$ – daytime) (dB $L_{night, outside}$ – night-time)		Magnitude of impact	Daytime		Night-time	
			Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Increase in noise level	<1.0	Negligible	3179	191	3470	203
	1.0 – 2.9	Minor	843	57	518	42
	3.0 – 4.9	Moderate	202	19	191	15
	>5.0	Major	84	2	66	2
No change	0.0	No change	26	8	139	15
Decrease in noise level	<1	Negligible	741	43	784	56
	1.0 – 2.9	Minor	480	129	423	120
	3.0 – 4.9	Moderate	101	4	84	0
	>5.0	Major	270	15	251	15

12.10.31 Table 12-26: Long-term Do-Something magnitude of change presents the predicted noise changes in terms of magnitude of change

bands for the long-term (future operational year) Do-Something assessment.

Table 12-26: Long-term Do-Something magnitude of change

Change in noise level ($dB L_{A10,18hr – daytime}$) ($dB L_{night, outside – night-time}$)		Magnitude of impact	Daytime		Night-time	
			Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Increase in noise level	<3.0	Negligible	4167	264	4438	268
	3.0 – 4.9	Minor	362	23	256	21
	5.0 – 9.9	Moderate	90	4	75	3
	>10.0	Major	16	0	13	0
No change	0.0	No change	76	6	69	6
Decrease in noise level	<3	Negligible	877	156	752	155
	3.0 – 5.9	Minor	83	0	80	1
	5.0 – 9.9	Moderate	113	6	124	6
	>10.0	Major	142	9	119	8

12.10.32 In addition to the noise level changes shown in Table 12-25: Short-term Do-Something magnitude of change and Table 12-26: Long-term Do-Something magnitude of change, the absolute noise levels and the guidance provided in *DMRB LA 111* (Table 12-14: Determining final operational significance on noise sensitive receptors (from *DMRB LA 111*)) have been considered to determine the significance of effects. Table 12-27: Summary of route wide operational significant effects provides a summary of the receptors for the whole route that are predicted to be subject to a significant effect. Appendix 12.4: Operational Assessment Results (Application Document 3.4) provides details of the residential areas where significant effects have been identified and assessed.

Table 12-27: Summary of route wide operational significant effects

Type of receptor	Predicted Operational Significant Effects	
	Adverse	Beneficial
Residential	128	408
Non-Residential	6	46

Noise insulation

12.10.33 There are four properties that are predicted could exceed the criteria to be eligible for noise insulation under the NIR (as described in section 12.9: Essential mitigation and enhancement measures). *DMRB LA 111* (Annex E/2) requires that potential noise insulation eligibility is considered as part of the assessment. These are listed below:

- Skirsgill Lodge, Redhills Lane, Redhills CA11 0DT
- Cross Lanes Farm, Cross Lanes, Barnard Castle DL12 9RT
- The Grove, Road Leading to The Grove, Rokeby DL12 9SA

- Tack Room Cottage, Road Leading to The Grove, Rokeby DL12 9SA

M6 Junction 40 to Kemplay Bank

Construction

12.10.34 There is a total of 728 residential and non-residential receptors within the noise construction study area. The predicted noise level in Table 12-28: M6 Junction 40 to Kemplay Bank noise construction assessment (without BPM) represents a worst-case scenario for each phase, as they represent the temporary noise levels experienced when the located at the closest point to each receptor and no BPM has been adopted.

Table 12-28: M6 Junction 40 to Kemplay Bank noise construction assessment (without BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		728	0	0
Phase 2 - road construction	Boundary fence	550	177	1
	Topsoil strip	47	611	70
	Drainage - v ditch	638	89	1
	Earthworks	13	170	545
	Capping/subbase	21	515	192
	Pavement/surfacing	60	625	43
	Road marking	722	6	0
	VRS	375	352	1
	Removal of current road	59	627	42
	Surface water channel	400	324	4
	Drainage	671	57	0
Phase 3 - structures	Excavation - hard standing	728	0	0
	Stone delivery	719	9	0
	Concreting	274	450	4
	Sheet pilling	489	237	2
	CFA piling	476	252	0
Phase 4 - Compound	Site clearance	213	507	8
	Boundary fence	723	4	1
	Topsoil strip	580	147	1
	Excavation	631	96	1
	Drainage	669	58	1
	Subbase	631	96	1
	Pavement/surfacing	655	72	1
	Operation and haul roads	684	43	1

12.10.35 Due to the close proximity of this scheme to the town of Penrith, a number of receptors are predicted to experience construction noise levels above the SOAEL. The greatest potential for construction noise levels to exceed the SOAEL is during Phase 2: Road Construction as shown in Table 12-28: M6 Junction 40 to Kemplay Bank noise construction assessment (without BPM). Although the construction noise levels may exceed the SOAEL during phase 3 (structures) and phase 4 (compound), the majority of receptors within the study area will experience construction noise levels below the SOAEL. No receptors are predicted to experience noise levels above the SOAEL during Phase 1 (demolition). Details of receptors predicted to experience noise levels above the SOAEL (without BPM) are provided in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.36 As discussed in section 12.4: Assessment methodology, a construction significant effect is likely if the predicted noise levels are above the SOAEL and are experienced for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months. As the programme of works and duration of each activity cannot currently be finalised, construction impacts have been assessed as significant effects when construction is at its busiest and closest to receptors. Nevertheless, BPM will be used to minimise the potential for significant effects to occur. Details of BPM are provided within the EMP and NVMP (Application Document 2.7), which states that BPM will be used to minimise the potential for significant effects to occur. The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management.

12.10.37 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it is estimated that the construction noise levels could generally be reduced by 5dB or possibly more in some situations. The number of receptors predicted to exceed the LOAEL and SOAEL, allowing the use of BPM, is summarised in Table 12-29: M6 Junction 40 to Kemplay Bank noise construction assessment (with BPM).

Table 12-29: M6 Junction 40 to Kemplay Bank noise construction assessment (with BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		728	0	0
Phase 2 - road construction	Boundary fence	720	8	0
	Topsoil strip	149	566	13
	Drainage - v ditch	712	16	0
	Earthworks	24	508	196
	Capping/subbase	53	616	59
	Pavement/surfacing	192	528	8

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	Road marking	728	0	0
	VRS	711	17	0
	Removal of current road	188	529	11
	Surface water channel	702	24	2
	Drainage	725	3	0
Phase 3 - structures	Excavation - hard standing	728	0	0
	Stone delivery	728	0	0
	Concreting	525	202	1
	Sheet pilling	703	24	1
	CFA piling	670	58	0
Phase 4 - Compound	Site clearance	560	166	2
	Boundary fence	723	5	0
	Topsoil strip	712	15	1
	Excavation	716	11	1
	Drainage	722	5	1
	Subbase	716	11	1
	Pavement/surfacing	718	9	1
	Operation and haul roads	725	2	1

12.10.38 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it remains possible that construction noise levels will exceed the SOAEL during each of the construction phases at a number of receptors, however, the total number of receptors likely to experience noise levels greater than the SOAEL has reduced. Where the construction noise level is predicted to be greater than the SOAEL, further mitigation measures will be utilised (where practicable) in the form of the construction program to minimise the possibility that receptors are not exposed to noise levels greater than the SOAEL for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months.

Operation

12.10.39 Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) represents the results of the Do-Minimum and Do-Something noise prediction modelling for M6 Junction 40 to Kemplay Bank. Conclusion of significance has been determined in line with the methodology stated in section 12.4: Assessment methodology.

Residential Receptors: Effects exceeding the SOAEL

12.10.40 There is one dwelling currently exceeding the SOAEL, where noise reductions would occur because of the scheme, and which will therefore experience a significant beneficial effect. This dwelling would experience a minor beneficial impact in the short-term and is located to the south of Kemplay Bank Roundabout.

12.10.41 There is one dwelling currently exceeding the SOAEL, where an increase in noise would occur because of the scheme and will therefore experience a significant adverse effect. This dwelling would experience a minor adverse impact in the short-term and is located to the west of Skirsgill Roundabout and west of Skirsgill Business Park. This receptor falls within the NIA reference 10284.

12.10.42 A 2-4m barrier installed for approximately 35m along the perimeter of the receptor on the roadside, would be likely to eliminate the significant effect. The barrier in the form of a fence with the characteristics described in Table 12-20: Noise mitigation measures for operation of the scheme (Ref 52) is likely to be sustainable (as per section 12.9: Essential mitigation and enhancement measures) but its provision would be subject to liaison with relevant stakeholders, including the resident(s) in question, given it impacts one residential receptor only and has other potential impacts.

12.10.43 Should the barrier not be installed, then this receptor would be eligible for noise insulation under NIR.

Residential Receptors: Effects between the LOAEL and SOAEL

12.10.44 There are no residential receptors predicted to experience effects between the LOAEL and SOAEL.

Residential Receptors: effects below the LOAEL

12.10.45 As discussed, *DMRB 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 terms of policy.

12.10.46 The methodology for assessing noise impacts in areas below the LOAEL is described in section 12.4: Assessment methodology.

12.10.47 There are 1,450 residential receptors associated with this scheme that would be subject to noise levels below the LOAEL with the scheme in operation. The impacts at these receptors are assessed as not significant.

12.10.48 According to the national relative tranquillity mapping (Figure 10.7: CPRE Tranquillity (Application Document 3.3)), none of these properties are located in a particularly sensitive high tranquillity area. Therefore, no significant noise effects, either beneficial or adverse, have been determined.

Non-Residential Receptors

12.10.49 There are three non-residential receptors that would be subject to noise levels between the LOAEL and SOAEL, where noise reductions would occur because of the scheme and will therefore experience

significant beneficial effects. These receptors are predicted to experience a moderate beneficial impact in the short-term and are located to the east of Kemplay Bank Roundabout. These receptors are offices i.e. commercial.

12.10.50 There is one non-residential receptors currently exceeding the SOAEL, which is likely to experience significant adverse effects because of the scheme. This receptor is predicted to experience a minor adverse impact in the short-term and are located to the north of Skirsgill Roundabout.

NIAs

12.10.51 There are four NIAs that are in close proximity to this scheme: NIA 6763, 10284, 10283 and 10285. No significant effects are predicted in any of the NIAs except at one receptor located close to the NIA reference 10284. This receptor located at Skirsgill Lodge will be subject to an increase in noise level which will occur because of the scheme and will therefore experience a minor impact in the short-term. If the noise barrier presented in section 12.9: Essential mitigation and enhancement measures (Table 12-20: Noise mitigation measures for operation of the scheme, Ref 52) above is implemented, the minor noise impact is likely to result in no change/negligible. This receptor is included in paragraph 12.10.40.

Committed developments

12.10.52 There are two committed developments located to the north of the scheme which are sensitive to noise as they are planned for residential purposes and located in close proximity to the existing A66. The Carleton East LDP Housing Allocation (reference 19/0426) for 261 housing units, has the potential to be impacted by operation of the Project. The Project is predicted to give rise to minor and negligible impacts at the development site. The predicted noise levels are well below the SOAEL and therefore effects are assessed as not significant. The Land at Carleton Hall Farm LDP Housing Allocation for 86 housing units also has the potential to be impacted by the Project. The Project is predicted to give rise to minor and negligible impacts at the development site. For the areas of the development site which are closest to the Project, noise levels may exceed the SOAEL and impacts may result in significant effects. However, the magnitude of impact will decrease as the site moves further away from the A66.

Penrith to Temple Sowerby

Construction

12.10.53 There is a total of 32 residential and non-residential receptors within the noise construction study area. The predicted noise level in Table 12-30: Penrith to Temple Sowerby noise construction assessment (without BPM) represents a worst-case scenario for each phase, as they represent the temporary noise levels experienced when the located at the closest point to each receptor and no BPM has been adopted.

Table 12-30: Penrith to Temple Sowerby noise construction assessment (without BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		20	2	10
Phase 2 - road construction	Boundary fence	10	20	2
	Topsoil strip	0	15	17
	Drainage - v ditch	25	6	1
	Earthworks	0	6	26
	Capping/subbase	0	4	28
	Pavement/surfacing	1	19	12
	Road marking	26	5	1
	VRS	9	21	2
	Removal of current road	2	26	4
	Surface water channel	10	20	2
	Drainage	2	22	8
Phase 3 - structures	Excavation - hard standing	32	0	0
	Stone delivery	32	0	0
	Concreting	27	5	0
	Sheet pilling	29	3	0
	CFA piling	32	0	0
Phase 4 - Compound	Site clearance	18	10	4
	Boundary fence	29	2	1
	Topsoil strip	28	1	3
	Excavation	28	1	3
	Drainage	28	1	3
	Subbase	28	1	3
	Pavement/surfacing	28	1	3
	Operation and haul roads	28	1	3

12.10.54 The greatest potential for construction noise levels to exceed the SOAEL is during Phase 2: Road Construction as shown in Table 12-30: Penrith to Temple Sowerby noise construction assessment (without BPM). Although the construction noise levels may exceed the SOAEL during phase 1 (demolition) and phase 4 (compound), the majority of receptors within the study area will experience construction noise levels below the SOAEL. No receptors are predicted to experience noise levels above the SOAEL during Phase 3 (structures). Details of receptors predicted to experience noise levels above the SOAEL (without BPM) are provided in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.55 As discussed in section 12.4: Assessment methodology, a construction significant effect is likely if the predicted noise levels are above the SOAEL and are experienced for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months. As the programme of works and duration of each activity cannot currently be finalised, construction impacts have been assessed as significant effects when construction is at its busiest and closest to receptors. Nevertheless, BPM will be used to minimise the potential for significant effects to occur. Details of BPM are provided within the EMP and NVMP (Application Document 2.7), which states that BPM will be used to minimise the potential for significant effects to occur. The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management.

12.10.56 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it is estimated that the construction noise levels could generally be reduced by 5dB or possibly more in some situations. The number of receptors predicted to exceed the LOAEL and SOAEL, allowing for use of BPM, is summarised in Table 12-31: Penrith to Temple Sowerby noise construction assessment (with BPM).

Table 12-31: Penrith to Temple Sowerby noise construction assessment (with BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		20	2	10
Phase 2 - road construction	Boundary fence	24	7	1
	Topsoil strip	2	22	8
	Drainage - v ditch	28	4	0
	Earthworks	0	20	12
	Capping/subbase	0	17	15
	Pavement/surfacing	2	23	7
	Road marking	31	1	0
	VRS	24	7	1
	Removal of current road	17	13	2
	Surface water channel	23	7	2
	Drainage	10	20	2
Phase 3 - structures	Excavation - hard standing	32	0	0
	Stone delivery	32	0	0
	Concreting	32	0	0
	Sheet pilling	32	0	0
	CFA piling	32	0	0
	Site clearance	26	3	3

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 4 - Compound	Boundary fence	29	3	0
	Topsoil strip	29	1	2
	Excavation	29	2	1
	Drainage	29	2	1
	Subbase	29	2	1
	Pavement/surfacing	29	2	1
	Operation and haul roads	29	3	0

12.10.57 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it remains possible that construction noise levels will exceed the SOAEL during each of the construction phases at a number of receptors, however, the total number of receptors likely to experience noise levels greater than the SOAEL has reduced. Where the construction noise level is predicted to be greater than the SOAEL, further mitigation measures will be utilised (where practicable) in the form of the construction program to minimise the possibility that receptors are not exposed to noise levels greater than the SOAEL for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months.

Operation

12.10.58 Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) present the results of the Do-Minimum and Do-Something noise prediction modelling for the Penrith to Temple Sowerby scheme. Conclusion of significance has been determined in line with the methodology stated in section 12.4: Assessment methodology.

Residential Receptors: Effects exceeding the SOAEL

12.10.59 There is one dwelling currently exceeding the SOAEL, where a noise reduction would occur as a result of the scheme, and which will therefore experience a significant beneficial effect. A moderate beneficial impact in the short-term is predicted and a minor impact in the long-term, where the noise levels reduce from above the SOAEL to below the SOAEL. This dwelling is located at the School House, near Whinfell.

Residential Receptors: Effects between the LOAEL and SOAEL

12.10.60 There are three residential receptors likely to be subject to significant beneficial effects between the LOAEL and SOAEL because of the scheme. The scheme results in a decrease in traffic using Moor Lane and hence there is a reduction in noise emissions from this road. The level of beneficial impact would be major or moderate for all these dwellings in the short-term and minor or moderate in the long-term. The dwellings are located at Moor Lane (Fremington).

12.10.61 There are four residential receptors likely to be subject to significant adverse effects because of the scheme. The level of adverse impact would be moderate for all these dwellings in the short-term and minor in the long-term. These dwellings are located at Whinfell Park to the south of the A66.

Residential Receptors: effects below the LOAEL

12.10.62 There are nine residential receptors associated with this scheme that would be subject to noise levels below the LOAEL with the scheme in operation. The impacts at these receptors are assessed as not significant.

12.10.63 According to the national relative tranquillity mapping (Figure 10.7: CPRE Tranquillity (Application Document 3.3)), none of these properties are located a particularly sensitive high tranquillity area. Therefore, no significant noise effects, either beneficial or adverse, have been determined.

Non-Residential Receptors: Effects exceeding the SOAEL

12.10.64 There is one non-residential receptor currently exceeding the SOAEL which would be subject to a decrease in noise level because of the scheme. A major beneficial impact is predicted in the short-term and a moderate beneficial impact in the long-term. The noise levels will reduce from above the SOAEL to below the SOAEL and is assessed as a significant beneficial effect. This receptor is located at the Brougham Institute at Whinfell.

12.10.65 There is one non-residential receptor likely to be subject to a significant adverse effect because of the scheme. The level of adverse impact would be minor in the short-term. This receptor is located at the Lords House and named Llama Karma Kafé. National Highways has acquired this building and temporarily repurposed it as National Highways offices. The office has not been considered as a receptor, for construction or operation, as it is part of the project infrastructure.

Non-Residential Receptors: Effects between the LOAEL and the SOAEL

12.10.66 There are no non-residential receptors predicted to experience effects between the LOAEL and SOAEL.

NIAs

12.10.67 There are no NIAs that are located within 600m of this scheme.

Committed developments

12.10.68 No committed developments are located within 600m of this scheme.

Temple Sowerby to Appleby

Construction

12.10.69 There is a total of 377 residential and non-residential receptors within the noise construction study area. The predicted noise level in

12.10.70 Table 12-32: Temple Sowerby to Appleby noise construction assessment (without BPM) represents a worst-case scenario for each phase, as they

represent the temporary noise levels experienced when the located at the closest point to each receptor and no BPM has been adopted.

Table 12-32: Temple Sowerby to Appleby noise construction assessment (without BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		257	118	2
Phase 2 - road construction	Boundary fence	150	223	4
	Topsoil strip	59	253	65
	Drainage - v ditch	272	105	0
	Earthworks	40	211	126
	Capping/subbase	30	184	163
	Pavement/surfacing	75	248	54
	Road marking	255	122	0
	VRS	320	57	0
	Removal of current road	123	228	26
	Surface water channel	127	240	10
	Drainage	104	258	15
Phase 3 - structures	Excavation - hard standing	375	2	0
	Stone delivery	363	14	0
	Concreting	180	197	0
	Sheet pilling	377	0	0
	CFA piling	377	0	0
Phase 4 - Compound	Site clearance	96	208	73
	Boundary fence	190	185	2
	Topsoil strip	130	208	39
	Excavation	134	209	34
	Drainage	145	206	26
	Subbase	135	208	34
	Pavement/surfacing	141	206	30
	Operation and haul roads	156	204	17

12.10.71 The greatest potential for construction noise levels to exceed the SOAEL is during Phase 2 (road construction) as shown in

12.10.72 Table 12-32: Temple Sowerby to Appleby noise construction assessment (without BPM). Although the construction noise levels may exceed the SOAEL during phase 1 (demolition) and phase 4 (compound) the majority of receptors within the study area will experience construction noise levels below the SOAEL. No receptors are predicted to experience noise levels above the SOAEL during Phase 3 (structures). Details of receptors predicted to experience noise levels above the SOAEL (without

BPM) are provided in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.73 As discussed in section 12.4: Assessment methodology, a construction significant effect is likely if the predicted noise levels are above the SOAEL and are experienced for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months. As the programme of works and duration of each activity cannot currently be finalised, construction impacts have been assessed as significant effects when construction is at its busiest and closest to receptors. Nevertheless, BPM will be used to minimise the potential for significant effects to occur. Details of BPM are provided within the EMP and NVMP (Application Document 2.7), which states that BPM will be used to minimise the potential for significant effects to occur. The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management.

12.10.74 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it is estimated that the construction noise levels could generally be reduced by 5dB or possibly more in some situations. The number of receptors predicted to exceed the LOAEL and SOAEL, allowing for use of BPM, is summarised in Table 12-33: Temple Sowerby to Appleby noise construction assessment (with BPM).

Table 12-33: Temple Sowerby to Appleby noise construction assessment (with BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		257	118	2
Phase 2 - road construction	Boundary fence	239	138	0
	Topsoil strip	105	257	15
	Drainage - v ditch	365	12	0
	Earthworks	88	243	46
	Capping/subbase	67	251	59
	Pavement/surfacing	113	253	11
	Road marking	332	45	0
	VRS	358	19	0
	Removal of current road	181	184	12
	Surface water channel	211	162	4
	Drainage	149	224	4
Phase 3 - structures	Excavation - hard standing	377	0	0
	Stone delivery	375	2	0
	Concreting	249	128	0
	Sheet pilling	377	0	0

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	CFA piling	377	0	0
Phase 4 - Compound	Site clearance	122	216	39
	Boundary fence	190	187	0
	Topsoil strip	172	195	10
	Excavation	176	195	6
	Drainage	189	186	2
	Subbase	176	195	6
	Pavement/surfacing	183	192	2
	Operation and haul roads	211	166	0

12.10.75 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it remains possible that construction noise levels will exceed the SOAEL during each of the construction phases at a number of receptors, however, the total number of receptors likely to experience noise levels greater than the SOAEL has reduced. Where the construction noise level is predicted to be greater than the SOAEL, further mitigation measures will be utilised (where practicable) in the form of the construction program to minimise the possibility that receptors are not exposed to noise levels greater than the SOAEL for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months.

Operation

12.10.76 ES Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) present the results of the Do-Minimum and Do-Something noise prediction modelling for the Temple Sowerby to Appleby scheme. Conclusion of significance has been determined in line with the methodology stated in section 12.4: Assessment methodology.

Residential Receptors: Effects exceeding the SOAEL

12.10.77 There are 74 dwellings currently exceeding the SOAEL, where noise reductions would occur as a result of the scheme, and which will therefore experience significant beneficial effects. These dwellings are predicted to experience a reduction in noise from above the SOAEL to below the SOAEL. The level of beneficial impact would be major or moderate for all these dwellings in the short-term and moderate in the long-term for eight properties. The majority of these dwellings are located within Kirkby Thore or along the existing A66. There is one receptor near Crackenthorpe predicted to experience a significant beneficial effect, but noise levels remain above SOAEL.

Residential Receptors: Effects between the LOAEL and SOAEL

12.10.78 There are 205 residential receptors likely to be subject to 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 these dwellings in the short-term. These dwellings are generally located along the existing A66, near or within Kirkby Thore, near or within Crackenthorpe and near to Long Marton Road, Appleby-in-Westmorland.

12.10.79 There are 67 residential receptors likely to be subject to significant adverse effects because of the scheme. Of these 67 receptors, 57 residential dwellings are located to the north of Kirkby Thore at Sandersons Croft to the south of the new A66 alignment. The majority of these dwellings are predicted to experience a major or moderate impact in the short-term, with 39 experiencing a reduction in impact in the long-term to either moderate or minor. The remaining 10 residential receptors are located to the north of the new A66 alignment around the areas of Spitals Farm, Halefield Farm, Sleastonhowe, Powls House, Castrigg Hill and Roger Head. These dwellings are predicted to experience a major or moderate impact in the short-term, with 9 experiencing a reduction in impact in the long-term to either moderate or minor. Due to engineering constraints the noise barrier could not be designed to mitigate these residual effects, therefore the residual effects remain.

Residential Receptors: effects below the LOAEL

12.10.80 There are 247 residential receptors in the study area for this scheme that would be subject to noise levels below the LOAEL with the scheme in operation. The impacts at these receptors are assessed as not significant.

12.10.81 According to the national relative tranquillity mapping (Figure 10.7: CPRE Tranquillity (Application Document 3.3)), none of these properties are located in a particularly sensitive high tranquillity area. Therefore, no significant noise effects, either beneficial or adverse, have been determined.

Non-Residential Receptors: Effects exceeding the SOAEL

12.10.82 There are seven non-residential receptors currently exceeding the SOAEL, where noise reductions would occur as a result of the scheme and will therefore experience significant beneficial effects. Six of these receptors are likely to reduce from above the SOAEL to below the SOAEL and for one receptor, even though there is a beneficial effect, the noise levels are predicted to still exceed SOAEL. These non-residential receptors are located within Kirkby Thore and include commercial premises, hotels, village halls and places of worship.

12.10.83 Kirkby Thore Primary School is one of the non-residential receptors predicted to experience significant beneficial effects as a result of the scheme. This is due to the existing road network being by-passed, in particular, Priest Lane and the effect of embedded mitigation. As such, traffic noise levels at Kirkby Thore Primary School would be lower with the Project.

Non-Residential Receptors: Effects between the LOAEL and the SOAEL

12.10.84 There are five non-residential receptors currently between the LOAEL and SOAEL that are likely to experience significant beneficial effects as a result of the scheme. These receptors are predicted to experience a major beneficial impact in the short-term and a moderate beneficial impact in the long-term for three of the receptors. All receptors are located within Kirkby Thore and include churches, places of worship, offices, hotels and parks.

12.10.85 There is one non-residential receptors that would be subject to noise levels between the LOAEL and SOAEL, where a noise increase would occur because of the scheme, and which will therefore experience an adverse significant effect. This receptor is predicted to experience a moderate impact in the short-term and a minor impact in the long-term. It is an office located in Spitals near to the existing A66 between Temple Sowerby and Kirkby Thore.

NIAs

12.10.86 There is one NIA that is located within 600m of this scheme: NIA 12113. The residential and non-residential receptors within or near to NIA 12113 are predicted to experience a reduction in noise levels because of the scheme that brings them below the SOAEL and will therefore experience a significant beneficial effect These receptors are included in paragraphs 12.10.77 and 12.10.82.

Committed developments

12.10.87 There are a number of committed developments located within 600m of the scheme, all of which are planned for residential purposes. Each of these areas is unlikely to experience significant effects as a result of the scheme.

Appleby to Brough

Construction

12.10.88 There are a total of 89 residential and non-residential receptors within the noise construction study area. The predicted noise level in Table 12-34: Appleby to Brough noise construction assessment (without BPM) represents a worst-case scenario for each phase, as they represent the temporary noise levels experienced when the located at the closest point to each receptor and no BPM has been adopted.

Table 12-34: Appleby to Brough noise construction assessment (without BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		84	5	0
Phase 2 - road construction	Boundary fence	44	43	2
	Topsoil strip	7	61	21
	Drainage - v ditch	48	38	3

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	Earthworks	2	54	33
	Capping/subbase	3	49	37
	Pavement/surfacing	7	62	20
	Road marking	66	23	0
	VRS	71	18	0
	Removal of current road	20	64	5
	Surface water channel	37	49	3
	Drainage	24	58	7
Phase 3 - structures	Excavation - hard standing	89	0	0
	Stone delivery	88	1	0
	Concreting	52	33	4
	Sheet pilling	89	0	0
	CFA piling	89	0	0
Phase 4 - Compound	Site clearance	89	0	0
	Boundary fence	89	0	0
	Topsoil strip	89	0	0
	Excavation	89	0	0
	Drainage	89	0	0
	Subbase	89	0	0
	Pavement/surfacing	89	0	0
	Operation and haul roads	89	0	0

12.10.89 The greatest potential for construction noise levels to exceed the SOAEL is during Phase 2 (road construction) as shown in Table 12-34: Appleby to Brough noise construction assessment (without BPM). Although the construction noise levels may exceed the SOAEL during phase 3 (structures) the majority of receptors within the study area will experience construction noise levels below the SOAEL. No receptors are predicted to experience noise levels above the SOAEL during Phase 1 (demolition) and phase 4 (compound). Details of receptors predicted to experience noise levels above the SOAEL (without BPM) are provided in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.90 As discussed in section 12.4: Assessment methodology, a construction significant effect is likely if the predicted noise levels are above the SOAEL and are experienced for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months. As the programme of works and duration of each activity cannot currently be finalised, construction impacts have been assessed as significant effects when construction is at its busiest and closest to

receptors. Nevertheless, BPM will be used to minimise the potential for significant effects to occur. Details of BPM are provided within the EMP and NVMP (Application Document 2.7), which states that BPM will be used to minimise the potential for significant effects to occur. The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management.

12.10.91 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it is estimated that the construction noise levels could generally be reduced by 5dB or possibly more in some situations. The number of receptors predicted to exceed the LOAEL and SOAEL, allowing for use of BPM has been adopted, is summarised in Table 12-35: Appleby to Brough noise construction assessment (with BPM).

Table 12-35: Appleby to Brough noise construction assessment (with BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		84	5	0
Phase 2 - road construction	Boundary fence	63	26	0
	Topsoil strip	25	58	6
	Drainage - v ditch	59	29	1
	Earthworks	9	61	19
	Capping/subbase	7	62	20
	Pavement/surfacing	32	52	5
	Road marking	84	5	0
	VRS	81	8	0
	Removal of current road	45	44	0
	Surface water channel	55	34	0
	Drainage	46	41	2
Phase 3 - structures	Excavation - hard standing	89	0	0
	Stone delivery	89	0	0
	Concreting	69	18	2
	Sheet pilling	89	0	0
	CFA piling	89	0	0
Phase 4 - Compound	Site clearance	89	0	0
	Boundary fence	89	0	0
	Topsoil strip	89	0	0
	Excavation	89	0	0
	Drainage	89	0	0
	Subbase	89	0	0
	Pavement/surfacing	89	0	0

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	Operation and haul roads	89	0	0

12.10.92 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it remains possible that construction noise levels will exceed the SOAEL during each of the construction phases at a number of receptors, however, the total number of receptors likely to experience noise levels greater than the SOAEL has reduced. Where the construction noise level is predicted to be greater than the SOAEL, further mitigation measures will be utilised (where practicable) in the form of the construction program to minimise the possibility that receptors are not exposed to noise levels greater than the SOAEL for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months.

Operation

12.10.93 Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) present the results of the Do-Minimum and Do-Something noise prediction modelling for the Appleby to Brough scheme. Conclusion of significance has been determined in line with the methodology stated in section 12.4: Assessment methodology.

Residential Receptors: Effects exceeding the SOAEL

12.10.94 There are four dwellings currently exceeding the SOAEL, where noise reductions would occur because of the scheme, and which will therefore experience significant beneficial effects. Major and moderate beneficial impacts in the long and short-term are predicted. The noise levels are likely to reduce from above the SOAEL to below the SOAEL. These dwellings are located near to the existing A66 at Wheatsheaf Cottage and at Turks Head.

12.10.95 There are 11 dwellings currently exceeding the SOAEL, where an increase in noise would occur because of the scheme and will therefore experience significant adverse effects. Two of these receptors are located immediately south of the A66 around West View and Foxtower View (Mains House). The remaining nine receptors are located within Brough at Lady Anne Drive and Pembroke Close and West View.

12.10.96 For the receptors within Brough, a 2-3m barrier installed for approximately 235m alongside the existing A66 (within the highways boundary) and next to the impacted community would be likely to eliminate the identified significant effects. The barrier in the form of a fence with the characteristics described in Table 12-20: Noise mitigation measures for operation of the scheme (Ref 14) is likely to be sustainable (as per section 12.9: Essential mitigation and enhancement measures).

Residential Receptors: Effects between the LOAEL and SOAEL

12.10.97 There is one dwelling currently predicted to experience effects between the LOAEL and SOAEL, where a decrease in noise would occur because of the scheme and which will therefore experience significant beneficial effects. This dwelling is located at Wheatsheaf Farm.

12.10.98 There are 22 dwellings currently predicted to experience effects between the LOAEL and SOAEL where an increase in noise would occur because of the scheme and will therefore experience significant adverse effects. The majority of these dwellings are predicted to experience a major or moderate impact in the short-term, with 13 experiencing a reduction in impact in the long-term to either moderate or minor. These dwellings are located near to the existing A66 at Warcop and Pembroke Close in Brough. For the receptors in Brough, if the noise barrier presented in section 12.9: Essential mitigation and enhancement measures (Table 12-20: Noise mitigation measures for operation of the scheme, Ref 14) above is installed, the significant effects are likely to be eliminated.

12.10.99 There is one dwelling located in Dyke Nook (Kirkdale), where if the centrelines are moved closer to the dwelling to the maximum extent of the LoD, then the predicted magnitude of impact may result in a moderate adverse impact and would be assessed as a likely significant effect at this receptor. As stated in the EMP (Application Document 2.7), further noise modelling will be undertaken during detailed design once information about the exact location of the road centrelines is established to establish the level of impact at this receptor and, where a likely significant adverse effect is predicted, mitigation measures will be investigated and, following the principles in section 12.9: Essential mitigation and enhancement measures, implemented should such mitigation be considered to be practicable and sustainable.

Residential Receptors: effects below the LOAEL

12.10.100 There are 298 residential receptors in the study area that would be subject to noise levels below the LOAEL with the scheme in operation. The impacts at these receptors are assessed as not significant.

12.10.101 According to the national relative tranquillity mapping (Figure 10.7: CPRE Tranquillity (Application Document 3.3)), none of these properties are located a particularly sensitive high tranquillity area. Therefore, no significant noise effects, either beneficial or adverse, have been determined.

Non-Residential Receptors: Effects exceeding the SOAEL

12.10.102 There is one non-residential receptor currently exceeding the SOAEL, where an increase in noise would occur because of the scheme and will therefore experience a significant adverse effect. A minor impact is predicted in the short-term. This receptor is a hotel located at Apple Tree Farm.

12.10.103 There is one non-residential receptor located in Coupland Beck (Ketland Moor), where if the centrelines are moved closer to the receptor to the maximum extent of the LoD, then the predicted magnitude of impact

may result in a minor adverse impact. Since the receptor is exposed to noise levels above the SOAEL, noise impacts may result in a likely significant effect at this receptor. As stated in the EMP (Application Document 2.7), further noise modelling will be undertaken during detailed design once information about the exact location of the road centrelines is established to establish the level of impact at this receptor and, where a likely significant adverse effect is predicted, mitigation measures will be investigated and, following the principles in section 12.9: Essential mitigation and enhancement measures, implemented should such mitigation be considered to be practicable and sustainable.

Non-Residential Receptors: Effects between the LOAEL and the SOAEL

12.10.104 There are no non-residential receptors predicted to experience significant effects between the LOAEL and SOAEL.

NIAs

12.10.105 There is one NIA that is near this scheme: NIA 10128. The residents within or near to this NIA are predicted to experience a reduction in noise levels. The Street house at Warcop is predicted to experience a significant beneficial effect with the reduction in noise levels bringing the receptor below the SOAEL. This receptor is included in paragraph 12.10.94.

Committed developments

12.10.106 There is one committed development located to the east of the scheme named 'Rowan House', which is planned for residential purposes. Given the proximity of the development site to the A66, its fronting area closest to the A66 has the potential to be impacted by the Project. The Project is predicted to give rise to minor and negligible impacts at the development site. For the areas of the development site which are closest to the A66, noise levels may exceed the SOAEL and impacts may result in significant effects. However, the magnitude of impact will decrease as the site moves further away from the A66.

12.10.107 There are two local applications within Brough immediately north of the existing A66 with the potential to be impacted by the scheme and hence be subject to significant effects. One development is called 'Castle Park (Brough) - 6 additional dwellings on site with original consent 14/0305' and has planning application reference 17/0400. The other development plan located further east is called 'Land East of Castle Park (Brough) erection of five dwellings' and has planning number reference 20/0234. Potential noise impacts at the area of the site closest to the A66 may occur. The Project is predicted to give rise to minor and negligible impacts at the development site. For the areas of the development site which are closest to the A66, noise levels may exceed the SOAEL and impacts may result in significant effects. However, the magnitude of impact will decrease as the site moves further away from the A66. With the implementation of the noise barrier reference 14 (refer to Table 12-20: Noise mitigation measures for operation of the scheme), adverse impacts at the Castle Park LDP could be lessened.

AONB

12.10.108 A proportion of the North Pennines AONB is located to the north of this scheme and within 600m of this scheme. For the vast majority of this AONB, negligible and minor increases in noise are predicted. However, a moderate increase in noise level is predicted north of the scheme at Hayber Lane and Felt Lane within a relatively small area of the AONB.

Bowes Bypass

Construction

12.10.109 There are a total of 139 residential and non-residential receptors within the noise construction study area. The predicted noise level in Table 12-36: Bowes Bypass noise construction assessment (without BPM) represents a worst-case scenario for each phase, as they represent the temporary noise levels experienced when the located at the closest point to each receptor and no BPM has been adopted.

Table 12-36: Bowes Bypass noise construction assessment (without BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		83	55	1
Phase 2 - road construction	Boundary fence	49	89	1
	Topsoil strip	2	129	8
	Drainage - v ditch	58	80	1
	Earthworks	2	93	44
	Capping/subbase	0	65	74
	Pavement/surfacing	22	110	7
	Road marking	132	7	0
	VRS	136	3	0
	Removal of current road	40	97	2
	Surface water channel	56	82	1
	Drainage	39	97	3
Phase 3 - structures	Excavation - hard standing	139	0	0
	Stone delivery	139	0	0
	Concreting	64	74	1
	Sheet pilling	139	0	0
	CFA piling	139	0	0
Phase 4 - Compound	Site clearance	26	100	13
	Boundary fence	123	15	1
	Topsoil strip	49	81	9
	Excavation	56	74	9

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	Drainage	69	61	9
	Subbase	56	74	9
	Pavement/surfacing	83	56	0
	Operation and haul roads	122	17	0

12.10.110 The greatest potential for construction noise levels to exceed the SOAEL is during Phase 2 (road construction) as shown in Table 12-36: Bowes Bypass noise construction assessment (without BPM). Although the construction noise levels may exceed the SOAEL during phase 1 (demolition), phase 3 (structures) and phase 4 (compound) the majority of receptors within the study area will experience construction noise levels below the SOAEL. Details of receptors predicted to experience noise levels above the SOAEL (without BPM) are provided in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.111 As discussed in section 12.4: Assessment methodology, a construction significant effect is likely if the predicted noise levels are above the SOAEL and are experienced for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months. As the programme of works and duration of each activity cannot currently be finalised, construction impacts have been assessed as significant effects when construction is at its busiest and closest to receptors. Nevertheless, BPM will be used to minimise the potential for significant effects to occur. Details of BPM are provided within the EMP and NVMP (Application Document 2.7), which states that BPM will be used to minimise the potential for significant effects to occur. The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management.

12.10.112 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it is estimated that the construction noise levels could generally be reduced by 5dB or possibly more in some situations. The number of receptors predicted to exceed the LOAEL and SOAEL, allowing for use of BPM, is summarised in Table 12-37: Bowes Bypass noise construction assessment (with BPM).

Table 12-37: Bowes Bypass noise construction assessment (with BPM)

Construction Phase	Number of receptors		
	Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition	83	55	1

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 2 - road construction	Boundary fence	120	19	0
	Topsoil strip	36	101	2
	Drainage - v ditch	90	49	0
	Earthworks	27	108	4
	Capping/subbase	10	122	7
	Pavement/surfacing	36	101	2
	Road marking	138	1	0
	VRS	139	0	0
	Removal of current road	118	21	0
	Surface water channel	134	5	0
	Drainage	51	87	1
Phase 3 - structures	Excavation - hard standing	139	0	0
	Stone delivery	139	0	0
	Concreting	124	14	1
	Sheet pilling	139	0	0
	CFA piling	139	0	0
Phase 4 - Compound	Site clearance	42	87	10
	Boundary fence	123	16	0
	Topsoil strip	116	22	1
	Excavation	119	19	1
	Drainage	124	14	1
	Subbase	119	19	1
	Pavement/surfacing	134	5	0
	Operation and haul roads	138	1	0

12.10.113 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it remains possible that construction noise levels will exceed the SOAEL during each of the construction phases at a number of receptors, however, the total number of receptors likely to experience noise levels greater than the SOAEL has reduced. Where the construction noise level is predicted to be greater than the SOAEL, further mitigation measures will be utilised (where practicable) in the form of the construction program to minimise the possibility that receptors are not exposed to noise levels greater than the SOAEL for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months.

Operation

12.10.114 Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) represents the results of the Do-Minimum and Do-Something noise prediction modelling for the Bowes Bypass scheme. Conclusion of significance has been determined in line with the methodology stated in section 12.4: Assessment methodology.

Residential Receptors: Effects exceeding the SOAEL

12.10.115 There are no residential receptors predicted to experience effects above SOAEL.

12.10.116 There are two dwellings located in Bowes (The Granary and the Old Barn, West End Farm), where if the centrelines are moved closer to the dwellings to the maximum extent of the LoD, then the predicted magnitude of impact may result in a minor adverse impact. Since the receptors may be exposed to noise levels above a SOAEL, then the noise impacts may result in a likely significant effect at this receptor. As stated in the EMP (Application Document 2.7), further noise modelling will be undertaken during detailed design once information about the exact location of the road centrelines is established to establish the level of impact at this receptor and, where a likely significant adverse effect is predicted, mitigation measures will be investigated and, following the principles in section 12.6: Essential mitigation and enhancement measures, implemented should such mitigation be considered to be practicable and sustainable.

Residential Receptors: Effects between the LOAEL and SOAEL.

12.10.117 There is one dwelling currently predicted to experience effects between the LOAEL and SOAEL, where an increase in noise would occur because of the scheme and will therefore experience significant adverse effects. A moderate effect in the short-term is predicted and a minor impact in the long-term. This dwelling is located on the existing A66, east of Bowes at Stone Bridge farm.

12.10.118 There is one dwelling located in Kilmond View where if the centrelines are moved closer to the dwelling to the maximum extent of the LoD, then the predicted magnitude of impact may result in a moderate adverse impact and a likely significant effect. As stated in the EMP (Application Document 2.7), further noise modelling will be undertaken during detailed design once information about the exact location of the road centrelines is established to establish the level of impact at this receptor and, where a likely significant adverse effect is predicted, mitigation measures will be investigated and, following the principles in section 12.6: Essential mitigation and enhancement measures, implemented should such mitigation be considered to be practicable and sustainable.

Residential Receptors: effects below the LOAEL

12.10.119 There are 81 residential receptors within the study area that would be subject to noise levels below the LOAEL with the scheme in operation. The impacts at these receptors are assessed as not significant.

12.10.120 According to the national relative tranquillity mapping (Figure 10.7: CPRE Tranquillity (Application Document 3.3)), none of these properties are located a particularly sensitive high tranquillity area. Therefore, no significant noise effects, either beneficial or adverse, have bene determined.

Non-Residential Receptors: Effects exceeding the SOAEL

12.10.121 There is one non-residential receptor currently exceeding the SOAEL, where an increase in noise would occur because of the scheme and will therefore experience a significant adverse effect. A minor impact is predicted in the short-term. This receptor is located near to the existing A66 on the western outskirts of Bowes and is an architectural studio.

Non-Residential Receptors: Effects between the LOAEL and the SOAEL

12.10.122 There are no non-residential receptors predicted to experience effects between the LOAEL and SOAEL.

NIAs

12.10.123 There are no NIAs that are located within 600m of the scheme.

Committed developments

12.10.124 There are no future receptor sites identified within 600m of the study area.

AONB

12.10.125 A proportion of the North Pennines AONB is located to the west of this scheme and within 600m of this scheme. For the majority of this AONB, a negligible change in noise is predicted and hence no significant effects are identified.

Cross Lanes to Rokeby

Construction

12.10.126 There are a total of 25 residential and non-residential receptors within the noise construction study area. The predicted noise level in Table 12-38: Cross Lanes to Rokeby noise construction assessment (without BPM) represents a worst-case scenario for each phase, as they represent the temporary noise levels experienced when the located at the closest point to each receptor and no BPM has been adopted.

Table 12-38: Cross Lanes to Rokeby noise construction assessment (without BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		25	0	0
Phase 2 - road construction	Boundary fence	14	8	3
	Topsoil strip	3	11	11
	Drainage - v ditch	18	7	0
	Earthworks	0	12	13
	Capping/subbase	0	11	14
	Pavement/surfacing	4	12	9
	Road marking	20	4	1
	VRS	25	0	0
	Removal of current road	10	14	1
	Surface water channel	16	9	0
	Drainage	7	13	5
Phase 3 - structures	Excavation - hard standing	25	0	0
	Stone delivery	25	0	0
	Concreting	23	2	0
	Sheet pilling	25	0	0
	CFA piling	25	0	0
Phase 4 - Compound	Site clearance	22	3	0
	Boundary fence	25	0	0
	Topsoil strip	25	0	0
	Excavation	25	0	0
	Drainage	25	0	0
	Subbase	25	0	0
	Pavement/surfacing	25	0	0
	Operation and haul roads	25	0	0

12.10.127 The greatest potential for construction noise levels to exceed the SOAEL is during Phase 2 (road construction) as shown in Table 12-38: Cross Lanes to Rokeby noise construction assessment (without BPM). No receptors within the study area are predicted to l experience construction noise levels above the SOAEL during phase 1 (demolition), Phase 3 (Structures) and Phase 4 (compound). Details of receptors predicted to experience noise levels above the SOAEL (without BPM) are provided in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.128 As discussed in section 12.4: Assessment methodology, a construction significant effect is likely if the predicted noise levels are

above the SOAEL and are experienced for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months. As the programme of works and duration of each activity cannot currently be finalised, construction impacts have been assessed as significant effects when construction is at its busiest and closest to receptors. Nevertheless, BPM will be used to minimise the potential for significant effects to occur. Details of BPM are provided within the EMP and NVMP (Application Document 2.7), which states that BPM will be used to minimise the potential for significant effects to occur. The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management.

12.10.129 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it is estimated that the construction noise levels could generally be reduced by 5dB or possibly more in some situations. The number of receptors predicted to exceed the LOAEL and SOAEL, after BPM allowing for use of BPM, is summarised in Table 12-39: Cross Lanes to Rokeby noise construction assessment (with BPM).

Table 12-39: Cross Lanes to Rokeby noise construction assessment (with BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		25	0	0
Phase 2 - road construction	Boundary fence	20	4	1
	Topsoil strip	7	13	5
	Drainage - v ditch	23	2	0
	Earthworks	0	22	3
	Capping/subbase	3	11	11
	Pavement/surfacing	7	13	5
	Road marking	22	3	0
	VRS	25	0	0
	Removal of current road	21	4	0
	Surface water channel	23	2	0
	Drainage	14	8	3
Phase 3 - structures	Excavation - hard standing	25	0	0
	Stone delivery	25	0	0
	Concreting	25	0	0
	Sheet pilling	25	0	0
	CFA piling	25	0	0
Phase 4 - Compound	Site clearance	23	2	0
	Boundary fence	25	0	0

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	Topsoil strip	25	0	0
	Excavation	25	0	0
	Drainage	25	0	0
	Subbase	25	0	0
	Pavement/surfacing	25	0	0
	Operation and haul roads	25	0	0

12.10.130 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it remains possible that construction noise levels will exceed the SOAEL during each of the construction phases at a number of receptors, however, the total number of receptors likely to experience noise levels greater than the SOAEL has reduced. Where the construction noise level is predicted to be greater than the SOAEL, further mitigation measures will be utilised (where practicable) in the form of the construction program to minimise the possibility that receptors are not exposed to noise levels greater than the SOAEL for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months.

Operation

12.10.131 Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) represents the results of the Do-Minimum and Do-Something noise prediction modelling for the Cross Lanes to Rokeby scheme. Conclusion of significance has been determined in line with the methodology stated in section 12.4: Assessment methodology.

Residential Receptors: Effects exceeding the SOAEL

12.10.132 There are five dwellings currently exceeding the SOAEL, where an increase in noise would occur as a result of the scheme and will therefore experience significant adverse effects. Moderate or minor impacts are predicted at each of these receptors are predicted in the short-term. These dwellings are primarily located along the existing A66 in the areas of North Bitts Farm, Cross Lanes and Rokeby.

12.10.133 For the residential receptor located in North Bitts, a 2-4m barrier installed for approximately 56m would be likely to eliminate the identified significant effect. The barrier in the form of a fence with the characteristics described in Table 12-20: Noise mitigation measures for operation of the scheme (Ref 86) is likely to be sustainable (as per section 12.9: Essential mitigation and enhancement measures). The development of the barrier would be subject to liaison with relevant stakeholders including the resident(s) in question, given it impacts one residential receptor only and has other potential impacts.

Residential Receptors: Effects between the LOAEL and SOAEL

12.10.134 There is one dwelling currently experiencing noise levels between the LOAEL and SOAEL, where a decrease in noise levels is predicted as a result of the scheme. This dwelling is predicted to experience a major impact in the short-term and a moderate impact in the long-term. This dwelling is located at the School House at Rokeby.

12.10.135 There are five dwellings currently experiencing noise levels between the LOAEL and SOAEL, where an increase in noise would occur because of the scheme and will therefore experience significant adverse effects. A moderate impact in the short-term and a minor impact in the long-term is predicted. These dwellings are located south of the existing A66 near to Tutta Beck and Birk House.

Residential Receptors: effects below the LOAEL

12.10.136 There are 22 residential receptors within this scheme that would be subject to noise levels below the LOAEL with the scheme in operation. The impacts at these receptors are assessed as not significant.

12.10.137 According to the national relative tranquillity mapping (Figure 10.7: CPRE Tranquillity (Application Document 3.3)), none of these properties are located a particularly sensitive high tranquillity area. Therefore, no significant noise effects, either beneficial or adverse, have been determined.

Non-Residential Receptors: Effects exceeding the SOAEL

12.10.138 There is one non-residential receptor currently exceeding the SOAEL, where a decrease in noise would occur because of the scheme and will therefore experience a significant beneficial effect. The non-residential receptor is predicted to be subject to major beneficial impacts in the short and long-term. The receptor is located in Rokeby and is a village hall named The Old School.

12.10.139 There is one non-residential receptor above the SOAEL where an increase in noise would occur because of the scheme and will therefore experience a significant adverse effect. A minor impact is predicted in the short-term. This receptor is the Cross Lanes Organic Farm Shop, located next to the junction between A66 and B6277.

Non-Residential Receptors: Effects between the LOAEL and the SOAEL

12.10.140 There is one non-residential receptor between the LOAEL and the SOAEL where noise reductions would occur as a result of the scheme and will therefore experience significant beneficial effects. The receptor is predicted to be subject to major impacts in the short-term and moderate in the long-term. The receptor is St Mary's Church in Rokeby.

NIAs

12.10.141 There are no NIAs that are located within 600m of the scheme.

Committed developments

12.10.142 There are no future receptor sites identified within 600m of the study area. The committed developments in Barnard Castle are unlikely to experience any significant effects as a result of the scheme operation.

Stephen Bank to Carkin Moor

Construction

12.10.143 There are a total of 29 residential and non-residential receptors within the noise construction study area. The predicted noise level in Table 12-40: Stephen Bank to Carkin Moor noise construction assessment (without BPM) represents a worst-case scenario for each phase, as they represent the temporary noise levels experienced when the located at the closest point to each receptor and no BPM has been adopted.

Table 12-40: Stephen Bank to Carkin Moor noise construction assessment (without BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		29	0	0
Phase 2 - road construction	Boundary fence	19	10	0
	Topsoil strip	7	21	1
	Drainage - v ditch	11	17	1
	Earthworks	0	15	14
	Capping/subbase	5	21	3
	Pavement/surfacing	8	20	1
	Road marking	28	1	0
	VRS	29	0	0
	Removal of current road	14	15	0
	Surface water channel	12	16	1
	Drainage	9	19	1
Phase 3 - structures	Excavation - hard standing	29	0	0
	Stone delivery	29	0	0
	Concreting	11	18	0
	Sheet pilling	29	0	0
	CFA piling	29	0	0
Phase 4 - Compound	Site clearance	25	4	0
	Boundary fence	29	0	0
	Topsoil strip	27	2	0
	Excavation	27	2	0
	Drainage	28	1	0
	Subbase	27	2	0

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	Pavement/surfacing	27	2	0
	Operation and haul roads	29	0	0

12.10.144 The greatest potential for construction noise levels to exceed the SOAEL is during Phase 2 (road construction) as shown in Table 12-40: Stephen Bank to Carkin Moor noise construction assessment (without BPM). No receptors within the study area are predicted to l experience construction noise levels above the SOAEL during phase 1 (demolition), Phase 3 (Structures) and Phase 4 (compound). Details of receptors predicted to experience noise levels above the SOAEL (without BPM) are provided in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.145 As discussed in section 12.4: Assessment methodology, a construction significant effect is likely if the predicted noise levels are above the SOAEL and are experienced for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months. As the programme of works and duration of each activity cannot currently be finalised, construction impacts have been assessed as significant effects when construction is at its busiest and closest to receptors. Nevertheless, BPM will be used to minimise the potential for significant effects to occur. Details of BPM are provided within the EMP and NVMP (Application Document 2.7), which states that BPM will be used to minimise the potential for significant effects to occur. The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management.

12.10.146 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it is estimated that the construction noise levels could generally be reduced by 5dB or possibly more in some situations. The number of receptors predicted to exceed the LOAEL and SOAEL, allowing for use of BPM, is summarised in Table 12-41: Stephen Bank to Carkin Moor noise construction assessment (with BPM).

Table 12-41: Stephen Bank to Carkin Moor noise construction assessment (with BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		29	0	0
Phase 2 - road construction	Boundary fence	28	1	0
	Topsoil strip	9	19	1
	Drainage - v ditch	18	11	0

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	Earthworks	1	23	5
	Capping/subbase	8	20	1
	Pavement/surfacing	11	17	1
	Road marking	28	1	0
	VRS	29	0	0
	Removal of current road	26	3	0
	Surface water channel	24	4	1
	Drainage	19	10	0
Phase 3 - structures	Excavation - hard standing	29	0	0
	Stone delivery	29	0	0
	Concreting	23	6	0
	Sheet pilling	29	0	0
	CFA piling	29	0	0
Phase 4 - Compound	Site clearance	27	2	0
	Boundary fence	29	0	0
	Topsoil strip	29	0	0
	Excavation	29	0	0
	Drainage	29	0	0
	Subbase	29	0	0
	Pavement/surfacing	29	0	0
	Operation and haul roads	29	0	0

12.10.147 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it remains possible that construction noise levels will exceed the SOAEL during each of the construction phases at a number of receptors, however, the total number of receptors likely to experience noise levels greater than the SOAEL has reduced. Where the construction noise level is predicted to be greater than the SOAEL, further mitigation measures will be utilised (where practicable) in the form of the construction program to minimise the possibility that receptors are not exposed to noise levels greater than the SOAEL for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months.

Operation

12.10.148 Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) represents the results of the Do-Minimum and Do-Something noise prediction modelling for the Stephen Bank to Carkin Moor scheme.

Conclusion of significance has been determined in line with the methodology stated in section 12.4: Assessment methodology.

Residential Receptors: Effects exceeding the SOAEL

12.10.149 There are six dwellings currently exceeding the SOAEL, where noise reductions would occur because of the scheme and will therefore experience significant beneficial effects. These receptors are predicted to experience a reduction in noise from above the SOAEL to below the SOAEL in the short and long-term. Most of these dwellings are located along or near to the existing A66 at Ravensworth Lodge, Foxwell and Foxhall.

Residential Receptors: Effects between the LOAEL and SOAEL

12.10.150 There are two residential receptors likely to be subject to significant beneficial effects between the LOAEL and SOAEL because of the scheme. The level of beneficial impact would be major and moderate for both these dwellings in the short and the long-term. These dwellings are located at Foxgrove Farm and Foxwell Farm.

12.10.151 There are 12 residential receptors likely to be subject to significant adverse effects because of the scheme. The level of adverse impact would be major and moderate for these dwellings. These dwellings are located near to West Layton and Carkin Moor Farm.

Residential Receptors: effects below the LOAEL

12.10.152 There are 64 residential receptors within the study area that would be subject to noise levels below the LOAEL with the scheme in operation. The impacts at these receptors are assessed as not significant.

12.10.153 According to the national relative tranquillity mapping (Figure 10.7: CPRE Tranquillity (Application Document 3.3)), none of these properties are located a particularly sensitive high tranquillity area. Therefore, no significant noise effects, either beneficial or adverse, have been determined.

Non-Residential Receptors: Effects exceeding the SOAEL

12.10.154 There are no non-residential receptors predicted to experience effects above the SOAEL.

Non-Residential Receptors: Effects between the LOAEL and the SOAEL

12.10.155 There are no non-residential receptors predicted to experience effects between the LOAEL and SOAEL.

NIAs

12.10.156 There is one NIA located near this scheme: NIA 10437. The residents within or near to these NIAs are predicted to experience a reduction in noise levels because of the scheme. There are eight residential receptors located near to these NIA, which are predicted to experience significant beneficial effects. The reduction in noise levels for the four residential receptors within NIA 10437 bring them below the SOAEL. These receptors are included in paragraph 12.10.149.

Committed developments

12.10.157 There are no future receptor sites identified within 600m of the study area.

A1(M) Junction 53 Scotch Corner

Construction

12.10.158 There are a total of 23 residential and non-residential receptors within the noise construction study area. The predicted noise level in Table 12-42: A1 (M) Junction 53 Scotch Corner noise construction assessment (without BPM) represents a worst-case scenario for each phase, as they represent the temporary noise levels experienced when the located at the closest point to each receptor and no BPM has been adopted.

Table 12-42: A1 (M) Junction 53 Scotch Corner noise construction assessment (without BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		23	0	0
Phase 2 - road construction	Boundary fence	23	0	0
	Topsoil strip	12	10	1
	Drainage - v ditch	23	0	0
	Earthworks	2	16	5
	Capping/subbase	1	18	4
	Pavement/surfacing	17	5	1
	Road marking	23	0	0
	VRS	21	2	0
	Removal of current road	17	5	1
	Surface water channel	20	3	0
	Drainage	18	5	0
Phase 3 - structures	Excavation - hard standing	23	0	0
	Stone delivery	23	0	0
	Concreting	23	0	0
	Sheet pilling	23	0	0
	CFA piling	23	0	0
Phase 4 - Compound	Site clearance	23	0	0
	Boundary fence	23	0	0
	Topsoil strip	23	0	0
	Excavation	23	0	0
	Drainage	23	0	0
	Subbase	23	0	0
	Pavement/surfacing	23	0	0

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	Operation and haul roads	23	0	0

12.10.159 The greatest potential for construction noise levels to exceed the SOAEL is during Phase 2 (road construction) as shown in Table 12-42: A1 (M) Junction 53 Scotch Corner noise construction assessment (without BPM). No receptors within the study area are predicted to l experience construction noise levels above the SOAEL during phase 1 (demolition), Phase 3 (Structures) and Phase 4 (compound). Details of receptors predicted to experience noise levels above the SOAEL (without BPM) are provided in Appendix 12.3: Construction Assessment Results (Application Document 3.4).

12.10.160 As discussed in section 12.4: Assessment methodology, a construction significant effect is likely if the predicted noise levels are above the SOAEL and are experienced for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months. As the programme of works and duration of each activity cannot currently be finalised, construction impacts have been assessed as significant effects when construction is at its busiest and closest to receptors. Nevertheless, BPM will be used to minimise the potential for significant effects to occur. Details of BPM are provided within the EMP and NVMP (Application Document 2.7), which states that BPM will be used to minimise the potential for significant effects to occur. The Principal Contractor (PC) will determine whether applications under Section 61 of the Control of Pollution Act 1974 are appropriate or required in relation to noise management.

12.10.161 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it is estimated that the construction noise levels could generally be reduced by 5dB or possibly more in some situations. The number of receptors predicted to exceed the LOAEL and SOAEL, allowing for use of BPM, is summarised in Table 12-43: A1 (M) Junction 53 Scotch Corner noise construction assessment (with BPM).

Table 12-43: A1 (M) Junction 53 Scotch Corner noise construction assessment (with BPM)

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
Phase 1 - demolition		23	0	0
Phase 2 - road construction	Boundary fence	23	0	0
	Topsoil strip	19	4	0
	Drainage - v ditch	23	0	0
	Earthworks	10	11	2

Construction Phase		Number of receptors		
		Below LOAEL	Between LOAEL and SOAEL	Exceed SOAEL
	Capping/subbase	17	5	1
	Pavement/surfacing	20	3	0
	Road marking	23	0	0
	VRS	23	0	0
	Removal of current road	20	3	0
	Surface water channel	23	0	0
	Drainage	23	0	0
Phase 3 - structures	Excavation - hard standing	23	0	0
	Stone delivery	23	0	0
	Concreting	23	0	0
	Sheet pilling	23	0	0
	CFA piling	23	0	0
Phase 4 - Compound	Site clearance	23	0	0
	Boundary fence	23	0	0
	Topsoil strip	23	0	0
	Excavation	23	0	0
	Drainage	23	0	0
	Subbase	23	0	0
	Pavement/surfacing	23	0	0
	Operation and haul roads	23	0	0

12.10.162 With the use of BPM, as per the EMP and NVMP (Application Document 2.7), it remains possible that construction noise levels will exceed the SOAEL during each of the construction phases at a number of receptors, however, the total number of receptors likely to experience noise levels greater than the SOAEL has reduced. Where the construction noise level is predicted to be greater than the SOAEL, further mitigation measures will be utilised (where practicable) in the form of the construction program to minimise the possibility that receptors are not exposed to noise levels greater than the SOAEL for ten or more days and/or nights in any 15 consecutive days and/or nights or if the noise level is above the SOAEL for a total number of 40 or more days in any six consecutive months.

Operation

12.10.163 Figure 12.2: Opening Year Do-Minimum Noise Level - Figure 12.7: Future Year Alignment Noise Difference (Application Document 3.3) represents the results of the Do-Minimum and Do-Something noise prediction modelling for the A1(M) Junction 53 Scotch Corner scheme.

Conclusion of significance has been determined in line with the methodology stated in section 12.4: Assessment methodology.

Residential Receptors: Effects exceeding the SOAEL

12.10.164 There are no residential receptors predicted to experience effects above the SOAEL.

Residential Receptors: Effects between the LOAEL and SOAEL

12.10.165 There are no residential receptors predicted to experience effects between the LOAEL and SOAEL.

Residential Receptors: effects below the LOAEL

12.10.166 There are 15 residential receptors within the study area that would be subject to noise levels below the LOAEL with the scheme in operation. The impacts at these receptors are assessed as not significant.

12.10.167 According to the national relative tranquillity mapping (Figure 10.7: CPRE Tranquillity (Application Document 3.3)), none of these properties are located a particularly sensitive high tranquillity area. Therefore, no significant noise effects, either beneficial or adverse, have been determined.

Non-Residential Receptors: Effects exceeding the SOAEL

12.10.168 There are no non-residential receptors predicted to experience effects above SOAEL.

Non-Residential Receptors: Effects between the LOAEL and the SOAEL

12.10.169 There are no non-residential receptors predicted to experience effects between the LOAEL and SOAEL.

NIAs

12.10.170 There are no NIAs that are located within 600m of this scheme.

Committed developments

12.10.171 There are no future receptor sites identified within 600m of the study area.

In-Combination Climate Change Impact Assessment

Construction

12.10.172 UKCP18 projections suggest that changes to the climate by the 2020s (construction period) are unlikely to have a significant impact on this effect.

Operation

12.10.173 The climate variables that have any relevance to the noise and vibration assessment are: mean temperature, mean daily maximum temperature, and mean daily minimum temperature. These variables do not directly affect the levels of noise predicted in the assessment but have an indirect effect on the average internal noise level if windows are open more frequently (as a result of mean changes in temperature due to

climate change). However, the assessment is based on noise level change rather than simply absolute noise levels inside buildings. Therefore, the reported noise effects associated with the Project do not alter when climate change is considered.

12.10.174 Stronger wind conditions have the potential to lead to additional maintenance requirements for acoustic barriers, however, stronger winds are not considered to be capable of directly affecting the performance of noise barriers. Instead, maintenance regimes for the proposed barriers would be adapted accordingly.

12.10.175 Although residents may need to open windows more often, that would also be true in future years in the absence of the Project, hence the occurrence of an impact would be equally as likely relative to Do-Minimum.

12.10.176 The in-combination climate change impact assessment concludes that there is no change to the significance of the effects identified in this chapter.

12.11 Summary

12.11.1 Table 12-44: Summary of significant effects (construction) and Table 12-45: Summary of significant effects (operation) provide a summary of significant effects for both the construction and operational phases of the Project. A summary of non-significant effects is provided in Appendix 12.5: Non-significant Effects (Application Document 3.4).

12.11.2 Where a moderate or major magnitude is predicted (following the implementation of essential and enhanced mitigation) an adverse significant effect is likely, therefore the total number of receptors likely to experience significant effects is provided in Table 12-44: Summary of significant effects (construction). When the magnitude impact is negligible or minor, then no significant effects are predicted and so no receptor counts are provided.

Table 12-44: Summary of significant effects (construction)

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Routewide						
Residential and non-residential receptors near M6 Junction 40 to Kemplay Bank	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction), phase 3 (structures) and phase 4 (compound)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at 196 receptors during phase two (road construction), one receptor during phase 3 (Structures) and two receptors during phase 4 (compound)	Significant Adverse
Residential and non-residential receptors near Penrith to Temple Sowerby	Noise	High	Noise levels exceeding the SOAEL during phase 1 (demolition), phase 2 (road construction) and phase 4 (compound)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or moderate or major adverse impact is predicted at six receptors during phase one (demolition),15 receptors during phase two (road construction) and three receptors during phase 4 (compound)	Significant Adverse
Residential and non-residential receptors near	Noise	High	Noise levels exceeding the SOAEL during phase	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at two	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Temple Sowerby to Appleby			1 (demolition), phase 2 (road construction) and phase 4 (compound)		receptors during phase one (demolition),68 receptors during phase two (road construction) and 37 receptors during phase 4 (compound)	
Residential and non-residential receptors near Appleby to Brough	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction) and phase 3 (structures)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at 21 receptors during phase two (road construction) and two receptors during phase 3 (structures)	Significant Adverse
Residential and non-residential receptors near Bowes Bypass	Noise	High	Noise levels exceeding the SOAEL during phase 1 (demolition), phase 2 (road construction), phase 3 (structures) and phase 4 (compound)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at seven receptors during phase two (road construction), one receptor during phase 3 (structures) and 10 receptors during phase 4 (compound)	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Residential and non-residential receptors near Cross Lanes to Rokeby	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at 11 receptors during phase two (road construction)	Significant Adverse
Residential and non-residential receptors near Stephen Bank to Carkin Moor	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at five receptors during phase two (road construction)	Significant Adverse
Residential and non-residential receptors near A1(M) Junction 53 Scotch Corner	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at two receptors during phase two (road construction)	Significant Adverse
M6 Junction 40 to Kemplay Bank						
Residential and non-residential receptors at Penrith	Noise	High	Noise levels exceeding the SOAEL during phase 1 (demolition), phase 2 (road construction), phase 3 (structures) and phase 4 (compound)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at 187 receptors during phase two (road construction), one receptor during phase 3 (structures) and one receptor	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
					during phase 4 (compound)	
Residential and non-residential receptors at Eamont Bridge	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction) phase 4 (compound)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at two receptors during phase 2 (road construction) and one receptor during phase 4 (compound)	Significant Adverse
Residential and non-residential receptors at Redhill	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at seven receptors during phase 2 (road construction)	Significant Adverse
Penrith to Temple Sowerby						
Residential and non-residential receptors at Brougham	Noise	High	Noise levels exceeding the SOAEL during phase 1 (demolition), phase 2 (road construction) and phase 4 (compound)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at 10 receptors during phase 1 (demolition), 13 receptors during phase 2 (road construction) and three receptors during phase 4 (compound)	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Residential and non-residential receptors at Temple Sowerby	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at two receptors during phase 2 (road construction)	Significant Adverse
Temple Sowerby to Appleby						
Residential and non-residential receptors at Kirkby Thore	Noise	High	Noise levels exceeding the SOAEL during phase 1 (demolition), phase 2 (road construction) and phase 4 (compound)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at one receptor during phase 1 (demolition), 64 receptors during phase 2 (road construction) and 38 receptors during phase 4 (compound)	Significant Adverse
Residential and non-residential receptors at Long Marton	Noise	High	Noise levels exceeding the SOAEL during phase 1 (demolition), phase 2 (road construction) and phase 4 (compound)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at one receptor during phase 1 (demolition) and one during phase 4 (compound)	Significant Adverse
Residential and non-residential receptors at Crackenthorpe	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at four receptors during	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
					phase 2 (road construction)	
Residential and non-residential receptors at Temple Sowerby	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	Minor adverse impact	Not significant
Residential and non-residential receptors at Colby	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	Minor adverse impact	Not significant
Residential and non-residential receptors at Appleby-In-Westmorland	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	Minor adverse impact	Not significant
Appleby to Brough						
Residential and non-residential receptors at Brough	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction) and phase 3 (structures)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at five receptors during phase 2 (road construction) and two receptors during phase 3 (structures)	Significant Adverse
Residential and non-residential receptors at Warcop	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at 13 receptors during	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
					phase 2 (road construction)	
Residential and non-residential receptors at Sandford	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at three receptors during phase 2 (road construction)	Significant Adverse
Residential and non-residential receptors at Coupland Beck	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	Minor adverse impact	Not significant
Bowes Bypass						
Residential and non-residential receptors at Bowes	Noise	High	Noise levels exceeding the SOAEL during phase 1 (demolition), phase 2 (road construction) and phase 4 (compound)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at one receptor during phase 1 (demolition), seven receptors during phase 2 (road construction), one receptor during phase 3 (structures) and 10 receptors during phase 4 (compound)	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Residential and non-residential receptors at Boldron	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at one receptor during phase 2 (road construction)	Significant Adverse
Residential and non-residential receptors at Gilmonby	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	Minor adverse impact	Not significant
Cross Lanes to Rokeby						
Residential and non-residential receptors at Barnard Castle	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at three receptors during phase 2 (road construction)	Significant Adverse
Residential and non-residential receptors at Rokeby	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at seven receptors during phase 2 (road construction)	Significant Adverse
Residential and non-residential receptors at Brignall	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at one receptor during	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
					phase 2 (road construction)	
Stephen Bank to Carkin Moor						
Residential and non-residential receptors at Ravensworth	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at one receptor during phase 2 (road construction)	Significant Adverse
Residential and non-residential receptors at West Layton	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	Minor adverse impact	Not significant
Residential and non-residential receptors at East Layton	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at four receptors during phase 2 (road construction)	Significant Adverse
A1(M) Junction 53 Scotch Corner						
Residential and non-residential receptors at Middleton Tyas	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	A moderate or major adverse impact is predicted at two receptors during phase 2 (road construction)	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Residential and non-residential receptors at Scotch Corner	Noise	High	Noise levels exceeding the SOAEL during phase 2 (road construction)	Compliance with the control measures detailed in the EMP and NVMP (Application Document 2.7).	Minor adverse impact	Not significant

Table 12-45: Summary of significant effects (operation)

Receptor	Attribute	Receptor sensitivity	Potential Impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
M6 Junction 40 to Kemplay Bank						
Residential dwelling at Toll Bar Cottage (south of Kemplay Bank Roundabout)	Noise	High	Significant Beneficial	None required	Minor Beneficial	Significant Beneficial
Skirsgill Lodge	Noise	High	Significant Adverse	Fence type noise barrier as per section 12.9: Essential mitigation and enhancement measures (Table 12-20: Noise mitigation measures for operation of the scheme, Ref 52) (subject to liaison with stakeholders)	Minor Adverse	Not Significant
Non-residential receptors in Kempley Bank Roundabout (The Green)	Noise	Medium	Significant Beneficial	None required	Moderate Beneficial	Significant Beneficial

Receptor	Attribute	Receptor sensitivity	Potential Impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Non-residential receptor by Skirsgill Roundabout (Gillian Way)	Noise	Medium	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Minor Adverse	Significant Adverse
Penrith to Temple Sowerby						
Residential dwelling by the School House near Whinfell	Noise	High	Significant Beneficial	None required	Moderate impact	Significant Beneficial
Residential dwellings by Moor Lane (Fremington)	Noise	High	Significant Beneficial	None required	Major and moderate impacts	Significant Beneficial
Residential dwellings at Whinfell Park	Noise	High	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section .	Moderate impacts	Significant Adverse
Non-residential receptor at Brougham Institute (Whinfell)	Noise	Medium	Significant Beneficial	None required	Major impact	Significant Beneficial
Non-residential receptor at Llama Karma Kafé (Lords House)	Noise	Medium	Significant Adverse	National Highways has acquired this building and has temporarily repurposed it as National Highways offices	N/A	Not Significant
Temple Sowerby to Appleby						
Residential dwellings within south and centre	Noise	High	Significant Beneficial	None required	Major and moderate impacts	Significant Beneficial

Receptor	Attribute	Receptor sensitivity	Potential Impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
areas of Kirkby Thore, and Crakenthorpe (by Long Marten Road)						
Residential dwellings to the north of Kirkby Thore by Sandersons Croft	Noise	High	Significant Adverse	Noise barriers in the form of earth works (combination of cutting and earth bunds) as presented in section 12.9: Essential mitigation and enhancement measures	Major and moderate impacts	Significant Adverse
Residential dwellings by Spitals Farm, Halefield Farm, Sleastonhowe, Powls House, Catrigg Hill and Roger Head	Noise	High	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Major and moderate impacts	Significant Adverse
Non-residential receptors within Kirkby Thore including commercial premises, hotels, village halls, places and worship and the Kirkby Thore Primary School	Noise	Medium	Significant Beneficial	None required	Major and moderate impacts	Significant Beneficial

Receptor	Attribute	Receptor sensitivity	Potential Impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Non-residential receptor at Spital Farm	Noise	Medium	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Moderate impacts	Significant Adverse
Appleby to Brough						
Residential dwellings by Wheatsheaf Cottage and Turks Head	Noise	High	Significant Beneficial	None required	Major and moderate impacts	Significant Beneficial
Residential dwellings by West View and Foxtower (Mains House)	Noise	High	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Minor impacts	Significant Adverse
Residential dwellings within Brough (Lady Anne Drive and Pembroke Close)	Noise	High	Significant Adverse	Fence type noise barrier as presented in section 12.9: Essential mitigation and enhancement measures (Table 12-20: Noise mitigation measures for operation of the scheme, Ref 14)	Negligible	Not Significant
Residential dwellings at Warcop	Noise	High	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Major and moderate impacts	Significant Adverse
Non-residential receptor at Apple Tree Farm	Noise	Medium	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Minor impact	Significant Adverse
Bowes Bypass						

Receptor	Attribute	Receptor sensitivity	Potential Impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Residential dwelling at Stone Bridge Farm	Noise	High	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Moderate and minor impacts	Significant Adverse
Non-residential receptor by A66 (western outskirts of Bowes)	Noise	Medium	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Minor impacts	Significant Adverse
Cross Lanes to Rokeby						
Residential dwellings located at Cross Lanes and Rokeby	Noise	High	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Moderate and minor impacts	Significant Adverse
Residential dwelling located at North Bitts Farm	Noise	High	Significant Adverse	Fence type noise barrier as presented in section 12.9: Essential mitigation and enhancement measures (Table 12-20: Noise mitigation measures for operation of the scheme, Ref 86) (subject to liaison with stakeholders)	Negligible	Not Significant
Residential dwelling at School House (Rokeby)	Noise	High	Significant Beneficial	None required	Major impact	Significant Beneficial
Residential dwellings near Tutta Beck and Birk House	Noise	High	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Moderate and minor impacts	Significant Adverse

Receptor	Attribute	Receptor sensitivity	Potential Impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Non-residential receptor at The Old School (Village Hall)	Noise	Medium	Significant Beneficial	None required	Major impact	Significant Beneficial
Non-residential receptor at Cross Lanes Organic Farm Shop	Noise	Medium	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Major and moderate impacts	Significant Adverse
Non-residential receptor at St Marys Church in Rokeby	Noise	Medium	Significant Beneficial	None required	Major impact	Significant Beneficial
Stephen Bank to Carkin Moor						
Residential dwellings at Ravensworth Lodge, Foxwell, Foxhall and Foxgrove	Noise	High	Significant Beneficial	None required	Major impacts	Significant Beneficial
Residential receptors near West Layton and Carking Moor Farm	Noise	High	Significant Adverse	Additional mitigation measures assessed as not sustainable as per section 12.9	Major and moderate impacts	Significant Adverse
A1(M) Junction 53 Scotch Corner						
No significant effects identified in this scheme	-	-	-	-	-	-

Receptor	Attribute	Receptor sensitivity	Potential Impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Route wide (areas not within a scheme)						
Residential dwellings by Moor Lane, Wetheriggs (via Cliburn), Chapel Street (via Bolton)	Noise	High	Significant Beneficial	None required	Major, moderate and minor impacts	Significant Beneficial
Residential dwellings and non-residential receptors within Barnard Castle (alongside A67 and Newgate)	Noise	High/Medium	Significant Beneficial	None required	Minor impacts	Significant Beneficial
Residential dwellings and non-residential receptors close to Ravensworth and Richmond alongside Waitlands Lane, Whashton Green Village Road, Barrack View and Gallowgate	Noise	High/Medium	Significant Beneficial	None required	Moderate and minor impacts	Significant Beneficial

12.11.3 The Government policy objectives are also defined in the England National Application Annex to *DMRB LA 111* (See section 12.3: Legislation). In accordance with the assessment requirements, the Project's compliance against these objectives is set out Table 12-46: Scheme compliance with Government Policy.

Table 12-46: Scheme compliance with Government Policy

Relevant Noise Government Policy Objective (NPSE)	Compliance with policy requirement
Aim 1: *Avoid significant adverse impacts on health and quality of life from noise* *(NPSE describes this aim in relation to impacts above the SOAEL)*	The road alignment, design and implementation of mitigation measures aim to avoid significant adverse effects from construction noise and vibration. In instances where significant adverse effects cannot be avoided further measures have been considered to mitigate and minimise such effects. The methods to control noise and vibration are provided in the EMP and the NVMP (Application Document 2.7). Construction Residual significant adverse effects have been reported in this assessment for construction noise and vibration. Where it is practicable and sustainable, further mitigation will be considered to avoid significant effects as part of the NVMP and Section 61 applications that will be prepared as required by the EMP (Application Document 2.7) following engagement with local authorities and stakeholders. Operation Residual significant adverse effects are also predicted for operational noise. A total of 17 residential receptors and 5 non-residential receptors will experience significant adverse effects above the SOAEL. Four residential receptors are identified as potential qualifiers for noise insulation. Operational significant adverse effects will be minimised as far as practicable and sustainable through scheme design and embedded mitigation, including scheme alignment and the use of lower noise road surface and noise screening where it is sustainable to do so. For receptors with a predicted operational significant adverse effect, the viability has been assessed of providing a noise barrier in the form of a fence to avoid these significant effects. Details of the process are presented in section 12.9.6 - 12.9.10. Table 12-20: Noise mitigation measures for operation of the scheme, summarises the essential mitigation assessed to be practicable and sustainable. Where appropriate, the potential fence noise barriers set out in Table 12-20: Noise mitigation measures for operation of the scheme and identified within the EMP (Application Document 2.7), will need to be discussed with relevant stakeholders (including, where appropriate, property owners) before they can be implemented as the decision to install a barrier needs to consider the potential visual and aesthetic impacts as well as the noise benefits. The significant effects identified in

Relevant Noise Government Policy Objective (NPSE)	Compliance with policy requirement
	the assessment are likely to be avoided if the barrier was implemented (where sustainable to do so). Noise insulation will be offered to eligible properties where appropriate to avoid indoor significant adverse effects, however, this does not alter the assessment of overall significance of effect at these receptors.
Aim 2: *Mitigate and minimise other adverse impacts on health and quality of life from noise* *(NPSE describes this aim in relation to impacts between the LOAEL and SOAEL*)	Adverse noise and vibration impacts during the construction phase will be mitigated and minimised through BPM as detailed within the EMP and NVMP (Application Document 2.7). Adverse impacts from operational noise have been identified at sensitive receptors which will be subject to noise levels between LOAEL and SOAEL. Impacts are minimised as far as practicable and sustainable through scheme design and embedded mitigation, including scheme alignment and the use of lower noise road surface and noise screening. Where sustainable to do so, the viability of providing a noise barrier in the form of a fence has been assessed. Details of the process are presented in section 12.9.6 - 12.9.10. Table 12-20: Noise mitigation measures for operation of the scheme summarises the essential mitigation assessed to be practicable and sustainable. The potential barriers set out in Table 12-20: Noise mitigation measures for operation of the scheme and identified within the EMP (Application Document 2.7), will need to be discussed and agreed with relevant stakeholders (including, where appropriate, property owners) before they can be implemented as the decision to install a barrier needs to consider the potential visual and aesthetic impacts as well as the noise benefits. Some residual adverse effects for operational noise between the LOAEL and SOAEL have been identified in this assessment in spite of the proposed mitigation measures.
Aim 3: *Contribute to improvements to health and quality of life through the effective management and control of noise where possible.* *(This applies to all noise levels)*	As a result of the Project's alignment selection and decrease in traffic flows on bypassed roads, significant beneficial effects have been identified at 408 residential receptors and 46 non-residential receptors. Noise levels within three NIAs are predicted to experience a reduction in noise as a result of the Project. Of the 408 residential receptors, the Project will reduce the operational noise levels at 140 properties from above the SOAEL to between LOAEL and SOAEL. 18 residential receptors are predicted to be subject to beneficial significant effects but noise levels will remain above SOAEL. 250 residential receptors between LOAEL and SOAEL are predicted to be subject to significant beneficial effects.

Relevant Noise Government Policy Objective (NPSE)	Compliance with policy requirement
	For non-residential receptors, there are 34 receptors above SOAEL and with the operation of the Project are predicted to be subject to noise levels between LOAEL and SOAEL. Two non-residential receptors are predicted to be subject to beneficial significant effects but noise levels will remain above SOAEL. There are 10 non-residential receptors between LOAEL and SOAEL which are predicted to experience a significant beneficial effect.

12.12 Monitoring

12.12.1 The prediction and assessment methodologies set out in section 12.4: Assessment methodology of this chapter would be used to support the verification of the effectiveness of any mitigation measures. Monitoring of the effectiveness of mitigation measures would be completed as part of National Highways Project Evaluation procedures (as set out in the EMP (Application Document 2.7)), which evaluates how highway schemes are delivered and would provide an opportunity to highlight any potential issues.

12.12.2 Should access to private land be required to undertake such measurements, then consultation with the owner and/or occupier will be undertaken to ensure appropriate arrangements are made before any monitoring is undertaken.

12.12.3 Under Regulation 6 of the NIR, National Highways has a duty to assess noise levels once the Project is operational. The purpose of this is to identify any buildings which were previously not identified to be eligible for noise insulation but are now potentially eligible due to an increase in traffic. Further assessments will be undertaken in accordance with the obligations set out in the NIR.

Construction

12.12.4 Monitoring of construction works should include one or more the methodologies described in *DMRB LA 111*. These include the verification that the recommended mitigation measures are in situ and are considered to remain appropriate, measurement of noise and/or vibration activities and verifying working procedures to ensure they are no worse than those set out as part of this ES. This would be completed as part of National Highways Project Evaluation procedures which is provided as part of the EMP (Application Document: 2.7).

Operation

12.12.5 As per *DMRB LA 111* section 4.2, for operational noise, monitoring measures should ensure embedded mitigation measures are included (or an equivalent performance is achieved with an alternative design), and any noise mitigation measures are verified to ensure they meet the design

specifications. This would be completed as part of national Highways Project Evaluation procedures which is provided as part of the EMP (Application Document: 2.7).

12.13 References

Highways England (now National Highways) (2020) Design Manual Roads Bridge LA 111 Noise and Vibration

Legislation (2018) The Environmental Noise (England) (Amendment) Regulations

Legislation (1974a) Control of Pollution Act Section 61

Legislation (1975) Noise Insulation Regulations

Legislation (1990) Environmental Protection Act 1990

Department for Transport (2014) National Policy Statement for National Networks (NPSNN)

Department for Environment, Food and Rural Affairs (2010) Noise Policy Statement for England Explanatory Note

Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework

Cumbria County Council (2017) Cumbria Minerals and Waste Local Plan 2015-2040

Eden District County Council (2018) Eden Local Plan 2014-3032

County Durham (2019) County Durham Plan,

Richmondshire District Council (2014) Local Plan

British Standard (2014a) Code of practice for noise and vibration control on construction and open sites. Noise

British Standard (2014b) Code of practice for noise and vibration control on construction and open sites. Vibration

British Standards (2010) 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

British Standards (1993) BS 7385-2:1993 Evaluation and measurement for vibration in buildings - Guide to damage levels from groundborne vibration

WHO (1999) Guidelines for community noise

WHO (2009) Night Noise Guidelines for Europe

Campaign to Protect Rural England (CPRE) (2006) Saving Tranquil Places: How to Protect and Promote a Vital Asset

Department for Transport (1988) Calculation of Road Traffic Noise

Transport Research Laboratory (2002) Converting the UK traffic noise level $L_{A10,18h}$ to EU noise indices for noise mapping

Noise Insulation Regulations (1975)