A66 Northern Trans-Pennine Project
TR010062

3.2 Environmental Statement Chapter 6 Biodiversity

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

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3.2 ENVIRONMENTAL STATEMENT CHAPTER 6 BIODIVERSITY

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TECHNICAL APPENDICES (VOLUME 3)

6 Biodiversity

6.1 Introduction

6.1.1 This chapter assesses the likely significant biodiversity effects of the construction and operation of the project, following the methodology set out in the Design Manual for Roads and Bridges (DMRB) and any other relevant guidance. It details the methodology followed, summarises the legislation and policy framework relevant to the biodiversity 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.

6.1.2 Any biodiversity effects predicted to be significant are identified in Section 6.10 of this chapter. Effects identified in the course of the assessment but not predicted to be significant are presented in ES Appendix 6.1: Non-significant Effects (Application Document 3.4).

6.1.3 The biodiversity assessment is supported by a number of figures (Environmental Statement Volume 2) and Technical Appendices (Environmental Statement Volume 3) as listed on the contents page.

6.1.4 This chapter of the ES has been undertaken by competent experts with relevant experience and expertise. The lead author for this chapter has:

- MSc Landscape Ecology, Design and Management and BSc (Hons) in Wildlife and Landscape Conservation
- Chartered Biologist, Chartered Environmentalist, Member of the Society of Biology and Member of the Institute of Ecology and Environmental Management
- 21 years of experience in professional practice relating to Ecology.

6.2 Key assessment parameters

6.2.1 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.

Table 6-1: Key Assessment Parameters

Key Assessment Parameters
• The assessment has assumed that all habitats within the indicative site clearance boundary (shown in Figure 2.2: Indicative site clearance boundary (Application Document 3.3)) will be lost as a result of construction with the exception of watercourses, where the assessment assumes that this habitat will be retained and protected where not required for the construction of the road itself. • It is assumed that habitats outside of the indicative site clearance boundary but within the Order Limits (e.g. hedgerows, trees, woodland, watercourses) will be retained and/or enhanced through the proposed environmental mitigation.

Key Assessment Parameters
• This assessment has been based upon the illustrative design but has considered the extent to which this could vary in accordance with the DCO works plans and defined limits of deviation (LoD). If the design alters during detailed design but remains within the LoD illustrated, this will not affect the outcomes presented in this biodiversity assessment.

6.3 Legislation and policy framework

Legislation

6.3.1 The following key legislation is applicable to the assessment:

- Wildlife and Countryside Act 1981 (as amended) (WCA) - the WCA is the primary legislation covering endangered species in England, it confers differing levels of protection on species themselves, their habitats, or both, depending on their conservation status.
- Conservation of Habitats and Species Regulations 2017 (Habitat Regulations) - the Habitats Regulations offer protection to a number of plant and animal species via the designation of Special Areas of Conservation (SAC) and Special Protection Areas (SPA). The Regulations also offer protection to a number of 'European Protected Species' (EPS). The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 does not make any substantive changes to the protection of SACs, SPAs or species classed as EPS as protected under the Habitats Regulations. It does however introduce amendments in light of the United Kingdom's withdrawal from the European Union, including to change the nomenclature of the protected sites network within the UK. The Natura 2000 site network, comprising SPAs, SACs and Ramsar sites is now titled the National Sites Network within the UK. The National Sites Network does not include Ramsar sites however it is noted that many Ramsar sites overlap with SAC and SPA sites and all Ramsar sites continue to be protected in the same way as SACs and SPAs.
- Natural Environment and Rural Communities (NERC) Act 2006 - the NERC Act supports delivery of the UKs wider biodiversity commitments, in part through the identification of habitats and species of principle importance (HoPI and SoPI) under Section 41. All planning decisions must be made with regard for the conservation of HoPI and SoPI. The UK Biodiversity Action Plan (UKBAP) covering 2011-2020 has been superseded by the UK Post-2010 Biodiversity Framework. The Framework identifies 65 Priority Habitats and 1150 Priority Species that are in need of protection from activities that threaten their long-term survival. This list has been used to define habitats and species of 'Principal Importance' in England (the Section 41 list) as required by the NERC Act.
- Environment Act 2021 - The act creates a post Brexit framework to protect and enhance the natural environment. Through amendments to the Town and Country Planning Act 1990, the Act will require all planning permissions in England to be granted subject to a new general pre-commencement condition that requires approval of a biodiversity net gain plan. This will ensure the delivery of a minimum

of 10% measurable biodiversity net gain. The key tool to calculate this will be the Defra Biodiversity 3.0 Metric. Works to deliver biodiversity net gain can be carried out either onsite or offsite or through the purchase of 'biodiversity credits' from the Secretary of State. Both onsite and offsite mitigation must be maintained for at least 30 years after development.

- The Protection of Badgers Act 1992 (as amended) - this Act lists activities and behaviours which constitute an offence in relation to badgers (*Meles meles)* in order to support the conservation and welfare of this historically persecuted species.
- The Hedgerow Regulations 1997 - these regulations set out criteria for determining whether hedgerows are 'important' and subsequently control the removal of 'important' hedgerows through a system of notification.
- Salmon and Freshwater Fisheries Act 1975 (as amended) (SaFFA) - SaFFA aims to protect freshwater fish and their habitats, with a particularly strong focus on salmonid species.
- Water Framework Directive (WFD) 2000/60/EC - the WFD is a legal framework for the protection and restoration of inland surface waters, transitional water, coastal waters and groundwater. Health and function of biological components of the water environment is a key measure of WFD status, which should be progressing towards good for all waters. It is implemented in part in England through The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.
- Eels (England and Wales) Regulations 2009 - the regulations are focussed on the management of commercial eel fisheries and passage/migration of eels with a view to support species recovery.

National level policy

National Policy Statement for National Networks

6.3.2 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)[1] , which sets out policies to guide how DCO applications will be decided and how the effects of national networks infrastructure should be considered by the relevant decision maker *(being in this case, the Secretary of State for Transport).* The policies for biodiversity and ecological conservation include statements that:

"Biodiversity is the variety of life in all its forms and encompasses all species of plants and animals and the complex ecosystems of which they are a part. Government policy for the natural environment is set out in the Natural Environment White Paper (NEWP). The NEWP sets out a vision of moving progressively from net biodiversity loss to net gain, by supporting healthy, well-functioning ecosystems and establishing more

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

coherent ecological networks that are more resilient to current and future pressures…" (NPSNN paragraph 5.20).

6.3.3 The *NPSNN* also advises:

"In taking decisions, the Secretary of State should ensure that appropriate weight is attached to designated sites of international, national and local importance, protected species, habitats and other species of principal importance for the conservation of biodiversity, and to biodiversity and geological interests within the wider environment." (NPSNN paragraph 5.26).

6.3.4 Table 6-2: Relevant *NPSNN* policies identifies the *NPSNN* policies relevant to the biodiversity assessment and a reference to where in this ES information is provided to address each policy.

Table 6-2: Relevant *NPSNN* policies

***NPSNN* paragraph reference**	**Requirement**	**Applicant response**	**Where addressed?**
5.22	Ensure environmental statement clearly sets out any likely significant effects on internationally, nationally and locally designated sites of ecological or geological conservation importance (including those outside England) on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity and that the statement considers the full range of potential impacts on ecosystems.	An assessment has been carried out to determine likely significant effects on internationally, nationally and locally designated sites and all potential ecological receptors.	Section 6.10: Assessment of likely significant effects.
5.23	The applicant should show how the Project has taken advantage of opportunities to conserve and enhance biodiversity conservation interests.	Opportunities to conserve and enhance biodiversity has been considered as part of the Project and this is demonstrated in the chapter.	Section 6.9: Essential mitigation and enhancement measures and Environmental Management Plan (EMP) (Application Document 2.7).
5.29	Where a proposed development on land within or outside a SSSI is likely to have an adverse effect on an SSSI (either individually or in combination with other developments), development consent should not normally be granted. Where an adverse effect on the site's notified special interest	All potential adverse impacts designated sites and ecological receptors have been avoided in the first instance. Where this has not been possible, adverse	Section 6.9: Essential mitigation and enhancement measures.

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
	features is likely, an exception should be made only where the benefits of the development at this site clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest, and any broader impacts on the national network of SSSIs. The Secretary of State should ensure that the applicant's proposals to mitigate the harmful aspects of the development and, where possible, to ensure the conservation and enhancement of the site's biodiversity are acceptable.	impacts have been mitigated.	
5.31	Sites of regional and local biodiversity (which include Local Nature Reserves and Local Wildlife Sites and Nature Improvement Areas) have a fundamental role to play in meeting overall national biodiversity targets. Give due consideration to such regional or local designations.	Full consideration has been given to all designated sites (including both regional and local designations) located within the defined study areas surrounding the Project.	ES Appendix 6:2: Designated sites (Application Document 3.4); Section 6.7: Baseline Conditions; Section 6.8: Potential Impacts; Section 6.10: Assessment of likely significant effects and Section 6.9: Essential mitigation and enhancement measures.
5.32	Ancient woodland is a valuable biodiversity resource both for its diversity of species and for its longevity as woodland. Permission should not be granted which would result in the loss or deterioration of irreplaceable habitats including ancient woodland and the loss of aged or veteran trees found outside ancient woodland, unless the national need for and benefits of the development, in that location, clearly outweigh the loss. Aged or veteran trees found outside ancient woodland are also particularly	Full consideration has been given to ancient woodland sites and known ancient, veteran and notable trees located within the defined study areas surrounding the Project.	ES Appendix 6:2: Designated sites (Application Document 3.4); Section 6.7: Baseline Conditions; Section 6.8: Potential Impacts; Section 6.10: Assessment of likely significant effects and section 6.9: Essential mitigation and

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
	valuable for biodiversity and their loss should be avoided. Where such trees would be affected by development proposals, the applicant should set out proposals for their conservation or, where their loss is unavoidable, the reasons for this.		enhancement measures.
5.33	Development proposals potentially provide many opportunities for building in beneficial biodiversity features as part of good design. When considering proposals, the Secretary of State should consider whether the applicant has maximised such opportunities in and around developments. The Secretary of State may use requirements or planning obligations where appropriate in order to ensure that such beneficial features are delivered.	Opportunities for enhancing and maximising biodiversity net gains and benefits as a result of the Project have been considered where appropriate.	Section 6.9: Essential mitigation and enhancement measures and EMP (Application Document 2.7).
5.34 and 5.35	Many individual wildlife species receive statutory protection under a range of legislative provisions. Other species and habitats have been identified as being of principal importance for the conservation of biodiversity in England and Wales and therefore requiring conservation action. The Secretary of State should ensure that applicants have taken measures to ensure these species and habitats are protected from adverse effects. Where appropriate, requirements or planning obligations may be used in order to deliver this protection.	Species and habitats of principal importance have been considered and measures to ensure these species and habitats are protected from adverse impacts have been included, where appropriate.	ES Appendix 6.2: Designated Sites to ES Appendix 6.22: White-Clawed Crayfish (Application Document 3.4); Section 6.7: Baseline conditions and section 6.9: Essential mitigation and enhancement measures.
5.36	Include appropriate mitigation measures as an integral part of their proposed development, including identifying where and how these will be secured. In particular, the applicant should demonstrate that: • during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works;	Outline details of appropriate mitigation (both inbuilt into the design, standard and bespoke mitigation measures) have been set out within the ES. These have been agreed with key stakeholders.	Section 6.9: Essential mitigation and enhancement measures; EMP (Application Document 2.7), and Environmental Mitigation Maps (Application Document 2.8).

NPSNN paragraph reference	Requirement	Applicant response	Where addressed?
	• during construction and operation, best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised (including as a consequence of transport access arrangements); • habitats will, where practicable, be restored after construction works have finished; • developments will be designed and landscaped to provide green corridors and minimise habitat fragmentation where reasonable; • opportunities will be taken to enhance existing habitats and, where practicable, to create new habitats of value within the site landscaping proposals, for example through techniques such as the 'greening' of existing network crossing points, the use of green bridges and the habitat improvement of the network verge.		
5.37	Consider what appropriate requirements should be attached to any consent and/or in any planning obligations entered into in order to ensure that mitigation measures are delivered.	Appropriate requirements have been included to ensure that the mitigation measures set out within the ES are achievable and can be delivered.	Section 6.9: Essential mitigation and enhancement measures; EMP (Application Document 2.7), and Environmental Mitigation Maps (Application Document 2.8)
5.38	Take account of what mitigation measures may have been agreed between the applicant and Natural England and/or the MMO, and whether Natural England and/or or the MMO has granted or refused, or intends to grant or refuse, any relevant licences, including protected species mitigation licences.	Consideration in relation to relevant protected species mitigation licences which may be required as a result of the project have been set out within the ES through consultation with Natural England.	Section 6.9: Essential mitigation and enhancement measures.

National Planning Policy Framework

6.3.5 The *National Planning Policy Framework (NPPF)* (Ministry of Housing, Communities & Local Government, 2021)[2] 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. The *NPPF* is *"an important and relevant matter to be considered in decision making for NSIP[3][4]".*

6.3.6 Chapter 15 'Conserving and enhancing the natural environment'[5], requires that planning policies and decisions should contribute to and enhance the natural and local environment.

6.3.7 It states that plans should aim to *"promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity".*

6.3.8 It highlights key principles for consideration of planning applications as being the application of the mitigation hierarchy (avoid, mitigate or, as a last resort, compensate), a presumption of refusal for development that will give rise to an adverse effect on sites of International or National importance or loss or deterioration of irreplaceable habitats unless the benefits clearly outweigh the impacts and a suitable compensation strategy exists.

Regional and local level policy

6.3.9 Other regional and local level policies have been considered as part of the Biodiversity 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:

- *Eden Local Plan (2014-2032)* (Eden District Council, 2014)[6] Policy ENV1, ENV2 and Policy ENV4
- *County Durham Plan (Adopted 2020)* (Durham County Council, 2020)[7] Policy 26, Policy 40, Policy 41, Policy 42 and Policy 43

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

[3] Nationally Significant Infrastructure Projects

[4]Department for Transport (2014) National Policy Statement for National Networks (Paragraph 1.18)

[5] Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework (Chapter 15 – Paragraph 174)

[6] Eden District Council (2014) Eden Local Plan 2014 to 2032

[7] Durham Council (2020) County Durham Plan – Adopted 2020

- *Richmondshire Local Plan (2012-2028)* adopted 2014 (Richmondshire District Council, 2014)[8] Core Policy CP12
- *Durham County Council Biodiversity Action Plan (BAP)* (2012/13) now listed on North East England Nature Partnership (North East England Nature Partnership, 2013)[9]
- *Richmondshire District Councils BAP* (Richmond County Council, 2014)[10]
- *Cumbria BAP* (Cumbria Biodiversity Partnership, 2001)[11].

6.3.10 Although the UK BAP has been superseded, local BAPs are still widely used at county level to support Biodiversity 2020 (Department for Environment, Food and Rural Affairs, 2011)[12].

Table 6-3-: Regional and local level policies

Policy document	Policy wording	Applicant response	Where addressed?
Eden Local Plan (2014-2032)	Policy ENV1: Protection and Enhancement of the Natural Environment, Biodiversity and Geodiversity: '*New development will be required to avoid any net loss of biodiversity and geodiversity, and where possible enhance existing assets. Should emerging proposals identify potential impacts upon designated sites, regard should be given to the objectives for each of the hierarchy of sites'*.	An assessment has been carried out to determine potential impacts and likely significant effects on internationally, nationally and locally designated sites and all ecological receptors potentially impacted by the Project. In doing so, full regard has been given to the objectives for each of the hierarchy of sites. Where impacts have been identified these have been avoided in the first instance. Where impacts cannot be avoided, appropriate mitigation measures have been set out through consultation with key stakeholders. The Project aims to deliver no net loss and has sought opportunities for environmental enhancements where possible.	Section 6.7: Potential impacts; Section 6.9: Assessment of likely significant effects; Section 6.8: Essential mitigation and enhancement measures; Environmental Management Plan (EMP) (Application Document 2.7).
Eden Local Plan (2014-2032)	Policy ENV2: Protection and Enhancement of Landscapes and Trees:	The loss of trees and hedgerows as a result of the Project has been minimised	Section 6.7: Potential impacts;

[8] Richmond County Council (2014) Richmondshire Local Plan 2012 - 2028 Core Strategy (Adopted 9 December 2014)

[9] North East England Nature Partnership (2013) Biodiversity Priorities

[10] Richmond County Council (2014) Richmondshire Biodiversity Action Plan

[11] Cumbria Biodiversity Partnership (2001) The Cumbria Biodiversity Action Plan

[12] Department for Environment Food and Rural Affairs (2011) Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services.

Policy document	Policy wording	Applicant response	Where addressed?
	'Development should contribute to landscape enhancement including the provision of new trees and hedgerows of appropriate species and in suitable locations. Loss of ancient woodland and significant /veteran trees will not be permitted unless it can be demonstrated that there is an overriding need for the development which outweighs their loss'.	where possible. Where this has not been possible, the provision of new trees and hedgerows of appropriate species and in suitable locations have been included within the Environmental Mitigation Maps. The loss of ancient woodland and known significant/veteran trees as a result of the project has been avoided.	Section 6.8: Essential mitigation and enhancement measures; EMP (Application Document 2.7); Environmental Mitigation Maps (Application Document 2.8)
Eden Local Plan (2014-2032)	Policy ENV4: Green Infrastructure Networks *'A multifunctional network of green infrastructure will be identified, protected, managed and enhanced. Proposals, which protect and enhance the existing network and promote the creation of new green infrastructure will be supported. Development which leads to direct loss, fragmentation or degradation of green infrastructure will be resisted unless there is demonstrable evidence of wider public benefits from the proposal.'*	The mitigation presented in the ES has sought opportunities to protect existing features with biodiversity value and maximise biodiversity enhancements where possible. This includes measures to provide habitat linkages increasing connectivity to areas of semi-natural habitats within the wider area and therefore enhancing and tying into existing green infrastructure networks.	Section 6.8: Essential mitigation and enhancement measures; EMP, including Annex B1 Landscape and Ecological Management Plan (LEMP) (Application Document 2.7), and Environmental Mitigation Maps (Application Document 2.8).
County Durham Plan (Adopted 2020)	Policy 26: Green Infrastructure '*Development will be expected to maintain and protect, and where appropriate improve, the county's green infrastructure network.'* Policy 40: Trees, Woodlands and Hedges *'Proposals for new development will not be permitted that would result in the loss of, or damage to, trees of high landscape, amenity or biodiversity*	An impact assessment has been carried out to determine likely significant effects on internationally, nationally and locally designated sites and all potential ecological receptors (Policy 40, 41, 42, 43). The mitigation presented in the ES has sought opportunities to protect existing features with biodiversity value and maximise biodiversity enhancements where possible (Policy 40). This includes measures to provide	Section 6.7: Potential impacts; Section 6.8: Essential mitigation and enhancement measures; Section 6.9: Assessment of likely significant effects; Section 6.8: Essential mitigation and enhancement measures;

Policy document	Policy wording	Applicant response	Where addressed?
	value unless the benefits of the proposal clearly outweigh the harm." Policy 41: Biodiversity and Geodiversity '*Proposals for new development will not be permitted if significant harm to biodiversity or geodiversity resulting from the development cannot be avoided, or appropriately mitigated, or, as a last resort, compensated for."* Policy 42: Internationally Designated Sites '*Development that has the potential to have an effect on internationally designated site(s), either individually or in combination with other plans or projects, will need to be screened in the first instance to determine whether significant effects on the site are likely and, if so, will be subject to an Appropriate Assessment.'* Policy 43: *Protected Species and Nationally and Locally Protected Sites 'All development proposals in, or which are likely to adversely impact upon (either individually or in combination with other developments), any of the following national designations (where not a component of an internationally designated site): (i) SSSI and (ii) NNR will only be permitted where the benefits of development in that location clearly outweigh the impacts on the interest features on the site and*	habitat linkages increasing connectivity to areas of semi-natural habitats within the wider area and therefore enhancing and tying into existing green infrastructure networks (Policy 26).	EMP, including Annex B1 LEMP (Application Document 2.7), and Environmental Mitigation Maps (Application Document 2.8).

Policy document	Policy wording	Applicant response	Where addressed?
	any wider impacts on the network of sites.'		
Richmondshire Local Plan (2012-2028)	Core Policy CP12: Conserving and Enhancing Environmental and Historic Assets *'Development or other initiatives will be supported where they conserve and enhance the significance of the plan area's natural and man-made, designated or undesignated assets'.*	An impact assessment has been carried out to determine likely significant effects on internationally, nationally and locally designated sites and all potential ecological receptors. The mitigation presented in the ES has sought opportunities to protect existing features with biodiversity value and maximise biodiversity enhancements where possible.	Section 6.7: Potential impacts; Section 6.8: Essential mitigation and enhancement measures; Section 6.9: Assessment of likely significant effects; Section 6.8: Essential mitigation and enhancement measures; EMP, including Annex B1 LEMP (Application Document 2.7), and Environmental Mitigation Maps (Application Document 2.8).

Other relevant policy and guidance

6.3.11 In addition to compliance with the *NPSNN* and *NPPF*, this assessment has been compiled in accordance with professional standards and guidance. The standards and guidance which relate to the assessment are:

- *UK Post-2010 Biodiversity Framework* (Joint Nature Conservation Committee and Department for Environment Food and Rural Affairs, 2021)[13]
- *A Green Future: Our 25 Year Plan to Improve the Environment* (HM Government, 2018[14]

[13] Joint Nature Conservation Committee and Department for Environment Food and Rural Affairs (on behalf of the Four Countries' Biodiversity Group) (2012) UK Post-2010 Biodiversity Framework. July 2012

[14] H M Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment

- The *UK Biodiversity Action Plan (UK BAP*) (Her Majesty's Stationary Office, 1994)[15]
- (CIEEM) *Guidance for Ecological Impact Assessment in the United Kingdom Third Edition* (Chartered Institute for Ecology and Environmental Management, 2018)[16]
- *DMRB LA 101 Introduction to Environmental Assessment (DMRB LA 101)*, Revision 1 July 2019 (Highways England, 2019a)[17]
- *DMRB LA 104 Environmental Assessment and Monitoring (DMRB LA 104),* Revision 1, Aug 2020 (Highways England, 2019b)[18]
- *DMRB LA 105 Air quality* (DMRB LA 105) (Highways England 2019c)[19]
- *DMRB LA 108 Biodiversity (DMRB LA 108),* Revision 1, March 2020 (Highways England, 2020a)[20]
- *DMRB LA 115 Habitat Regulation Assessment (DMRB LA 115*), Revision 1, January 2020 (Highways England, 2020b)[21]
- *DMRB LD 118 Biodiversity Design (DMRB LD 118),* Revision 1, March 2020 (Highways England, 2020c)[22]
- *DMRB LD 119 Roadside environmental mitigation and enhancement (DMRB LD 119),* Revision 1, March 2020 (Highways England, 2020d)[23]
- Birds of Conservation Concern (Stanbury et al., 2021)[24]

6.4 Assessment methodology

6.4.1 The methodology for the biodiversity assessment follows the guidance set out within *DMRB LA 104*, *DMRB LA 108* and *DMRB LD 118* and the *CIEEM Guidance for Ecological Impact Assessment*.

6.4.2 In broad terms the assessment considers how delivery of the Project will change the baseline conditions. The extent to which the baseline changes is considered for each ecological feature

[15] Her Majesty's Stationary Office (1994) The UK Biodiversity Action Plan

[16] Chartered Institute for Ecology and Environmental Management (2018) Guidance for Ecological Impact Assessment in the United Kingdom Third Edition

[17] Highways England (2019a) Design Manual for Roads and Bridges LA 101 Introduction to Environmental Assessment

[18] Highways England (2019b) Design Manual for Roads and Bridges LA 104 Environmental Assessment and Monitoring

[19] Highways England (2019) Design Manual for Roads and Bridges LA 105 Air quality

[20] Highways England (2020a) Design Manual for Roads and Bridges LA 108 Biodiversity

[21] Highways England (2020b) Design Manual for Roads and Bridges LA 115 Habitat Regulation Assessment

[22] Highways England (2019a) Design Manual for Roads and Bridges LD 118 Biodiversity Design

[23] Highways England (2019a) Design Manual for Roads and Bridges LD 119 Roadside environmental mitigation and enhancement

[24] Stanbury, A.J., Eaton, M.A., Aebischer, N.J., Balmer, D., Brown, A.F., Douse, A., Lindley, P., McCulloch, N., Noble, D.G. & Win, I. (2021) The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds 114, 723–747

and is determined by the impacts upon a given feature and the feature's sensitivity to those impacts.

6.4.3 The assessment considers both construction and operation and is also informed by the air quality assessment (refer to Chapter 5: Air Quality), the climate assessment (Chapter 7: Climate), noise assessment for sensitive resources (Chapter 12: Noise and Vibration) and the drainage and hydrology assessment (Chapter 14: Road Drainage and the Water Environment).

Importance of ecological features

6.4.4 The assessment to inform this chapter first considers the importance of the ecological features identified as part of the baseline assessment within the study area as defined below in Section 6.6: Study area and ES Figure 6.19: Study Areas/Zone of Influence for Ecological Features (Application Document 3.3)). Ecological features are classified as important at the following geographic scales:

- International or European importance
- UK or National importance
- Regional importance
- County or equivalent authority importance
- Local importance.

6.4.5 Criteria for each level of importance are outlined in Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108* Ecological features considered of less than local importance will not be considered within this assessment.

Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*

International or European importance	
Sites	Sites including: 1) European sites: a) Sites of Community Importance (SCIs) b) Special Protection Areas (SPAs) c) potential SPAs (pSPAs) d) Special Areas of Conservation (SACs) e) Candidate or possible SACs (cSACs or pSACs) f) Wetlands of International Importance (Ramsar sites) 2) Biogenetic Reserves, World Heritage Sites (where recognised specifically for their biodiversity value) and Biosphere Reserves. 3) areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.
Habitats	N/A
Species	Resident, or regularly occurring, populations of species which can be considered at an international or European level where: 1) the loss of these populations would adversely affect the conservation status or distribution of the species at an international or European scale 2) the population forms a critical part of a wider population at this scale

International or European importance	
	3) the species is at a critical phase of its life cycle at an international or European scale
UK or National Importance	
Sites	Sites including: 1) Sites of Special Scientific Interest (SSSIs) or Areas of Special Scientific Interest (ASSIs) 2) National Nature Reserves (NNRs) 3) National Parks 4) Marine Protected Areas (MPAs) including Marine Conservation Zones (MCZs) 5) areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such
Habitats	Habitats including: 1) areas of UK BAP priority habitats or HoPI 2) habitats included in the relevant statutory list of priority species and habitats 3) areas of irreplaceable habitats including: a) ancient woodland b) ancient or veteran trees c) blanket bog d) limestone pavement e) sand dunes f) salt marsh g) lowland fen 4) areas of habitat which meet the definition for habitats listed above but which are not themselves designated or listed as such.
Species	Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: 1) the loss of these populations would adversely affect the conservation status or distribution of the species at a UK or national scale; or 2) the population forms a critical part of a wider population at this scale; or 3) the species is at a critical phase of its life cycle at a UK or national scale.
Regional Importance	
Sites	Designated sites (non-statutory) including heritage coasts.
Habitats	Areas of habitats identified (including for restoration) in regional plans or strategies (where applicable).
Species	Species including: 1) resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: a) the loss of these populations would adversely affect the conservation status or distribution of the species at a regional scale; or b) the population forms a critical part of a wider regional population; or c) the species is at a critical phase of its life cycle. 2) Species identified in regional plans or strategies.
County or equivalent authority importance	
Sites	Wildlife and nature conservation sites designated at a county (or equivalent) level including:

International or European importance	
	1) Local Wildlife Sites (LWS) 2) Local Nature Conservation Sites (LNCS) 3) Local Nature Reserves (LNRs) 4) Sites of Importance for Nature Conservation (SINCs) 5) Sites of Nature Conservation Importance (SNCIs) 6) County Wildlife Sites (CWSs)
Habitats	Areas of habitats identified in county or equivalent authority plans or strategies (where applicable).
Species	Species including: 1) resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: a) the loss of these populations would adversely affect the conservation status or distribution of the species at a county or unitary authority scale; or b) the population forms a critical part of a wider county or equivalent authority area population, e.g. metapopulations; or c) the species is at a critical phase of its life cycle. 2) Species identified in a county or equivalent authority area plans or strategies
Local Importance	
Sites	Wildlife / nature conservation sites designated at a local level including: 1) LWS 2) LNCS 3) LNRs 4) SINCs 5) SNCIs 6) Sites of Local Nature Conservation Importance (SLNCIs)/CWSs
Habitats	Areas of habitat considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange.
Species	Populations or communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange.

Characterising impacts

6.4.6 Potential impacts on important ecological features resulting from the Project are described using the following characteristics:

- Positive (beneficial) or negative (adverse) impact
- Duration (temporary [during construction only] or permanent)
- Reversibility (for example, reversible or irreversible)
- Extent (geographic area of impact)
- Magnitude (a measure of impact such as % habitat loss or number of breeding sites lost)
- Frequency and timing (both with respect to assessing a total impact but also with consideration of how the impact interacts with important seasons or critical life stages of ecological features)

6.4.7 Impacts have been characterised taking account of embedded mitigation.

6.4.8 DMRB guidance document *DMRB LA 108* defines a level of impact on ecological features based on the characterisation outlined in paragraph 6.4.6. This ranges from major to no change as described in Table 6-5: Example descriptions to define the level of impact. Positive alternative descriptions are given in parenthesis, for example, negative [positive]. Impacts identified in this chapter are given an impact level which is taken forward to inform the assessment of significance.

Table 6-5: Example descriptions to define the level of impact. Positive alternative descriptions are given in parenthesis, for example, negative [positive]

Level of impact (change)	Typical description of effects
Major	1) Permanent/irreversible damage [addition / improvement/ restoration] to an ecological feature; and 2) the extent, magnitude, frequency, and/or timing of an impact negatively [positively] affects the integrity or key characteristics of the ecological feature.
Moderate	1) Temporary/reversible damage [addition / improvement/ restoration] to an ecological feature; and 2) the extent, magnitude, frequency, and/or timing of an impact negatively [positively] affects the integrity or key characteristics of the ecological feature.
Minor	1) Permanent/irreversible damage [addition / improvement/ restoration] to an ecological feature; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the ecological feature.
Negligible	1) Temporary/reversible damage [addition / improvement/ restoration] to an ecological feature; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of ecological feature.
No change	No observable effect

Characterising significant effects

6.4.9 This assessment follows DMRB guidance document *DMRB LA 108* which outlines a process for determining significant effects.

6.4.10 *DMRB LA 108* defines the scale of the effects based on the level of impact (Table 6-5: Example descriptions to define the level of impact. Positive alternative descriptions are given in parenthesis, for example, negative [positive]) and the importance of the impacted ecological feature (Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*) as described in Table 6-6: Scale of effects matrix adapted from *DMRB LA 108* (Table 3.13 Significance Matrix).

6.4.11 The scale of effects is characterised in the absence of mitigation and following implementation of proposed mitigation strategies. Effects which remain within the moderate, large or very large-

scale categories after implementation of mitigation are considered significant.

6.4.12 CIEEM guidance defines a significant effect as:

"an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity)[25]".

6.4.13 Despite the more formulaic methodology to define significant effects prescribed in *DMRB LA 108,* the approach adopted by this assessment is fully compatible with the CIEEM definition. All effects are described with reference to conservation objectives, the maintenance and functional integrity of habitats and sites, and the viability and health of species and populations.

Table 6-6: Scale of effects matrix adapted from *DMRB LA 108* (Table 3.13 Significance Matrix(=)

Ecological feature importance	Level of impact				
	No change	Negligible	Minor	Moderate	Major
International/ European	Neutral	Slight	Moderate or large	Large or very large	Very large
UK or National	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
Regional	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
County	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
Local	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Scoping

6.4.14 Table 6-7: Summary of scoping opinion and response sets out the key points from the Planning Inspectorate Scoping Opinion relevant to the biodiversity assessment. The full Scoping Opinion is provided in ES Appendix 4.1 Scoping Opinion (Application Document 3.4).

6.4.15 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.

[25] Chartered Institute for Ecology and Environmental Management (2018) Guidance for Ecological Impact Assessment in the United Kingdom Third Edition (paragraph 5.24, pg 40

Table 6-7: Summary of scoping opinion and response

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
The Planning Inspectorate	The ES should clearly identify the study areas/ZoI and provide a robust justification as to why the defined study areas are appropriate for assessing potential impacts.	Noted. Defined study areas and robust justification of them is provided within the ES.	Section 6.3: Assessment methodology.
The Planning Inspectorate and the Environment Agency	The ES should also consider whether the study area selected for migratory fish species and otters (*Lutra lutra*) is appropriate to identify the presence/absence of these ecological receptors.	Noted. Environment Agency desk study records are included for the Order Limits plus a 2km buffer. Watercourse crossing designs will facilitate the passage of all migratory fish species and otters.	ES Appendix 6.16: Otters; ES Appendix 6.18: Fish (Application Document 3.4) and Section 6.8: Potential impacts.
The Planning Inspectorate	For clarity the ES should include figures to show the geographical extent of the surveys that have been used to inform the assessment.	Noted. Figures presented in the ES show the geographical extent of all surveys undertaken.	ES Figures 6.3 to 6.19 (Application Document 3.3).
The Planning Inspectorate	The ES should also include figures to show the proximity of designated sites to the Affected Road Network (ARN), where considered in the ES.	Noted. A figure showing the location of the ARN and designated sites considered in the ES has been included.	ES Appendix 5.4: Air Quality Assessment Results (Application Document 3.4); ES Figure 5.1: Affected Road Network Study Area – Air Quality Constraints and Modelling Results (Application Document 3.3).
The Planning Inspectorate	Impacts on water crowfoot in relation to the River Eden SAC should be assessed in the ES where likely significant effects could occur.	Noted. An assessment covering all designated SAC features, including of water crowfoot, has been covered in the ES and Habitat Regulations Assessment.	Section 6.6: Baseline conditions; Section 6.9: Assessment methodology; Habitat Regulation Assessment Stages 1 and 2 (Application Document .3.5 and 3.6).
The Planning Inspectorate	The ES should make clear what mitigation, compensation and/or enhancement measures are being relied upon for the conclusions of the	Noted. Outline details of mitigation, compensation and enhancement measures and how they will be delivered have	Section 6.8: Essential mitigation and enhancement measures; EMP (Application Document 2.7) and Environmental Mitigation

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
	EIA and how these are delivered and secured through the DCO.	been set out within the ES.	Maps (Application Document 2.8).
The Planning Inspectorate	The ES should be as complete as possible at the point of DCO application and any information gaps resulting in a precautionary approach should be discussed in terms of limitations of the assessment, and, where possible, the approach agreed with relevant consultation bodies.	Noted. All survey information is as complete as possible. Where there are any gaps resulting in a precautionary approach, the approach has been discussed and agreed with relevant consultation bodies.	ES Appendix 6.3: Phase 1 Habitat Survey to Appendix 6.22: White-Clawed Crayfish (Application Document 3.4); ES Appendix 1.1 Evidence Plan (Application Document 3.4).
The Planning Inspectorate	The ES should clearly state where effects are deemed to be significant or non-significant in accordance with the EIA Regulations. The assessment should also consider and determine whether effects may be significant for those receptors valued at County level or below.	Noted. A full impact assessment in accordance with the EIA Regulations has been undertaken and presented in the ES. This includes receptors valued at County level or below.	Section 6.3: Assessment methodology.
Natural England	Raised a number of comments relating to the River Eden and Tributaries SAC and SSSI designated features.	All comments have been noted and addressed within the ES.	Appendix 6.2: Designated Sites (Application Document 3.4); Section 6.7: Baseline conditions.
Natural England	Raised comments relating to previous comments made to the Ecology Survey Strategy in relation to bat surveys (10/03/2020). Significant bat roost records and potential areas of high bat activity were also requested for inclusion in the ES.	Noted. All comments on the Ecology Survey Strategy received have been addressed and incorporated within the bat surveys undertaken. Significant roost records and potential areas of high bat activity have been described in the ES.	ES Appendix 6.9: Bats (Application Document 3.4); Section 6.7: Baseline conditions; Section 6.8: Potential impacts.
Natural England	Raised comments relating to otters being	Noted. Potential impacts relating to otters and	Section 6.7: Baseline conditions

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
	sensitive to light pollution.	light pollution are provided in the ES.	
Natural England	Raised comments relating to watercourse crossings and changes to hydrology which may alter the natural functioning, hydrology and geomorphology of watercourses and their floodplain during operation and construction.	Noted. The design, including of any proposed watercourse crossings, has focussed on maintaining natural river function, hydrology and geomorphological processes of watercourses and their floodplains during both the operation of the scheme and construction.	Section 6.7: Baseline conditions and 6.8; Chapter 14: Road Drainage and Water Environment.
Natural England and the Planning Inspectorate	Raised comments requesting clarity on survey methodologies, timings etc of surveys undertaken.	Information on all surveys undertaken, including survey methodologies and timings, have been providing within the supporting Technical Appendix for each species and summarised within the ES.	Appendix 6.2: Phase 1 Habitat Survey to Appendix 6.20: Aquatic Invertebrates (Application Document 3.4); Section 6.5: Assumptions and limitations and Section 6.6: Study area.
Environment Agency	Raised comments relating to the 2km search radius for otter records and the potential to miss otter records in the wider area where populations are low and therefore the potential for them to commuting across the scheme.	Noted. The baseline created in relation to otters (including the desk study and field surveys) to inform the assessment and proposed mitigation (including mammal crossing points and fencing) has followed standard best practice and industry guidance. This includes ensuring that the potential for otters to be commuting within the habitat impacted by the Project, or where they have the potential to exist in low numbers, has been fully considered within the assessment undertaken. This has included consultation with local organisations, where	ES Appendix 6.14: Barn Owls (Application Document 3.4); Section 6.8: Potential impacts.

Consultee/ respondent	Scoping opinion comment	Applicant response	Where addressed?
		appropriate has also been undertaken to understand the movement of otters within the wider area.	
Environment Agency and Planning Inspectorate	Raised concerns relating to impacts on the aquatic environment not being fully addressed., particularly in relation to temporary losses of habitat continuity, silt pollution from exposed soils entering rivers and silt pollution from accumulation of site water with high sediment loads. This could be significant to fish and other aquatic species as well as SSSI/SAC habitats.	Noted. A full impact assessment including both potential construction (including temporary losses of habitat continuity and silt pollution) and operational impacts on the aquatic environment (which includes fish, all relevant aquatic species as well as designated habitats (including SSSI/SAC habitats) is provided in the ES. This includes appropriate mitigation for potential impacts identified.	Section 6.7: Baseline conditions and Section 6.8: Potential impacts; Chapter 14: Road Drainage and the Water Environment
Environment Agency	Raised concerns relating to the Project causing changes in flow patterns that affect the ability for fish and mammals to move through culverts.	Noted. Watercourse crossings have been designed to support natural river processes in line with CIRIA 2019. Mammal passage will also be maintained where culverts are used on minor watercourses. Design has been led by detailed freshwater ecology surveys including riverine eDNA.	ES Appendix 6.15: Barn Owls to Appendix 6.21: Aquatic Invertebrates (Application Document 3.4); Section 6.8: Potential impacts; Chapter 14: Road Drainage and the Water Environment

Consultation

6.4.16 A number of stakeholders have been consulted to gather baseline data and inform the assessment. This includes Natural England, the Environment Agency and all relevant Local Authorities. Two biodiversity focussed Technical Working Groups (TWG) have been established involving these organisations (covering the Habitats Regulations Assessment and the Ecological Impact Assessment), through which baseline evidence, the emerging design, assessment methodology and initial assessment findings have been shared, discussed and feedback received on a monthly basis. Details of these meetings can be found within the

recorded minutes and Evidence Plan (ES Appendix 1.1: Evidence Plan (Application Document 3.4)).

6.4.17 Other stakeholders have also been engaged through the Project's Focus Groups and through the scoping opinion and statutory consultation process. The full record of consultation, responses and minutes are provided in the Consultation Report (Application Document 4.4) and Evidence Plan (ES Appendix 1.1: Evidence Plan (Application Document 3.4)). A summary of key points of relevance to the Ecological Impact Assessment is provided in Table 6-8: Summary of key consultation comments received.

Table 6-8: Summary of key consultation comments received

Consultee/ respondent	Comment	Applicant response	Where addressed?
Natural England District Level Licensing Team	Consultation was undertaken to agree a District Level Licensing (DLL) approach in relation to great crested newts (GCN) *(Triturus cristatus)* and the Project (pers. comms. 01/02/22 and Impact Assessment and Conservation Payment Certificate Dated: 14/04/2022).	The project team welcomed the adoption of a DLL approach. As agreed with Natural England, it is understood that the DLL approach effectively removes GCN from both the impact and mitigation sections of the ES (see ES Appendix 6.6: Amphibians (Application Document 3.4)) for further details.	ES Appendix 6.5: Amphibians (Application Document 3.4).
Natural England	Consultation was undertaken to discuss the Reptile Survey and Mitigation Strategy and the Botanical Survey Strategy (pers. comms.19/11/21 and follow up emails)	The project team welcomed confirmation from Natural England that they were satisfied with the approach being taken - most significantly that detailed reptile surveys will be undertaken pre-construction to inform mitigation and that for the purpose of the assessment assumed presence of reptiles would be used based on the reptile habitat suitability field surveys undertaken (see ES Appendix 6.6: Reptiles (Application Document 3.4) for further details).The project team also welcomed Natural England's support in undertaking National	ES Appendix 6.7: Reptiles and ES Appendix 6.5: Phase 2 NVC; ES Appendix 1.1 Evidence Plan (Application Document 3.4).

Consultee/ respondent	Comment	Applicant response	Where addressed?
		Vegetation Classification (NVC) surveys in April/May/June 2022 (see ES Appendix 6.4: Phase 2 NVC (Application Document 3.4) for further details)..	
Natural England	Consultation was undertaken to discuss potential impacts on an area of fen (Priority Habitat) (Appleby to Brough) and an area of ancient woodland (Cross Lanes to Rokeby) (pers. comms. 14/03/22).	During consultation the project team welcomed Natural England's agreement with the following: 1. Fen habitat - If the Project can provide like for like or better mitigation within the scheme extents (including the full area the fen is likely to be degraded following a hydrology assessment rather than just the direct loss), we can consider this mitigation with no Likely Significant Effect (LSE). 2. Ancient woodland: There would be no LSE on the area of ancient woodland as a result of proposed drainage works once appropriate measures and NE standing advice for ancient woodland is included in the EMP and once a 15m buffer from woodland edge is implement.	ES Appendix 6.1: Designated Sites; ES Appendix 6.2: Phase 1 habitat survey, ES Appendix 1.1: Evidence Plan, (Application Document 3.4), Section 6.7: Baseline conditions and Section 6.8: Potential impacts.
Natural England	Consultation was undertaken with Natural England in relation to assessment air quality impacts via email correspondence in relation to the following items: 1. Can Natural England clarify their concerns and expectation with regards	It was agreed that the project team would incorporate the ammonia/CREAM model, as advised and provided by Natural England, within the air quality modelling. No further correspondence with Natural England and air quality has been	ES Chapter 5: Air Quality; ES Chapter 6 Biodiversity Section 6.10: Assessment of likely significant effects.

Consultee/ respondent	Comment	Applicant response	Where addressed?
	the loss of one species metric given that this is referenced in both LA105 and NEA001. 2. Are Natural England aware of any evidence of existing habitat impacts/degradation or species impacts associated with air pollution within the Project area (email dated 02/12/21). Natural England responded to confirm: 'Natural England do not endorse LA105 as it is not compliant with the Habs Regs process (as correctly explained in LA115) and it uses NECR210 to propose a loss of one species metric which is used to screen sites out of further assessment based upon this information in isolation. Natural England do support the use of NECR210, as identified in NEA001, however only at the appropriate assessment stage, for the specific habitat types the reports covers and alongside other sources of site-specific evidence (email dated 15/12/21)	undertaken to date - however it is understood that National Highways have since agreed to pursue an updated approach to assessing air quality in collaboration with Natural England.	
Various	Raised comments during statutory consultation relating to designated sites in terms of descriptions used and features and associated geographic value of importance.	Noted. The designated site citations and associated geographical value of importance have been updated and addressed accordingly in the ES.	Appendix 6.2: Designated Sites (Application Document 3.4); Section 6.8: Potential impacts; Section 6.10: Assessment of likely significant effects.
Natural England	Raised comments relating to the bat surveys and assessing	All bat related comments have been noted, addressed where	Section 6.7: Baseline conditions; Section 6.8: Potential impacts;

Consultee/ respondent	Comment	Applicant response	Where addressed?
	impacts on habitat loss, fragmentation and mitigation.	appropriate and included within the ES.	Section 6.9: Essential mitigation and enhancement measures; Section 6.10: Assessment of likely significant effects; Appendix 6.10: Bats (Application Document 3.4).
Various	A number of comments were raised on the Preliminary Environmental Information (PEI) Report seeking further clarification in relation to the field surveys undertaken including survey methodologies, survey areas and mapping of survey findings.	Noted. The ES and supporting technical appendices provide full details of all field surveys undertaken to inform the baseline. This includes survey methodologies, results and mapping of key findings.	Section 6.6: Study area and Appendix 6.2: Designated Sites to Appendix 6.21: Aquatic Invertebrate (Application Document 3.4).
Various	A number of comments were raised on the PEI Report requesting further clarity in relation to specific design recommendations for mitigation items (especially relating to crossing for bats, red squirrels and connectivity for aquatic and terrestrial habitats) and enhancement measures.	Noted. Species specific crossing points, planting/additional habitat and associated fencing have been included in the design to mitigate potential fragmentation impacts. These include, but are not limited to, suitable fencing, planting and crossing points for bats, badgers, birds, otter, red squirrels (*Sciurus vulgaris)*, herptile species and aquatic species and associated habitats. All outline ecological mitigation is presented in the ES.	Section 6.8: Potential impacts; EMP (Application Document 2.7).
Natural England and the Environment Agency	Raised comments on the PEI Report relating to potential noise and vibration impacts on fish, mammals and birds.	Noted. Potential noise and vibration impacts on all relevant sensitive receptors are included in the ES (this includes mammals, birds and fish species).	Section 6.8: Potential Impacts; Chapter 12: Noise and Vibration

Consultee/ respondent	Comment	Applicant response	Where addressed?
Environment Agency	Raised comments relating to the requirement for a biosecurity and Invasive Non-Native Species (INNS) management plans.	Noted. Measures for dealing with invasive species and implementing biosecurity measures will be incorporated in the EMP.	EMP (Application Document 2.7).

In-combination climate impact assessment

6.4.18 An in-combination climate change assessment 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 biodiversity receptors in the surrounding environment. The assessment considers whether climate change could impact the likelihood and magnitude of the effects of the project on biodiversity 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.

6.5 Assumptions and limitations

6.5.1 Limitations specific to baseline surveys are stated within the individual technical reports in ES Appendix 6.2: Designated Sites to Appendix 6.22: White-Clawed Crayfish (Application Document 3.4).

6.5.2 Mitigation measures are described in Section 6.9 and details and plans are provided in the accompanying Environmental Mitigation Maps (Application Document 2.8), and EMP (Application Document 2.7). The final environmental design may alter slightly during the detailed design process prior to construction. However, the impact assessment has taken account of the worst-case scenarios and mitigation measures are included within the Project design accordingly and within the Limits of Deviation (Project Design Principles (Application Document 5.11)).

6.5.3 For the purposes of this assessment, it has been assumed that all habitat within the indicative site clearance boundary (ES Figure 2.2: Indicative Site Clearance Boundary (Application Document 3.3)) will be lost as a result of construction. This assumption has been made in order to inform a realistic assessment of the effects on important ecological features within each the Zone of Influence (ZoI) of the Project (as defined in Section 6.6. paragraph [6.6.3] below) and adopt a precautionary approach. See Table 6-1: Key Assessment Parameters for further details.

6.6 Study area

6.6.1 The study area was defined in accordance with *DMRB LA 108*, DMRB *LD 118* and CIEEM *Guidelines for Ecological Impact Assessment in the UK and Ireland*. In accordance with this guidance, the study area covers the Project in its entirety including construction compounds, areas for landscaping and habitat creation, and extends beyond the Order Limits, where necessary, to encompass all the areas potentially within the ZoI for impacts from the Project.

6.6.2 In establishing the ZoI, potential impact pathways during construction and operational phases were considered in relation to water quality, and noise and vibration, which could have direct or indirect effects on ecological features.

6.6.3 The ZoI differs for each ecological feature as follows (see ES Figure 6.19: Indicative Zone of Influence for Ecological Features (Application Document 3.3)):

- 2km radius from the Order Limits for international sites of nature conservation importance (or 30km for SACs where bats are noted as one of the qualifying interests)
- 2km radius from the Order Limits for nationally designated sites for nature conservation importance
- 1km radius from the Order Limits for regionally important and local non-statutory designated sites
- 1km radius from the Order Limits for Section 41 Habitats of Principal Importance (HoPI), Ancient Woodland Inventory (AWI) sites and veteran trees
- 500m radius from the Order Limits for breeding birds, wintering birds and barn owl (*Tyto alba)*
- 500m length (250m upstream and downstream) of all new and existing watercourse crossing points within the Order Limits for aquatic receptors
- 250m radius from the Order Limits for habitats, otter, badger, red squirrel, other terrestrial mammals and amphibians
- 100m radius from the Order Limits for bat roosts (structures), bat crossing points, water vole (*Arvicola amphibius)*, reptiles and terrestrial invertebrates
- 50m radius from the Order Limits for hedgerows
- Within the Order Limits for bat roosts (trees).

6.6.4 The maximum ZoI for internationally, nationally and locally designated sites including ancient woodland and veteran trees relating to potential air quality impacts is established at 200m from the Affected Road Network (ARN) (see ES Figure 5.1: Air Quality Study Area (Application Document 3.3)). Further details are provided within Chapter 5: Air Quality (Application Document 3.4)

6.7 Baseline conditions

Designated sites

6.7.1 This section of the report should be read in conjunction with ES Appendix 6.2: Designated Sites (Application Document 3.4).

6.7.2 As detailed in Section 6.4 Assessment Methodology, the ZoI for designated sites in relation to the Project is:

- 2km radius from the Order Limits for international sites of nature conservation importance (or 30km for SACs where bats are noted as one of the qualifying interests)
- 2km radius from the Order Limits for nationally designated sites for nature conservation importance
- 1km radius from the Order Limits for regionally important and local non-statutory designated sites
- 1km radius from the Order Limits for Ancient Woodland Inventory (AWI) sites and veteran trees.
- 200m from the ARN for internationally, nationally and locally designated sites including ancient woodland and veteran trees.

6.7.3 There are 18 statutory designated sites within 2km of the Project. Potential pollution pathways have been identified with the following:

- River Eden SAC
- River Eden and Tributaries SSSI

6.7.4 Of these 18 statutory designated sites, five are also within 200m of the ARN. A further five additional statutory sites are also located within 200m of the ARN.

6.7.5 There are 27 non-statutory designated sites within 1km of the Project. Potential pollution pathways have been identified with the following:

- Skirsgill Wood CWS
- Chapel Wood (Appleby in Westmoorland) CWS
- Rokeby Park and Mortham Wood LWS

6.7.6 Of these 27 non-statutory designated sites, seven sites are also within 200m of the ARN. A further 42 additional non-statutory designated sites are also located within 200m of the ARN.

6.7.7 There are 16 ancient woodlands within 1km of the Project. Potential pollution pathways have been identified with the following:

- Skirsgill Wood CWS
- Chapel Wood CWS
- Graham's Gill/Jack Wood

6.7.8 Of these 16 ancient woodlands, five are also located within the ARN. A further 15 ancient woodlands are located within 200m of the ARN.

6.7.9 From desk-based sources there are 69 known veteran, ancient and notable trees within 1km of the Project (10 ancient, 38 veteran and 21 notable). All are located outside the Order Limits, although two are within less than 1m and are therefore immediately adjacent (a veteran oak within the Temple Sowerby to Appleby Scheme and one notable sycamore in the Cross Lanes to Rokeby scheme). Five (1 ancient and 4 veteran) of the above 69 trees are also located within 200m of the ARN.

6.7.10 From the field data available, a further three trees (one confirmed ancient oak, namely the Sleastonhow oak, dating from around 1600) and two veteran or ancient ash (*Fraxinus excelsior*) trees were identified within the Temple Sowerby to Appleby scheme. These three trees are within the Order Limits and are within 200m of the ARN.

Habitats

6.7.11 This section of the report should be read in conjunction with ES Appendix 6.3: Phase 1 Habitat Survey (Application Document 3.4).

6.7.12 As detailed in Section 6.4 Assessment methodology, the ZoI for habitats in relation to the Project is a 250m radius from the Order Limits.

6.7.13 The area within the Order Limits of the Project is dominated by habitats of limited ecological interest. These include improved grassland and cultivated/disturbed land - arable which together account for approximately 600ha of the approximately 800ha recorded within the Order Limits.

6.7.14 Habitats of ecological interest are limited in area and distribution throughout the Order Limits of the Project. 'Broadleaved woodland - semi-natural' (approximately 12.4ha recorded throughout the Order Limits of the Project) was the most commonly recorded habitat of notable ecological interest and was recorded within the Order Limits of all schemes, with the exception the A1(M) Junction 54 Scotch Corner scheme.

6.7.15 Other areas of habitat that are of ecological interest were recorded but were smaller in area. These include areas of acid grassland - semi-improved, lichen/bryophyte heath, swamp, some parts of the recorded marsh/marshy grassland, and standing water.

6.7.16 A number of individual trees, which have been recorded as point data and classified as 'Mixed Parkland/scattered trees', are also of notable ecological interest. A number of these were identified as mature or veteran specimens which further elevates their potential importance.

6.7.17 Linear habitats have been identified throughout the Order Limits of the Project and are detailed within the relevant appendices (see ES Appendix 6.4: Hedgerow (Application Document 3.4))

and ES Appendix 6.18: Fish Habitat Assessment and MorPH (Application Document Number 3.4) for full description).

6.7.18 The desk study has identified a number of notable floral species within the Order Limits of the Project. This includes a number of non-native invasive species listed under Schedule 9 of the Wildlife and Countryside Act 1981. Other notable floral species are detailed with ES Appendix 6.5: National Vegetation Classification (Application Document 3.4).

6.7.19 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of DMRB LA 108, habitats within the ZoI are considered to be of Local to National importance (low to high sensitivity). They are therefore scoped in for further assessment (see 6.4 Assessment Methodology).

Hedgerow

6.7.20 This section of the report should be read in conjunction with ES Appendix 6.4: Hedgerows (Application Document 3.4).

6.7.21 As detailed in Section 6.4 Assessment Methodology, the ZoI for hedgerows in relation to the Project is a 50m radius from the Order Limits.

6.7.22 A total length of 86.70km of hedgerows has been subject to survey and assessment.

6.7.23 Overall, many of the hedgerows were not in good condition and either had a low diversity of species, were hard grazed up to the edges, or generally defunct.

6.7.24 Temple Sowerby to Appleby, Appleby to Brough and Stephen Bank to Carkin Moor schemes had the greatest length of hedgerow within the ZoI. The total length of hedgerows are 24.56km, 11.43km and 11.77km respectively. Conversely, Penrith to Temple Sowerby is a similar size to Stephen Bank to Carkin Moor but has a much lower density of hedgerows. The total length of hedgerow is 2.06km.

6.7.25 The landscape at Temple Sowerby to Appleby is dominated by improved grassland mainly used for grazing agricultural purposes, and consequently the hedgerows are less diverse and more defunct; however, they have been retained in the landscape.

6.7.26 The less rural sections of the Project, at M6 Junction to Kemplay Bank and A1 (M) Junction 53 Scotch Corner, have a shorter length of hedgerows or no hedgerows.

6.7.27 Of the total length of hedgerows surveyed, 48% were recorded to be 'important' under the biodiversity criteria as defined by *The*

Hedgerow Regulations (1997)[26] and 82% were recorded to be Priority Habitat as defined by *UK Habitat Classification*[27].

6.7.28 The most common hedgerow type recorded across the Project was hawthorn, this being reflective of a number of defunct hedgerows across the survey area. Next were hedgerows comprising a mix of hawthorn, ash, blackthorn (*Prunus spinosa*), field maple (*Acer campestre*), crab-apple (*Malus sylvestris*), elder (*Sambucus nigra*), dog rose.aggregate. (*Rosa canina agg*) and bramble aggregate (*Rubus fruticosus agg.).*

6.7.29 Stephen Bank to Carkin Moor supported the greatest diversity of woody species, with a total of 19 species recorded within the ZoI of this scheme. The landscape at this scheme is markedly different to the other scheme, where it is dominated by cropland and has established hedgerows with a greater range of associated features.

National Vegetation Classification

6.7.30 This section of the report should be read in conjunction with ES Appendix 6.5: Phase 2 National Vegetation Classification (Application Document 3.4).

6.7.31 As detailed in Section 6.4 Assessment methodology, the ZoI for habitats and floral species in relation to the Project is a 250m radius from the Order Limits.

6.7.32 A total of 22 NVC communities/subcommunities were identified routewide.

6.7.33 The following sites were identified within 250m of the Order Limits and are subsequently most likely to be directly or indirectly impacted by construction or operation:

- River Eden SAC
- North Pennine Moors SAC
- Bowes Moor SSSI
- River Eden Tributaries SSSI
- Temple Sowerby Moss SSSI
- Skirsgill Woods CWS
- Yanwath Wood CWS
- Myers Beck (Mardale Road) CWS
- Whinfell Forest CWS
- Chapel Wood (Appleby in Westmorland) CWS
- Ross Wood CWS
- Sandford Mire CWS
- Rokeby Park and Mortham Wood LWS.

[26] UK Government Legislation (1997): The Hedgerow Regulations 1997

[27] Butcher, B., Carey, P., Edmonds, R., Norton, L. and Treweek, J. (2020) UK Habitat Classification - Habitat Definitions V1.1 at http://ukhab.org

6.7.34 The NVC communities recorded within these sites included a mix of grassland, woodland, mires, swamp and tall-herb fen and vegetation of open habitats.

6.7.35 As these sites comprise designated sites, refer to the designated sites assessment for further information on assessment, mitigation and residual effects (Section 6.10: Assessment of likely significant effects).

6.7.36 NVC surveys are being planned based on all the Phase 1 habitat survey data collected and are due to commence during the survey season in 2022. These surveys will inform detailed planting schedules, landscaping proposals, and mitigation.

Amphibians

6.7.37 This section of the report should be read in conjunction with ES Appendix 6.6: Amphibians (Application Document 3.4).

6.7.38 As detailed in Section 6.4 Assessment methodology, the ZoI for amphibians in relation to the Project is a 250m radius from the Order Limits.

6.7.39 The desk study and field surveys have confirmed the presence of GCN, smooth newt (*Lissotriton vulgaris)*, palmate newt (*Lissotriton helveticus)*, common toad (*Bufo bufo)* and common frog (*Rana temporaria)* within the ZoI.

6.7.40 The results indicate that native amphibians appear to be widespread throughout the ZoI where suitable breeding ponds occur in combination with good terrestrial habitat such as rough grassland, woodland, hedgerows and scrub.

6.7.41 Small to medium sized aggregations populations of toads, frogs and newts were recorded during pond surveys. Large aggregations populations were not recorded and are likely to be limited to particularly favourable habitat within the wider area, such as disused quarry workings.

6.7.42 The presence of multiple ponds and waterbodies with confirmed amphibian records within the ZoI indicates that individual common frog, common toad, smooth newt, palmate newt or GCN are likely to be encountered within the Order Limits during site clearance and construction activities. These species will readily colonise standing water, including balancing ponds and wetlands, wherever there is connected habitat to existing amphibian populations.

6.7.43 Any adverse effects upon the GCN population as a result of loss of breeding ponds and terrestrial habitats suitable for other life cycle stages, are not considered further due to the confirmation of this Project's involvement in the DLL process. Through this process, offsite compensation is provided for 15.6 breeding ponds, located within suitable terrestrial habitat, and this process

is overseen by Natural England (see ES Appendix 6.6: Amphibians for further details).

6.7.44 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, the amphibian assemblage within the ZoI is considered to be of Local importance/Low sensitivity and is therefore scoped out of further assessment (see 6.4 Assessment methodology).

Reptiles

6.7.45 This section of the report should be read in conjunction with Appendix 6.7: Reptiles (Application Document 3.4).

6.7.46 As detailed in Section 6.4 Assessment methodology, the ZoI for reptiles in relation to the Project is a 100m radius from the Order Limits.

6.7.47 Ecological impact assessment is moving towards strategic, landscape-scale habitat provision in favour of localised/isolated mitigation and compensation where greater benefit can be demonstrated. The approach taken for reptiles is in line with this shift and has been agreed with Natural England (see Table 6-8: Summary of key consultation comments received and ES Appendix 6.6: Reptiles (Application Document 3.4) for further details).

6.7.48 This approach has been chosen because widespread presence and large populations of reptiles are thought to be unlikely due to the lack of records, unsuitable nature of the majority of the habitats present across the range of the Project (predominately structurally poor agricultural fields) and because the Project provides the opportunity to improve habitats for this species group. This section presents the results of a desk study and habitat suitability survey results, which together provide the baseline for assessment. Further surveys are proposed prior to construction to inform the extent and method of mitigation measures necessary to mitigate for the risk of death or injury of individual reptiles during the construction period (see ES Appendix 6.6: Reptiles (Application Document 3.4) and EMP (Application Document 2.7) for further details. The habitats within the Project are largely unsuitable for reptiles as they comprise intensive agriculture that is structurally deficient and lacking resting places (Edgar *et al*., 2010). Nevertheless, intermittent pockets of suitable habitat were sporadically distributed across the local area, largely associated with linear features (such as roadside verges, stone walls, hedgerows, ditches and streams) and a few areas of rank semi-natural habitat, for example rough grassland and scrub.

6.7.49 Coupled with a lack of records, large populations and widespread presence of reptiles is unlikely. Nevertheless, the presence of common lizard (*Zootoca vivipara)*, slow worm (*Anguis fragilis)* and, to a lesser extent, adder (*Vipera berus)* cannot be ruled out.

Reptiles are therefore assumed to be present in all suitable habitat.

6.7.50 It is proposed that pre-construction presence/likely absence surveys are undertaken in the appropriate survey season prior to site enabling works and site establishment works (due to start by 2024). The proposed survey programme aims to be proportionate and robust and is focussed on identifying required mitigation to avoid harm or injury to individual reptiles that may be present (see ES Appendix 6.6: Reptiles (Application Document 3.4). The programme will minimise the collection of irrelevant and abortive information and the need for surveys to be updated to ensure the survey information is reliable during construction.

6.7.51 The locations for further surveys required are shown on Figure 6.5: Reptile Habitat Suitability Survey (Application Document 3.3) along with all habitats that have been identified as suitable for reptiles. These collectively make up the area where mitigation measures for reptiles will be undertaken (these are described within Section 6.9: Essential mitigation and enhancement of this document).

6.7.52 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, the reptile assemblage within the ZoI is considered to be of Local importance/Low sensitivity and is therefore scoped out of further assessment (see 6.4 Assessment Methodology).

Terrestrial invertebrates

6.7.53 This section of the report should be read in conjunction with ES Appendix 6.8: Terrestrial Invertebrates (Application Document 3.4).

6.7.54 As detailed in Section 6.4 Assessment methodology, the ZoI for terrestrial invertebrates in relation to the Project is a 100m radius from the Order Limits.

6.7.55 Habitats suitable for terrestrial invertebrates are present routewide including structured mature broadleaved woodland canopy, tall sward and scrub and short sward and bare ground. While these are suitable habitats for a range of terrestrial invertebrates including pollinator species, these are, in general, common habitats within the area with no specific invertebrate assemblages of importance present.

6.7.56 Shingle banks within the River Eden SSSI are designated in part for the presence of a number of terrestrial invertebrate species; shore bug *Sadula fucicola*; leaf beetle *Hydrothassa hannoverianna*; ground beetles *Bembidian schuepelli*, *B. fluviatile* and *Asaphidian pallipes*; flies *Loncoptera meijeri*, *Camspicnemus marginatus* and *Rhaphium fractrum.* The shingle banks found were upstream, north of the Project and outside of the Order Limits. Therefore, no direct impacts are expected on any

invertebrate assemblages using these. There is likely to be some shading impacts on a short stretch of stream and river margin, and some temporary construction impacts on the habitats themselves. However, any temporary loss to populations is likely to be quickly made up and enhancement and creation of additional riverine habitat will result in an increase in quality and amount of useable habitat for this assemblage. No riparian sand was identified as currently present within the Order Limits of the Project. For both shingle banks and riparian sand, it should be noted that these can move significantly during high water flow events and therefore surveys will be undertaken to ensure none are present when construction is due to begin (see Section 6.8: Potential impacts for further details).

6.7.57 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, the terrestrial invertebrate assemblage within the ZoI is considered to be of Local importance/Low sensitivity and is therefore scoped out of further assessment (see Section 6.4: Assessment methodology).

Badger

6.7.58 This section of the report should be read in conjunction with ES Appendix 6.9: Badger (Application Document 3.4).

6.7.59 As detailed in Section 6.4 Assessment methodology, the ZoI for badger in relation to the Project is a 250m radius from the Order Limits.

6.7.60 Badger presence was confirmed within the ZoI of the majority of the schemes, evidenced by field signs such as hair, prints, latrines and scratching posts, and the presence of setts.

6.7.61 Field surveys have shown that badger activity is greater towards the western end of the Project. Activity was limited in the eastern extent of the Project, and no activity was identified within the Bowes Bypass scheme or A1(M) Junction 53 Scotch Corner scheme. This finding is consistent with National Highways' roadkill data, for which there are no records within the Bowes Bypass scheme. This is likely due to the North Pennine Moors acting as a barrier to dispersal for badger due to its high altitude and lack of woodland, hedgerow and cereal crop habitat suitable for badger foraging and sett creation. The greatest density of setts was situated within Penrith to Temple Sowerby, with setts present both north and south of the existing A66.

6.7.62 Of particular relevance are the survey results within the ZoI for M6 Junction 40 to Kemplay Bank. The findings from the badger bait marking surveys on sett 13.1 (ES Figure 6.6: Badger Setts, Field Signs and Badger Bait Marking (Application Document 3.3)) suggest badgers previously using this as a main sett were now

using sett 13.2 as their main sett. Roper's Badger (2010)[28] states that some social groups periodically migrate en masse from one sett to another within their territory, and therefore have more than one main sett. Following a precautionary approach, it has been assumed that this badger clan occupies two main setts, sett 13.1 and 13.2. Based on the locations of baited latrines (ES Figure 6.6: Badger Setts, Field Signs and Badger Bait Marking (Application Document 3.3)) it has been concluded that the badgers using the two setts commute between them through the woodland directly to the north of the A66 carriageway and use the existing underpass to cross the A66 and enter the woodland to the south.

6.7.63 Furthermore, the results of survey within the ZoI indicate that:

- badger are regularly crossing the existing A66 within the Penrith to Temple Sowerby scheme, Temple Sowerby to Appleby scheme and Stephen Bank to Carkin Moor scheme
- badger cross the current A66 between setts 2, 18 and 19 within the Appleby to Brough scheme
- within the Penrith to Temple Sowerby scheme a small badger clan occupies two main setts, sett 8.1 and 8.2

6.7.64 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of DMRB LA 108, badger within the ZoI are considered to be of Local importance/Low sensitivity and are therefore scoped out of further assessment (see 6.4 Assessment Methodology).

Red squirrel

6.7.65 This section of the report should be read in conjunction with ES Appendix 6.10: Red Squirrels (Application Document 3.4).

6.7.66 As detailed in Section 6.4 Assessment methodology, the ZoI for red squirrel in relation to the Project is a 250m radius from the Order Limits.

6.7.67 Red squirrel are confirmed present within the ZoI of two schemes, M6 Junction 40 to Kemplay Bank and Penrith to Temple Sowerby.

6.7.68 In addition, red squirrel are assumed to be present within the ZoI of two further schemes, Temple Sowerby to Appleby and Appleby to Brough.

6.7.69 Red squirrel are likely absent from within the ZoI of all other schemes, predominantly due to a lack of suitable habitat, or the presence of grey squirrel combined with a lack of records of red squirrel within the desk study data received.

6.7.70 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, red squirrel within

[28] Roper, T. (2010) Badger. London: Collins. Pg 84

the ZoI are considered to be of Regional importance/Medium sensitivity and are therefore scoped in for further assessment (see Section 6.4: Assessment methodology).

Bats

6.7.71 This section of the report should be read in conjunction with ES Appendix 6.11 Bats (Application Document 3.4).

6.7.72 As detailed in Section 6.4 Assessment methodology, the ZoI for bats in relation to the Project is as follows:

- 100m radius from the Order Limits for bat roosts (structures) and bat crossing points
- Within the Order Limits for bat roosts (trees)

6.7.73 The survey results illustrate the Core Sustenance Zones (CSZs) of the local bat populations (see ES Figure 6.10: Core Sustenance Zones of Bat Roosts Identified from Survey) and confirm the importance of the woodland blocks, linear woodland corridors, hedgerows and watercourses present throughout the study area for the foraging and commuting of local bat populations. Roosting opportunities exist throughout the schemes, within residential properties (predominantly constructed of stone), farm buildings and many mature trees present across all the habitat types (see ES Figure 6.11: Bat Roost Survey Map).

6.7.74 The extent of woodland areas and individual mature trees throughout the project area, of which over 300 single trees within the Order Limits were surveyed and 39 tree roosts were identified across all survey methods, indicates that mature trees are a valuable roost resource in the local/regional context.

6.7.75 The surveys identified the presence of the ten species below within the Project area (and species groups where identification unconfirmed), with all of the species/genus listed below recorded in each scheme (% of total bph by species across all static locations):

- *Pp (44.38%)*
- *Py (25.29%)*
- *Pn (0.20%)*
- *Pa (0.3%)*
- *Md (7.4%)*
- *Mn (0.27%)*
- *Mb (0.35%)*
- *Mm (2.49%)*
- *Nn (5.22%)*
- *Nl (0.01%)*
- *Psp (5.32%)*
- *Msp (7.13%)*
- *Plsp (0.23%)*
- *Nsp (1.37%).*

6.7.76 Thirty-two individual maternity roosts of five different species (Pp, Py, Pa, Md and Mn) were identified during the desk study within 2km of the Order Limits. None of these roosts were located within the Order Limits, although three roosts were within 60m.

6.7.77 The surveys undertaken during the 2021 survey season identified 128 individual bat roosts (trees and structures) across eight different species (Pn and Nl were not represented in the confirmed bat roost results) including 11 roosts which supported two or three different species (see ES Figure 6.11: Bat Roost Survey Map). Of these roosts, 61 were identified as maternity roosts.

6.7.78 The schemes can be ranked according to the total bat passes per hour (bph), as a proxy of overall bat activity, recorded by the remote acoustic surveys to provide an indicative assessment of the importance of each scheme area to the local bat populations. The following order represents an average of the all the detectors deployed within each individual scheme:

- Temple Sowerby to Appleby
- Penrith to Temple Sowerby
- Bowes Bypass
- M6 Junction 40 to Kemplay Bank
- Appleby to Brough
- Cross Lanes to Rokeby
- Stephen Bank to Carkin Moor
- A1(M) Junction 53 Scotch Corner (noting no detectors were deployed for this scheme in 2021).

6.7.79 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, bats within the ZoI are considered to be of Local to Regional importance (low to medium sensitivity), due to the species and types of roosts present. They are therefore scoped in for further assessment (see section 6.4: Assessment Methodology).

Other terrestrial mammals

6.7.80 This section of the report should be read in conjunction with ES Appendix 6.12: Other Terrestrial Mammals (Application Document 3.4).

6.7.81 As detailed in Section 6.4 Assessment Methodology, the ZoI for other terrestrial mammals in relation to the Project is a 250m radius from the Order Limits.

6.7.82 Brown hare (*Lepus europaeus)*, hedgehog (*Erinaceus europaeus)* and assumed polecat (*Mustela putorius)* were recorded in multiple locations throughout the Order Limits of the Project confirming their presence.

6.7.83 Due to lack of detection on camera traps and absence of desk study data, pine marten (*Martes martes)* are considered to be absent from the Order Limits of the Project.

6.7.84 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, other terrestrial mammals (brown hare, hedgehog and polecat) within the ZoI are considered to be of Local importance/Low sensitivity and are therefore scoped out of further assessment (see Section 6.4: Assessment methodology).

Breeding birds

6.7.85 This section of the report should be read in conjunction with ES Appendix 6.13: Breeding Birds (Application Document 3.4).

6.7.86 As detailed in Section 6.4 Assessment methodology, the ZoI for breeding birds in relation to the Project is a 500m radius from the Order Limits.

6.7.87 The surveys confirmed that breeding birds are abundant and are using habitats present within the ZoI of the Project.

6.7.88 With the exception of the A1(M) Junction 53 Scotch Corner scheme, breeding bird territories were recorded within the Order Limits of every scheme. Whilst no breeding bird territories were recorded within the Order Limits of the A1(M) Junction 53 Scotch Corner scheme, territories were present within the ZoI.

6.7.89 No North Pennine Moors SPA qualifying species were recorded breeding within the ZoI.

6.7.90 Barn owl were the only schedule 1 species recorded breeding within the Project survey area. Five occupied barn owl breeding sites were identified during the barn owl nest verification surveys undertaken in 2021. Two breeding sites were within the Project Order Limits. Full details are provided in ES Appendix 6.15: Barn Owl (Application Document 3.4) and barn owl are assessed in their own right within this document.

6.7.91 Low numbers of kingfisher *(Alcedo atthis)* were recorded within the ZoI, and whilst it is considered possible that this species breeds along suitable watercourses within the ZoI, no evidence of breeding was recorded.

6.7.92 Fieldfare (*Turdus pilaris*) was recorded within the ZoI but no evidence of breeding was recorded.

6.7.93 Two notable species identified as 'probable' breeding[29] within the ZoI were mallard (*Anas platyrhynchos* (three territories) and dipper (*Cinclus cinclus)* (one territory), both BoCC Amber List. These two species were both associated with wetland and riverine habitats towards the western end of the Project.

6.7.94 The following species were identified as 'possible' breeding within the survey area of the Project:

- Kingfisher

[29] [redacted]

- Lesser redpoll (*Carduelis carduelis)*
- Marsh tit (*Poecile palustris)*
- Tree pipit (*Anthus trivialis)*
- Swift (*Apus apus)*
- Snipe (*Gallinago gallinago)*
- Greylag goose (*Anser answer)*
- Kestrel (*Falco tinnunculus)*
- Mute swan (*Cygnus olor)*
- Tawny owl (*Strix aluco)*
- Teal (*Anas crecca).*

6.7.95 Habitats within and adjacent to the Order Limits of every scheme provide foraging opportunities for a range of bird species as noted by the diversity of species recorded during the breeding bird surveys. The abundance of woodland, scrub and hedgerow habitats supported a number of passerine species. Large expanses of grassland are also abundant throughout the Project and supported a number of ground nesting bird species such as lapwing (*Vanellus vanellus)*. Areas of flooded and wet short grazed grassland supported waders, gulls and geese.

6.7.96 The species richness (total number of breeding species present) within the ZoI was 39. This total includes barn owl which is assessed in a separate section of this report (ES Appendix 6.15: Barn Owl (Application Document 3.4)).

6.7.97 The schemes with the highest diversity (number of species) of birds were Temple Sowerby to Appleby (65), Appleby to Brough (64) and Bowes Bypass (59). In addition, these schemes also supported the highest number of breeding territories, 47, 54 and 61 respectively.

6.7.98 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, the breeding bird assemblage within the ZoI is considered to be of County importance/Medium sensitivity and are therefore scoped in for further assessment (see Section 6.4: Assessment methodology).

Wintering birds

6.7.99 This section of the report should be read in conjunction with ES Appendix 6.14 Wintering Birds (Application Document 3.4).

6.7.100 As detailed in Section 6.4 Assessment methodology, the ZoI for wintering birds in relation to the Project is a 500m radius from the Order Limits.

6.7.101 The surveys confirmed that wintering birds are abundant and are using habitats present within the ZoI of the Project.

6.7.102 Golden plover (*Pluvialis apicaria)* and merlin *(Falco columbarius)*, two North Pennine Moors SPA citation species, were recorded within the ZoI.

6.7.103 Two merlin were recorded in excess of 100m of the Project Order Limits. One merlin was recorded 3.2km to the west of the SPA, within the Appleby to Brough scheme located 105m north of the Order Limits. A second merlin was recorded 2.6km to the east of the SPA, within the Bowes Bypass scheme, located 110m north of the Order Limits.

6.7.104 Flocks of wintering golden plover have been recorded throughout the central schemes of the Project with notable numbers recorded within the Cross Lanes to Rokeby scheme. It is considered wintering golden plover use the abundance of flat grassland adjacent to the scheme before moving upland to suitable nesting habitat within the North Pennine Moors SPA.

6.7.105 No counts of wintering bird species recorded across ZoI of each scheme approaches the 1% level of the national wintering population estimates as detailed by the RSPB (Royal Society for the Protection of Birds, 2022)[30] and BTO (British Trust for Ornithology, 2022)[31].

6.7.106 Habitats within and adjacent to the Order Limits provide foraging opportunities for a range of bird species, indicated by the diversity of species recorded during the wintering bird surveys. The abundance of woodland, scrub and hedgerow habitats supported a number of passerine species. Large expanses of grassland and wet short, grazed grassland supported waders, gulls and geese such as golden plover and lapwing.

6.7.107 The wintering bird assemblage recorded across the ZoI is largely typical of species associated with agricultural areas. The presence of agricultural features such as arable fields, wet grassland, hedgerows and improved grassland along with pockets of built-up areas has resulted in the recording of notable numbers of wintering thrushes, waders, gulls and wildfowl.

6.7.108 Notable individual species recorded along with their total abundance include lapwing (7,356), starling (*Sturnidae vulgaris)* (5,325), common gull (*Larus canus*) (2,198), black-headed gull (*Chroicocephalus ridibundus*) (1,627), fieldfare (1,337), golden plover (1,098) and redwing (Turdus iliacus) (960).

6.7.109 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, the wintering bird assemblage within the ZoI is considered to be of County importance/Medium sensitivity and are therefore scoped in for further assessment (see Section 6.4: Assessment methodology).

Barn owl

6.7.110 This section of the report should be read in conjunction with ES Appendix 6.15: Barn Owls (Application Document 3.4).

[30] Royal Society for the Protection of Birds (2022) Birds A- Z | Bird Guides

[31] British Trust for Ornithology (2022) Welcome to BirdFacts

6.7.111 As detailed in Section 6.4 Assessment methodology, the ZoI for barn owl in relation to the Project is a 500m radius from the Order Limits.

6.7.112 The surveys confirmed that barn owl are using habitats present within the ZoI and adjacent to it for foraging, roosting and breeding.

6.7.113 Barn owl nesting and roosting sites were recorded within the ZoI of all schemes, with the exception of M6 Junction 40 to Kemplay Bank scheme and the A1(M) Junction 53 Scotch Corner scheme. Within these schemes, evidence of nesting or roosting barn owl was not recorded.

6.7.114 A total of 31 Potential Nest Sites (PNS), two Temporary Roost Sites (TRS) and 16 Active Roost Sites (ARS) were recorded within the ZoI for barn owl of the Project.

6.7.115 Five pairs of barn owl were recorded breeding within the ZoI, however only two pairs were recorded within the Order Limits:

- One OBS was recorded in a building within the Temple Sowerby to Appleby scheme (outside Order Limits)
- Two OBS were recorded in buildings within the Appleby to Brough scheme (one outside and one within the Order Limits)
- One OBS was assumed to be present in a tree within the Bowes Bypass scheme (outside Order Limits)
- One OBS was assumed to be present in a tree within the Stephen Bank to Carkin Moor scheme (within Order Limits)

6.7.116 Potential barn owl territories can be inferred from the ARS and PNS (which were not inspected due to health and safety restrictions). Given the difficulties in locating barn owl nests and roosts, breeding sites are often under recorded and therefore a precautionary approach has been taken to this assessment. Based on the available foraging habitat within the ZoI, it is considered that the area could support a higher number of breeding barn owl pairs than identified through the OBS. A further 11 active roosting sites not adjacent to another nest or roost site indicates an additional 11 potential home ranges.

6.7.117 Where evidence of barn owl nests or roosts was not recorded, barn owls are not considered to be absent given the presence of suitable habitats throughout the Order Limits. It is possible further barn owl nests or roosts are present within the ZoI which were not identified or further nests or roosts are present outside the ZoI, as discussed below.

6.7.118 Following the precautionary principle, it has been assumed that where Type 1 or Type 2 barn owl habitat has been recorded within the study area (Figure 6.15: Barn Owl Territory Map (Application Document 3.2)), these areas support foraging barn owl.

6.7.119 Barn owl home ranges alter seasonally in response to food abundance. The average distribution density of barn owl equates to approximately a 1km radius around the nest when they are breeding, and approximately 4km radius at other times.

6.7.120 Potential traffic accident blackspots (TABs) have been identified throughout the Project at locations where data indicates likely barn foraging routes bisect the Project. ES Figure 6.15: Barn Owl Territory Map (Application Document 3.2) shows the locations of these potential TABs within the Order Limits of the Project.

6.7.121 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, barn owl within the ZoI are considered to be of County importance/Medium sensitivity and are therefore scoped in for further assessment (see Section 6.4: Assessment methodology).

Otter

6.7.122 This section of the report should be read in conjunction with ES Appendix 6.16: Otters (Application Document 3.4).

6.7.123 As detailed in Section 6.4 Assessment methodology, the ZoI for otter in relation to the Project is a 250m radius from the Order Limits.

6.7.124 The surveys confirmed that otter are using the majority of watercourses surveyed, with the exception of those within the Stephen Bank to Carkin Moor and A1(M) Junction 53 Scotch Corner schemes, where evidence of otter was not recorded (Table 6-9: Otter results summary table).

6.7.125 Where evidence of otter has not been recorded, it is considered likely that otters will pass through those sections of watercourses which are linked to others where evidence of otter has been recorded. These comprise the two unnamed tributaries of River Greta, the three unnamed tributaries of River Eamont, the six unnamed tributaries of Trout Beck, Manyfold Beck, and the three unnamed tributaries of Cringle Beck. No evidence of potential resting sites or holts were recorded along these watercourses.

6.7.126 There is a low potential that otter could occasionally use watercourses where no evidence was found and which are not linked to watercourses where evidence of otter was identified for commuting. These comprise unnamed tributary of Cottonmill Beck, two unnamed tributaries of Holme Beck, unnamed tributary of Mains Gill and Mains Gill. In addition, no evidence of potential holts or resting sites for otter were recorded on these watercourses. These watercourses were considered unsuitable to support otter given their ephemeral nature and the presence of dense vegetation within the channel at the time of survey (see Table 6-9: Otter results summary table).

6.7.127 Following the precautionary principle, it has been assumed that where prints, spraints or anal jelly has been recorded, without the

presence of resting sites, that a watercourse is likely to be used as a commuting or foraging route.

Table 6-9: Otter results summary table

Scheme	Watercourse	Field Signs	
		Spraints, prints, anal jelly, and bedding	Resting sites and holts
M6 Junction 40 to Kemplay Bank	River Eamont	Spraints	Two resting sites – unconfirmed
			Four otter holts – one confirmed, three unconfirmed
	Thacka Beck	Spraints	Resting site - unconfirmed
Penrith to Temple Sowerby	River Eamont	Spraints, anal jelly and prints	One resting sites - unconfirmed
			Five otter holts – four unconfirmed, one confirmed
			One otter holt - confirmed
	Unnamed Tributary of Light Water	-	-
	Three Unnamed Tributaries of the River Eamont	-	-
	Swine Gill	Spraints	-
Temple Sowerby to Appleby	River Eden	Spraints and prints	One resting site – unconfirmed Three otter holts – two unconfirmed one confirmed
	Trout Beck	Spraints	One resting site - unconfirmed Two otter holts – one unconfirmed, one confirmed
	Six Unnamed Tributaries of Trout Beck	-	-
	Keld Sike	Spraints	-
Appleby to Brough	Unnamed Tributary of Mire Sike (B)	Spraints and prints	-

Scheme	Watercourse	Field Signs	
		Spraints, prints, anal jelly, and bedding	Resting sites and holts
	Mire Sike	Spraints and prints	-
	Cringle Beck	Spraints and prints	
	Three Unnamed Tributary of Cringle Beck	-	-
	Moor Beck	Spraints and prints	One otter natal holt – confirmed
	Hayber Beck	Spraints and prints	
	Crooks Beck	Spraints and prints	
	Eastfield Sike	Spraints and prints	
	Lowgill Beck	Spraints and prints	-
	Two unnamed Tributaries of Lowgill Beck	Spraints and prints	-
	Woodend Sike	Spraints and prints	
	Yosgill Sike	Spraints and prints	
Bowes Bypass	Two Unnamed Tributaries of River Greta	-	-
	River Greta	Spraint	-
Cross Lanes to Rokeby	Punder Gill	-	-
	Unnamed Tributary of Punder Gill	-	-
	Unnamed Tributary of Manyfold Beck	-	-
	Tutta Beck	Spraints and prints	-

Scheme	Watercourse	Field Signs	
		Spraints, prints, anal jelly, and bedding	Resting sites and holts
	Three Unnamed Tributaries of Tutta Beck	-	-
	Manyfold Beck	Spraints	-
	Wellfield Strand	Spraint	-
	River Greta	Spraints	-
Stephen Bank to Carkin Moor	Unnamed Tributary of Cottonmill Beck	-	-
	Two unnamed Tributaries of Holme Beck	-	-
	Unnamed Tributary of Mains Gill	-	-
	Mains Gill	-	-
A1(M) Junction 53 Scotch Corner	-	-	-

6.7.128 One confirmed natal holt was recorded under a large rock on Moor Beck within the Appleby to Brough Scheme (Table 6-10: Watercourses used as resting sites for otter). This was located north of Warcop Training Centre and immediately adjacent to the existing A66. Bedding and large quantities of spraint were recorded associated with this feature. Two cubs were recorded between June and August 2021 during camera trapping.

6.7.129 Where potential resting sites and holts have not been confirmed, a precautionary approach has been adopted. Therefore, these potential features have been assumed to be active resting sites or holts respectively. Table 6-10: Watercourses used as resting sites for otter outlines the number and location of confirmed and unconfirmed (and therefore assumed active) holts and resting sites throughout the Project.

6.7.130 No confirmed or unconfirmed holts and resting sites were recorded within the Bowes Bypass, Cross Lanes to Rokeby, Stephen Bank to Carkin Moor and A1(M) Junction 53 Scotch Corner schemes and therefore these are not included.

Table 6-10: Watercourses used as resting sites for otter

Scheme	Watercourse	Confirmed		Unconfirmed	
		Holt (number) (distance from Order Limits)	Resting site (number) (distance from Order Limits)	Holt (number) (distance from Order Limits)	Resting site (number) (distance from Order Limits)
M6 Junction 40 to Kemplay Bank	River Eamont	(1) (500m)	(2) (200m, 320m)	(3) (525m, 380m, 185m)	-
	Thacka Beck	-	-	-	(1) (115m)
Penrith to Temple Sowerby	River Eamont	(1) (170m)	-	(4) (200m, 420m, 120m, 100m)	(1) (100m)
Temple Sowerby to Appleby	River Eden	(1) (150m)	-	(2) (80m, 80m)	(1) (70m)
	Trout Beck	(1) (280m)		(1) (280m)	(1) (280m)
Appleby to Brough	Moor Beck	(1)** (within)	-	-	-

** Natal otter holt.

6.7.131 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, the population of otter within the ZoI is considered to be of County importance/Medium sensitivity and is therefore scoped in for further assessment (see Section 6.4: Assessment methodology).

Water vole

6.7.132 This section of the report should be read in conjunction with ES Appendix 6.17: Water Voles (Application Document 3.4).

6.7.133 As detailed in Section 6.4 Assessment methodology, the ZoI for water vole in relation to the Project is a 250m radius from the Order Limits.

6.7.134 Water voles are considered to be absent from the survey area and will therefore not be considered further in the ecological assessment of this Project.

Fish

6.7.135 This section of the report should be read in conjunction with ES Appendix 6.19: Fish and ES Appendix 6.18: Fish Habitat Assessment and MoRPh (Application Document 3.4), where fish survey data, desk study information and the results of the fish habitat assessment are described in full.

6.7.136 Based on the habitat assessment, numerous watercourses within the Order Limits were considered to have the potential to support fish of conservation value. This was later confirmed during fish

surveys (electric fishing and eDNA), as outlined in Appendix 6.19: Fish (Application Document 3.4).

6.7.137 Whilst no definitive spawning redds were identified during survey, areas of clean gravel offering potential spawning opportunities for salmonid and lamprey species were commonplace. It should be noted that fish habitat assessment was undertaken in spring and summer, which is outside the period of salmonid species spawning but within the spawning period for river, brook and sea lamprey.

6.7.138 Areas of optimal and suboptimal juvenile lamprey habitat (sand/silt) were recorded in numerous watercourses surveyed.

6.7.139 Protected and/or notable species of fish were found across all survey sites where fish were caught. These species are:

- Atlantic salmon (*Salmo salar*): Atlantic salmon are an EC Habitats Directive Annex II species and are a UK Biodiversity Action Plan (BAP) priority fish species
- Bullhead (*Cottus gobio*): Bullhead are an EC Habitats Directive Annex II species and listed on the International Union for Conservation of Nature (IUCN) red list of threatened species
- River (*Lampetra fluviatilis*)/Brook (*Lampetra planeri*) Lamprey: Lamprey are an EC Habitats Directive Annex II species and are a UK Biodiversity Action Plan (BAP) priority fish species
- European eel (*Anguilla anguilla*): European eel are listed as Critically endangered on the IUCN red list of threatened species. They are a UK Biodiversity Action Plan priority species, a species of principal importance for the purpose of conserving biodiversity under the NERC act 2006 and protected under the Eels (England and Wales) Regulations 2009
- Brown Trout (*Salmo trutta*): Brown Trout are a UK Biodiversity Action Plan priority fish species

6.7.140 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, the population of fish within the ZoI is considered to be of National importance/High sensitivity and is therefore scoped in for further assessment (see Section 6.4: Assessment methodology).

Aquatic macrophyte

6.7.141 This section of the report should be read in conjunction with ES Appendix 6.20: Aquatic Macrophyte and River Corridor Survey (Application Document 3.4).

6.7.142 As detailed in Section 6.4 Assessment methodology, the ZoI for aquatic macrophyte in relation to the Project is a 500m length (250m upstream and downstream) of all new and existing watercourse crossing points within the Order Limits.

6.7.143 There were five sites where features associated with the watercourse categorised the site as being of high conservation value.

6.7.144 Light Water (Penrith to Temple Sowerby), downstream of the existing A66 (WCP_03_DS) conforms to the Annex I habitat: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and is considered linked to the River Eamont, which form part of the River Eden SAC.

6.7.145 Areas of woodland adjacent to Light Water both upstream (WCP_03_U/S) and downstream (WCP_03_D/S) of the existing A66 conform to the Annex I habitat: 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*.

6.7.146 Trout Beck (Temple Sowerby to Appleby) forms part of the River Eden SAC and all surveyed reaches of Trout Beck conform to the Annex I habitat types: 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation habitat, a qualifying feature of the SAC.

6.7.147 The upper section of the surveyed reach of the Trout Beck (WCP_08_US-RED_US) is considered of high conservation value. Whilst the other sites on Trout Beck conform to the 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation habitat, their conservation value is severely limited by the steep banks and almost continuous shade from bankside trees. Their conservation value could be increased through removal of bank protection and allowing the channel to move through erosion and deposition.

6.7.148 Riparian woodland recorded adjacent to Crooks Beck (WCP_17_D/S) in the Appleby to Brough scheme, conforms to the 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior.*

6.7.149 Species found that are listed on the England Red List but not on the UK Red List (*Hydrocotyle vulgaris*, *Lychnis flos-cuculi*, *Valeriana officinalis*) are common in the north and west but are declining in the south and east.

6.7.150 The invasive non-native riparian plant Himalayan balsam (*Impatiens glandulifera*) was recorded at the following sites:

- Unnamed Tributary of River Eamont 3.3 (WCP_04_D/S)
- All sites on Trout Beck, with the exception of WCP_08_D/S-4.

6.7.151 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, the assemblage of aquatic macrophytes within the ZoI is considered to be of Local importance/Low sensitivity and is therefore scoped out of further assessment (see section 6.4: Assessment methodology).

Aquatic invertebrates

6.7.152 This section of the report should be read in conjunction with ES Appendix 6.21: Aquatic Invertebrates (Application Document 3.4).

6.7.153 As detailed in Section 6.4 Assessment methodology, the ZoI for aquatic invertebrates in relation to the Project is a 500m length (250m upstream and downstream) of all new and existing watercourse crossing points within the Order Limits.

6.7.154 Species of conservation value, including nationally scarce, nationally notable and nationally rare species were identified at 10 sites across the following schemes:

- Temple Sowerby to Appleby
- Appleby to Brough
- Cross Lanes to Rokeby

6.7.155 White-clawed crayfish (WCC) (*Austropotamobius pallipes*) were recorded at three sites in the Appleby to Brough scheme: WCP_11 (Unnamed Tributary of Mire Sike 6.12), WCP_17 (Eastfield Sike) and WCP_18 (Unnamed Tributary of Lowgill Beck 6.1).

6.7.156 Sites with a macroinvertebrate assemblage indicative of a high conservation value were recorded in the Temple Sowerby to Appleby scheme; Keld Sike (WCP_08_KS), the Appleby to Brough scheme; Moor Beck (WCP_16), Eastfield Sike (WCP_17), and Lowgill Beck (WCP_19), and the Cross Lanes to Rokeby scheme; Tutta Beck (WCP_24) and Unnamed Tributary of Tutta Beck 8.2 (WCP_25).

6.7.157 No invasive non-native macroinvertebrates were recorded during the surveys.

6.7.158 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, the assemblage of aquatic invertebrates within the ZoI is considered to be of Local importance/Low sensitivity and is therefore scoped out of further assessment (see Section 6.4: Assessment methodology).

White-clawed crayfish

6.7.159 This section of the report should be read in conjunction with ES Appendix 6.22: White-clawed Crayfish (Application Document 3.4).

6.7.160 As detailed in Section 6.4 Assessment methodology, the ZoI for white-clawed crayfish in relation to the Project is a 500m length (250m upstream and downstream) of all new and existing watercourse crossing points within the Order Limits.

6.7.161 WCC or WCC DNA were recorded at 12 of the 23 sites surveyed. These positive records were limited to two schemes (Temple Sowerby to Appleby and Appleby to Brough).

6.7.162 Positive records of WCC crayfish from manual search and/or eDNA were recorded during surveys of the following rivers:

- Trout Beck and Keld Sike (Temple Sowerby to Appleby)

- Unnamed Trib. of Mire Sike 6.12, Moor Beck, Eastfield Sike, Unnamed Trib. of Lowgill Beck 6.1, Lowgill Beck, Woodend Sike and Yosgill Sike (Appleby to Brough).

6.7.163 These rivers therefore qualify as priority river habitat.

6.7.164 Whilst surveys did not result in positive records for WCC in the M6 Junction 40 to Kemplay Bank or Penrith to Temple Sowerby schemes, it should be noted that watercourses interacting with these schemes (Thacka Beck, Light Water, and Unnamed Tributary of River Eamont 3.3) flow into the River Eden SAC where there is potential for WCC, so risks relating to construction and associated mitigation are relevant.

6.7.165 A positive record for signal crayfish (*Pacifastacus leniusculus)* DNA was returned from Mains Gill (WCP_30). Note that this was the only site across all schemes where a positive record for signal crayfish DNA was returned. No signal crayfish were caught or observed during manual search surveys at any site.

6.7.166 In accordance with Table 6-4: Table of importance of ecological features following Table 3.9 of *DMRB LA 108*, white-clawed crayfish within the ZoI are considered to be of National importance/High sensitivity and are therefore scoped in for further assessment (see Section 6.4: Assessment methodology).

Future baseline

6.7.167 As described in Chapter 4: Environmental Assessment Methodology, in order to identify the effects of the Project on biodiversity, it is important to understand the baseline (at year of construction) and future baseline (at year of opening/operation) as these may be different.

Construction year baseline (2024)

6.7.168 The baseline provided in ES Appendix 6.2: Designated Site to ES Appendix 6.22: White-clawed Crayfish (Application Document 3.4) and summarised in the above sections describes the biodiversity as they were in the years they were surveyed (2020-2022).

6.7.169 The majority of the land to be impacted by the Project has been classified as agricultural land and associated linear boundaries. Where more natural habitats are present these have been present for some time and are not anticipated to change significantly in the near future. As such, the biodiversity baseline is unlikely to change significantly unless any large-scale changes in agricultural policy and practices occur.

Opening year baseline (2029)

6.7.170 It is not possible to accurately predict the baseline for the opening year (2029) or future operational years. It is anticipated that at the western end of the Project, around Penrith, in particular, there is

potential for urban pressures associated with an increased population to lead to expansion of the built environment. Recreational pressures across the route are also anticipated to increase over time. Should there be any large-scale changes in agricultural policies and practices (which may emerge following the UK's exit from the European Union, implementation of the Environment Act 2021 and an increased political focus on biodiversity protection and carbon sequestration) there may result in changes to land-use surrounding the Project. As such, in the absence of the Project, it might be expected that there would be an overall reduction in the extent of the heavily farmed agricultural land in the surrounding landscape, potentially alongside increases in woodland cover. This is unlikely to increase the value of biodiversity features currently identified by 2029 due to the time taken for newly created habitats to mature.

6.7.171 The changing climate is also expected to have a long-term effect on the biodiversity baseline, with a trend towards warmer conditions and more extreme weather events. No species or habitats have been identified that are on the extreme edge of their range within the study area (which would be expected to be more sensitive to climatic changes in the short term), and therefore it is not expected that climate change will significantly affect the biodiversity present within the study area by the opening year.

6.7.172 Planned future developments have been taken into consideration during the assessment (for example, changes in future traffic that would affect air quality and hence vegetation).

6.8 Potential impacts

6.8.1 Based on the Project design and associated construction activities, the Project has the potential to impact upon biodiversity during both construction and operation.

6.8.2 The design of the Project, including any embedded mitigation measures that have been incorporated, are described in Chapter 2: The Project. Any key aspects of the design and embedded mitigation are also referenced in this section where they are directly applicable to the biodiversity assessment.

6.8.3 Potential impacts of the Project are described in this section prior to the implementation of the essential mitigation described in section 6.8: Potential impacts below. The residual effects of the Project, taking into account this essential mitigation, are then described in section 6.9: Essential mitigation and enhancement measures.

Construction

Design and embedded mitigation

6.8.4 Avoidance and minimisation of impacts on important biodiversity features has been incorporated throughout the development of the design of the Project. Details of relevant elements which have been incorporated into this assessment are described in Section 2.

6.8.5 In addition, the Project Design Principles (Application Document 5.11) outlines measures to reduce impacts in relation to habitats, including:

- Use of ecologically sensitive lighting where possible
- Improved ecological connectivity to Trout Beck through provision of woodland planting
- The structure crossing Trout Beck must allow for full functionality of supporting river processes

6.8.6 The assessment of impacts on biodiversity also assumes the implementation of the following embedded measures, which are secured through the EMP (Application Document 2.7) and associated management plans:

- Pre-construction biodiversity surveys, to update the baseline, inform the requirements for European Protected Species Licences (EPSL) or development licences if required, and inform suitable construction method statements. These surveys will include, but not be limited to, the following:
  - Schedule 9 listed invasive plant species surveys, both terrestrial and aquatic, undertaken at the appropriate time of year to inform any requirement to avoid or remove invasive species. Any such removal or treatment should be undertaken under advice of a specialist invasive non-native species contractor
  - Badger activity and badger sett surveys within the Order Limits of the Project, to be undertaken at an optimal time of year
  - Reptile surveys in the year prior to construction commencing to confirm presence/absence within the habitats identified as potentially supporting reptile species, to inform mitigation required to prevent injury or harm
  - Roost activity surveys will be undertaken pre-construction and during construction on the maternity roosts at Eden View Cottages (Roost 11), Old Stone Barn (Roost 23), Streetside Farm (Roost 29) and Rokeby Grove (Roosts 30 to 32) in order to monitor the effects of the Project on these maternity roosts. Where a notable drop in bat numbers, or roost abandonment, is observed during these surveys, further restrictive working measures will need to be employed under the direction of the Ecological Clerk of Work (ECoW)
  - For both shingle banks and riparian sand, it should be noted that these can move significantly during high water flow events and therefore surveys will be undertaken to ensure none are present

when construction is due to begin. In the unlikely event that shingle banks are identified during pre-construction surveys and potential impacts are considered likely (i.e. where in-channel works are required), further surveys would be required to establish the presence of invertebrates of importance using the shingle. Subsequently, Method Statements would need to be prepared to ensure that the features are protected during works under the direction/supervision of the ECoW (e.g. exclusions zones, restrictions to channel alterations etc).

- Adherence to the EMP (Application Document 2.7) in which avoidance and mitigation measures have been included to minimise the effects of construction on biodiversity features. Measures include, but are not limited to, the following:
  - Implementation of biosecurity best practice described as 'check, clean, dry'
  - Dust suppression methods which avoid and minimise effects caused by the deposition of dust by construction traffic and construction related activities
  - Measures to ensure compliance with *BS 5837 (2012) – Trees in Relation to Design, Demolition and Construction (BS 5837)* (British Standard Institution, 2012)[32] to secure appropriate protection of retained trees and hedges during construction
  - Fencing will be used in order to ensure no accidental encroachment on retained habitats, specifically where construction works are adjacent to designated sites
  - Should permanent fencing be required within Graham's Gill/Jack Wood ancient replanted woodland or Skirsgill Wood CWS, fence posts will be hand dug to avoid heavy machinery being used which may result in ground compaction. In addition, low pressure vehicles and vehicle mats or pads to avoid ground compaction will be used where required
  - Implementation of a lighting strategy to prevent light spill from construction, and specifically to ensure artificial lighting is not positioned where it would fall on a main badger sett, or well used paths leading directly from a main badger sett (determined following the pre-construction survey)or barn owl foraging habitat
  - Avoidance of excavation works or movement of heavy machinery within 30m of active badger setts as determined following the pre-construction survey
  - Implementation of measures to avoid injury and mortality to badger and other species within construction areas. This will include, but not be limited to the provision of exclusions measures of badger and other wildlife from excavations. If access cannot be prevented, then provision of a means of escape with will be provided escape, from any excavations for the duration of construction
  - Speed limits along all haul roads and within all construction areas

[32] British Standards Institution (2012) Trees in relation to design, demolition and construction. Recommendations. BS 5837 2012.

- Where tree felling results in a reduction of potential roosting opportunities, alternative roosting opportunities in the form of bat boxes will be installed in adjacent unaffected habitats
- Construction works will need to be undertaken sensitively in proximity to identified bat roosts and established flight lines, with particular emphasis on key seasonal timings for bats, namely the maternity period and the weeks before and after the hibernation period. These key periods extend from May to August and November to March respectively. Protection zones around roosts are dependent on the type of work being undertaken. For light works using handheld tools, a 10m protection zone is recommended. For works generating noise and vibration, a minimum 30m protection zone should be applied. Specifically, works during the maternity period, between May and August inclusive, should be avoided where summer or maternity roosts are present or likely to be present within 30m. For structures such as buildings or bridges with hibernation potential, the hibernation period from November to the end of February inclusive should also be avoided, as these times of year are particularly sensitive times for bats, where they may be at an increased risk of suffering adverse effects from disturbance.
- Production of an invasive non-native species (INNS) management plan which will be produced by the Contractor(s) (in consultation with specialist contractors)
- Instream works, or works close to the river banks giving rise to excessive (>13mm/s Particle Peak Velocity) vibration will be undertaken outside of the key fish spawning and incubation period of 1st October to 31st May
- No compaction, piling (or other activities resulting in Peak Particle Velocities (PPV) of greater than 13mm/s) will be permitted with 5m of watercourses with gravel substrate that support gravel spawning species (salmon, trout, lamprey sp., bullhead) without prior consultation with the Environment Agency and Natural England
- If works giving rise to significant vibration are required adjacent to potential spawning gravels, redd surveys (Lemon and Rummel, 2020)[33] to determine whether spawning has occurred within the zone of impact would be undertaken, and the acceptability of in-channel works agreed with the Environment Agency and Natural England (depending on location)
- Any water storage areas, for example, water butts, troughs, tanks, should always be covered to prevent barn owls and other wildlife from drowning
- Any use of rodenticide should be avoided where possible on construction compounds so as to prevent deaths of barn owls through eating poisoned rodents. The Barn Owl Trust provides

[33] Lemon, J. and Rummel, S. (2020) Redd Survey Handbook]

guidance in relation to the safe use of rodenticides with respect to barn owls (Barn Owl Trust, 2021)[34].

6.8.7 The EMP also details the requirement for a permanent Ecological Clerk of Works (ECoW) role during the construction phase of the Project. The ECoW role will be required to ensure that all measures and methods detailed within this section and within the EMP (Application Document 2.7), including monitoring surveys are adhered to.

6.8.8 Of particular note, the ECoW role will include, but not be limited to, the following:

- ECoW presence on specific sites and during specific tasks which have the potential to impact protected/sensitive species/habitats
- delivering toolbox talks highlighting the importance of avoiding incidental impacts on species such as amphibians and outlining key control measures in relation to INNS management
- overseeing dusk and night time works relating to protected/sensitive species and habitats as required.
- reviewing and approving any crepuscular or night-time working within 30m of all bat roosts and any night time works in the bat active season in close proximity to flight lines of district importance or above to ensure the work practices will not be at risk of causing elevated bat mortality of bats exiting or entering the roost as a result of either direct site vehicle collision or indirectly through site activities forcing a change in behaviour of bats, resulting in harm from local road traffic or changes in local lighting. The sensitive maternity period between May to August and hibernation period between November and March are of particular note, particularly with juvenile bats at risk when flying close to the maternity roost. Roosts requiring specific ECoW input include, but are not limited to, the following:
  - construction activity in the area surrounding Monks Rest Farm (Roost 35) will require consultation with the ECoW to determine requirement for restrictions to work activities to prevent direct and indirect roost disturbance effects. These may include, but are not limited to, timing of works within certain months of the year, lighting plans to reduce overnight light spill, limitation of works generating noise and vibration within 30m of the roost and further surveys, for example endoscope or thermal imaging checks.
  - any site clearance or construction works within 30m of the maternity roosts identified at Eden View Cottages (Roost 11), the stone barn roost to the north of Blacklodge Farm underpass (Roost 23), Street Side Farm (Roost 29) and Rokeby Grove (Roosts 30, 31 and 32) and the replacement bat houses for Roosts 3 and 24 will require individual consideration with regard to the limitations and timings of physical works with the potential to result in disturbance, such as piling, earth moving activities or vegetation clearance of linear habitats radiating away from the roost location.

[34] Barn Owl Trust (2021) Barn Owl Hazards: rat poison

Activities will be subject to agreement with an ECoW in advance of the works.

- managing fish translocation and white-clawed crayfish translocation where required
- monitoring of barn owl and their nests within 500m of the Project to ensure any new active nest is identified and assessed by a licensed barn owl ecologist
- monitoring of all mitigation measures throughout construction to ensure all measures are being maintained or enacted in accordance with relevant best practices and industry standards, where relevant and as agreed in advance of the works (CIEEM, 2021)[35].

6.8.9 To mitigate impacts on GCN, offsite mitigation has been purchased through a district level licence provided by Natural England. This fully discharges the requirement for GCN specific mitigation. The Impact Assessment and Conservation Payment Certificate (IACPC) is provided as an annex to ES Appendix 6.6: Amphibian (Application Document 3.4).

6.8.10 To mitigate impacts to reptiles, a combination approach of exclusion and displacement has been agreed with Natural England (see Table 6-8: Summary of key consultation comments received) and this will be further detailed within a Reptile Method Statement to be prepared prior to site preparation and construction works commencing.

6.8.11 This comprises:

- The installation of reptile proof fencing (some of which may remain in place for the duration of construction) and drift fencing (used to compartmentalise the capture and translocation areas) under supervision of the ECoW
- Capture and translocation of reptiles to pre-identified areas capable of supporting reptiles, to be undertaken by the ECoW
- Displacement by habitat manipulation.

6.8.12 Prior to construction a Reptile Method Statement will be prepared which will detail the location where these methods are used. The Reptile Method Statement will be informed by the surveys described in ES Appendix 6.7: Reptile (Application Document 3.4) to confirm the presence or absence of reptiles and identify suitable receptor sites and detail the preparation and management required of these receptor sites in order for them to receive translocated reptiles.

6.8.13 The Reptile Method Statement will also develop a mitigation solution that ensures an increase in area of better-quality habitat than that lost to development and that these habitats are well connected to the wider landscape.

[35] Chartered institute of Ecology and Environmental Management (2021) Good Practice Guidance for Habitats and Species

6.8.14 Rivers and streams will be protected during construction through the implementation of best practice construction techniques and pollution prevention. Site-specific measures, as secured in Annex B7 of the EMP (Application Document 2.7) and will include a surface water management system using measures such as temporary silt fencing, cut off ditches, settlement ponds and bunds. These will be set up early in the construction period to capture all runoff and prevent ingress of sediments and contaminants into existing drainage ditches where necessary. This will be managed by the EMP in accordance with CIRIA guidelines and the Environment Agency's approach to groundwater protection and groundwater protection guidelines (Environment Agency, 2018)[36] (Construction Industry Research and Information Association, 2006)[37].

6.8.15 Direct loss of aquatic habitat has been minimised through mitigation embedded in the design of the Project. Open span watercourse crossings that will avoid the loss of aquatic habitat within Tout Beck, which forms part of the River Eden SAC (Temple Sowerby to Appleby) and functionally linked watercourses in the Appleby to Brough scheme, forms part of the design. This design feature is secured through the Project Design Principles (Application Document 5.11).

6.8.16 Watercourse crossings have been designed to facilitate the free movement of aquatic and riparian species, for example, through culverts.

6.8.17 On smaller watercourses where new culverts are proposed, or where existing culverts are to be replaced or extended, their design will be in accordance with CD 529 (Design of outfall and culvert details) and CIRIA C786 (Culvert, Screen and Operation Manual guidance) during detailed design.

6.8.18 In order to reduce riparian habitat loss and maintain natural geomorphological processes, new discharges to the River Eden SAC and functionally linked watercourses will be open ditches with no headwall where natural river banks are present under baseline conditions. This will allow free migration of the channel and natural geomorphological change to occur. Where artificial banks, or bank protection is in place under baseline conditions, discharges will tie into the existing river bank structures.

6.8.19 Embedded design measures relevant to otter comprise 17 new culverts and the installation of ledges on five existing culverts (Table 6-11: Embedded mitigation otter crossings) to allow for the continued passage of otter alongside watercourses.

[36] Environment Agency (2018) 'The Environment Agency's approach to groundwater protection'

[37] Construction Industry Research and Information Association (2006) Control of Water Pollution from Linear Construction Projects (C648) https://www.ciria.org/ProductExcerpts/C648.aspx

6.8.20 The design of any culvert should allow for plenty of air space above the water during times of flood or if this is not possible an alternative route should be provided. It is vital that any bridge or culvert has provision for otters to walk under the road during spate levels. All ledges should be at least 500 mm wide and must be accessible from the bank by ramps.

6.8.21 There must also be provision for the otter to gain access to the ledge from the water, either via the bank, or by use of a ramp sloping down to below the water level. The ledge should be sited at least 150 mm above the highest water level and allow for 600 mm headroom (Highways Agency, 2001)[38].

Table 6-11: Embedded mitigation otter crossings

Scheme	Mitigation Measure	New/ Existing	Description	Location (OS Grid Reference)
M6 Junction 40 to Kemplay Bank	Culvert	Existing	Addition of ledges to the existing culvert	NY 52484 29334
Penrith to Temple Sowerby	Culvert	Existing	Installation of ledges to the existing box culvert OR creation of separate underpass	NY 54911 28974
Temple Sowerby to Appleby	Otter passage	New	Bridge design should allow space between the abutments of the bridge and the river bank to enable otters to pass at times of high water flow. The abutments should be set back far enough to allow the natural riverbank and riverbed to be retained.	NY 64999 24479
Appleby to Brough	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding, to encourage use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NY 73567 17021
Appleby to Brough	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding, to encourage use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NY 74446 16446
Appleby to Brough	Addition of ledges	Existing	Addition of ledges to the culvert	NY 74941 16299
Appleby to Brough	Box culvert/	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even	NY 74945 16211

[38] Highways Agency (2001) Design Manual for Roads and Bridges, Volume 10, Section 4, Nature Conservation Advice in Relation to Otters

Scheme	Mitigation Measure	New/ Existing	Description	Location (OS Grid Reference)
	ledges/ underpass		during flooding, to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	
Appleby to Brough	Box culvert/ ledges/ underpass	New	Natal/maternity otter holt. Destruction should be avoided where possible. If holt is destroyed, otter passage is required. Bridge with space between abutments preferred option. Box culvert with ledges- base of culvert min 150 mm below the height of the riverbed second option.	NY 75040 16117
Appleby to Brough	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NY 75180 15897
Appleby to Brough	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NY 75277 15826
Appleby to Brough	Ledges or underpass	Existing	Use of ledges if existing culvert is large enough for ledges and dry passage for otter even during flood time. Where dry passage is not possible, creation of underpass adjacent to watercourse	NY 75479 15830
Appleby to Brough	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NY 77314 15257
Appleby to Brough	Box culvert	Existing	Addition of ledges within box culvert	NY 78342 15152
Cross Lanes to Rokeby	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding, to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NZ 04650 13691
Cross Lanes to Rokeby	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding, to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible	NZ 04776 13814

Scheme	Mitigation Measure	New/ Existing	Description	Location (OS Grid Reference)
Cross Lanes to Rokeby	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NZ 04904 13951
Stephen Bank to Carkin Moor	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NZ 15126 09222
Stephen Bank to Carkin Moor	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding, to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NZ 15700 08706
Stephen Bank to Carkin Moor	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding, to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NZ 16045 08389
Stephen Bank to Carkin Moor	Box culvert/ ledges/ underpass	New	Bridge with no impact on banks - preferred option. Box culvert second option. Dry passage required, even during flooding, to encourage the use of ledges. Underpass created adjacent to watercourse if dry passage not possible.	NZ 16282 08091
Stephen Bank to Carkin Moor	Ledges/ underpass	New	Addition of ledges to existing box culvert	NZ 16359 08210

Potential impacts before essential mitigation and enhancement

6.8.22 The majority of potential impacts will arise during the construction phase. The potential impacts associated with construction are based on the assumption that the construction phase will last approximately five years (2024 to 2029), though this timescale will vary for individual schemes within the overall five-year programme.

Habitat loss

6.8.23 Temporary and permanent habitat loss will occur routewide. The indicative site clearance boundary (shown in ES Figure 2.2: Indicative site clearance boundary (Application Document 3.3)

shows the likely extent of temporary and permanent habitat loss to facilitate construction.

6.8.24 The illustrative highway designs detailed for each scheme (shown in the illustrative General Arrangement drawings (Application Document 2.5) show the likely extent of permanent habitat loss. The types of habitat lost permanently are predominantly improved grassland, arable land, hedgerows, woodland and semi-improved grassland.

6.8.25 The remainder of the area included within the indicative site clearance boundary that falls outside the permanent land take, will be used for temporary construction compounds, haul and access routes, storage and borrow pits. Temporary land take areas will be reinstated post-construction taking account of disturbance and compaction or will be utilised for environmental (ecological or landscape) mitigation planting.

Fragmentation of populations or habitats

6.8.26 Construction of the Project will cause temporary and permanent habitat fragmentation through habitat loss, severance and disturbance. This will have the greatest impact on schemes which are all or partially offline, including Temple Sowerby to Appleby, Appleby to Brough, Cross Lanes to Rokeby and Stephen Bank to Carkin Moor.

6.8.27 Noise and temporary lighting from construction compounds and vehicle movements along haul routes may compound disturbance effects and deter species from crossing an area to reach an important resource.

Disturbance

6.8.28 Construction activities including vehicle and personnel movements, noise and vibration may have potential impacts on sensitive species such as breeding and over-wintering birds, roosting bats and other mammals such as otters. If disturbance causes one or several individuals to move away from an area this can result in abandonment of young, reduction in territory and breeding opportunities, increased predation risk and use of critical energy reserves.

6.8.29 Temporary lighting for construction may affect nocturnal species including bats by deterring use of traditional foraging resources, commuting routes or roost locations, and altering the availability of airborne invertebrate prey.

Habitat damage or degradation

6.8.30 Habitats within or adjacent to the site clearance boundary of the Project (for the purposes of the assessment, this is assumed to be the area shown in Figure 2.2: Indicative site clearance boundary (Application Document 3.3), and those which are hydrologically connected, will be at risk of damage and degradation as a result of sediment run-off, water pollution, and dust and vehicle emission deposits.

6.8.31 Changes to temporary drainage and the hydrological regime may lead to loss, degradation or pollution of sensitive habitats. This is particularly relevant at the crossing of Trout Beck which forms part of the River Eden SAC and River Eden and Tributaries SSSI. Further details of potential impact pathways are discussed in Chapter 14: Road Drainage and the Water Environment.

6.8.32 Increased deposition of dust on sensitive habitats may cause degradation (for example, loss of species or alteration of vegetation community). This is particularly relevant to habitats such as ancient woodland, veteran trees and sites designated for their habitat composition such as River Eden and Tributaries SSSI, Chapel Wood LWS, and Rokeby Park and Mortham Wood LWS.

Species mortality

6.8.33 Activities required for construction, such as vegetation clearance and topsoil stripping, have potential to injure and kill a wide range of species. For example, slow moving species, such as reptiles, amphibians, hedgehogs, terrestrial invertebrates and nesting birds, are susceptible to vegetation clearance activities. Similarly, tree felling operations can directly injure or kill roosting bats, nesting birds and squirrels.

6.8.34 In-channel works may also risk injury or killing of fish, white-clawed crayfish and aquatic invertebrates.

6.8.35 In addition, depending on the timing of vegetation and site clearance, species may be in hibernation or breeding, increasing the risk of direct mortality. The effects of mortality on species populations will vary depending on their reproductive strategy, parental investment, how long-lived individual animals are, the rarity of the species and how well connected the habitat is to source populations. For example, site clearance on a habitat containing a rare species may affect long-term population viability, or destruction of a bat maternity colony may have a long-term effect on a regional population.

6.8.36 Temporary construction traffic and vehicle diversions may also increase the chance of a road traffic collisions, particularly on species such as badger, otter, deer, polecat, hedgehog, bats and barn owl.

6.8.37 Increased mortality may also be caused by risk of entrapment in excavations, storage piles and equipment

Operation

Design and embedded mitigation

6.8.38 Avoidance and minimisation of impacts on biodiversity features has been incorporated throughout the development of the design of the Project. Details of relevant elements which have been incorporated into this assessment are described in Section 2.

6.8.39 Watercourse crossings, if poorly designed, have the potential to alter fluvial geomorphological processes and the distribution and quality of aquatic habitats during operation. Open span watercourse crossings have been incorporated into the design to minimise impacts on fluvial geomorphological process. The design of watercourse crossings has been informed by and tested through. detailed fluvial geomorphology modelling as outlined in Chapter 14: Road drainage and the water environment and ES Appendix 14.9: Detailed Geomorphological Modelling (Application Document 3.4). This design feature is secured through the Project Design Principles (Application Document 5.11).

Potential impacts before essential mitigation and enhancement

Fragmentation of populations or habitats

6.8.40 During the operational phase, the Project will result in permanent habitat fragmentation as a result of severance. The east-west alignment of the Project will result in loss of ecological connectivity for north-south movements, which has potential implications for ecosystem and species resilience.

Disturbance

6.8.41 Operational traffic noise and lighting may have permanent effects on how species use foraging, commuting and breeding resources. Spatially limited and ubiquitous species may habituate to areas with higher disturbance effects (Bennie, et al.,, 2018)[39]. However, increased levels of disturbance, such as noise and lighting, will displace most species, including inhibiting and compromising breeding in faunal species. In plants disturbance impacts have been shown to affect vegetation composition and times of flowering as a result of effects upon plant and invertebrate interactions (foraging). (Bennie, et al., 2016)[40].

6.8.42 Roads and associated infrastructure, such as footpaths, cycle paths and bridleways, may also increase levels of human disturbance, as a result of improved access to recreational areas.

Habitat damage or degradation

6.8.43 Habitats within or adjacent to the operational Project, and those which are hydrologically connected, will be at risk of indirect damage and degradation through permanent changes to drainage, pollution from road-run off, changes to vehicle emissions and nitrogen deposition. The permanent effects of changes to drainage design and pollution from the operational road surface are detailed in Chapter 14: Road Drainage and the Water Environment.

[39] Bennie, J., Davies, T.W., Cruse, D., Bell.F.,Gaston, K.J., (2017) Journal of Applied Ecology 2018; 55;442-440 for Artificial light at night alters grassland vegetation species composition and phenology

[40] Bennie, J., Davies, T.W., Cruse, D., Gaston, K.J., (2016) Journal of Applied Ecology 2016; Vol104; issue3; pgs611-620 for Ecological effects of artificial light at night on wild plants

6.8.44 Increased deposition of nitrogen and other airborne pollutants arising from increased traffic volumes in the wider road network and diversions, may also affect the integrity of vegetation communities. This may occur through changes in chemical status of the soil, accelerating or damaging plant growth, altering vegetation structure and composition and causing the loss of sensitive typical species associated with the community.

Species mortality

6.8.45 Habitat severance may result in species crossing the new carriageway to access foraging and breeding resources. This is likely to result in an increased risk of road traffic accidents through vehicle collision, causing injury and direct mortality. This is particularly likely to impact larger mammal species such as deer, badger and otter, although many other smaller species are also susceptible to direct mortality from vehicle collision. Barn owl can be particularly susceptible to road traffic collision as they forage on roadside verges, and equally, many bat species are at risk of collision with vehicles as they fly low when crossing roads.

6.8.46 In addition, species with reduced ranges, compromised foraging or breeding resources, and suffering stresses from changes to their environment, may be more susceptible to wildlife diseases as a result of the works.

6.9 Essential mitigation and enhancement measures

6.9.1 The Project incorporates measures that are considered essential mitigation in order to mitigate for the potential impacts described in section 6.8: Potential impacts which cannot be avoided or minimised sufficiently.

6.9.2 The following sections outline these measures and how they would minimise the impacts of the Project on biodiversity. Details are provided in the Environmental Mitigation Maps (Application Document 2.8 and the EMP (Application Document 2.7).

Construction

Essential mitigation

Habitat loss

6.9.3 Habitats lost to the Project will be replaced on a like-for-like or better basis. Whilst biodiversity net gain is not currently a requirement within the policy set out in the NPSNN, the principles of net gain have been applied to the Project mitigation in order to maximise biodiversity within the footprint of the Project. Ratios for habitat replacement have been based on the prevailing national guidance, within the Natural England Biodiversity Metric 3.0 (Natural England, 2021)[41] and aim to achieve a no-net-loss outcome on a habitat replacement basis

[41] Natural England (2021) The Biodiversity Metric 3.0 (JP039)

6.9.4 Where the Project results in a loss of an identified bat roost, the roost will be compensated for in a form appropriate to the species of bat and type of roost, characterised by the baseline surveys.

6.9.5 All bat roosts will be replaced in accordance with a mitigation plan approved by Natural England through the EPSL. A bat mitigation licence (A13) will need to be applied for by the contractor, including a method statement, work schedule, reasoned statement and references for the named ecologist (where the named ecologist has not held a bat mitigation licence within the past three years). This document will cover all works that will impact upon known bat roosts, including details of the roosts such as species and number of bats, and the activities undertaken to mitigate the impacts caused.

6.9.6 Specifically, bat houses will be provided at two locations, High Barn (Roost 3) and Low Broats Farm (Roost 24). These bat houses will replace lost roosts in as close to like-for-like conditions as possible for the species impacted.

6.9.7 Replacement of tree roosting opportunities lost (within trees unconfirmed as roosts) as a result of site clearance will be required to mitigate the medium-term temporal reduction in tree roosting opportunities within the Project. These trees will be replaced by inclusion of pole-mounted bat boxes within areas of woodland habitat planting to provide a medium-term roosting resource as the created woodland matures. Installation of the bat boxes will be required at the earliest stage possible after the tree felling to prevent any short-term absence in tree roosting resource.

6.9.8 Existing mature trees recorded to have moderate or high bat roost potential within the baseline surveys will determine the equivalent number of replacement roosting opportunities through inclusion of one rocket style bat box (Nextbox Company, 2022)[42] per five moderate or high potential trees to be lost. Within the Order Limits, there are 193 trees with moderate or high bat roost potential, equating to the provision of 39 bat boxes. These will be located along linear habitats or within woodland edge habitats. Tree mounted bat boxes of mixed designs will also be used where access to established local woodland or tree lines allows.

6.9.9 Where the Project results in the loss or disturbance to a main sett or annexe sett, an artificial sett will be built (for each sett impacted) and the existing sett closed. In addition, any setts classified as subsidiary or outlier setts that are impacted by disturbance will also require closure however an artificial sett is not required to be constructed.

[42] Nestbox Company (2022) Eco Rocket Bat Box

6.9.10 Disturbance requiring closure is likely to result from any excavation, noise emitting or vibration emitting works within 30m of a sett.

6.9.11 Artificial setts will be constructed within suitable habitat within the territory of the main sett (informed by the results of bait marking surveys) and, in relation to replacement for a main sett, construction of the artificial sett would take place at least six months in advance of closure of the main sett.

6.9.12 This work would be subject to approval from Natural England and would need to be carried out under a development licence, applied for by the contractor. Licences for these reasons are normally only granted for sett closures to be undertaken in the period 1st July to 30th November (outside the breeding season for badger).

6.9.13 It is essential that the suitable habitat surrounding the artificial sett is retained and maintained. Due to the prevalence of suitable habitat for badger within the Order Limits, it is likely that the artificial setts can be constructed in areas where habitat creation to support badger would not be necessary.

6.9.14 As part of the habitat mitigation work, habitats suitable for badger foraging will be created within the Order Limits of the Project. This mitigates for the loss of foraging and sett building habitat as a result of the Project, but also provides the opportunity for existing badger populations to expand into previously unsuitable habitat.

6.9.15 Riparian habitat adjacent to Light Water (upstream of the existing A66) will be improved through woodland planting. Planting will connect areas of existing riparian woodland to the north and south of the existing A66. This will mitigate for the loss of riparian habitat associated with the extension of the existing Light Water culvert and new crossing required to enable access to the attenuation ponds.

6.9.16 Riparian habitat adjacent to adjacent Swine Gill (both upstream and downstream of existing A66) will be improved through woodland planting and management. This will connect and extend areas of existing woodland and mitigate for the loss of riparian habitat associated with the extension of the existing Swine Gill culvert.

Habitat fragmentation

6.9.17 Greening of the proposed bridges detailed in Table 6-12: Locations of greening of bridges to maintain habitat connectivity will maintain north-south connectivity, reduce the barrier effect of the Project and avoid species mortality that could otherwise be caused by potential road traffic collisions.

6.9.18 Replacement planting on both sides of the bridges will maximise the effectiveness of the mitigation's connectivity to surrounding habitats. Inclusion of both light and noise deflection screens into

the bridge design further enhances the mitigation's effectiveness to provide a sheltered crossing point for species such as bats commuting within the landscape.

Table 6-12: Locations of greening of bridges to maintain habitat connectivity

Chainage	Name of Structure
31590	Cross Street overbridge
34470	Fell Lane overbridge
33320	Sleastonhow Lane overbridge
37550	Rogerhead Farm overbridge
44340	Warcop overbridge
52490	East Bowes accommodation access bridge
60050	Cross Lanes junction overbridge
72080	Collier Lane, West Layton

6.9.19 The green bridges will incorporate a minimum 1m wide strip of wooded scrub along one road verge, with connective planting to the north and south approaches of the bridge, providing a continuous green corridor across the live carriageway.

6.9.20 Planting of woodland habitats, including linear woodland and hedgerows, on both the northern and southern approaches to the underpass structures listed in Table 6-13: Locations of planting surrounding underpasses to maintain habitat connectivity, will also provide connectivity for species such as bats across the Project once in operation.

Table 6-13: Locations of planting surrounding underpasses to maintain habitat connectivity

Chainage	Name of Structure
11120	Carleton Hall underpass
20860	Lightwater culvert
21930	Whinfell Park accommodation underpass
23080	Centre Parcs junction underpass
31090	Priest Lane underpass
35330	Long Marton Lane
36670	Crackenthorpe underpass
42960	Sandford underbridge
43200-43270	Cringle Beck underbridge
45740	Flitholme underbridge
51700	Blacklodge farm underpass
62190	Rokeby Junction underbridge
73550	Moor Lane underbridge

6.9.21 Blacklodge Farm underpass will also require open mesh bat fencing7 or a suitable alternative extending for 100m to the west and 50m to the east of the underpass on both the north and south sides to avoid and minimise the potential for bats to fly across the

new widened carriageway in this location, and encourage bats to use the underpass.

6.9.22 In addition to the green bridges, the design incorporates mammal underpasses, specifically designed for badger however also facilitating the movement of many species north-south (Table 6-14: Mammal underpass locations).

Table 6-14: Mammal underpass locations

Scheme	Crossing point grid reference
Penrith to Temple Sowerby	NY54702897
	NY55142895
	NY55612893
	NY56402888
	NY57342884
	NY57562882
	NY58202875
Temple Sowerby to Appleby	NY63322622
	NY65912334
Appleby to Brough	NY72681749
Stephen Bank to Carkin Moor	NZ15200914
	NZ16060837

6.9.23 The installation of these underpasses will be phased during construction, with some existing underpasses retained until new underpasses have been constructed to ensure badger are able to move across the Project throughout the construction phase. For example, within the M6 Junction 40 to Kemplay Bank scheme, badger are recorded to use the underpass below the existing A66 which connects the Police Station to the A686. Without considered programming, if this underpass were to be blocked or heavily disturbed during construction without the provision of an alternative, it is likely that badger, which are habituated to this route, will seek to cross the existing A66.

6.9.24 Where known bat flight lines are severed as a result of construction, temporary hedgerows or treelines will be reinstated each evening and overnight throughout the construction period, with bat activity monitored by the ECoW (Section 6.8: Potential impacts). Particular emphasis will be required on the flight lines radiating away from maternity roosts that are intersected by the Order Limits.

Enhancement

6.9.25 A number of pressures and potential opportunities to enhance aquatic habitats, improve water quality, and improve connectivity of for fish and other aquatic species were identified during surveys and habitat assessment. These opportunities will develop further at detailed designs stage and include:

- Barriers to fish migration; Thacka Beck (M6 Junction 40 to Kemplay Bank) is disconnected from the River Eamont under low flow conditions as the watercourse is significantly perched at the confluence with the River Eamont, which restricts fish migration between the two rivers under low flows. Fish passage improvements could be made locally to address this.
- Degradation of riparian habitats as a result of poaching (sheep) of the banks was recorded along Light Water and Unnamed Tributary of River Eamont 3.3 (Penrith to Temple Sowerby). Improvements in riparian and instream habitat, as well as water quality improvements through reduced nutrients and fine sediment input, could be achieved through the addition of stockproof fencing and riparian planting.
- A small weir on Unnamed Tributary of Mire Sike 6.12 (Appleby to Brough) was assessed as likely to be impassable by all fish species under normal flow conditions. Removal or mitigation of this weir has the potential to improve connectivity of habitats locally.
- Removal of redundant culvert on Eastfield Sike associated with the MOD tank turning area. The current Flood Risk Assessment is based on modelling that assumes the presence of this culvert and the acceptability of this mitigation, in terms of flood risk, will need to be fully assessed during detailed design.
- Extensive poaching (sheep) was recorded along Eastfield Sike (Appleby to Brough). Improvements in riparian and instream habitat, as well as water quality improvements through reduced nutrients and fine sediment input, could be achieved through the addition of stockproof fencing and riparian planting.
- A 300m length of Mains Gill is within a culvert. There is potential to daylight this section by removing the pipe culvert reconnecting habitats locally. The value of this mitigation, in terms of fish, should be assessed noting that the existing A66 culvert presents a barrier to the upper reaches of Mains Gill and that this section is ephemeral.

6.9.26 Opportunities to enhance the habitat in Unnamed Tributary of Mire Sike 6.12 and Unnamed Tributary of Lowgill Beck 6.1 were identified during baseline surveys. The surveyor noted a lack of large refuges for adult white-clawed crayfish to use in these minor watercourses which is considered a potential limiting factor on white-clawed crayfish population structure and density. Unnamed Tributary of Lowgill Beck 6.1 will be subject to minor realignment and the addition of a new culvert. Unnamed Tributary of Mire Sike 6.12 will be subject to culvert extension. As part of the works, larger sediment sizes (such as cobbles and small bounders) will be introduced to increase the productivity of habitat in the watercourses.

6.9.27 Additional barn owl nest boxes could be provided at approximately 1km to 2km intervals, where feasible. These should be placed no closer than 1km, ideally 2km, from the indicative site clearance boundary and in pairs within 500m of each other at a density of approximately one pair per km^2.

Operation

Essential mitigation

Species mortality

6.9.28 The landscaping and habitat replacement works are anticipated to provide equivalent habitat connectivity in an east-west direction across the Project, by linking habitats between the locations where crossing provision has been provided in the form of greening overbridges, planting leading from or to underbridges, and creating tree canopy links across the live carriageway. This will form part of the mitigation to avoid and minimise potential road traffic collision mortality arising from the operation of the Project.

6.9.29 One proven method for deterring badger from crossing an operational road and therefore reducing the likelihood of a road traffic collision is the use of badger fencing, placed to direct badger to specific crossing points.

6.9.30 Badger fencing will be installed on either side of the new badger culverts (to a distance of 500m each side) and on both sides of the road. The fencing will be used to guide badgers to the crossing by providing an angled approach or recess leading to the culvert.

6.9.31 Tree planting will take place at specific locations (Table 6-15: Locations of tree planting either side of new carriageway) on the verges either side of the new live carriageway to avoid and minimise potential injury and mortality caused by road traffic collisions by raising commuting bats over the live carriageway.

Table 6-15: Locations of tree planting either side of new carriageway

Chainage	Location
24130 - 24280	Swinegill Plantation
24910 - 25000	Whinfell House
32750 - 32800	Main Street Kirkby Thore
34900 - 34950	Long Marton Lane
60800 - 61000	Streetside Farm
63300 - 63690	Southern road verge between Rokeby Grove and Rokeby Park

Enhancement

6.9.32 Improvement of the existing habitats will enhance habitats for bats to forage and commute within in the short to longer term and for roosting in the longer term when the roost features develop in maturing trees.

6.9.33 Woodland areas that will be created across the Project will provide a mosaic of foraging resource in combination with the reinstatement of the linear habitats to provide landscape connectivity.

6.9.34 Provision of multiple engineering balancing ponds will provide focussed prey sources for bats that favour collecting prey over water or from around the marginal vegetation that will develop.

6.9.35 Mammal fencing will be installed associated with existing and proposed culverts (Table 6-11: Embedded mitigation otter crossings) to improve their use by otter. This will comprise 50mm mesh with a mesh overhang of 300mm, angled away from the road, to prevent otter from climbing up and over the fence, as referenced within the design manual for roads and bridges (Highways Agency, 2001)[43]. Otter fencing will be located within all schemes with the exception of Bowes Bypass and A1(M) Junction 53 Scotch Corner schemes.

6.10 Assessment of likely significant effects

6.10.1 This section identifies the likely biodiversity effects of the Project.

6.10.2 Due to the complexity of the biodiversity assessment, in terms of the number of biodiversity features considered and the number of potential pathways of potential impact assessed, the key findings of the assessment are summarised in this section for receptors of County importance/Medium sensitivity or above (see Section 6.4: Assessment methodology).

6.10.3 For all receptors categorised as of Local importance/Low sensitivity, it is anticipated that all effects will be mitigated for through the incorporation of the embedded and essential mitigation (see Section 6.8: Potential Impacts and Section 6.9 Essential Mitigation and Enhancement Measures). This will therefore result in a neutral residual effect for the following receptors:

- amphibians
- reptiles
- terrestrial invertebrates
- badger
- other terrestrial mammals (brown hare, hedgehog and polecat)
- aquatic macrophytes
- aquatic invertebrates

6.10.4 Further details regarding likely effects not predicted to be significant are presented in ES Appendix 6.1: Non-significant Effects (Application Document 3.4). Effects which remain within the moderate, large or very large-scale categories after implementation of mitigation (Table 6-5: Example descriptions to define the level of impact. Positive alternative descriptions are given in parenthesis, for example, negative [positive]) are considered significant and are described fully within this section.

[43] Highways Agency (2001) Design Manual for Roads and Bridges, Volume 10, Section 4, Nature Conservation Advice in Relation to Otters

Construction

6.10.5 The majority of potential effects will arise during the construction phase. These are described in the following sections.

Designated sites

River Eden SAC and River Eden and Tributaries SSSI

6.10.6 The River Eden SAC and River Eden and Tributaries SSSI have the same boundary, and are located within 2km of the Order Limits of the Project. The Project lies adjacent to these designated sites and will cross the designated sites and its associated tributaries within Temple Sowerby to Appleby and Appleby to Brough schemes.

6.10.7 The anticipated construction related impacts on these designated sites include:

- Habitat loss - minor habitat loss of the riparian habitat will occur in relation to the proposed attenuation basin discharges to the river. Trout Beck viaduct will be constructed within Temple Sowerby to Appleby
- Habitat or species fragmentation - fragmentation of qualifying species may occur as a result of disturbance from increased noise, vibration and lighting
- Habitat damage/degradation - non-native species may be introduced and/or spread. Impacts may be on the habitat itself e.g. damage to banks or directly on characteristic biota e.g. through predation, competition and disease
- Construction activities have the potential to generate water-borne pollution e.g. dust, fine sediments, fuels and oils. Poorly designed watercourse crossings and temporary and permanent floodplain utilisation have the potential to alter fluvial geomorphological processes locally. This may result in alterations of habitats locally and indirect effects on populations of qualifying species
- Disturbance - noise, vibration and lighting disturbance may impact on qualifying species
- Air quality- potential impacts on qualifying habitats.

6.10.8 The Appropriate Assessment relating to the River Eden SAC is provided within the HRA Stage 2: Statement to Inform Appropriate Assessment (Application Document 3.6).

6.10.9 The following embedded mitigation measures will be implemented which result in non-significant effects on the River Eden SAC and River Eden and Tributaries SSSI:

- Habitat loss - the habitat loss in relation to the attenuation basin discharges to the river are considered localised and minor and consequently do not result in significant effects. The construction of Trout Beck viaduct will not result in the physical loss of habitat and the viaduct piers will be set well back from the bank top
- Habitat or species fragmentation - measures to be implemented to minimise potential noise, vibration and lighting include the following:

instream works resulting in species fragmentation will be undertaken outside of the key salmonid breeding season; construction activities resulting in excess noise and vibration will be sensitively timed to reduce disturbance impacts on migrating fish; night working will be avoided where practicable adjacent to watercourses and will only be implemented where traffic management on a road necessitates it for safety; construction sites will not be illuminated at night, where possible (where this is not possible (e.g. due to security considerations in non-green field locations), lighting will be sensitive to nocturnal species using the river and riparian corridor and face away from the watercourse, thus reducing disturbance of nocturnal migrants)

- Habitat damage/degradation - an Invasive Species Management Plan will be produced by the Contractor(s) as specified in the EMP (Application Document 2.7). Site-specific measures regarding surface and groundwater quality, quantity and hydrogeology, dust and pollution prevention are secured within the EMP. Modelling data predicts the design of Trout Beck Viaduct does not affect the fluvial geomorphological processes both within the channel and on the floodplain
- Disturbance - as outlined in habitat or species fragmentation above

6.10.10 Air quality - the only qualifying feature assessed for air quality impacts for this site is 3260 watercourse habitat. This is a result of other qualifying features relating to impacts from nitrogen deposition, being absent at crossing points assessed as part of the air quality modelling. In the absence of a critical load value for 3260 watercourse habitat, the air quality assessment presents nitrogen deposition as a percentage change from baseline and the change in nitrogen deposition (kgN/ha/yr) from a single point immediately adjacent to the road. Increases in nitrogen deposition were recorded at the following crossings:

- River Eamont (A66 at Castle Bridge) upstream, increase of 1.64% - Penrith to Temple Sowerby NY5397229144
- Trout Beck (A66 proposed new crossing) downstream, increase of 1.18% - Temple Sowerby to Appleby NY6495624460

6.10.11 When considering the results of the air quality modelling it should be noted that whilst change in deposition rate is a useful metric to understand the net increase in pollutants in the air, this metric is less applicable to this aquatic habitat type. Aquatic plants that are a component of the vegetation community are submerged for the majority of the year due to their growth form, consequently they are regularly inundated and flushed during modest flood events.

6.10.12 The local contributions to nitrogen deposition (kg N/ha/yr) from sources (UK) shows that the largest contributor for the River Eden SAC is livestock (56.4% 8.81kgN/ha/yr) (APIS, 2022). The remaining sources of contribution (e.g. Europe import, fertiliser application) identified which are unrelated to road transport, equate to 38.2%. Nitrogen deposition in relation to road transport is the smallest identified source of 4.0% 0.63kgN/ha/yr (APIS,

2022). Based on this, it is considered that any increase in nitrogen deposition as a result of the Project, even a an increase over 1000 Annual Average Daily Traffic (AADT) will not make a considerable impact on the overall source of nitrogen deposition that the SAC currently receives from various other sources.

6.10.13 The contribution of nitrogen from road transport in the context of other nitrogen sources (as discussed above) is modest, especially when the flushing effect of the water is considered. The impacts are localised and therefore, it is considered that nitrogen deposition would not result in an adverse effect of this feature within the respective SSSI units. Subsequently no significant effect is predicted on the River Eden SAC and River Eden and Tributaries SSSI. Following application of the above mitigation, slight adverse (not significant) effects are predicted on the River Eden SAC and River Eden and Tributaries SSSI.

Temple Sowerby Moss SSSI

6.10.14 Temple Sowerby Moss SSSI is located approximately 143m north of the Order Limits of the Temple Sowerby to Appleby scheme.

6.10.15 The anticipated construction related impacts on the designated site include:

- Habitat damage/degradation - potential dust deposition as a result of construction related activities

6.10.16 The following embedded mitigation measures will be implemented which result in non-significant effect on Temple Sowerby SSSI:

- Habitat damage/degradation - site-specific measures regarding dust emitting activities in line with Institute of Air Quality Management (IAQM) guidance[44]. The potential for hydrological impacts has been reviewed and is identified as not likely, due to the new alignment cuttings being lower than the site, and therefore it is not possible for a hydrological impact upon this site (Chapter 14: Road Drainage and Water Environment), despite being within the potential impact risk zone for this SSSI as defined on MAGIC.

6.10.17 Following application of the above mitigation, neutral (not significant) effects are predicted on Temple Sowerby Moss SSSI.

North Pennine Moors SAC and SPA and Bowes Moor SSSI

6.10.18 The North Pennine Moors SAC and SPA, and Bowes Moor SSSI (and in this location sharing the same boundary, although these boundaries differing at distance) are located 255m west of Bowes Bypass Order Limits. This association of designated sites is adjacent to the existing A66 and consequently falls within the ARN.

[45] Natural England (2022) Ancient Woodland (England)

6.10.19 No further impact pathways were identified for this designated site. Subsequently no significant effects are predicted on North Pennine Moors SAC and SPA and Bowes Moors SSSI.

Eamont Bridge, Banks of River Eamont Site of Invertebrate Significance (SIS) and Lowther Bridge SIS

6.10.20 Eamont Bridge, Banks of River Eamont SIS are located adjacent to M6 Junction 40 to Kemplay Bank and are a component part of the River Eden and Tributaries SSSI. All comprise areas of sandbanks and gravel bar deposits within the River Eden SAC and River Eden and Tributaries SSSI, which support the associated SSSI designatory invertebrate species.

6.10.21 Lowther Bridge SIS is located 392m south of the Order Limits of M6 Junction 40 to Kemplay Bank but is hydrologically connected through the River Eden and Tributaries SSSI.

6.10.22 The anticipated construction related impacts on the designated site comprise:

- Habitat damage/degradation - construction activities have the potential to generate water-borne pollution, for example dust, fine sediments, fuels and oils. Potential for dust deposition from dust emitting activities which may smother vegetation and affect evapotranspiration and photosynthesis
- Poorly designed watercourse crossings and temporary and permanent floodplain utilisation have the potential to alter fluvial geomorphological processes locally. This may result in alterations of habitats locally and indirect effects on populations of invertebrates associated with sandbanks and gravel bar deposits.

6.10.23 The following embedded mitigation measures will be implemented which result in non-significant effects on the Eamont Bridge, Banks of River Eamont SIS and Lowther Bridge SIS:

- Habitat damage/degradation - Site-specific measures regarding surface and groundwater quality, quantity and hydrogeology, dust and pollution prevention are secured within the EMP (Application Document 2.7). Modelling data predicts the design of Trout Beck Viaduct does not affect the fluvial geomorphological processes both within the channel and on the floodplain

6.10.24 Following application of the above mitigation, no significant effects are predicted on the Eamont Bridge, Banks of River Eamont SIS and Lowther Bridge SIS.

Skirsgill Wood CWS

6.10.25 Skirsgill Wood CWS is located within the Order Limits of M6 Junction 40 to Kemplay Bank.

6.10.26 Skirsgill Woods CWS is of national value due to the presence of ancient woodland habitat, however it is not listed on the Ancient

Woodland Inventory (Natural England, 2022)[45]. Ancient woodland habitat was confirmed during the field habitat surveys in 2021.

6.10.27 The anticipated construction related impacts on the designated site include:

- Habitat loss - loss of woodland adjacent to and on the bank of the River Eden is required for the construction of new drainage from an attenuation basin. Compaction of soil and damage to, or loss of ground flora, or damage to adjacent trees as a result of construction activities
- Habitat damage/degradation - construction activities have the potential to generate pollution e.g. dust, fine sediments, fuels and oils. Potential for dust deposition from dust emitting activities which may smother vegetation and affect evapotranspiration and photosynthesis
- Potential spread of non-native invasive species which have been recorded within the woodland

6.10.28 The following embedded mitigation measures will be implemented which result in non-significant effects on Skirgill Woods CWS:

- Habitat loss - environmental mitigation takes account of the potential minor loss of or damage to trees required for the drainage. Fencing to be used to ensure no accidental encroachment on habitats outside of the area required for construction activities
- Habitat damage/degradation - an Invasive Species Management Plan will be produced by the Contractor(s) as specified in the EMP (Application Document 2.7). Site-specific measures regarding surface and groundwater quality, dust and pollution prevention are secured within the EMP (Application Document 2.7). Should permanent fencing be required, fence posts are to be hand dug to avoid heavy machinery being used. If machinery is required, low pressure vehicles and vehicle mats/pads are to be used to avoid ground compaction.

6.10.29 Following application of the above mitigation, slight adverse (not significant) effects are predicted on Skirsgill Wood CWS.

Yanwath Wood CWS and Yanwath Wood

6.10.30 Yanwath Wood CWS contains ancient woodland habitat but is not listed on the Ancient Woodland Inventory. It is situated 52m south of the Order Limits and on the southern bank of the River Eamont, part of the River Eden SAC and River Eden and Tributaries SSSI.

6.10.31 This site is of national value due to supporting and being designated for its broadleaved woodland (a HoPI), ancient woodland and the presence of red squirrel. No direct impacts are anticipated to this site. However, it is located within 200m of the construction works.

[45] Natural England (2022) Ancient Woodland (England)

6.10.32 The anticipated construction related impacts on the designated site include:

- Habitat damage/degradation - Potential dust deposition from dust emitting activities which may smother vegetation and affect evapotranspiration and photosynthesis
- Beneficial - woodland losses for other woodland habitat outside of this designated site are to be mitigated for through additional woodland planting proposed for the northern bank of the River Eamont, which is within linked habitat to this site. The site citation lists this as being the only location where both sides of the River Eamont are wooded, so this planting will add to this habitat and will serve to further buffer this designated site and provide additional linked habitat for the species within this site

6.10.33 The following embedded mitigation measures will be implemented which result in non-significant effects on Yanwath Wood CWS and Yanwath Wood as an ancient woodland habitat:

- Habitat damage/degradation: Site-specific measures regarding dust emitting activities from construction or haul routes are secured within the EMP (Application Document 2.7) and follow IAQM guidance (Institute of Air Quality Management, 2014)[46]

6.10.34 Beneficial: adjacent planting will be of native broad-leaved woodland species and sensitive to the species within this designated site.

6.10.35 Following application of the above mitigation, slight beneficial (not significant) effects are predicted on on Yanwath Wood CWS and Yanwath Wood as an ancient woodland habitat.

Whinfell Forest CWS

6.10.36 Whinfell Forest CWS is located 191m south of the Order Limits of Penrith to Temple Sowerby (Center Parcs).

6.10.37 The designated site is of national value due to supporting heathland (a HoPI), ancient woodland and the presence of red squirrel.

6.10.38 The anticipated construction related impacts on the designated site include:

- Habitat damage/degradation - Potential dust deposition from dust emitting activities which may smother vegetation and affect evapotranspiration and photosynthesis

6.10.39 The following embedded mitigation measures will be implemented which result in non-significant effects on Whinfell Forest CWS:

[46] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London

- Habitat damage/degradation: Site-specific measures regarding dust emitting activities from construction or haul routes are secured within the EMP (Application Document 2.7) and follow *IAQM guidance*.

6.10.40 Following application of the above mitigation, neutral (not significant) effects are predicted on Whinfell Forest CWS.

Salter Wood

6.10.41 Salter Wood, a Planted Ancient Woodland Site (PAWS), is located 191m south of the Order Limits of Penrith to Temple Sowerby (Center Parcs).

6.10.42 The boundary of one part of Salter Wood overlaps with Whinfell Forest CWS, the other is outside of the latter designation. Both blocks of this site are PAWS. Review of historical mapping indicates that this qualifies as ancient woodland.

6.10.43 The anticipated construction related impacts on the designated site include:

- Habitat damage/degradation - Potential dust deposition from dust emitting activities which may smother vegetation and affect evapotranspiration and photosynthesis

6.10.44 The following embedded mitigation measures will be implemented which result in non-significant effects on Salter Wood PAWS:

- Habitat damage/degradation: Site-specific measures regarding dust emitting activities from construction or haul routes are secured within the EMP (Application Document 2.7) and follow *IAQM guidance.*

6.10.45 Following application of the above mitigation, no significant effects are predicted on Salter Wood PAWS.

Bolton Shingle Bank, River Eden Oglebird Scar Ers and Temple Sowerby Shingle Bank SIS

6.10.46 These following three SIS sites of Bolton Shingle Bank (237m west of Order Limits), River. Eden, Oglebird Scar Ers (459m west of the Order Limits), Temple Sowerby Shingle Bank (603m north-west of the Order Limits) all comprise areas of sandbanks and gravel bar deposits within the River Eden SAC and River Eden and Tributaries SSSI, which support the associated SSSI designatory invertebrate species.

6.10.47 The anticipated construction related impacts on the designated site comprise:

- Habitat damage/degradation - Poorly designed watercourse crossings and temporary and permanent floodplain utilisation have the potential to alter fluvial geomorphological processes locally. This may result in alterations of habitats locally and indirect effects on populations of invertebrates associated with sandbanks and gravel bar deposits. Dust deposition with the potential to temporarily smother areas of gravel bar or sand banks, as habitat for invertebrate species

6.10.48 The following embedded mitigation measures will be implemented which result in non-significant effects on Bolton Shingle Bank SIS, River Eden, Oglebird Scar Ers SIS and Temple Sowerby Shingle Bank SIS:

- Habitat damage/degradation - Modelling data predicts the design of Trout Beck Viaduct does not affect the fluvial geomorphological processes both within the channel and on the floodplain. Site-specific measures regarding dust emitting activities from construction or haul routes are secured within the EMP (Application Document 2.7) and follow *IAQM guidance.*

6.10.49 Following application of the above mitigation, neutral (not significant) effects are predicted on Bolton Shingle Bank SIS, River. Eden, Oglebird Scar Ers SIS and Temple Sowerby Shingle Bank SIS.

Chapel Wood (Appleby in Westmoorland) LWS and Chapel Wood ASNW

6.10.50 Chapel Wood (Appleby in Westmoorland) CWS and Chapel Wood Ancient Semi-Natural Woodland (ASNW) lie adjacent to the Order Limits south of Temple Sowerby to Appleby.

6.10.51 Chapel Wood ASNW lies partially within Chapel Wood LWS.

6.10.52 The anticipated construction related impacts on the designated site include:

- Habitat damage/degradation - Construction activities and haul routes have the potential to generate pollution, for example dust, fine sediments, fuels and oils. Potential dust deposition from dust emitting activities which may smother vegetation and affect evapotranspiration and photosynthesis
- Accidental encroachment onto sensitive habitats within this site. With the potential for indirect effects upon vegetation through ground compaction which may affect growth success for ancient woodland trees and presence of ground flora
- Habitat loss - minor temporary habitat loss within Chapel Wood (Appleby in Westmoorland) CWS

6.10.53 The following embedded mitigation measures will be implemented which result in non-significant effects on Chapel Wood (Appleby in Westmoorland) CWS and Chapel Wood ASNW:

- Habitat loss - environmental mitigation takes account of the potential temporary minor loss of or damage to trees required for construction works. Fencing to be used to ensure no accidental encroachment on habitats outside of the area required for construction activities.
- Habitat damage/degradation: Site-specific measures regarding dust emitting activities from construction or haul routes are secured within the EMP (Application Document 2.7) and follow IAQM guidance. Fencing will be used in order to ensure no accidental encroachment on retained habitats. Works adjacent to this site will be 50m away from the boundary of the ancient woodland habitat, avoiding the

potential for impacts to trees within the ancient woodland habitat, or for loss of, or damage to ground flora.

6.10.54 Following application of the above embedded mitigation, slight adverse (not significant) effects are predicted on Chapel Wood (Appleby in Westmoorland) CWS and Chapel Wood ASNW.

Sandford Mire CWS

6.10.55 Sandford Mire LWS is located 7m south of the Order Limits of the Appleby to Brough (Warcop) scheme. It is hydrologically connected to tributaries of the River Eden SAC and River Eden and Tributaries SSSI.

6.10.56 The anticipated construction related impacts on the designated site include:

- Habitat damage/degradation - Construction activities have the potential to generate pollution e.g. dust, fine sediments, fuels and oils. Potential for impacts to groundwater dependent habitats within Sandford Mire, causing potential from vegetation change and damage to or loss of notable plant species.

6.10.57 The following embedded mitigation measures will be implemented which result in non-significant effects on Sandford Mire CWS:

- Habitat damage/degradation: Site-specific measures regarding surface and groundwater quality, dust and pollution prevention are secured within the EMP (Application Document 2.7)
- No specific measures are required regarding the potential for impacts via ground water, due to the scheme being above the level of the ground water for this site and presence of a cutting (rail line) between the Order limits and the site.

6.10.58 Following application of the above mitigation, neutral (not significant) effects are predicted on Sandford Mire CWS.

Four Special Roadside Verges C2P (10a and 10b), C25 (7a and 7b)

6.10.59 The four Special Roadside Verges are designated for their species-rich neutral grassland habitat and are located adjacent to each other and form the verges of the Road to Sandford village (C25 7a,7b) and the B6259 (C2P 10a,10b) to Warcop. The sites are parallel to each other on either side of the road and at the following distances from the Order Limits (in brackets following the site reference): C2P 10b (12 metres), 10a (32 metres), and C25: 7a (13 metres) and 7b (33 metres) are all outside of and south of the Order Limits of the Appleby to Brough (Warcop) scheme. The relationship of the four Special Roadside Verges to adjacent surface water from Cringle Beck and Mire Sike, or to ground water, is not known, but being species-rich there may be some connection to this resource.

6.10.60 The anticipated construction related impacts on the designated site include:

- Habitat damage/degradation - construction activities (works and haul routes) have the potential to generate pollution for example dust, fine sediments, fuels and oils
- Changes to local drainage may affect the ground or surface water to the local soils here and indirectly affect the plant species by creating different conditions which may then support different plant species and create a different vegetative type which is less species-rich

6.10.61 The following embedded mitigation measures will be implemented which result in non-significant effects on the Special Roadside Verges C25: 7a, 7b or C2P:10a, and 10b.

6.10.62 Habitat damage/degradation: Site-specific measures regarding surface and groundwater quality, dust and pollution prevention are secured within the EMP (Application Document 2.7). Groundwater and surface water are not considered to be a significant impact to this site based on a hydrological review, due to this site being lower in the landscape than the proposed construction works to the north and the presence of the rail cutting which provides a barrier for perceived ground water flow impacts. The surface drainage in this location is attenuated and no change is anticipated to local flows in either Cringle Beck or Moor Beck, which could affect this site if they were related.

6.10.63 Following application of the above mitigation, neutral (not significant) effects are predicted on the Special Roadside Verges C25: 7a, 7b or C2P:10a, and 10b.

Graham's Gill/Jack Wood

6.10.64 Graham's Gill/Jack Wood is a PAWS and located within the Order Limits of the Cross Lanes to Rokeby scheme. This site is designated for its plantation over ancient woodland habitat, with evidence of ancient woodland indicator species.

6.10.65 The anticipated construction related impacts on the designated site comprise:

- Habitat loss - potential minor loss of habitat due to the Order Limits extending into the designated site. An existing channel in this woodland is to be used to accommodate new drainage from an attenuation basin to the north
- Habitat damage/degradation - construction activities have the potential to generate pollution, for example dust, fine sediments, fuels and oils. Adjacent construction works and the potential requirement of a post and rail fence (within 15m of the ancient woodland) have the potential for compaction impacts of works adjacent to and within this site to compact local soils and affect root systems of adjacent mature trees, which may affect water uptake and transpiration and affect the health of the tree or may affect adjacent ground flora resulting in loss of or damage to ground flora
- Beneficial impacts: Woodland planting adjacent to this woodland is proposed for external woodland losses and provides both additional

woodland habitat and further buffering capacity for this ancient woodland from other existing environmental effects.

6.10.66 The following embedded mitigation measures will be implemented which result in non-significant effects on Graham's Gill/Jack Wood PAWS:

- Habitat loss - environmental mitigation takes account of the potential minor loss of or damage to trees required for the drainage. Fencing to be used to ensure no accidental encroachment on habitats outside of the area required for construction activities
- Habitat damage/degradation - an Invasive Species Management Plan will be produced by the Contractor(s) as specified in the EMP (Application Document 2.7). Site-specific measures regarding surface and groundwater quality, dust and pollution prevention are secured within the EMP (Application Document 2.7). Should permanent fencing be required, fence posts are to be hand dug to avoid heavy machinery being used. If machinery is required, low pressure vehicles and vehicle mats/pads are to be used to avoid ground compaction
- Construction of the new track to the north of the woodland are 15m away from the edge of the Ancient Woodland as per guidance (UK Government, 2022)47. The track is designed using sensitive construction measures to not affect ground conditions for the adjacent ancient woodland in accordance with measures set out within the EMP (Application Document 2.7)
- Should the post and wire permanent fencing be required, fence posts are to be hand dug to avoid heavy machinery being used
- If machinery is required, low pressure vehicles and vehicle mats/pads are to be used to avoid ground compaction
- Discussions with Natural England (14.03.2022) have considered the use of the existing drainage channel for the area of permanent land take and the location and construction for the track to the north of this woodland and their suggestions are incorporated here and in the EMP. Provided the suggested protection measures are applied and those within the UK Government advice (2022)[47] are followed the impacts from the proposed drainage works or fence to this woodland are deemed to have a slight adverse (not significant) effect on the integrity, or functions of the ancient woodland from the proposed drainage works or fence.

Rokeby Park and Mortham Wood LWS

6.10.67 Rokeby Park and Mortham Wood LWS is located within the Order Limits of the Cross Lanes to Rokeby Scheme, at its south-western and southern boundaries. It is designated for its parkland habitat with mature trees and areas of potential ancient woodland, including some limestone gorge woodland on the steep banks to the River Greta.

[47] UK Government (2022) Ancient woodland, ancient trees and veteran trees: advice for making planning decisions

6.10.68 The parkland habitat and woodland supports many mature tree and being a HoPI is of national value, with some trees likely qualifying as ancient or veteran as irreplaceable habitat.

6.10.69 The anticipated construction related impacts on the designated site comprise:

- Potential for compaction impacts to the soils and root systems of adjacent mature trees, which may affect water uptake and transpiration and affect the health of the tree or may affect adjacent ground flora resulting in loss of or damage to ground flora
- Habitat damage/degradation - construction activities have the potential to generate pollution, for example dust, fine sediments, fuels and oils.
- Changes in air quality - potential impacts from additional nitrogen deposition as a result of construction related traffic.

6.10.70 The following embedded mitigation measures will be implemented which result in non-significant effects on Rokeby Park and Mortham Wood LWS:

- Habitat damage/degradation: Site-specific measures regarding dust, pollution and protection measures for the designated site, mature trees and ground flora are secured within the EMP (Application Document 2.7). Works associated with the junction improvement works will utilise existing hardstanding and consequently no impact to root protection zones is predicted

6.10.71 Changes in air quality - construction related air quality impacts detail more than 1% change against the critical load at 0m of the transect, located approximately 5m from the road (Plate A). The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 0.4kgN/ha/yr. No further breaches of the critical load were identified past 0m within the model for construction. The site was recorded to be sheep and cattle grazed with short cropped improved grassland with scattered mature trees during the Phase 1 survey. No woodland ground flora exists beneath trees within this area of the site.

6.10.72 Potential ancient or veteran trees are the qualifying features for the designated site which are relevant to potential impacts from nitrogen deposition. No veteran, ancient or notable trees were noted within 200m of the existing A66 within Rokeby Park and Mortham Wood LWS on the ancient tree inventory.

6.10.73 Using mapping Google Earth, December 2021, and reviewing historical OS maps 1885-1900, the number of mature trees which may qualify as veteran or ancient trees within the site that may be impacted by increases in nitrogen deposition within 0m of the transect during construction is approximately five (Plate B). No trees will be lost or disturbed as a result of construction.

6.10.74 It should be noted that the critical load for nitrogen deposition for woodland takes a precautionary approach derived from potential

impacts to woodland ground flora and epiphytes which are more sensitive to nitrogen.

6.10.75 Nitrogen deposition is not believed to have direct major effects on tree growth, rather indirect impacts such as loss of understorey species diversity (APIS, 2022). The grassland was recorded to be heavily grazed and improved. Therefore potential impacts from nitrogen deposition are solely related to potential ancient or veteran trees.

6.10.76 The ground flora and associated soil microbiota will be subject to existing nitrogen deposition pressures from livestock manure. As well as existing levels of nitrogen deposition from the existing A66, which will decrease with increasing distance from the road (Truscott, et al. 2005)[48].

6.10.77 Soil microorganisms, mycorrhizal fungi and fungi antagonistic to pathogens are significant in the protection of plants against the effects of pollution. Studies have shown that diversity of ectomycorrhiza is low in forests characterised by higher concentrations of nutrients verses forests with low concentrations of nutrients. Furthermore, forests with high concentration of nutrients were also recorded to have the highest microfungal abundance (Stankevičienė & Pečiulytė, 2004)[49]. Grasslands which have been subject to anthropogenic pressures were also found to have weakened arbuscular mycorrhizal fungi (Koziol and Bever, 2016)[50]. Therefore, the current management of livestock on the site combined with the improved grassland recorded may result in a low diversity of ectomycorrhizal fungi within the existing site. Subsequently potential impacts from nitrogen deposition as a result of the Project are not predicted to lead to indirect impacts on the functioning of ectomychorrhizal fungi to support the protection of potential veteran or ancient trees.

6.10.78 The frequency of the impact is considered continual and will be a temporary impact. However, it should be noted that an assessment on operational impacts is included below. Based on the evidence outlined above it is predicted that the ecological structure and function of the designated site as a whole would not be significantly affected by the increase in nitrogen deposition predicted by the modelling. This is classified as a slight adverse (not significant) effect.

[48] Truscott, A.M., Palmer, S.C.F., McGowan, G.M., Cape, J.N. and Smart, S. (2005) Vegetation composition of roadside verges in Scotland: the effects of nitrogen deposition, disturbance and management. *Environmental Pollution* Vol. 136: 109-118.

[49] Stankevičienė, D. and Pečiulytė, D. (2004) Functioning of ectomycorrhizae and soil microfungi in deciduous forests situated along a pollution gradient next to a fertilizer factory. *Polish Journal of Environmental Studies* Vol. 13 No. 6: 715-721.

[50] Koziol, L. and Bever, J.D. (2016) The missing link in grassland restoration: arbuscular mycorrhizal fungi inoculation increases plant diversity and accelerates succession. *Journal of Applied Ecology* Vol 54: 1301-1309.

Veteran and notable trees

Table 6-16: Veteran and notable trees within 200m of the Order Limits

Scheme	Designation	Tree species	Identification reference (Woodland Trust)	Grid reference
M6 Junction 40 Penrith	Veteran tree	Field maple	74611	NY50902840
M6 Junction 40 Penrith	Veteran tree	Common lime	74606	NY50902840
M6 Junction 40 Penrith	Veteran tree	Holly	74612	NY50902840
M6 Junction 40 Penrith	Veteran tree	Beech	74610	NY50902840
M6 Junction 40 Penrith	Veteran tree	Silver birch	74604	NY50902840
Penrith to Temple Sowerby (Center Parcs)	Notable tree	Pedunculate oak	188745	NY5403528734
Penrith to Temple Sowerby (Center Parcs)	Notable tree	Pedunculate oak	188746	NY5412428777
Penrith to Temple Sowerby (Center Parcs)	Veteran tree	Ash	188747	NY5419628805
Penrith to Temple Sowerby (Center Parcs)	Veteran tree	Ash	188748	NY5426828844
Temple Sowerby to Appleby	Veteran tree	Oak	187817	NY6480223290
Temple Sowerby to Appleby	Ancient tree	Oak (Sleastonhow oak, field data)	Not in this dataset	NY6447025455
Temple Sowerby to Appleby	Veteran tree	Ash (field data)	Not in this dataset	NY6451125405
Temple Sowerby to Appleby	Ancient or Veteran tree	Ash (field data)	Not in this dataset	NY6463725519
Cross Lanes to Rokeby	Notable tree	Sycamore	96261	NZ07001379
Cross Lanes to Rokeby	Notable tree	Sycamore	101543	NZ0700913800

Scheme	Designation	Tree species	Identification reference (Woodland Trust)	Grid reference
Cross Lanes to Rokeby	Notable tree	Sycamore	101544	NZ0701213824
Cross Lanes to Rokeby	Notable tree	Sycamore	101545	NZ0701313840
Cross Lanes to Rokeby	Notable tree	Sycamore	101546	NZ0701613863

6.10.79 The anticipated construction related impacts on these designated trees within 200m of the Order Limits (Table 6-16: Veteran and notable trees within 200m of the Order Limits) comprise:

- Habitat damage/degradation - Potential dust deposition from dust emitting activities which may smother vegetation and affect evapotranspiration and photosynthesis. Adjacent ground compaction which may affect water uptake and transpiration rates, which affect the tree's health or physical damage to tree limbs

6.10.80 The following embedded mitigation measures will be implemented which result in non-significant effects on veteran trees:

- Habitat damage/degradation: Site-specific measures regarding dust are secured within the EMP (Application Document 2.7). Avoidance and protection measures will be stated in the EMP and follow government advice for avoidance of impacts upon ancient or veteran trees (UK Government, 2022)
- Should permanent fencing be required fence posts are to be hand dug to avoid heavy machinery being used. If machinery is required, low pressure vehicles and vehicle mats/pads are to be used to avoid ground compaction.

6.10.81 Following application of the above mitigation, no significant effects are predicted on veteran and notable trees.

Other designated sites

6.10.82 The following designated sites are scoped out from further assessment due to the following combination of factors:

- the distance of the designated site from the Project
- the qualifying features of the designated site and lack of complementary habitat within the Project
- the lack of suitable habitat connecting the designated site and the Project.

6.10.83 Designated sites scoped out from further assessment comprise:

- Helbeck and Swindale Woods SAC, Helbeck Wood SSSI/Helbeck Wood SIS and Swindale Wood SSSI - located 427m north, 427m north and 1.3km north of the Order Limits of Temple Sowerby to Appleby.

- Moor House Upper Teesdale SAC - located 0.9km north of the Order Limits of Temple Sowerby to Appleby
- George Gill SSSI - located 395m north-west of the Order Limits of Temple Sowerby to Appleby.
- Cowraik Quarry SSSI and LNR - located 1.7km north of the Order Limits of M6 Junction 40 to Kemplay Bank.
- Udford Low Moss SSSI - located 0.9km north of the Order Limits of Penrith to Temple Sowerby (Centre Parcs).
- Kilmond Scar SSSI - located 410m south-east of the Order Limits of Bowes Bypass.
- Brignall Banks SSSI - located 571m south of the Order Limits of Cross Lanes to Rokeby.
- Black Scar Quarry SSSI - located 1.2km east of the Order Limits of A1 (M) Junction 53 Scotch Corner.
- Myers Beck LWS - located 444m north of the Order Limits of M6 Junction 40 to Kemplay Bank.
- Yanwath Wood LWS - located 52m south of the Order Limits of M6 Junction 40 to Kemplay Bank. However, it is noted that the designated site lies south of the River Eamont and permanent acquisition of land is located 500m north.
- Watersmeet LWS - located 994m north of the Order Limits of Penrith to Temple Sowerby (Center Parcs).
- Tipperary and Dudford Woods PAWS - located 658m north of the Order Limits of Penrith to Temple Sowerby (Center Parcs).
- Acorn Bank Woods and Garden LWS - located 957m north of the Order Limits of Temple Sowerby to Appleby.
- Roadside Verges C2L (8a and 8b) - located 976m south-west of the Order Limits of Temple Sowerby to Appleby.
- Ross Wood ASNW and PAWS - located 207m south of the Order Limits of Temple Sowerby to Appleby.
- Dowpits Wood LWS and ASNW - located 941m south of the Order Limits of Temple Sowerby to Appleby.
- Oglebird Plantation PAWS - located 451m west of the Order Limits of Temple Sowerby to Appleby.
- Roadside Verges C25 (6a, 6b, 4a and 4b) - located more than 650m south of the Order Limits of Temple Sowerby to Appleby.
- Swindale Wood LWS - located 515m south of the Order Limits of Temple Sowerby to Appleby.
- Kiln Hill Wood ASNW - located 623m north-east of the Order Limits of Temple Sowerby to Appleby.
- Yosgill Wood ASNW north of the Order Limits of Temple Sowerby to Appleby.
- Teesbank Woods, Rokeby LWS - located 328m north of the Order Limits of Temple Sowerby to Appleby.
- Thorsgill Wood LWS and PAWS - located 734m north of the Order Limits of Temple Sowerby to Appleby.
- Waterfall Wood ASNW - located 331m north of the Order Limits of Cross Lanes to Rokeby.

- Mill Wood ASNW - located 470m south of the Order Limits of Cross Lanes to Rokeby.
- Tees Bank Plantation ASNW - located 617m north of the Order Limits of Cross Lanes to Rokeby
- Aske Estate Woodlands SINC and Hartforth Wood PAWS - located 937m south of the Order Limits of Stephen Bank to Carkin Moor (Layton)

6.10.84 Designated sites scoped out from further assessment which are located within 200m of the ARN:

- Roadside Verges: C25 (7a and 7b) - both located on the B6259.
- Roadside Verges: C2P (10a and 10b) - both located on the B6259.

6.10.85 Veteran and ancient trees scoped out from further assessment which are located within 200m of the ARN are outlined in Table 6-17: Veteran and ancient trees within 200m of the ARN scoped out from further assessment.

Table 6-17: Veteran and ancient trees within 200m of the ARN scoped out from further assessment

Location	Designation	Tree species	Identification reference (Woodland Trust)	Grid reference	Air quality reference
M6	Ancient tree	Common ash	192552	NY6103101277	AT_7_M6
M6	Veteran tree	Sessile oak	28658	NY4403245033	VT_1_M6
M6	Veteran tree	Lime	61692	NY43635131	VT_2_M6
M6	Veteran tree	Lime	61700	NY43645129	VT_3_M6
M6	Veteran tree	Lime	61702	NY43655129	VT_4_M6
M6	Veteran tree	Oak	158745	NY4376051128	VT_11_M6
M6	Veteran tree	Common lime	2718	NY52792839	VT_16_M6
A66	Ancient tree	Common ash	137317	NZ1129411289	AT_6_A66
A66	Ancient tree	Alder	82054	NZ03651205	AT_8_A66
A66	Ancient tree	Common yew	82055	NZ03661207	AT_9_A66
A66	Ancient tree	Elder	83555	NZ03581204	AT_10_A66
A66	Ancient tree	Birch	84179	NZ03691203	AT_11_A66
A66	Ancient tree	Rowan [Mountain Ash]	84180	NZ03571204	AT_12_A66
A66	Ancient tree	Hazel	110998	NZ0354412131	AT_13_A66
A66	Ancient tree	Alder	110999	NZ0365912125	AT_14_A66
A66	Ancient tree	Crab apple	141625	NZ0375311517	AT_15_A66
A66	Ancient tree	Downy birch	141626	NZ0374611496	AT_16_A66
A66	Veteran tree	Pedunculate oak	74602	NY76801350	VT_7_A66
A66	Veteran tree	Crab apple	68057	NZ03481234	VT_17_A66
A66	Veteran tree	Crab apple	68058	NZ03991328	VT_18_A66
A1M	Ancient tree	Crab apple	57725	SE22359935	AT_2_A1
A1M	Ancient tree	Crab apple	2098	SE22339932	AT_1_A1
A1M	Veteran tree	Ash	174275	NZ2203307478	No ref
A1M	Veteran tree	Ash	174276	NZ2210407375	No ref

Habitats

6.10.86 The habitats within the ZoI have been assessed as being between Local importance/low sensitivity to National importance/high sensitivity.

6.10.87 The impacts of construction of relevance to habitats are:

- habitat loss and gain
- habitat degradation.

Habitat loss and gain

6.10.88 The construction phase will result in the permanent or temporary loss of all semi-natural habitats affected by construction.

6.10.89 For the purposes of this assessment, as detailed in Table 6-1: Key Assessment Parameters, it is assumed that all habitats within the indicative site clearance boundary will be removed. This equates to an area of approximately 687.6ha.

6.10.90 It is assumed that areas within the Order Limits outside the indicative site clearance boundary will be retained and enhanced for ecological mitigation. Should this assumption change at detailed design stage, this assessment will need to be reviewed and the required mitigation adjusted accordingly.

6.10.91 Table 6-18: Area of habitat loss shows the areas of habitats within the Order Limits and within the indicative site clearance boundary. Table 6-19: Summary of baseline phase 1 habitat points shows the point habitats that are present within the Order Limits and within the indicative site clearance boundary. Point habitats are individual features (such as isolated trees).

6.10.92 The largest areas of habitat removal will be of improved grassland, poor semi-improved grassland, arable land and woodland.

Table 6-18: Area of habitat loss

Phase 1 habitat	Area within Order Limits (ha)	Area of habitat assumed to be removed within the indicative site clearance boundary (ha)	Importance of lost habitats
B4 - Improved grassland	365.74	335.73	Local value
B6 - Poor semi-improved grassland	79.03	69.97	Local value
B2.2 - Neutral grassland - semi-improved	20.18	18.31	Range from National to Local value
B1.2 - Acid grassland - semi-improved	0.15	0.15	Range from National to Local value
J1.1 - Cultivated/disturbed land - arable	231.45	198.57	Local value

Phase 1 habitat	Area within Order Limits (ha)	Area of habitat assumed to be removed within the indicative site clearance boundary (ha)	Importance of lost habitats
			Some arable field margins may qualify as National value
J1.2 - Cultivated/disturbed land - amenity grassland	3.92	3.85	Negligible value
D3 - Lichen/bryophyte heath	0.37	0.37	National value
A1.3.2 - Mixed woodland - plantation	17.81	14.95	Range from National to Local value Dominated by Local value
A1.1.2 - Broadleaved woodland - plantation	16.46	11.14	Range from National to Local value Dominated by Local value
A1.2.2 - Coniferous woodland - plantation	11.48	8.05	Local value
A1.1.1 - Broadleaved woodland - semi-natural	8.19	7.85	Majority of National value Some areas of County value
J5 - Other habitat	2.55	2.71	Range from National to Negligible value
A1.3.1 - Mixed woodland - semi-natural	1.92	2	Majority of National value. Some areas of County to Local value
A3.1 - Broadleaved Parkland/scattered trees	0.38	0.22	Range from National to Local value
A3.3 - Mixed Parkland/scattered trees	0.09	0.04	National value
A2.1 - Scrub - dense/continuous	6.18	5.84	Local value
B5 - Marsh/marshy grassland	10.79	6.32	Range from National to Local value
F1 - Swamp	2.81	1.43	Local to County value
G1.1 - Standing water - eutrophic	0.14	0.13	National value
G1 - Standing water	0.01	0.01	Range from National to Negligible value

Phase 1 habitat	Area within Order Limits (ha)	Area of habitat assumed to be removed within the indicative site clearance boundary (ha)	Importance of lost habitats
G1.2 - Standing water - mesotrophic	>0.01	>0.01	National to Local value

Table 6-19: Summary of baseline phase 1 habitat points

Phase 1 habitat type	Number of points within Order Limits	Number of points assumed to be removed within the indicative site clearance boundary	Importance of lost habitats
A2.2 - Scrub - scattered	60	43	Local value
A3.1 - Broadleaved Parkland/scattered trees	166	147	National value
A3.2 - Coniferous Parkland/scattered trees	2	2	Local value

6.10.93 Where the Project results in the removal of habitat on either a temporary or permanent basis, this will be replaced on a like-for-like or better basis. Some areas of habitat present at baseline will be replaced by smaller areas of higher quality habitat to provide mitigation.

6.10.94 Approximately 648ha of replacement habitats will be provided during the construction phase to mitigate for baseline habitat losses.

6.10.95 The Environmental Mitigation Maps (Application Document 2.8) show an illustration of how the proposed habitat replacement can be achieved within the Order Limits, based on the illustrative design. This is subject to change during detailed design, however the replacement ratios described in Table 6-20: Areas of habitat loss and mitigation must be achieved to ensure the mitigation measures relied on within this assessment are achieved. The ratios provided in Table 6-20: Areas of habitat loss and mitigation inform the quantum of habitat mitigation that might be required to off-set additional habitat losses that are introduced at detailed design stage. The ratios assume the target condition of created habitat will be moderate and managed for the benefit of wildlife over a minimum 30-year period. Ratios have been based on the prevailing guidance within the *Natural England Biodiversity Metric 3.0* and achieve a no-net-loss outcome.

6.10.96 Details of the habitat types for habitats created or reinstated and their associated management requirements are provided within the Annex B1: LEMP of the EMP (Application Document 2.7), with the aim that reinstated and created habitats maximise opportunities for wildlife and biodiversity.

6.10.97 Table 6-18: Area of habitat loss and Table 6-19: Summary of baseline phase 1 habitat points show the areas of habitat that will be removed during the construction phase of the Project and areas of habitat planted post-construction to provide mitigation.

Table 6-20: Areas of habitat loss and mitigation

Phase 1 habitat	Area within Order Limits (ha)	Area of habitat lost (ha)	Replacement habitat type	Gross area of replacement habitat (ha)	Mitigation ratio and habitat creation type
B4 - Improved grassland	365.74	335.73	Grassland	451.92	1:0.3 Other neutral grassland
B6 - Poor semi-improved grassland	79.03	69.97	Grassland	451.92	1:0.6 Other neutral grassland
B2.2 - Neutral grassland - semi-improved	20.18	18.31	Grassland	451.92	1:1.2 Other neutral grassland
B1.2 - Acid grassland - semi-improved	0.15	0.15	Grassland	451.92	1:1.43 Other lowland acid grassland
J1.1 - Cultivated/disturbed land - arable	231.45	198.57	Grassland	451.92	1:0.3 Other neutral grassland
J1.2 - Cultivated/disturbed land - amenity grassland	3.92	3.85	Grassland	451.92	1:0.3 Other neutral grassland
D3 - Lichen/bryophyte heath	0.37	0.37	Heathland	1.56	1:6.19 Lowland Heathland
A1.3.2 - Mixed woodland - plantation	17.81	14.95	Woodland	105.18	1:1.71 Other woodland; broadleaved
A1.1.2 - Broadleaved	16.46	11.14	Woodland	105.18	1:1.71 Other woodland; broadleaved

Phase 1 habitat	Area within Order Limits (ha)	Area of habitat lost (ha)	Replacement habitat type	Gross area of replacement habitat (ha)	Mitigation ratio and habitat creation type
woodland - plantation					
A1.2.2 - Coniferous woodland - plantation	11.48	8.05	Woodland	105.18	1:0.85 Other woodland; broadleaved
A1.1.1 - Broadleaved woodland - semi-natural	8.19	7.85	Woodland	105.18	1:9.45 Lowland mixed deciduous woodland
J5 - Other habitat	2.55	2.71	Woodland and Open mosaic habitat on previously developed land	105.18 and 10.34	1:1.72 assumes habitat is open mosaic habitat on previously developed land. Mitigation likely to be less for Locally important habitat types.
A1.3.1 - Mixed woodland - semi-natural	1.92	2	Woodland	105.18	1:9.45 Lowland mixed deciduous woodland
A3.1 - Broadleaved Parkland/scattered trees	0.38	0.22	Woodland and Parkland	105.18 and 0.04	Assumes that habitat is of National importance. Therefore, bespoke compensation likely to be required. Assume minimum of 1:10. Wood-pasture and parkland.

Phase 1 habitat	Area within Order Limits (ha)	Area of habitat lost (ha)	Replacement habitat type	Gross area of replacement habitat (ha)	Mitigation ratio and habitat creation type
A3.3 - Mixed Parkland/scattered trees	0.09	0.04	Parkland	0.04	Assumes that habitat is of National importance. Therefore, bespoke compensation likely to be required. Assume minimum of 1:10. Wood-pasture and parkland.
A2.1 - Scrub - dense/continuous	6.18	5.84	Scrub	56.57	1:1.2 Mixed scrub
B5 - Marsh/marshy grassland	10.79	6.32	Fen and Purple moor grass and rush pasture	21.51 and 0.53	For Nationally important habitat losses require bespoke compensation. Assume minimum of 1:10. For Locally important areas of habitat mitigation habitat should be delivered at 1:3.10. Purple moor grass and rush pastures.
F1 - Swamp	2.81	1.43	Fen and Purple moor grass and rush pasture	21.51 and 0.53	1:10 Fen and Purple moor grass and rush pasture.
G1.1 - Standing water - eutrophic	0.14	0.13	Pond	0.48	1:1.66 Ponds (Priority Habitat)
G1 - Standing water	0.01	0.01	Pond	0.48	1:1.66 Ponds (Priority Habitat)

Phase 1 habitat	Area within Order Limits (ha)	Area of habitat lost (ha)	Replacement habitat type	Gross area of replacement habitat (ha)	Mitigation ratio and habitat creation type
G1.2 - Standing water - mesotrophic	>0.01	>0.01	Pond	0.48	1:1.66 Ponds (Priority Habitat)

Table 6-21: Summary of baseline phase 1 habitat points and mitigation

Phase 1 habitat type	Number of points within Order Limits	Number of points within 250m of Order Limits	Replacement habitat type	Gross area of replacement habitat (ha)
A2.2 - Scrub - scattered	60	92	Scrub	56.57
A3.1 - Broadleaved Parkland/scattered trees	166	325	Woodland and Parkland	105.18 and 0.04
A3.2 - Coniferous Parkland/scattered trees	2	8	Woodland and Parkland	105.18 and 0.04

6.10.98 The following sections of the habitat assessment discuss the indicative areas of habitat loss and indicative areas of habitat creation required to mitigate those losses to achieve an outcome of no net loss. This is based upon the illustrative design (Environmental Mitigation Maps (Application Document 2.8) with ratios provided in Table 6-20: Areas of habitat loss and mitigation to provide guidance should the areas of habitat loss alter at detailed design stage.

Grassland and heathland

6.10.99 Grassland habitats dominate the Project, covering approximately 465ha within the Order Limits. This area comprises the following grassland habitat types:

- Improved grassland - 365.74ha
- Poor semi-improved grassland - 79.03ha
- Neutral grassland - semi-improved - 20.18haha
- Cultivated/disturbed land - amenity grassland - 3.92ha
- Acid grassland - semi-improved - 0.15ha.

6.10.100 At this stage it is estimated that approximately 335.73ha of improved grassland will be removed during the construction phase. However, given the common and widespread nature of this habitat type, this removal is not considered to affect the integrity of the resource.

6.10.101 Approximately 69.97ha of poor semi-improved grassland will be permanently lost. However, given the common and widespread nature of this habitat type, this loss is not considered to affect the integrity of the resource.

6.10.102 Approximately 18.31ha of neutral grassland - semi-improved will be lost. The small areas of Nationally and County important habitat are not considered to comprise a significant quantum of this habitat's resource on a Local level. In addition, the areas of Local importance are common and widespread with a moderate level of human modification and disturbance from management and land use type.

6.10.103 The entire area of acid grassland - semi-improved (0.15ha) will be permanently removed as a result of the Project. The species composition and underlying soil conditions are such that the habitat meets the HoPI criteria for Lowland Dry Acid Grassland. However, given the small area of habitat, this is not anticipated to result in an impact that would affect the integrity of the habitat's resource.

6.10.104 Approximately 198.57ha of cultivated/disturbed land - arable is anticipated to be permanently lost during the construction phase of the Project. This habitat is dominated by pasturelands and arable fields of Local importance. In addition, occasional field margins up to 3m wide are also present. These field margins, where present, have the potential to fulfil the HoPI criteria for Arable Field Margins and are treated as such on a precautionary

basis. Due to local and national abundance of this habitat type and the small area of potentially Nationally important arable field margin, the integrity of this resource is not anticipated to be significantly affected by its permanent loss.

6.10.105 Approximately 451.92ha of grassland habitats will be created during the construction phase of the Project. The grassland creation will comprise the following broad habitat types and areas:

- Grassland - Other neutral grassland - 240.98ha
- Grassland - Modified grassland - 183.2ha
- Grassland - Upland acid grassland - 13.38ha
- Grassland - Other lowland acid grassland - 8.97ha
- Grassland - Floodplain Wetland Mosaic - 4.65ha.

6.10.106 This will include approximately 183.2ha of modified grassland which fulfils the same ecological niche as poor semi-improved grassland.

6.10.107 Approximately 8.97ha and 13.38ha of lowland and upland acid grassland will be provided as part of the Project. This quantum of habitat creation will mitigate the loss of approximately 0.15ha of acid grassland - semi-improved and provide a net gain in acid grassland Project wide.

6.10.108 Once established, the created grassland habitats will result in a net gain of species diversity and opportunities for wildlife, compared to the conditions within baseline neutral grassland - semi-improved habitats. Details of species seed mixes and management regimes to maximises opportunities for biodiversity are provided within LEMP (Annex B1 of the EMP (Application Document 2.7).

6.10.109 Approximately 0.37ha of lichen/bryophyte heath (the entire area within the indicative site clearance boundary) is anticipated to be permanently lost as a result of the Project. This habitat type is limited in its national extent, due to the rarity of soil, nutrient and hydrological conditions required for it to prevail.

6.10.110 Mitigation for the loss of this habitat as a result of this Project will include the provision of approximately 1.56ha of heathland creation (based on a 1:6 ratio). This habitat creation is anticipated to partly replicate the ecological niches found within the baseline lichen/bryophyte heath. However, heathland creation is complex and requires careful site selection, ground preparation and long-term management. Details of these measures are provided within B1: LEMP of the EMP (Application Document Number 2.7) to ensure opportunities for biodiversity are maximised. The created heathland will take years to establish and there is high risk that those areas created will not be equal to those present at baseline. However, the approximate 400% increase of heathland area within the Project is anticipated to largely mitigate for the reduced condition and time lag in establishment.

Woodland

6.10.111 As a result of the Project approximately 14.95ha of mixed woodland - plantation will be lost. The majority of this habitat is of Local importance. However, there are smaller areas which have been assessed as of National and Country importance.

6.10.112 Areas of National importance qualify as HoPI Lowland Mixed Deciduous Woodland due to the presence of well-established ground flora, complex canopy structure and mixed age ranges which include mature specimens (present within the M6 Junction 40 to Kemplay Bank scheme). There are also areas which fall short of the HoPI criteria, however they remain of County importance as they fulfil a number of the qualifying features (within the Appleby to Brough scheme).

6.10.113 Although small in area, the Nationally and County important areas of this habitat are more biologically complex and rarer within the local and wider landscape than the Locally important areas. As such, they have a greater degree of fragility and the losses, in the absence of mitigation, are anticipated to adversely affect the integrity of this resource.

6.10.114 As a result of the Project approximately 11.14ha of broadleaved woodland - plantation will be lost. The majority of this habitat is of Local importance. However, there are smaller areas which have been assessed as being of National and Country importance.

6.10.115 Areas of National importance qualify as HoPI Lowland Mixed Deciduous Woodland due to the presence of well-established ancient woodland ground flora, complex canopy structure and mixed age ranges which include mature specimens (present within the M6 Junction 40 to Kemplay Bank and Cross Lanes to Rokeby schemes). There are also areas which fall short of the HoPI criteria, however they remain of County importance as they fulfil a number of the qualifying features (within the Bowes Bypass scheme).

6.10.116 In the absence of mitigation, losing the areas of Locally important habitat is anticipated to result in an adverse minor impact as the integrity of the resource is not considered to be affected.

6.10.117 Although small in area, the Nationally and County important areas of this habitat are more biologically complex and rarer within the local and wider landscape than the Locally important areas. As such, they have a greater degree of fragility and the losses, in the absence of mitigation are anticipated to adversely affect the integrity of this resource due to loss of irreplaceable habitat cover.

6.10.118 As a result of the Project approximately 8.05ha of coniferous woodland - plantation, a Locally important habitat, will be lost.

6.10.119 In the absence of mitigation, losing this habitat is anticipated to result in an adverse minor impact as the integrity of the resource is not considered to be affected.

6.10.120 As a result of the Project approximately 7.85ha of this habitat will be lost. This habitat is of National importance, qualifying as HoPI Lowland Mixed Deciduous Woodland due to the presence of well-established ground flora, complex canopy structure and mixed age ranges which include mature specimens.

6.10.121 In addition to meeting the HoPI criteria, a proportion of this habitat within various schemes fulfils County BAP Habitat criteria.

6.10.122 In the absence of mitigation, losses of this habitat are anticipated to adversely affect the integrity of this resource within the local and wider landscape.

6.10.123 Approximately 2ha of mixed woodland - semi-natural will be lost as a result of the Project. The majority of his habitat is of National importance, qualifying as HoPI Lowland Mixed Deciduous Woodland due to the presence of well-established ground flora, complex canopy structure and mixed age ranges which include mature specimens. Small areas within the M6 Junction 40 to Kemplay Bank scheme fall short of HoPI criteria, however, as a semi-natural woodland habitat with a native broadleaved component, there remains ecological interest at the County level.

6.10.124 In the absence of mitigation losses of this habitat will have an adverse impact on the integrity of this resource within the local and wider landscape.

6.10.125 To mitigate for woodland loss, 105.18ha of woodland creation is proposed. It is assumed that any woodland creation would take approximately 30 years to develop woodland characteristics. However, once established, the quantum of habitat creation is substantially greater than the woodland area being lost. B1: LEMP of the EMP (Application Document Number 2.7) will seek to maximise opportunities for biodiversity within the woodland habitats with long-term management (at least 30 years) secured as part of the Project, ensuring successful establishment.

Other habitats

6.10.126 Approximately 2.71ha of other habitat is present within the indicative site clearance boundary of the Project. The majority of this habitat comprises artificial sealed and unsealed surfaces of Negligible importance. However, small areas of orchard are also included within this habitat type. The ecological importance of the orchard areas varies from National importance, for those areas that qualify as HoPI Traditional Orchards (within the Appleby to Brough scheme), to Local importance for those which fall short of the HoPI criteria (within the Cross Lanes to Rokeby scheme).

6.10.127 The Nationally important area of orchard covers approximately 0.23ha. Although the area of direct habitat loss is small, the local

abundance of this habitat type is rare. In addition, many fruit trees require cross fertilisation to bear fruit and as such, rely on a local network of suitable trees which they can be pollinated by. This habitat inter-reliance increases the fragility of orchards and means that losses within the Project have the potential to indirectly effect other orchards outside of the Order Limits. As such, any losses in the absence of mitigation are considered to have a Major adverse effect on the integrity of the resource.

6.10.128 A proportion of the woodland planting proposed as mitigation includes groups of fruit bearing trees in the apple (*Malus* sp.), pear (*Pyrus* sp.) and cherry (*Prunus* sp.) families to replace those lost from baseline orchard habitats. It is considered that any fruit tree planting would take approximately 20 years to develop traditional orchard characteristics. However, once established, it is considered that the ecological opportunities lost from baseline would be effectively replaced.

6.10.129 Approximately 0.22ha of Broadleaved Parkland/scattered trees, 0.04ha of Mixed Parkland/scattered trees and 147 individual trees (categorised as A3.1 - Broadleaved Parkland/scattered trees, of which 53 are mature and 7 veteran trees) mature or veteran trees will be lost as a result of the Project. The majority of these habitats are of up to National importance, meeting the HoPI criteria for Wood-Pasture and Parkland. Losses of this magnitude are anticipated to adversely affect the integrity of this resource.

6.10.130 The Project will result in the permanent loss of approximately 5.84ha of Scrub. The ecological importance of this habitat type falls short of any HoPI classifications and County level BAP Habitat types. However, as a successional habitat type there is some ecological importance at the Local level.

6.10.131 This habitat type is common and widespread within the local and wider landscape. Therefore, a loss of this magnitude is not anticipated to adversely affect the integrity of the resource.

6.10.132 Approximately 53.62ha of scrub habitat will be created to mitigate for habitat losses. Locally important scrub habitat is a replaceable habitat type and therefore moderate to high quality creation of this habitat is well within the means of the Project, with the B1: LEMP of the EMP (Application Document 2.7) securing long-term management and monitoring.

6.10.133 There are 60 individual points of scattered scrub throughout the Project within the Order Limits, 43 of which are located within the indicative site clearance boundary. The ecological importance of this habitat type falls short of any HoPI classifications and County level BAP Habitat types. However, as a successional habitat type there is some ecological importance at the Local level.

6.10.134 As a result of the Project, approximately 6.32ha of marsh/marshy grassland will be lost. Approximately 0.2ha of this habitat, recorded within the Appleby to Brough scheme, qualifies as HoPI Purple Moor Grass and Rush Pastures or Fen and is of National importance.

6.10.135 The remainder of this habitat within the Project falls short of HoPI criteria and is of Local importance.

6.10.136 The Nationally important HoPI Purple Moor Grass and Rush Pastures is limited in its nationwide and international extent. Therefore, this loss is anticipated to adversely affect the integrity of the habitat resource.

6.10.137 Approximately 21.51ha of fen and 0.53ha of purple moor grass and rush pasture will be created. The successful creation and long-term management (30 years) of these habitats will be secured through the implementation of the LEMP. The LEMP seeks to maximise opportunities for biodiversity within the created habitats, set out long-term management (at least 30 years) and detail legally binding funding mechanisms for its implementation.

6.10.138 It is anticipated that 1.36ha of swamp will be lost as a result of the Project. The extent of this habitat is limited throughout the Project to several schemes (Penrith to Temple Sowerby scheme, Cross Lanes to Rokeby scheme and Stephen Bank to Carkin Moor scheme).

6.10.139 The majority of this habitat, approximately 1.33ha, is found within the Stephen Bank to Carkin Moor scheme. Due to a low water table, this area of habitat fails to fulfil HoPI criteria and has been classified as of County importance.

6.10.140 An approximate 0.02ha area of this habitat is present within the Cross Lanes to Rokeby scheme. This area meets a number of qualifying features within the HoPI reedbed description. However, given its limited extent it fails to fulfil this criterion. As such, its importance is considered to fall short of National, and has been classified as of County importance.

6.10.141 An approximate 0.01ha area of swamp is present within the Penrith to Temple Sowerby scheme. The area fails to meet the HoPI criteria due to the low abundance of common reed and inclusion of non-desirable species such as common nettle. However, limited ecological opportunities remain present and as such, this area is of Local importance.

6.10.142 Approximately 20.1ha of wetland will be created. The creation of this habitat will mitigate for the loss of Locally and County important areas of swamp within the Project.

Standing water

6.10.143 Approximately 0.13ha of standing water - eutrophic is present within the indicative site clearance boundary and therefore likely to be lost as a result of construction of the Project. The majority of

the habitat is associated with a SuDS basin within the Stephen Bank to Carkin Moor scheme. The remainder of this habitat comprises a pond within the Cross Lanes to Rokeby scheme. Both areas of this habitat are assumed to fulfil the criteria for HoPI Pond and are therefore of National importance.

6.10.144 Although the habitat is of National importance, it is not considered to be integral to the integrity of the habitat resource within the local or wider landscape.

6.10.145 Standing water - mesotrophic comprises an area of less than 0.01ha, consisting of a recently constructed ornamental pond. This habitat is confirmed as falling short of the HoPI criteria for pond and as such is not of National importance. Moreover, given the ornamental nature of the pond and its age, its importance is limited to the Local level.

6.10.146 The loss of this habitat as a result of the Project will not adversely effect the integrity of the habitat resource.

6.10.147 Approximately 0.48ha of pond habitat will be created as part of the Project. It is anticipated that all or a substantial quantum of created ponds will be designed and managed as wildlife ponds to maximise opportunities for biodiversity. Detail of wildlife friendly design and management prescriptions are provided within the LEMP. It is anticipated that these mitigation measures are sufficient to compensate for the anticipated loss of ponds that have been classified as standing water - eutrophic and mesotrophic.

Habitat degradation

6.10.148 In addition to the permanent loss of 0.2ha of HoPI Purple Moor Grass and Rush Pastures or Fen within the Appleby to Brough scheme, as this habitat extends into land adjacent to the indicative site clearance boundary (within the Order Limits) construction work will likely degrade a further 2.7ha of this habitat.

6.10.149 Degradation of this area of habitat is anticipated as a result of earth works immediately adjacent to this habitat, which are likely to change the hydrological conditions within the area. As a wetland habitat type, any changes to hydrological conditions presents a risk of degrading or destroying the habitat currently present. The Groundwater Dependant Terrestrial Ecosystems assessment, set out in ES Appendix 14.7: Groundwater Dependant Terrestrial Ecosystem Assessment (Application Document 2.7) has considered the potential risk of changes to the hydrology of the fen habitat. A detailed hydrogeological risk assessment will be completed, and either the cutting will be lined to prevent loss of water supply to the fen, or the junction and adjacent pond will be adjusted within the Limits of Deviation (which allow for the avoidance of the fen) to ensure there is no effect on the hydrology of the fen (see ES Appendix 14.7:

Groundwater Dependent Terrestrial Ecosystem Assessment (Application Document 2.7)).

6.10.150 Sufficient space has been allowed within the Order Limits and limits of deviation to avoid loss of the fen habitat through further design iteration. However, for the purpose of taking a precautionary approach to this assessment, it has been assumed that degradation as a result of construction will adversely effect the 2.7ha of this habitat adjacent to the indicative site clearance boundary, and suitable areas for mitigation have been identified within the Order Limits. This approach has been agreed with Natural England as detailed in Table 6-8.

6.10.151 Primarily, impacts upon this habitat should be avoided and then minimised through detailed design however, in the event indirect effects (degradation) on 2.7ha area of this Nationally important habitat outside of the indicative site clearance boundary cannot be avoided at the detailed design stage, then the creation of approximately 24ha of fen habitat will be required to minimise the effect upon this habitat. A suitable area for this habitat creation has been identified within the Temple Sowerby to Appleby scheme (see Environmental Mitigation Maps (Application Document 2.8)). If the effect can be avoided through design, this replacement habitat will not be required.

6.10.152 Areas of woodland and individual trees located adjacent to the indicative site clearance boundary are at risk of degradation during the construction phase as a result of damaged root protection areas, canopy damage or ground compaction. Any of these impacts would result in adversely compromised tree health and potentially tree death.

6.10.153 Temporary indirect impacts associated with dust deposition during construction also have the potential to adversely effect all habitats adjacent to the indicative site clearance boundary.

6.10.154 Temporary indirect impacts such as compaction and dust deposition will be avoided by methods set out in the EMP (Application Document 2.7) and therefore no significant short-term or long-term impacts are anticipated.

Watercourses

6.10.155 The watercourses throughout the Project were assessed as ranging from International importance/very high sensitivity to Local importance / low sensitivity.

6.10.156 The impacts of construction of relevance to watercourses are:

- Habitat loss
- Habitat degradation
- Habitat alteration.

Habitat loss

6.10.157 The construction phase will result in the permanent shading of instream habitat and associated loss of instream and riparian vegetation as a result of new watercourse crossings, and the extension of existing culverts.

6.10.158 Open span watercourse crossings that will avoid the loss of aquatic habitat within the River Eden SAC (Trout Beck) or functionally linked watercourses in Appleby to Brough have been designed. This design feature has minimised the potential for habitat loss and is secured through the Project Design Principles (Application Document 5.11). Further detailed information on the impact assessment for the River Eden SAC is provided within Habitats Regulations Assessment Stage 1: Likely Significant Effects Report (Application Document 3.5).

Habitat degradation

6.10.159 Construction activities have the potential to generate water-borne pollution (for example, dust, fine sediment, fuels and oils) which could give rise to an adverse effect on individual watercourses as well as aquatic habitats downstream. Construction activities, such as cutting, piling, temporary abstractions and discharges and floodplain utilisation, also have the potential to impact on the water environment through changes in surface and groundwater quality and quantity as outlined in Chapter 14: Road drainage and the water environment (Application Document 3.2) and ES Appendix 14.3: Water Quality Assessment (Application Document 3.4).

6.10.160 Watercourses will be protected during construction through the implementation of best practice construction techniques. Construction mitigation is included in the Ground and Surface Water Management Plan (Annex B7 of the EMP). and pollution prevention. A surface water management system using measures such as temporary silt fencing, cut off ditches, settlement ponds and bunds set up early in the construction period to capture all runoff and prevent ingress of sediments and contaminants into existing drainage ditches will be implemented where necessary. This will be managed by the EMP in accordance with CIRIA guidelines and the Environment Agency's approach to groundwater protection and groundwater protection guidelines.

6.10.161 constitute a major threat to many river systems and could be introduced and/or spread during construction. Impacts may occur on the river habitat itself (e.g. damage to banks and consequent siltation) or directly on characteristic biota (through predation, competition and disease), or a combination of these. Of particular relevance to the Project and the River Eden SAC are signal crayfish (*Pacifastacus leniusculus*) which have been responsible for much of the decline of native crayfish in the UK) and Himalayan balsam (*Impatiens glandulifera*), which grows in dense

stands and can shade out and outcompete native species and cause sedimentation issues.

6.10.162 The introduction and/or spread of INNS will be managed through the strict implementation of an INNS Management Plan. This plan will be produced by the Contractor(s) (in consultation with specialist contractors), as specified and secured within the EMP (Application Document 2.7).

Habitat alteration

6.10.163 There will be localised alteration of the riparian habitats as a result of new discharges to watercourses which will transfer treated water from road runoff attenuation ponds.

6.10.164 In order to reduce riparian habitat loss and maintain natural geomorphological processes, new discharges to the River Eden SAC and functionally linked watercourses will be open ditches with no headwall where natural river banks are present under baseline conditions. Where artificial banks, or bank protection is in place under baseline conditions, discharges will tie into the existing river bank structures.

M6 Junction 40 to Kemplay Bank

6.10.165 Key features of this scheme with respect to watercourses include:

- Three temporary construction compound areas located between the existing A66 and the SAC boundary to the south. At their closest point the compounds are located at a distance of approximately 225m, 115m and 25m from the SAC boundary respectively
- Three attenuation basins for the purposes of treating of road run-off, with associated discharges to the River Eamont, part of the River Eden SAC
- Extension (by approximately 26m) of Thacka Beck at Carlton Hall underpass south of existing A66
- Widening of existing cuttings for the approach arms at the location of M6 Junction 40, together with new cuttings for access roads and the Kemplay Bank Roundabout underpass

6.10.166 Despite being heavily modified, Thacka Beck is assessed as being of National importance (high value) as it supports salmon, a qualifying species of the River Eden SAC. Permanent shading of instream habitat and associated loss of loss of instream and riparian vegetation in Thacka Beck, as a result of the extension of the Carlton Hall underpass culvert is assessed, when considering the successful implementation of the proposed avoidance and mitigation measures, as Slight adverse (Minor).

6.10.167 The River Eamont is assessed as being of International importance (very high value) as it forms part of the River Eden SAC. Alteration of riparian habitats associated with new discharges from three attenuation basins (for the purposes of treating of road run-off) is assessed, when considering the

successful implementation of the proposed avoidance and mitigation measures, as Slight adverse.

Penrith to Temple Sowerby

6.10.168 Key features of this scheme with respect to the watercourses include:

- Light Water: minor extension (~5m of extension to the north, ~3.5m extension to the south) of existing A66 culvert, one additional minor (~7m in length) watercourse crossing to the A66, to enable access to the attenuation ponds for maintenance, and two attenuation basins for the purposes of treating of road run-off, with associated discharges to Light Water
- A temporary compound storage area and construction compound adjacent to Light Water, south of the existing A66
- Unnamed Tributary of River Eamont 3.3: Extension (~15m of extension to the north) of existing A66 culvert, a new minor watercourse crossing to enable access to the attenuation ponds for maintenance, and one attenuation basin for the treatment of road run-off with associated discharges
- Unnamed Tributary of River Eamont 3.5: one attenuation basin for the treatment of road run-off, with associated discharges
- Swine Gill: extension (~40m) of the existing A66 culvert, and one attenuation basin for the treatment of road run-off, with associated discharges
- The Whinfell Park Underpass which may require cutting into the underlying Penrith Sandstone in this scheme
- Widening of existing cuttings to provide full dualling, together with realigned and new cuttings for access roads and underpasses (such as the Whinfell Park Underpass noted above)

6.10.169 Light Water is assessed as being of National importance (high value) as its conforms to habitat 3260: Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, and supports salmon, a qualifying species of the River Eden SAC. Permanent shading of instream habitat and associated loss of instream and riparian vegetation (as a result of the extension of the existing A66 culvert and new minor crossing) is assessed, when considering the successful implementation of the proposed avoidance and mitigation measures, as Slight adverse.

6.10.170 All other tributaries impacted (Unnamed Tributary of River Eamont 3.3, Unnamed Tributary of River Eamont 3.5 and Swine Gill) are assessed as being of Local importance (low value) within the Order Limits. Permanent shading of instream habitat and associated loss of instream and riparian vegetation (as a result of the culvert extension and new minor crossings) is assessed, when considering the successful implementation of the proposed avoidance and mitigation measures, as Slight adverse (Minor).

Temple Sowerby to Appleby

6.10.171 Key features of this scheme with respect to the watercourses include:

- A multi-span viaduct over the Trout Beck and its floodplain, consisting of seven bridge piers located in the Trout Beck floodplain (three piers located to the north of the watercourse and four located to the south)
- Installation of a temporary bridge to enable the construction of the Trout Beck viaduct
- A cutting associated with the Kirkby Thore Bypass, widening of existing cuttings, together with realigned and new cuttings for access roads, junctions and underpasses.
- A number of construction compounds in close proximity to the River Eden SAC, and one that lies within the SAC boundary in the vicinity of the proposed Trout Beck crossing
- One attenuation basin for the treatment of road run-off, with associated discharges to Unnamed Tributary of River Eden 4.0
- Four attenuation basins for the treatment of road run-off, with associated discharges to Trout Beck
- One attenuation basin for the treatment of road run-off, with associated discharges to Unnamed Tributary of Trout Beck 4.2
- One attenuation basin for the treatment of road run-off, with associated discharges to Unnamed Tributary of River Eden 4.2
- One attenuation basin for the treatment of road run-off, with associated discharges to Unnamed Tributary of River Eden 4.3.

6.10.172 Trout Beck is assessed as being of International importance (very high value) as it forms part of the River Eden SAC and has been shown to support all qualifying features.

6.10.173 The viaduct design, which will minimise habitat loss and disturbance during construction has been informed by and tested through detailed fluvial geomorphology modelling as outlined in Chapter 14: Road drainage and the water environment (Document Number 3.2) and ES Appendix 14.9: Detailed Geomorphological Modelling (Application Document 3.4) is secured through the Project Design Principles (Application Document 5.11).

6.10.174 This design has reduced the construction impact on Trout Beck to localised (~30m of channel length or 0.06ha) permanent shading of instream habitat and associated loss of instream and riparian vegetation. When considering the successful implementation of the proposed avoidance and mitigation measures, the effect on Trout Beck is assessed as Slight adverse (Negligible).

Appleby to Brough

6.10.175 Key features of this scheme with respect to watercourses include:

- Unnamed Tributary of Mire Sike 6.12: widening of the existing A66 culvert that conveys under the road, and two attenuation basins for

the purposes of treating of road run-off, with associated discharges to Unnamed Tributary of Mire Sike 6.12

- Cringle Beck: new open span crossing of the watercourse and its floodplain, one attenuation basin for the purposes of treating of road run-off, with associated discharge to Cringle Beck
- Moor Beck: A multi-span viaduct over the Moor Beck and its floodplain, two flood storage area adjacent to Moor Beck, north of Warcop that will fill in major flood events, one attenuation basin for the purposes of treating of road run-off, with an associated discharge to Moor Beck, two open span bridges of Moor Beck; one upstream of the heritage railway and confluence with Eastfield Sike and a second upstream of the Warcop village access road
- Eastfield Sike: replacement and widening the existing A66 culvert
- Lowgill Beck: two attenuation basins for the purposes of treating of road run-off, with associated discharges, a new culvert and minor channel realignment of a minor tributary (Unnamed Tributary of Lowgill Beck 6.1), one attenuation basin for the purposes of treating of road run-off, with an associated discharge to Lowgill Beck
- Woodend Sike/Yosgill Sike: extension of the existing A66 culvert at the confluence with these watercourses and Lowgill Beck and associated minor channel realignment to shift the confluence of these watercourses slightly north and upstream of the extended culvert

6.10.176 A series of cuttings, that are typically extensions of existing cuttings associated with online widening, will be required in this scheme. In addition, a number of realigned and new cuttings are required for access roads, junctions and underpasses.

6.10.177 With the exception of Cringle Beck, all the watercourses affected by this scheme qualify as priority river habitat as defined in the UK Biodiversity Action Plan Priority Habitat Descriptions (Joint Nature Conservation Committee, 2016)[51] under Criterion 7 "Species" due to the confirmed presence of white-clawed crayfish and/or the confirmed presence of six of more criterion level B species[52]. The watercourses are therefore considered to be of National importance (high value). In addition, the watercourses, including Cringle Beck have been shown to support qualifying species of the River Eden SAC and are therefore considered functionally linked to the SAC. Cringle Beck is therefore also considered to be of National importance (high value).

6.10.178 Essential design mitigation includes best practice watercourse crossing design, remediation of the existing A66 culvert in the vicinity of the Woodend Sike and Yosgill Sike confluence (considered a barrier to migration for all fish species with the exception of eel under normal low flow conditions due to

[51]Joint Nature Conservation Committee (2016) UK Biodiversity Action Plan Priority Habitat Descriptions.

[52] White-clawed crayfish are a criterion A species and automatically trigger priority habitat where present. Eel, bullhead, salmon, brown trout, river lamprey, brook lamprey, sea lamprey and otter are criterion B species, where six or more listed species trigger priority habitat.

insufficient water depth) and replacement of culverts in line with current best practice.

6.10.179 When considering the design of watercourse crossings, which will minimise habitat loss and disturbance during construction and is secured through the Project Design Principles (Application Document Number 5.11), and the successful implementation of the proposed avoidance and mitigation measures, the effect on watercourses in this scheme are assessed as Slight adverse (Minor).

Bowes Bypass

6.10.180 This scheme crosses only Unnamed Tributary of River Greta 7.3 north of Bowes. This minor watercourse is heavily modified by numerous culverts. The watercourse is already culverted for approximately 600m (under the existing A66 and surrounding agricultural land) within the area of the alignment. This tributary is disconnected from the wider River Greta catchment due a natural waterfall approximately 50m upstream the River Greta that is considered a barrier for all species. This watercourse is considered to be of Local importance (low value).

6.10.181 Impacts are limited to potential construction-related runoff. When considering the successful implementation of the proposed avoidance and mitigation measures, the effect on watercourses in this scheme is assessed as Neutral (Negligible).

Cross Lanes to Rokeby

6.10.182 Key features of this scheme with respect to watercourses include:

- Punder Gill / Tutta Beck; two additional culverts and channel realignment through the Cross Lanes Junction, five attenuation basins for the purposes of treating of road run-off, with associated discharges
- Unnamed Tributary of Punder Gill 8.1: extension of the existing A66 culvert
- Tutta Beck: three attenuation basins for the purposes of treating of road run-off, with associated discharges

6.10.183 Watercourses impacted are assessed as being as being of Local importance (low value). The realignment of Tutta Beck has been minimised through design at this location to reduce effects upon the watercourse.

6.10.184 Permanent shading of instream habitat and associated loss of instream and riparian vegetation (as a result of the culvert extension and new watercourse crossings) is assessed, when considering the successful implementation of the proposed avoidance and mitigation measures, as Slight adverse (Minor).

Stephen Bank to Carkin Moor

6.10.185 Key features of this scheme with respect to watercourses include:

- Unnamed Tributary of Cottonmill Beck 9.3: two attenuation basins for the purposes of treating of road run-off, with associated discharges
- Unnamed Tributary of Holme Beck 9.6: new culvert to the north of the existing A66, and one attenuation basin for the purposes of treating of road run-off, with associated discharges.
- Mains Gill: new culvert to the north of the existing A66, and one attenuation basin for the purposes of treating of road run-off, with associated discharges
- Unnamed Tributary of Holme Beck 9.8: new culvert to the south of the existing A66 and extension of the existing A66 culvert
- Unnamed Tributary of Holme Beck 9.2: new culvert to the south of the existing A66, extension of the existing A66 culvert, and two attenuation basins for the purposes of treating of road run-off, with associated discharges

6.10.186 Watercourses impacted in this scheme are assessed as being as being of Local importance (low value). Permanent shading of instream habitat and associated loss of instream and riparian vegetation (as a result of the culvert extension and new watercourse crossings) is assessed, when considering the successful implementation of the proposed avoidance and mitigation measures, as Slight adverse (Minor).

A1(M) Junction 53 Scotch Corner

6.10.187 This scheme does not interact with any watercourses.

Red squirrel

6.10.188 The population of red squirrel within the ZoI was assessed as being of Regional importance/Medium sensitivity.

6.10.189 The impacts of construction of relevance to red squirrel are:

- habitat loss
- habitat fragmentation
- disturbance
- species mortality.

Habitat loss

6.10.190 Habitat loss will affect existing populations of red squirrel as it will result in a loss of suitable foraging and breeding habitat available and put pressure on existing suitable habitat areas, which could become degraded over time due to the increased use.

6.10.191 Until mitigation planting becomes established there will be a temporary loss of seasonal food resources. This could lead to a reduction in population numbers.

6.10.192 Habitat creation, proposed as mitigation for habitat loss, will provide suitable habitat for foraging and drey construction, ultimately supporting the existing red squirrel population to expand. It is recognised that there would be a time lag between

habitat loss and the provision of suitable habitat to mitigate for this effect.

6.10.193 This would result in an effect that is slight adverse and not significant.

Habitat fragmentation

6.10.194 Temporary habitat fragmentation from construction activities will occur. This will result in temporary loss of connectivity between areas of habitat which could lead to a loss of available seasonal food resources and put increased pressure on resources in remaining areas of woodland.

6.10.195 Over time this will result in fragmenting populations, with limited dispersal availability. Small, isolated populations of red squirrels, with limited dispersal availability, have shown to have decreased genetic diversity which can lead to potential deleterious effects on the genetic health of the population[53].

6.10.196 The provision of green bridges throughout the Project will provide permanent suitable connective habitat for red squirrel to safely cross the live carriageway.

6.10.197 As a result, the effects are considered to be neutral and not significant.

Disturbance

6.10.198 There is potential for temporary disturbance to red squirrels through construction activities including noise, vibration and lighting. Continued disturbance could result in red squirrels abandoning an area or abandoning breeding dreys.

6.10.199 Disturbance is most likely to affect young red squirrels who are unable to leave dreys until sufficiently mature, which may result in mortality as a result of adults abandoning their dependent young or accidental removal of an active drey.

6.10.200 However, as described in Chapter 12: Noise and Vibration no significant effects are anticipated. In addition, the inclusion of the mitigation during construction, including that outlined for red squirrel in Section 6.9: Essential mitigation and enhancement and the EMP, including installation of green overbridges, habitat creation and feeding stations to sustain red squirrels whilst habitat matures, would result in effects associated with disturbance to red squirrel to be neutral and not significant.

Species mortality

6.10.201 There may be an increase in incidental red squirrel injury and mortality from road traffic accidents from construction traffic. Collisions may occur from vehicle movement or when plant are in operation and vehicle movement in areas where red squirrel are present.

[53] REFERENCE

6.10.202 As red squirrels naturally occur in low densities, individuals could become stressed from the presence of more red squirrels which could lead to an increase of disease transmission and susceptibility.

6.10.203 However, the inclusion of the mitigation during construction outlined for red squirrel in Section 6.9: Essential mitigation and enhancement and the EMP, including installation of green overbridges, habitat creation and feeding stations, would result in effects associated with direct mortality to red squirrel to be neutral and not significant.

Bats

6.10.204 The assemblage of bat species within the ZoI has been assessed as being between Local importance/low sensitivity to Regional importance/medium sensitivity.

6.10.205 The impacts of construction of relevance to bats are:

- habitat loss
- habitat fragmentation
- habitat damage
- disturbance
- species mortality.

Habitat loss

6.10.206 Direct loss of bat roosts together with the loss of woodland, mature trees, structures and hedgerow habitats will influence the local bat populations' Core Sustenance Zones (*Collins, 2016* and *CIEEM, 2021*), specifically the number of roosting opportunities in the landscape together with their ability to forage and commute through the landscape. The functionality of replacement or reinstated roosts and habitats will require time to establish and mature to the equivalent resource currently available (notably potential roosting features in mature trees).

6.10.207 Twenty-two bat roosts are located within the Order Limits of the Project.

6.10.208 One hundred and ninety-three mature trees and 82 structures with moderate or high bat roosting potential are located within the Order Limits.

6.10.209 Construction of the Project would also result in the permanent loss of foraging and commuting areas.

6.10.210 Habitat creation, proposed as mitigation for habitat loss, will provide suitable habitat for foraging and provide roosting opportunities. It is recognised that there would be a time lag between habitat loss and the provision of suitable habitat to mitigate for this effect; however, this is not considered significant given the abundance of surrounding habitats for bats to utilise in the intervening period.

6.10.211 Where the Project results in a loss of an identified bat roost, the roost will be compensated for in a form appropriate to the species of bat and type of roost, characterised by the baseline surveys.

6.10.212 All bat roosts will be replaced in accordance with a mitigation plan approved by Natural England through the EPSL. A bat mitigation licence (A13) will need to be applied for by the contractor, including a method statement, work schedule, reasoned statement and references for the named ecologist (where the named ecologist has not held a bat mitigation licence within the past three years). This document will cover all works that will impact upon known bat roosts, including details of the roosts such as species and number of bats, and the activities undertaken to mitigate the impacts caused.

6.10.213 Specifically, bat houses will be provided at two locations, High Barn (Roost 3) and Low Broats Farm (Roost 24). These bat houses will replace lost roosts in as close to like-for-like conditions as possible for the species impacted.

6.10.214 As a result, the effects are considered to be slight adverse and not significant.

Habitat fragmentation

6.10.215 Vegetation clearance required for construction of the Project will affect bat flight lines for the duration of works until replacement habitats are created and established.

6.10.216 Removal of linear corridors for construction compounds will result in temporary severance of flight routes together with a loss of functionality of connections between roosts and foraging grounds.

6.10.217 Section 6.8: Potential Impacts and Section 6.9: Essential mitigation and enhancement measures provide details of embedded and essential mitigation which support the minimisation of the effects of fragmentation. This includes the construction of green bridges which incorporate a minimum 1m wide strip of trees or wooded scrub along one road verge, with connective planting to the north and south approaches of the bridge, providing a continuous green corridor across the live carriageway.

6.10.218 As a result, the effects are considered to be slight adverse and not significant.

Habitat degradation

6.10.219 Potential impacts could arise from an increase in dust and vehicle emission deposits during the construction phase which may degrade sensitive habitats used as key resources for foraging, notably ancient woodland. For further information see Section 6.8: Potential impacts.

6.10.220 Water pollution arising from construction may affect aquatic habitats. This degradation may result in a potential loss of invertebrate food source(s) in the local area. For further information see Section 6.8: Potential impacts.

6.10.221 However, the inclusion of the mitigation during construction outlined for bats in Section 6.9: Essential mitigation and enhancement and the EMP would result in effects associated with habitat degradation to bats to be neutral and not significant.

Disturbance

6.10.222 The proximity of construction works and construction traffic to sensitive bat roosts (notably seasonally important maternity and hibernation roosts) may cause disturbance through elevated noise and vibration.

6.10.223 Temporary lighting for construction could impact bats by deterring them from roost locations along with impacting on the abundance of airborne invertebrate prey species.

6.10.224 However, as described in Chapter 12: Noise and Vibration no significant effects are anticipated. In addition, the inclusion of the mitigation during construction outlined for bats in in Section 6.9: Essential mitigation and enhancement and the EMP would result in effects associated with disturbance to bats to be neutral and not significant.

Species mortality

6.10.225 Vegetation clearance during construction has the potential to cause injury or mortality of roosting bats, notably when hibernating in roosts that have not been identified.

6.10.226 Increases in construction traffic in proximity to bat roosts and known flight lines may increase mortality through collisions with construction vehicles.

6.10.227 Construction disturbance (for example, from noise generating activities or lighting) may also cause mortality through forcing a change in bat behaviour, such as bats crossing the active road network at a different location to that previously known.

6.10.228 However, the inclusion of the mitigation during construction outlined for bats in Section 6.9: Essential mitigation and enhancement and the EMP would result in effects associated with direct mortality to bats to be neutral and not significant.

Breeding birds

6.10.229 The breeding bird assemblage within the ZoI has been assessed as being of County importance/Medium sensitivity.

6.10.230 The impacts of construction of relevance to breeding birds are:

- Habitat loss
- Disturbance
- Species mortality.

Habitat loss

6.10.231 The Project will result in a loss of habitat causing a temporary reduction of nesting, foraging and roosting habitats for breeding birds. Habitat loss could potentially contribute to the localised decrease in, loss or displacement of relatively small numbers of notable bird species. Dualling the carriageway and construction of offline areas will decrease the ability of some species to move through the landscape due to the increased width of the road.

6.10.232 The ZoI was recognised as supporting a high number of territories for ground nesting bird such as curlew (26), lapwing (35), oystercatcher (28) and skylark (24) owing to the abundance of open short grassland within and adjacent to the Project. Open short grassland is abundant in the wider area and the temporary losses of suitable habitat to facilitate the Project is unlikely to represent a notable loss of available nesting habitat for these species. Song thrush (29) and willow warbler were also recorded in notable numbers within the ZoI. Any loss of nesting habitat will be replaced on at least a like for like basis.

6.10.233 Due to the abundance of suitable habitat present in the local area and the creation of diverse semi-natural habitats within the Order Limits that are suitable to support foraging and nesting opportunities, it is considered that habitat loss would result in a neutral effect and is not considered significant.

Disturbance

6.10.234 Construction related activity may increase noise and light disturbance levels at irregular times. Consequently, breeding birds may be less likely to become habituated to irregular disturbance events. Human presence and visual disturbance may also deter breeding birds from using habitats or cause them to abandon nests. However, ground nesting breeding birds are likely to be more sensitive to this impact. The majority of the Project will follow the existing A66 and increases in construction related disturbance is considered to be relatively limited.

6.10.235 Where the Project departs offline to the north of Kirkby Thore, disturbance could have a more pronounced effect and reduce the suitably of habitats for breeding birds more significantly.

6.10.236 However, as described in Chapter 12: Noise and Vibration no significant effects are anticipated. In addition, the inclusion of the mitigation during construction including sensitive working methods as outlined in Section 6.9: Essential mitigation and enhancement and the EMP (Application Document 2.7) and overseen by the ECoW would help avoid and minimise the effects of disturbance on breeding birds. These measures include but are not limited to the use of directional lighting and pre-vegetation clearance checks.

6.10.237 It is considered likely that habitat degradation would result in a minor adverse effect and is not considered significant.

Species mortality

6.10.238 Vegetation clearance activities may result in the direct mortality of birds. In the absence of mitigation, vegetation clearance activities undertaken during the bird nesting season (March to August inclusive) may result in the direct destruction of active nests and risk mortality to unfledged birds.

6.10.239 Destruction of active birds nests would be avoided through working methods set out in the EMP (Application Document 2.7), which stipulates that vegetation clearance activities would be undertaken outside the breeding bird season where possible and would provide protection for birds and their nests throughout the construction period. Targeted replacement nest boxes would also be incorporated into the Project. It is considered that mortality would result in a minor adverse effect and is not considered significant.

Wintering birds

6.10.240 The wintering bird assemblage within the ZoI has been assessed as being of County importance/Medium sensitivity.

6.10.241 The impacts of construction of relevance to wintering birds are:

- Habitat loss or gain
- Disturbance
- Species mortality.

Habitat loss or gain

6.10.242 The loss of habitat as a result of construction of the Project would cause a temporary reduction of foraging and roosting habitats for wintering birds. Habitat loss could contribute to the localised decrease in, loss or displacement of, relatively small numbers of notable bird species.

6.10.243 The Project was recognised as supporting high numbers of gulls, waders and wildfowl, in particular golden plover and lapwing. Golden plover is an SPA citation species of the North Pennine Moors SPA and may use habitats adjacent to the Project during winter to forage before heading upland into the SPA to breed.

6.10.244 Golden plover were recorded largely outside the Order Limits of the Project within open short grassland. This habitat is abundant in the wider area and the temporary loss of a relatively small amount of suitable habitat to facilitate construction of the Project is likely to represent a minimal loss of available habitat for golden plover or other species. Where the Project departs significantly from the existing A66 and will cause the loss of arable land, no golden plover were recorded.

6.10.245 Due to the abundance of suitable habitat present in the local area and the creation of additional habitat, it is considered that

habitat loss would result in a minor adverse effect and is not considered significant.

Disturbance

6.10.246 Construction related activity may increase noise and light disturbance levels at irregular times. Consequently, wintering birds may be less likely to become habituated to irregular disturbance events. Human presence and visual disturbance may also deter wintering birds from using specific habitats.

6.10.247 The majority of the Project will follow the existing A66 and increases in construction related disturbance is considered to be relatively limited.

6.10.248 Where the Project departs significantly offline to the north of Kirkby Thore, disturbance could reduce the suitably of habitats for wintering bird. No golden plover were recorded in this area. It is considered likely that disturbance would result in a minor adverse effect and is not considered significant.

Species mortality

6.10.249 Vegetation clearance activities may result in injury and mortality to wintering birds. However, due to the mobile nature of birds during the wintering period and the general lack of breeding activity, this is likely to be a neutral effect on the wintering bird assemblage and is not considered significant.

Barn owl

6.10.250 The population of barn owl within the survey area have been assessed as being of Regional importance/medium sensitivity.

6.10.251 The impacts of construction of relevance to barn owl are:

- Habitat loss or gain
- Disturbance
- Fragmentation
- Species mortality

Habitat loss or gain

6.10.252 A total of ten nest and roosts sites (two OBS, three ARS and five PNS) were recorded within the Order Limits of the Project. Of these, within the indicative site clearance boundary, one OBS, one ARS and two PNS will be lost.

6.10.253 Mitigation measures have been incorporated within the Project to minimise potential impacts to barn owls. These are as outlined in Section 6.9: Essential mitigation and enhancement and the EMP (Application Document 2.7). These measures include the closure of OBS 7 by a licensed ecologist, provision of replacement and compensatory nest boxes and protection zones of 20m around all active nests and roosts.

6.10.254 Barn owl foraging habitat, both Type 1 (high quality) and Type 2 (moderate quality) will be lost on a temporary and permanent

basis as a result of construction of the Project. It is unlikely that the temporary habitat loss would impact the local population due to the large expanse of suitable habitat within the surrounding area.

6.10.255 Permanent habitat loss of barn owl foraging habitat could reduce barn owl foraging success, causing the abandonment of existing territories, or increased barn owl mortality due to prey scarcity.

6.10.256 Habitat reinstatement and creation will be undertaken to mitigate for temporary and permanent habitat loss. Rough tussocky grassland and mature trees that are lost will be replaced. The focus will be on reinstating grassland areas of Type 1 and Type 2 habitat, either in situ or within areas identified for ecological mitigation within the Order Limits.

6.10.257 As a result, this is likely to be a neutral effect on the barn owl population and is not considered significant.

Disturbance

6.10.258 A relative increase in noise disturbance to the nest locations closest to the Project above that of the current levels may cause abandonment of the nesting locations. Initial nest location selection, egg laying and incubation are particularly sensitive to nest desertion and breeding failure. The Forestry Commission (2007)[54] recommend a safe working distance from nesting barn owls of no less than 250m for those activities which are likely to cause disturbance. Two OBS are within 250m of the indicative site clearance boundary and may be subject to disturbance.

6.10.259 One will be lost as it is located within the indicative site clearance boundary and will be closed under licence. A second OBS is located approximately 90m from the indicative site clearance boundary and may be subject to disturbance.

6.10.260 A further 28 nests and roosts are present within 250m of the indicative site clearance boundary which are currently retained but have the potential to be impacted by the works. Any alteration at the design stage will require consideration of any additional impacts on these nests and roosts.

6.10.261 The lighting associated with construction areas and access routes during periods of darkness may cause barn owls to avoid specific areas and cause a further barrier to dispersal. Lighting of specific areas may affect the movement of barn owls around foraging areas, which also has the potential to cause impacts to territory size and survival.

6.10.262 Possible temporary increased noise impacts associated with overnight works may cause some disturbance to foraging

[54] Forestry Commission (2007) Forest Operations and Birds in Scottish Forests – the Law and Good Practice. Guidance Note 32. Forestry Commission, Scotland.

behaviour but is unlikely to reduce their foraging success because the hearing of owls is attuned to the high-pitched sounds of small mammals, rather than lower frequency noise from construction.

6.10.263 Mitigation measures have been incorporated within the Project to minimise potential disturbance effects to barn owl (Section 6.9: Essential mitigation and enhancement and the EMP (Application Document 2.7)). These include retaining at least a 20m buffer around active barn owl nests to reduce potential disturbance effects and minimising light spill through a sensitive lighting design.

6.10.264 As a result, this is likely to be a neutral effect on the barn owl population and is not considered significant

Fragmentation

6.10.265 The construction of the Project will fragment habitats, particularly in offline schemes, across which barn owl would usually commute and forage.

6.10.266 The effects of this fragmentation (species mortality as a result of road traffic collisions) will become apparent once the Project becomes operational and so this has been appraised within the operational assessment for barn owl (see Section 6.10: Assessment of likely significant effects - Operation – Barn owl below).

Species mortality

6.10.267 Mortality to barn owls could occur through drowning in uncovered water butts or troughs and through rodenticide poisoning by eating poisoned rats and mice.

6.10.268 However, the inclusion of the mitigation during construction outlined in Section 6.9: Essential mitigation and enhancement and the EMP (Application Document 2.7), including avoiding the use of rodenticide where possible on construction compounds, would avoid this impact and therefore result in effects associated with direct mortality to barn owl to be neutral and not significant.

Otter

6.10.269 The population of otter within the survey area has been assessed as being of County importance/Medium sensitivity.

6.10.270 The impacts of construction of relevance to otter are:

- Habitat loss or gain
- Habitat degradation
- Disturbance
- Species mortality.

Habitat loss or gain

6.10.271 Construction of the Project will cause the loss of a range of habitats suitable for otter including woodland, scrub and

grassland adjacent to watercourses, albeit limited to where the Project crosses watercourses which is localised and infrequent. Habitat clearance would also temporarily reduce connectivity between retained areas of these habitats.

6.10.272 The permanent loss of a confirmed natal holt on Moor Beck, north of Warcop Training Centre and immediately adjacent to the existing A66, within the Order Limits of the Appleby to Brough scheme, has been assumed on a precautionary basis, as the location of and construction area required for the supporting columns of a proposed bridge in this location is not yet confirmed.

6.10.273 Riparian habitat creation along key watercourses would restore connectivity and would increase the areas of less intensively managed habitats that are likely to be of greatest value to otter (see Environmental Mitigation Maps (Application Document 2.8) for further details). These include native broadleaved woodland, species-rich grassland and species-rich scrub and hedgerows.

6.10.274 Closure of the assumed natal holt would occur under a EPSL, with agreement from Natural England. This licence will include certain mitigation measures which will be dependent upon the exact impact of the Project on the natal holt.

6.10.275 Two additional holts will be created on Moor Beck, approximately 400m south and 100m north of the existing holt, to mitigate for the loss of breeding and sheltering habitat during construction. This provides mitigation for the impact anticipated on a precautionary basis, but also increases the breeding opportunity for otter within the Order Limits.

6.10.276 As a result of the embedded and essential mitigation, it is likely that a temporary slight beneficial effect will result, although this is not considered significant.

Habitat degradation

6.10.277 Habitats within or adjacent to the Project and those that are hydrologically connected to it, are sensitive to potential impacts from pollution events, such as from dust, fuel and chemical spills, from changes in air quality due to vehicle emissions, and from sediment run-off from construction areas causing degradation of habitat.

6.10.278 Dust deposition, especially from activities such as material crushing, could have an adverse effect on vegetation by smothering, reducing the ability to photosynthesise and respire.

6.10.279 Dust leached into soils can affect the chemical composition of the soil and therefore plant health or plant communities that the food resource of the otter depend upon, bioaccumulating in otters.

6.10.280 Indirect effects may occur as a result of increased susceptibility of degraded habitats to environmental stresses such

as disease and pests and, as the quality or suitability of foraging habitat of the food source of otters is reduced, this will have consequential effects on otter.

6.10.281 The inclusion of the mitigation during construction outlined in Section 6.9: Essential mitigation and enhancement and the EMP (Application Document 2.7), including the creation of artificial holts, otter ledges, dry culverts and riparian habitat enhancements, would avoid and minimise this impact and therefore result in effects anticipated to be neutral and not significant.

Disturbance

6.10.282 The proximity of construction works and construction traffic to sensitive otter holts (notably natal holts) may cause disturbance through elevated noise and vibration.

6.10.283 Temporary lighting for construction could impact otters by deterring them from holt locations and from foraging and dispersing along the watercourses in proximity to the Project.

6.10.284 However, the inclusion of the mitigation during construction outlined in Section 6.9: Essential mitigation and enhancement and the EMP (Application Document 2.7) including best practice working methods to be followed in relation to dust management, pollution control and buffers around retained sensitive habitat, would result in effects associated with disturbance to otter to be neutral and not significant.

Species mortality

6.10.285 Mortality and injury of otter could occur during clearance and construction. Habitat clearance designed and timed to be sensitive to this species, alongside habitat manipulation clearance techniques to deter species away from areas, would remove or reduce these risks.

6.10.286 In addition, wildlife crossing points have been included in the design in the form of culverts and ledges to improve connectivity and reduce mortality risk, as well as the provision of otter fencing in large portions of the Project to prevent access to the road network and direct animals to the safe crossing points. The provision of these wildlife crossing points will also increase landscape permeability for otter compared to the present conditions.

6.10.287 The inclusion of the mitigation during construction outlined in section 6.9: Essential mitigation and enhancement and the EMP (Application Document 2.7) such as inclusion of otter fencing, otter ledges and dry culverts would avoid this impact and therefore result in effects associated with direct mortality to otter to be neutral and not significant.

Fish

6.10.288 The importance and corresponding sensitivity of fish assemblages ranges from International (very high sensitivity) to Local (low sensitivity). Only those assessed as being of County value or above are discussed further.

6.10.289 The fish assemblage of Thacka Beck (M6 Junction 40 to Kemplay Bank) is assessed as being of National importance (high value) as it supports salmon, a qualifying species of the River Eden SAC. The fish assemblage of the River Eamont is assessed as being of International importance (very high value) as this river forms part of the River Eden SAC.

6.10.290 The fish assemblage of Light Water (Penrith to Temple Sowerby) is assessed as being of National importance (high value) as it supports salmon, a qualifying species of the River Eden SAC. The fish assemblage of the River Eamont (Penrith to Temple Sowerby) is assessed as being of International importance (very high value) as this river forms part of the River Eden SAC.

6.10.291 The fish assemblage of Trout Beck (Temple Sowerby to Appleby) is assessed as being of International importance (very high sensitivity) as it forms part of the River Eden SAC and has been shown to support all qualifying fish features.

6.10.292 The fish assemblage in watercourses within the Appleby to Brough scheme is assessed as being of National importance (very high sensitvity) as the watercourses have been shown to support qualifying species of the River Eden SAC and are therefore considered functionally linked to the SAC.

6.10.293 The impacts of construction of relevance to fish are consistent with those described in detail for watercourses:

- Habitat loss
- Habitat degradation
- Habitat alteration.

6.10.294 The following additional impacts of construction of relevance to fish are:

- Species disturbance
- Habitat fragmentation
- Species mortality.

Species disturbance

6.10.295 Potential disturbance of fish has been materially reduced as a result of open span watercourse crossing design. However, culvert construction/replacement and extension, and the construction of the open span crossings in or near water could result in temporary disturbance from potential noise, vibration, and lighting. Temporary dewatering and over pumping associated

with culvert construction could also present a temporary barrier disturbing fish.

6.10.296 When considering the successful implementation of the proposed avoidance and mitigation measures (outlined in ES Appendix 6.1: Non-Significant Effects and the EMP (Application Document 2.7)) and includes sensitive construction practices including: avoiding night working where practicable adjacent to watercourses (night working will only be implemented where traffic management on a road necessitates it for safety); construction sites will not be illuminated at night, where possible (where this is not possible (e.g. due to security considerations in non-green field locations, lighting will be sensitive to nocturnal species using the river and riparian corridor and face away from the watercourse, thus reducing disturbance of nocturnal migrants); works which will give rise to excessive vibration will be undertaken outside of the key fish spawning seasons (and will be implemented across all schemes where fish has been identified as a receptor), the effect on the fish is assessed as slight adverse (negligible) and not significant.

Habitat fragmentation

6.10.297 Temporary fragmentation of fish habitat could occur as a result of disturbance arising of from construction activities, or as a result of a physical barrier associated with dewatering and over pumping during culvert construction.

6.10.298 Essential design mitigation includes best practice watercourse crossing design, remediation of the existing A66 culvert in the vicinity of the Woodend Sike and Yosgill Sike confluence (considered a barrier to migration for all fish species with the exception of eel under normal low flow conditions due to insufficient water depth) and replacement of culverts in line with current best practice.

6.10.299 The extension of the Thacka Beck culvert (M6 Junction 40 to Kemplay Bank) is not considered to adversely affect fish passage, as the reach is heavily culverted under the baseline scenario, as a result of the A686, the A66 and of the Cumbria Constabulary buildings. The culvert extension will be designed such that the potential for fish passage is not reduced and opportunities to improve fish passage through the culvert, and between Thacka Beck and the River Eamont will be investigated as part of the detailed design (see further details within the EMP (Application Document 2.7)).

Species mortality

6.10.300 In the absence of mitigation excessive vibration and dewatering activities could give rise to injury or mortality of fish. Vibration can cause damage or mortality of eggs and embryos in spawning gravels, which could have an adverse effect on the populations of conservation species that are gravel spawners, notably bullhead, brown trout, lamprey sp., and salmon. Fish may

also be entrained into pumps, or suffocate if not translocated prior to dewatering.

6.10.301 When considering the successful implementation of the proposed avoidance and mitigation measures (outlined in ES Appendix 6.1: Non-Significant Effects and the EMP (Application Document 2.7)) and includes sensitive construction practices such as: night working will be avoided where practicable adjacent to watercourses (night working will only be implemented where traffic management on a road necessitates it for safety); construction sites will not be illuminated at night, where possible (where this is not possible (e.g. due to security considerations in non-green field locations, lighting will be sensitive to nocturnal species using the river and riparian corridor and face away from the watercourse, thus reducing disturbance of nocturnal migrants); works which will give rise to excessive vibration will be undertaken outside of the key fish spawning seasons (and will be implemented across all schemes where fish has been identified as a receptor), measures to minimise disturbance to migrating species, the effect on the fish is assessed as slight adverse (negligible) and not significant.

White-clawed crayfish

6.10.302 The importance and corresponding sensitivity of WCC populations ranges from International (very high) to National (high).

6.10.303 The WCC assemblage of the River Eamont (Penrith to Temple Sowerby) is assessed as being of International importance (very high sensitivity) as this river forms part of the River Eden SAC.

6.10.304 The WCC population of Trout Beck and the River Eamont are assessed as being of International importance (very high sensitivity) as these rivers form part of the River Eden SAC.

6.10.305 Based on the results of the manual search and/or eDNA surveys, WCC were confirmed present in the following watercourses within the Appleby to Brough scheme:

- Unnamed Tributary of Mire Sike 6.12
- Moor Beck
- Eastfield Sike
- Unnamed Tributary of Lowgill Beck 6.1
- Lowgill Beck
- Woodend Sike
- Yosgill Sike.

6.10.306 The WCC populations in these watercourses are assessed as being of National importance (high value).

6.10.307 The impacts of construction of relevance to WCC are consistent with those described in detail for watercourses:

- Habitat loss
- Habitat degradation

- Habitat alteration
- Introduction and/or spread of invasive non-native species.

6.10.308 The following additional impacts of construction of relevance to WCC are:

- Species disturbance
- Habitat fragmentation
- Species mortality.

Species disturbance

6.10.309 Potential disturbance of WCC has been significantly reduced as a result of open span watercourse crossing design. However, culvert construction/replacement and extension, and the construction of the open span crossings in or near water could result in temporary disturbance from potential noise, vibration, and lighting. Temporary dewatering and over pumping associated with culvert construction could also present a temporary barrier to migration for WCC.

6.10.310 When considering the essential mitigation (outlined in ES Appendix 6.1: Non-Significant Effects and the EMP (Application Document 2.7)) to protect WCC, the effect on WCC is assessed as slight adverse and not significant.

Habitat fragmentation

6.10.311 Temporary fragmentation of WCC habitat could occur as a result of disturbance arising of from construction activities, or as a result of a physical barrier associated with dewatering and over pumping during culvert construction.

6.10.312 When considering the essential mitigation (outlined in ES Appendix 6.1: Non-Significant Effects and the EMP (Application Document 2.7)) to protect WCC, the effect on WCC is assessed as slight adverse and not significant.

Species mortality

6.10.313 In the absence of mitigation excessive vibration and dewatering activities could give rise to injury or mortality of fish. WCC may also be entrained into pumps or suffocate if not translocated prior to dewatering.

6.10.314 Permanent shading of instream habitat and associated loss of instream and riparian vegetation (as a result of the culvert extension and new watercourse crossings) is assessed, when considering the successful implementation of the proposed avoidance and mitigation measures (outlined in ES Appendix 6.1: Non-Significant Effects and the EMP (Application Document 2.7) and includes translocation of WCC from the construction areas as required by an appropriate Natural England licenced surveyor and overseen by the ECoW), as slight adverse and not significant.

Operation

Designated sites

6.10.315 As part of the air quality assessment of significant effects on designated sites, *DMRB LA105 Air Quality* (Highways England, 2019)[55] prescribes the need to determine whether the site air quality attribute is either 'restore' or 'maintain'. Air quality attributes are publicly specified for European designated sites, but not for locally or nationally designated sites or ancient woodland. Subsequently, where these attributes are not specified for sites included within the assessment, where suitable information is available, professional judgement is applied. Where insufficient information is available, the air quality attribute has been set to 'restore' as outlined within *DMRB LA105 Air Quality.*

6.10.316 In addition, *DMRB LA105 Air Quality* prescribes the need to utilise Table 21 within the *Natural England Commissioned Report NECR210* (Natural England, 2016)[56] to determine whether nitrogen deposition associated with the Project will lead to the theoretical loss of one species. The results of using Table 21 is used in conjunction with other sources of information to undertake the assessment including desk study information and survey information, where available. Professional judgement and ecological principles are then applied in concluding the assessment.

6.10.317 The Plates used in this section of the assessment i.e. Designated Sites, are used to provide a visualisation of areas potentially impacted by air quality. It should be noted that these are approximate areas and therefore the depiction of boundaries of the sites within these plates are indicative.

North Pennine Moors SAC and SPA and Bowes Moor SSSI

6.10.318 The Appropriate Assessment relating to the North Pennine Moors SAC is provided within the HRA Stage 1: Likely Significant Effects Report (Application Document 3.6).

6.10.319 The anticipated operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.320 The boundaries of North Pennine Moors SAC, SPA and Bowes Moor SSSI align along the ARN. Subsequently the potential area of impact as a result of potential changes in air quality would occur on an area covered by all three designated sites and therefore they are considered together within this assessment.

[55] Highways England (2019) DMRB LA105 Air Quality

[56] Natural England (2016) Natural England Commissioned Report NECR210. Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance

6.10.321 The SSSI units which occur within 200m of the ARN are unit 1, unit 3 and unit 4. Unit 1 is in unfavourable - recovering condition. Unit 3 is in unfavourable - no change condition. Unit 4 is in unfavourable - no change condition.

6.10.322 The units are designated for supporting a range of qualifying habitats, however following a habitat survey (HRA Stage 2: Statement to Inform Appropriate Assessment (Application Document 3.6), the qualifying habitat recorded within 200m of the ARN was blanket bog. No other qualifying habitat was recorded within the survey area. Consequently, only potential impacts on this habitat type are taken forward in this assessment. This excludes the remaining 12 habitats and one Annex II species for which the SAC is designated (as primary reasons for selection and qualifying features). In addition, the two other supporting processes outlined within the conservation objectives; hydrology and conservation measures, will be unaffected by the Project and are ruled out from further assessment.

6.10.323 In line with *DMRB LA105 Air Quality*, the site air quality attribute is considered to be 'restore'. This is a result of the site-relevant critical load for bog at the North Pennine Moors SAC and SPA already exceeding the lower critical load of 5kgN/ha/yr. The current levels of nitrogen deposition on the SAC/SPA are exceeded with an average 19.4kgN/ha/yr (APIS, 2022).

6.10.324 Using Table 21 *NECR210* (Natural England, 2016), the change in nitrogen deposition required to result in the theoretical loss of one species for bog habitat is 3.3kg, with no variation in rates relating to background long-term nitrogen deposition levels.

6.10.325 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 0.9kgN/ha/yr Table 6-22: Air quality assessment of designated sites). It is acknowledged that this threshold is high and does not account for varying levels of background deposition levels.

6.10.326 To provide some further context, the habitat areas within North Pennine Moors SAC and SPA and Bowes Moor SSSI are already subject to background levels of nitrogen deposition which exceed the higher critical load of 10kgN/ha/yr (APIS, 2022). Furthermore, the habitat within proximity to the existing A66 will be subject to impacts associated with the maintenance of the existing road, for example localised drainage from the road, salt spray, compaction from road maintenance vehicles and roadside vegetation maintenance. Therefore, it would not be unreasonable to assume that these pressures will have altered the vegetation community and any species susceptible to high levels of nitrogen will already be impacted at baseline.

6.10.327 By taking a precautionary approach and interrogating the modelling data where 1% of the critical load is breached along the transect, the approximate area where a significant impact may occur can be calculated. For areas of the designated site which

lie north of the existing A66, the 1% change against the critical load is breached up to 60m along the transect. For the areas of the designated site which lie south of the existing A66, the 1% change against the critical load is breached up to 30m along the transect.

6.10.328 A habitat survey was undertaken in 2021 on areas within the North Pennine Moors SAC which were located within 200m of the ARN to determine the presence and extent of cover of qualifying features of the SAC (HRA Stage 2: Statement to Inform Appropriate Assessment (Application Document 3.6). The areas of blanket bog recorded within 60m of the transect during the survey were mostly recorded to be a mosaic with acid and marshy grassland. These habitat areas are on the edge of the site and given the proximity to the existing A66 are therefore likely to be of lower quality - potentially reflected in the fact this habitat was recorded to be in a patchy mosaic with acid and marshy grassland and subject to sheep grazing. The total area of blanket bog only (not recorded as a mosaic) within 60m was 4.01ha. No blanket bog was recorded within 30m of SAC located south of the existing A66.

6.10.329 On review of previous historical habitat mapping in the *Conservation objectives and definitions of favourable condition for designated features of interest* (Natural England, 2009)[57], habitat mapping of the NVC communities within the SAC was undertaken in 2002. The mapping confirms the results of the habitat survey undertaken in 2021 that areas of blanket bog within 60m of the A66 were very limited in extent and the majority of habitat was recorded to be one of the calcifugous grassland and montane communities.

6.10.330 The Conservation Objectives Supplementary Advice (Natural England, 2019)[58] states blanket bog covers an area of approximately 39,181.58ha of the North Pennine Moors SAC. Bowes Moor SSSI covers an area of 4,457.7ha (Department for Environment Food Rural Affairs, 2022)[59]. On a precautionary basis, it is assumed that the area of potential significant impact (4.01ha) would be on areas of blanket bog. This equates to 0.01% of the North Pennine Moors SAC and 0.09% of Bowes Moor SSSI.

6.10.331 The maximum magnitude of impact is 0.9kgN/ha/yr, with the exceedance of threshold covering an extent of approximately 4.01ha.

[57] Natural England (2009) Conservation objectives and definitions of favourable condition for designated features of interest

[58] Natural England (2019) European Site Conservation Objectives: supplementary advice on conserving and restoring site features. North Pennine Moors Special Area of Conservation (SAC) Site code: UK0030033

[59] Department for Environment Food Rural Affairs (2022) MAGIC Map

6.10.332 The frequency of the impact is annual with the timing of the impact being within the operation period of the Project.

6.10.333 In summary, blanket bog is the only qualifying feature that may be impacted by changes in nitrogen deposition. The remaining 12 habitats and one Annex II species for which the SAC is designated were not recorded within 60m north of the existing A66 or 30m south of the existing A66 within the SAC. Furthermore, no adverse effects on hydrology and conservation measures occur as a result of the Project. Given the small area of edge blanket bog habitat within the designated site which would be subject to additional deposition of nitrogen (no other qualifying features affected), in combination with the fact that these areas are already adjacent to the existing A66 and subject to road transport emission, it is predicted that the ecological structure and function of the designated site as a whole would not be significantly impacted by the increase in nitrogen deposition predicted by the modelling.

6.10.334 Considering the evidence provided above, it is predicted that no significant effect would occur on North Pennine Moors SAC and SPA and Bowes Moor SSSI as a result of air quality impacts. This is classified as a slight adverse, not significant effect.

River Eden SAC and River Eden and Tributaries SSSI

6.10.335 The qualifying habitat features for the River Eden SAC include floating vegetation of plain and sub-mountainous rivers (Annex I) and alluvial forest (Annex I). The qualifying habitat feature for River Eden and Tributaries SSSI is floating vegetation of plain and sub-mountainous rivers (Annex I).

6.10.336 The Appropriate Assessment relating to the River Eden SAC is provided within the HRA Stage 2: Statement to Inform Appropriate Assessment (Application Document 3.6).

6.10.337 The anticipated operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.338 The only qualifying feature assessed for air quality impacts for this site is 3260 watercourse habitat. This is a result of other qualifying features relating to impacts from nitrogen deposition, being absent at crossing points assessed as part of the air quality modelling. In the absence of a critical load value for 3260 watercourse habitat, the air quality assessment presents nitrogen deposition as a percentage change from baseline and the change in nitrogen deposition (kgN/ha/yr) from a single point immediately adjacent to the road.

6.10.339 During operation, the most significant change in nitrogen deposition are associated with the existing and proposed crossing of Trout Beck. A significant decrease (-60.00%) in nitrogen deposition is predicted by the model at the existing A66 Trout Beck crossing as traffic follows the proposed offline section. A

significant increase in nitrogen deposition of 31.12% and 30.12% is predicted by the model upstream and downstream of the proposed A66 crossing respectively.

6.10.340 Elsewhere increases in nitrogen deposition ranging from 1.66% (0.23 kgN/ha/yr) at River Belah (A685 at Belah Bridge) upstream, to 8.94% (1.22 kgN/ha/yr) at River Eden (A66 at Oglebird) downstream, are predicted by the model as a result of changes in traffic flow.

6.10.341 When considering the results of the air quality modelling it should be noted that whilst change in deposition rate is a useful metric to understand the net increase in pollutants in the air, this metric is less applicable to this aquatic habitat type. Aquatic plants that are a component of the vegetation community are submerged for the majority of the year due to their growth form, consequently they are regularly inundated and flushed during modest flood events.

6.10.342 The local contributions to nitrogen deposition (kg N/ha/yr) from sources (UK) shows that the largest contributor for the River Eden SAC is livestock (56.4% 8.81kgN/ha/yr). The remaining sources of contribution (e.g. Europe import, fertiliser application) identified which are unrelated to road transport, equate to 38.2%. Nitrogen deposition in relation to road transport is the smallest identified source of 4.0% 0.63kgN/ha/yr (APIS, 2022). Based on this, it is considered that any increase in nitrogen deposition as a result of the Project, even an increase over 1000 Annual Average Daily Traffic (AADT) will not make a considerable impact on the overall source of nitrogen deposition that the SAC currently receives from various other sources.

6.10.343 An increase in nitrogen deposition was predicted at five locations where the ARN interacts with the SAC during operation; this potential effect is considered localised.

6.10.344 The contribution of nitrogen from road transport in the context of other nitrogen sources (as discussed above) is modest, especially when the diluting effect of the water is considered. The impacts are localised and therefore, it is considered that nitrogen deposition would not result in an adverse effect of this feature within the respective SSSI units.

6.10.345 Full details of the HRA assessment are included within HRA Stage 2: Statement to Inform Appropriate Assessment (Application Document 3.6).

6.10.346 The HRA concludes that there are no adverse effects on the integrity of the site as a result of air quality. Therefore, it is predicted that no significant effect would occur on River Eden SAC and River Eden and Tributaries SSSI as a result of habitat degradation caused by air quality. This is classified as a slight adverse, not significant effect.

Oglebird Plantation PAWS

6.10.347 Oglebird Plantation PAWS is located 451m west of the Order Limits of Temple Sowerby to Appleby but lies within 200m of the ARN.

6.10.348 No citation was provided for this site. Review of available desk study data (aerial mapping sources Google maps, December 2021), show the woodland on the eastern extent of the site on the top of the scar is planted conifers consisting of scot's pine and larch (Larix sp.) (Plate 1). This habitat type is consistent with the designation type being a replanted woodland. The wooded area on the escarpment consists of broadleaved trees and these are likely to be naturalised and not replanted due to the steep topography and lack of easy access for management.

6.10.349 The anticipated operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.350 Insufficient detailed information is available to determine the air quality attribute for this site. As such, in line with *DMRB LA 105 Air Quality* the air quality attribute is set to 'restore', which takes a precautionary approach and the lower critical load value rather than the background rate of nitrogen deposition. However, to provide some context, the nitrogen deposition for forest on APIS (APIS, 2020) is 36.12kgN/ha/yr in 2018 for the majority of the grid square which Oglebird Plantation PAWS is located within.

6.10.351 Table 21 (Natural England, 2016) does not provide directly comparable data for woodland habitat. In line with *DMRB LA 105 Air Quality* where designated habitats are not included within Table 21, '*the habitat with the lowest change in nitrogen deposition likely to lead to the loss of one species, excluding nutrient impoverished sand dunes, shall be used to inform the judgement of significant air quality effect*'. As such, the threshold used for the designated site is 0.4kg.

6.10.352 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 0.6kgN/ha/yr (Table 6-22: Air quality assessment of designated sites

6.10.353 By taking a precautionary approach and interrogating the modelling data where 1% of the critical load is breached along the transect, the approximate area where a significant impact may occur can be calculated. The 1% change in critical load is breached up to 40m in the transect. This equates to 0.15ha. The total area of the designated site is 7.27ha. Therefore, the area of potential impact equates to 2.06% of the designated site (Plate 2).

6.10.354 Woodland habitat is not included within Table 21 (Natural England, 2016) therefore a precautionary approach is taken in line with *DMRB LA 105* and the most sensitive habitat is used to determine the loss of one species, with the lowest background

level of 5kgN. It is acknowledged that the background levels of nitrogen deposition in 2018 for the grid square far exceed this deposition level. Furthermore, it is not unreasonable to assume that this high background level of nitrogen deposition will have altered the vegetation community and any species susceptible to high levels of nitrogen will already be impacted at baseline. The aerial imagery also confirms the presence of planted conifers which are not considered local native species. Whilst it is possible that the original seed bank under these trees exists, the presence of scot's pine and their pine needles dropping onto the ground will likely have an influence on the ground flora present and the reason for designation of the site i.e ancient woodland indicators. Therefore, any potential impacts from air quality affecting the integrity of the site are likely to impact on a smaller area of the site i.e. the broadleaved trees on the scar (Plate 2).

6.10.355 The maximum magnitude of impacts is 0.6kgN/ha/yr with the exceedance threshold covering an extent of approximately 0.15ha.

6.10.356 The frequency of the impact is continual throughout the operational period of the Project.

6.10.357 Given the small area of the designated site which would be subject to additional deposition of nitrogen and the dominance of planted Scot's pine, it is predicted that the ecological structure and function of the designated site as a whole would not be significantly impacted by the increase in nitrogen deposition predicted by the modelling.

6.10.358 Considering the evidence provided above it is predicted that no significant effect would occur on Oglebird Plantation PAWS as a result of air quality impacts. This is classified as a slight adverse (not significant) effect.

Augill Bridge Wood ASNW

6.10.359 Augill Bridge Wood ASNW lies within 200m of the ARN, on the north side and directly adjacent to the existing A66, approximately 2.5km to the east of Appleby to Brough (Warcop).

6.10.360 The site is designated for supporting ancient semi-natural woodland and is on the Ancient Woodland Inventory.

6.10.361 No citation was provided for this site, however a description of the woodland is included within the citation for Augill Valley Pastures SSSI:.'The *transition from grassland to woodland is marked by scattered birch scrub (Betula pubescens) grading into denser thickets of birch, blackthorn (Prunus spinosa) and hawthorn (Crataegus monogyna) and eventually into woodland on the steeper slopes and river cliffs of the Augill Beck. The woodland is dominated by ash (Fraxinus excelsio) birch and rowan (Sorbus aucuparia) with an understorey of hazel (Corylus avellana) and hawthorn. The woodland ground flora is varied and includes dog's mercury (Mercurialis perennis), bluebell*

*(Hyacinthoides non-scripta), wood avens (Geum urbanum), sanicle (Sanicula europaea) as well as a number of ferns such as male fern (Dryopteris filix-mas), broad buckler-fern (D. dilatata) and lady-fern (Athyrium filix-f*emina)'.

6.10.362 Review of available desk study data (aerial mapping sources Google maps, June 2021) shows dense hawthorn and blackthorn scrub in the southern area of the woodland nearest the A66. Scattered ash was noted and becomes more prevalent approximately 50m north (away from the A66). Due to the density of the scrub it is less likely that this area of woodland will support a diverse range of ground flora due to the density of scrub (Plate 3).

6.10.363 The anticipated operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.364 Insufficient detailed information is available to determine the air quality attribute for this site. As such, in line with *DMRB LA 105* the air quality attribute is set to 'restore', which takes a precautionary approach and the lower critical load value rather than the background rate of nitrogen deposition. However, to provide some context, the nitrogen deposition for forest on APIS (APIS, 2020) is 33.18kgN/ha/yr in 2018 for the majority of the grid square which Augill Bridge Wood ASNW is located within.

6.10.365 Table 21 (Natural England, 2016) does not provide directly comparable data for woodland habitat. In line with DMRB LA105 Air Quality (Highways England, 2019) where designated habitats are not included within Table 21, '*the habitat with the lowest change in nitrogen deposition likely to lead to the loss of one species, excluding nutrient impoverished sand dunes, shall be used to inform the judgement of significant air quality effect*'. As such, the threshold utilised for the designated site is 0.4kg.

6.10.366 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 1.1kgN/ha/yr (Table 6-22: Air quality assessment of designated sites).

6.10.367 By taking a precautionary approach and interrogating the modelling data where 1% of the critical load is breached along the transect, the approximate area where a significant impact may occur can be calculated. The 1% change in critical load is breached up to 50m in the transect. This equates to 0.26ha. The total area of the designated site is 2.78ha. Therefore. the area of potential impact equates to 9.3% of the designated site (Plate 4).

6.10.368 Woodland habitat is not included within Table 21 (Natural England, 2016) therefore a precautionary approach is taken in line with *DMRB LA 105* and the most sensitive habitat is used to determine the loss of one species, with the lowest background level of 5kgN. It is acknowledged that the background levels of nitrogen deposition in 2018 for the grid square far exceed this

deposition level. Furthermore, it is not unreasonable to assume that this high background level of nitrogen deposition will have altered the vegetation community and any species susceptible to high levels of nitrogen will already be impacted at baseline.

6.10.369 The maximum magnitude of impacts is 1.1kgN/ha/yr with the exceedance threshold covering an extent of approximately 0.26ha.

6.10.370 The frequency of the impact is continual throughout the operational period of the Project.

6.10.371 Given the small area of the designated site which would be subject to additional deposition of nitrogen, in combination with the fact that a large proportion of this area appeared to be supporting dense scrub, it is predicted that the ecological structure and function of the designated site as a whole would not be significantly impacted by the increase in nitrogen deposition predicted by the modelling.

6.10.372 Considering the evidence provided above it is predicted that no significant effect would occur on Augill Bridge Wood ASNW as a result of air quality impacts. This is classified as a slight adverse (not significant) effect.

Stainmore Common LWS

6.10.373 Stainmore Common LWS lies within 200m of the ARN, approximately 9.2km to the east of Appleby to Brough (Warcop) and is located both north and south of the existing A66.

6.10.374 The site supports blanket bog on the plateau and upper slopes with acidic grassland on the lower slopes.

6.10.375 Review of available desk based sources (aerial mapping sources Google maps, August 2018 to December 2021), shows a farm entrance into Stainmore Common LWS. Sheep grazing was noted within the site adjacent to the A66 and the access track is likely used for the land owner to manage grazing activities within the site. Aerial imagery shows the habitat likely constitutes a mosaic of mire communities with acid grassland nearest the A66 (Plate 5). The habitat mapping survey undertaken in 2021 within the North Pennine Moors SAC recorded blanket bog directly adjacent to the east boundary of the site. Furthermore the historical habitat mapping undertaken in 2002 as part of Natural England's conservation objectives and definitions of favourable condition for designated features of interest (Natural England, 2009) recorded both a mosaic of mire communities and acid grassland in the area adjacent to Stainmore Common LWS.

6.10.376 The anticipated operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.377 Insufficient detailed information is available to determine the air quality attribute for this site. As such, in line with DMRB LA105

Air Quality (Highways England, 2019) the air quality attribute is set to 'restore', which takes a precautionary approach and the lower critical load value rather than the background rate of nitrogen deposition. However to provide some context, the nitrogen deposition for moorland on APIS (APIS, 2020) is 19.74kgN/ha/yr in 2018 in the grid square which Stainmore Common LWS falls in adjacent to the existing A66.

6.10.378 Using Table 21 (Natural England, 2016), the change in nitrogen deposition required to result in the theoretical loss of one species for bog habitat is 3.3kg, with no variation in rates relating to background long-term nitrogen deposition levels.

6.10.379 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 0.8kgN/ha/yr (Table 6-22: Air quality assessment of designated sites) which does not exceed the 3.3kg threshold. It should be noted that two modelled transects were placed for Stainmore LWS due to the site lying north and south of the existing A66. The transect on the north side of the existing A66 was modelled to predict >1% change against the critical load, however transect points on the south were not breached.

6.10.380 It is acknowledged that this threshold is high and does not account for varying levels of background deposition levels.

6.10.381 To provide some further context, the habitat areas within Stainmore Common LWS are already subject to background levels of nitrogen deposition which exceed the higher critical load of 10kgN/ha/yr. Furthermore, the habitat within proximity to the existing A66 will be subject to impacts associated with the maintenance of the existing road e.g. localised drainage from the road, salt spray, compaction from road maintenance vehicles and roadside vegetation maintenance. The land is also grazed by sheep which may add additional pressure to the habitats through overgrazing, trampling and dunging and the habitat likely constitutes a mosaic with acid grassland. Therefore, it would not be unreasonable to assume that these pressures will have altered the vegetation community and any species susceptible to high levels of nitrogen will already be impacted at baseline.

6.10.382 By taking a precautionary approach and interrogating the modelling data where 1% of the critical load is breached along the transect, the approximate area where a significant impact may occur can be calculated. For areas of the designated site which lie north of the existing A66, the 1% change against the critical load is breached up to 50m in the transect. This equates to 0.67ha. The total area of the designated site is 2890.81ha. Therefore, the area of potential impact equates to 0.02%.

6.10.383 The maximum magnitude of impact is 0.8kgN/ha/yr, with the exceedance of threshold covering an extent of approximately 0.67ha.

6.10.384 The frequency of the impact is continual throughout the operational period of the Project.

6.10.385 Given the extremely small area of the designated site which would be subject to additional deposition of nitrogen and potential grazing pressures, it is predicted that the ecological structure and function of the designated site as a whole would not be significantly impacted by the increase in nitrogen deposition predicted by the modelling.

6.10.386 Considering the evidence provided above it is predicted that no significant effect would occur on Stainmore Common LWS as a result of air quality impacts. This is classified as a slight adverse (not significant) effect.

Belah to Stainmore Disused Line LWS

6.10.387 Belah to Stainmore Common Disused Line LWS lies within 200m of the ARN approximately 6km east of Appleby to Brough (Warcop) Order Limits and is located to the south of the existing A66.

6.10.388 The site description states trees growing along the old railway include ash, sessile oak (*Quercus petraea*) and wych elm (*Ulmus glabra*) with hazel (*Corylus avellana*), hawthorn (*Crataegus monogyna*) and goat willow (*Salix carprea*).The ground flora includes wood anemone (*Anemone nemorosa*) lesser celandine (*Ficaria verna*), herb robert (*Geranium robertianum*), foxglove (*Digitalis purpurea*), common polypody (*Polypody vulgare*), bracken (*Pteridium aquilinum*), violet (*Viola* sp.) and wood sorrel (*Oxalis acetosella*).

6.10.389 Review of available desk study data (aerial mapping sources Google maps, September 2014 to December 2021), shows a regularly used access track running parallel to the A66 which demarcates the northern boundary of the site. The habitat within areas impacted by air quality were identified as short sheep grazed grassland with rocky outcrops (Plate 7). The British Geological Survey website[60] outlines the bedrock to be sandstone with thin limestones (Stainmore Formation) with superficial deposits of peat. Therefore it's likely that the grassland is acidic with limestone influence around the outcrops. No trees exist within the section of the designated site which is impacted by air quality.

6.10.390 The anticipated operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.391 Insufficient detailed information is available to determine the air quality attribute for this site. As such, in line with *DMRB LA 105* the air quality attribute is set to 'restore', which takes a

60 [redacted]

precautionary approach and the lower critical load value rather than the background rate of nitrogen deposition. However, to provide some context, the nitrogen deposition for forest on APIS (APIS, 2020) is 29.82kgN/ha/yr in 2018 in the grid square which Belah to Stainmore Disused Line LWS falls in adjacent to the existing A66.

6.10.392 Table 21 (Natural England, 2016) does not provide directly comparable data for grassland habitat. In line with *DMRB LA 105* where designated habitats are not included within Table 21, '*the habitat with the lowest change in nitrogen deposition likely to lead to the loss of one species, excluding nutrient impoverished sand dunes, shall be used to inform the judgement of significant air quality effect*'. As such, the threshold utilised for the designated site is 0.4kg.

6.10.393 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 0.8kgN/ha/yr (Table 6-22: Air quality assessment of designated sites).

6.10.394 To provide some further context, the habitat areas within Belah to Stainmore Disused Line LWS are already subject to background levels of nitrogen deposition which exceed the higher critical load of 10kgN/ha/yr. Furthermore, the habitat within proximity to the existing A66 will be subject to impacts associated with the maintenance of the existing road e.g. localised drainage from the road, salt spray, impacts from vehicles used for access, and grazing pressure. Therefore, it would not be unreasonable to assume that these pressures will have altered the vegetation community and any species susceptible to high levels of nitrogen will already be impacted at baseline.

6.10.395 By taking a precautionary approach and interrogating the modelling data where 1% of the critical load is breached along the transect, the approximate area where a significant impact may occur can be calculated. For areas of the designated site which lie north of the existing A66, the 1% change against the critical load is breached up to 50m in the transect. This equates to 1.56ha. The total area of the designated site is 28.68ha. Therefore, the area of potential impact equates to 5.44%.

6.10.396 The maximum magnitude of impact is 0.8kgN/ha/yr, with the exceedance of threshold covering an extent of approximately 1.56ha.

6.10.397 The frequency of the impact is continual throughout the operational period of the Project.

6.10.398 Given the small area of the designated site which would be subject to additional deposition of nitrogen, in combination with the fact that these areas are already adjacent to the existing A66 and subject to road transport emission and grazing pressure, it is predicted that the ecological structure and function of the

designated site as a whole would not be significantly impacted by the increase in nitrogen deposition predicted by the modelling.

6.10.399 Considering the evidence provided above it is predicted that no significant effect would occur on Belah to Stainmore Disused Line LWS as a result of air quality impacts. This is classified as a neutral effect.

Augill Valley Pasture SSSI

6.10.400 Augill Valley Pasture SSSI lies within 200m of the ARN approximately 2.5km east of to the east of Appleby to Brough (Warcop). The site comprises of one SSSI Unit. This site is also a Plantlife (Plantlife, 2022)[61] Reserve named Augill Pasture and is described as one of the best remnants in Cumbria of mountain hay meadow (pasture) and is managed by the Cumbria Wildlife Trust on behalf of Plantlife. The grassland area is raised above the A66 road (outwith the Project schemes) and has a southern and open aspect.

6.10.401 The site is designated (Natural England, 2022)[62] for supporting (upland neutral grassland) with a high cover of herb species (80%) and is botanically diverse with some notable and locally rare species including globeflower (*Trollius europaeus*), frog orchid (*Coeloglossum viride*) and bird's-eye primrose (*Primula farinosa*). The western half of the site comprises woodland (ash, birch and willow with an understorey of hazel and rowan) which is not a notified feature. However, it is noted that this area of woodland is designated as Augill Bridge Wood ASNW.

6.10.402 The site is managed by grazing (pony), mechanised cutting of rush vegetation and select pulling of ragwort as management activities.

6.10.403 The identified potential threats to this site include intermittent grazing (increase in tree, scrub or grass presence and change in vegetation structure leading to loss of positive indicator species) or heavy grazing (potential for too many bare areas) and potential for climate change impacts to cause increased rush presence.

6.10.404 Details were reviewed of HoPI[63] covering almost the entirety of the SSSI (2.82ha), state for the eastern area of 1.53ha, a main habitat of lowland meadows, with the habitat type upland neutral grassland, NVC community MG5. Additional habitats (include purple moor grass and rush pastures, upland hay meadow with farm environment plan features of T11 upland mixed ash and G08 upland calcareous grassland). For the western area of 1.27ha, this is stated as the main habitat of broadleaved

[61] Plantlife (2022) Augill Valley Pasture, a Plantlife Reserve

[62] Natural England (2022) Valley pasture SSSI

[63] Plantlife website (2022), For details of Augill Valley Pasture, a Plantlife Reserve. Available at: [redacted]. Accessed [24.01.2022].

deciduous woodland, with the habitat type of T11 upland mixed ashwood, and additional habitats (of lowland meadows, purple moor-grass and rush pastures, upland hay meadows) with the SSSI feature of the MG5 grassland. The 0.2ha remaining within the western woodland component, comprise two separate areas of 0.1ha each of lowland meadows as the main habitat, with the habitat type upland neutral grassland, NVC community MG5 and additional habitats (of deciduous woodland, purple moor-grass and rush pastures, upland hay meadows).

6.10.405 On review of available desk study data (Google Earth aerial mapping (dated 2019 for aerial and 2022 from roadside)) the two small areas of lowland meadows (c.0.02ha) do not appear to be still evident, one appearing as a derelict structure and the other with a closed canopy above, otherwise the habitat types seem consistent with the descriptions.

6.10.406 The anticipated construction operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.407 APIS (APIS, 2022) states the average nitrogen critical load for neutral grassland within Augill Valley Pasture SSSI is 21.8kgN/ha/yr. The critical loads are noted to be 20-30kgN/ha/yr.

6.10.408 The SSSI site unit is noted to be in favourable condition, with potential threats relating to grazing (Natural England, 2022). The favourable condition does not refer to air quality as a threat or pressure and the baseline levels of nitrogen deposition are not impacting on the condition of the designated site. It is noted that the baseline nitrogen deposition levels are noted to be marginally higher than the lower critical load. It is therefore determined that the air quality attribute should be 'restore'.

6.10.409 Table 21 (Natural England, 2016) does not provide directly comparable data for grassland habitat. In line with *DMRB LA 105* where designated habitats are not included within Table 21, '*the habitat with the lowest change in nitrogen deposition likely to lead to the loss of one species, excluding nutrient impoverished sand dunes, shall be used to inform the judgement of significant air quality effect'*. As such, the threshold utilised for the designated site is for upland heath. Taking into consideration the ‘restore' air quality attribute, the threshold assigned is 0.4kg.

6.10.410 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 0.7kgN/ha/yr (Table 6-22: Air quality assessment of designated sites). This is noted to fall below 0.4kgN/ha/yr at the 30m transect point.

6.10.411 By taking a precautionary approach and interrogating the modelling data where 1% of the critical load is breached along the transect, the approximate area where a significant impact may occur can be calculated. The 1% change in critical load is breached up to 50m in the transect (Plate 9). This equates to

0.30ha within areas of grassland. The total area of the designated site is 2.82ha. Therefore, the area of potential impact equates to 10.6% of the designated site.

6.10.412 Neutral grassland habitat is not included within Table 21 (Natural England, 2016) therefore a precautionary approach is taken in line with *DMRB LA 105* and the most sensitive habitat is used to determine the loss of one species. It is acknowledged that the background levels of nitrogen deposition for Augill Valley Pasture are noted to be an average of 21.8kgN/ha/yr. Furthermore, the critical load values for neutral grassland habitat are noted to be 20-30kgN/ha/yr on APIS, which is higher than the assigned critical load values for upland heath within Table 21 (Natural England, 2016). Additionally, the SSSI unit is noted to be in favourable condition and air quality is not noted as a pressure or threat with current levels of nitrogen deposition.

6.10.413 The maximum magnitude of impacts is 0.7kgN/ha/yr with the exceedance threshold covering an extent of approximately 0.3ha.

6.10.414 The frequency of the impact is continual throughout the operational period of the Project.

6.10.415 Given the evidence described above, taking into account the favourable condition of the designated site, the existing area already subject to road transport emissions and the small contribution this source has on the site, it is predicted that the ecological structure and function of the designated site as a whole would not be significantly impacted by the increase in nitrogen deposition predicted by the modelling.

6.10.416 Considering the evidence provided above it is predicted that no significant effect would occur on Augil Valley Pastures SSSI as a result of air quality impacts. This is classified as a slight adverse (not significant) effect.

Argill Woods and Pastures SSSI

6.10.417 Argill Woods and Pastures SSSI lies within 200m of the ARN approximately 4.4km east of Appleby to Brough (Warcop). This site comprises of six units, units 2 to 5 are contiguous, and unit 1 and unit 6 are separate. Unit 6 is nearest the A66 and separate to the other units, the entirety of this unit is within the 200m buffer from the ARN centreline, no other units of this SSSI site are within 200m of the ARN.

6.10.418 The site is designated for supporting a mosaic of semi-natural woodland with unimproved grassland. Unit 6 of the SSSI unit is an area of grassland (with limestone outcrops at the northern end) and woodland on the edge of a steep-sided gorge. The grassland is species-rich with an abundant herb element and few negative indicators, with the last condition assessment (using Common Standards Monitoring criteria) from 2009, stating the site as in favourable condition and the last site check in 2019 also reporting good condition. The woodland is limited in extent but

supports a variety of age classes and is regenerating well in the absence of grazing.

6.10.419 Details for HoPI covering a total of 0.58ha of the 0.97ha (56% of Unit 6) of the SSSI show the following:

- 0.40ha – no main HoPI habitat, however thefollowing additional SSSI features are listed: U4 acid grassland; neutral grassland of the NVC types MG3 and MG5; and upland mixed ashwood with Farm Environment Plan features of G03 species-rich grassland
- 0.18ha HoPI deciduous woodland, specified as upland mixed ashwoods, with additional SSSI features: U4 acid grassland; neutral grasslands MG3 and MG5 with Farm Environment Plan features of G03 species-rich grassland. These further confirm the presence of these SSSI features, as specifically within unit 6 of the SSSI.

6.10.420 Available desk study data (aerial mapping sources Google maps, December 2021), shows sheep grazing within the grassland area directly adjacent to the existing A66.

6.10.421 The anticipated construction operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.422 APIS (APIS, 2022) states the average nitrogen critical load for neutral and acid grassland within Argill Woods and Pastures SSSI is 21.7kgN/ha/yr. The critical loads vary according to the grassland community but the lower critical loads are noted to be 10-20kgN/ha/yr. The average nitrogen critical load for broadleaved, mixed and yew woodland is 33kgN/ha/yr with critical loads noted to be 10-15kgN/ha/yr for more sensitive woodland communities within the SSSI.

6.10.423 The SSSI site unit is noted to be in favourable condition. The condition of the grassland within this unit is not currently being affected by seedling regeneration (Natural England, 2022). The favourable condition does not refer to air quality as a threat or pressure and the baseline levels of nitrogen deposition are not impacting on the condition of the designated site. It is noted that the baseline nitrogen deposition levels are noted to be higher than the lower critical load. It is therefore determined that it is suitable to assign the air quality attribute as 'restore'.

6.10.424 Table 21 (Natural England, 2016) does not provide directly comparable data for grassland or woodland habitat. In line with *DMRB LA 105* where designated habitats are not included within Table 21, 'the habitat with the lowest change in nitrogen deposition likely to lead to the loss of one species, excluding nutrient impoverished sand dunes, shall be used to inform the judgement of significant air quality effect'. As such, the threshold utilised for the designated site is for upland heath. Taking into consideration the 'restore' air quality attribute, the threshold assigned is 0.4kg.

6.10.425 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 0.6kgN/ha/yr (Table 6-22: Air quality assessment of designated sites).

6.10.426 By taking a precautionary approach and interrogating the modelling data where 1% of the critical load is breached along the transect, the approximate area where a significant impact may occur can be calculated. The 1% change in critical load is breached up to 20m in the transect (Plate 10). This equates to 0.13ha. The total area of the designated site is 30.4ha. Therefore, the area of potential impact equates to 0.43% of the designated site.

6.10.427 Grassland and woodland habitat are not included within Table 21 (Natural England, 2016) therefore a precautionary approach is taken in line with *DMRB LA 105* and the most sensitive habitat is used to determine the loss of one species. It is acknowledged that the background levels of nitrogen deposition for Argill Woods and Pastures SSSI are noted to be an average of 21.7kgN/ha/yr for grassland and 33kgN/ha/yr for woodland. Additionally, the SSSI unit is noted to be in favourable condition and air quality is not noted as a pressure or threat with current levels of nitrogen deposition.

6.10.428 The maximum magnitude of impacts is 0.6kgN/ha/yr with the exceedance threshold covering an extent of approximately 0.13ha.

6.10.429 The frequency of the impact is continual throughout the operational period of the Project.

6.10.430 Given the evidence described above, taking into account the favourable condition of the designated site, small area of potential impact and grazing pressure on the area of grassland directly adjacent to the existing A66, it is predicted that the ecological structure and function of the designated site as a whole would not be significantly impacted by the increase in nitrogen deposition predicted by the modelling.

6.10.431 Considering the evidence provided above it is predicted that no significant effect would occur on Argill Woods and Pastures SSSI as a result of air quality impacts. This is classified as a slight adverse (not significant) effect.

Rokeby Park and Mortham Wood CWS

6.10.432 Rokeby Park and Mortham Wood CWS is located within the Order Limits of Cross Lanes to Rokeby, at its south-western and southern boundaries. It is designated for its parkland habitat with mature trees and areas of potential ancient woodland, including some limestone gorge woodland on the steep banks to the River Greta.

6.10.433 The parkland habitat and woodland supports many mature trees and being a HoPI is of national value, with some trees likely qualifying as ancient or veteran as irreplaceable habitat.

6.10.434 The anticipated operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.435 Insufficient detailed information is available to determine the air quality attribute for this site. As such, in line with *DMRB LA 105* the air quality attribute is set to 'restore', which takes a precautionary approach and the lower critical load value rather than the background rate of nitrogen deposition.

6.10.436 Table 21 in NECR210 (Natural England, 2016) does not provide directly comparable data for woodland habitat. In line with *DMRB LA 105* where designated habitats are not included within Table 21, 'the habitat with the lowest change in nitrogen deposition likely to lead to the loss of one species, excluding nutrient impoverished sand dunes, shall be used to inform the judgement of significant air quality effect'. As such, the threshold utilised for the designated site is 0.4kg.

6.10.437 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 1.4kgN/ha/yr (Table 6-22: Air quality assessment of designated sites).

6.10.438 By taking a precautionary approach and interrogating the modelling data where 1% of the critical load is breached along the transect, the approximate area where a significant impact may occur can be calculated. For areas of the designated site where the 1% change against the critical load is breached is up to 60m in the transect (Plate 11). This equates to 3.76ha. The total area of the designated site is 49ha. Therefore the area of potential impact equates to 7.67%. It should be noted that the critical load for nitrogen deposition for woodland takes a precautionary approach derived from potential impacts to woodland ground flora and epiphytes which are more sensitive to nitrogen. Furthermore, potential veteran or ancient trees are scattered throughout the area of impact and consequently this total area is an over-estimate of potential impact on qualifying feautures. No veteran, ancient or notable trees were noted within 200m of the existing A66 within Rokeby Park and Mortham Wood CWS on the ancient tree inventory.

6.10.439 Reviewing available desk study data (aerial mapping Google maps, December 2021) and reviewing historical OS maps 1885-1900, the number of mature trees which may qualify as veteran or ancient trees within the site that may be impacted by increases in nitrogen deposition within 60m of the transect during operation is approximately eight (Plate 12).

6.10.440 Nitrogen deposition is not believed to have direct major effects on tree growth, rather indirect impacts such as loss of understorey species diversity (APIS, 2022). The grassland was recorded to be heavily grazed and improved. Therefore potential

impacts from nitrogen deposition are solely related to potential ancient or veteran trees.

6.10.441 The ground flora and associated soil microbiota will be subject to existing nitrogen deposition pressures from livestock manure. As well as existing levels of nitrogen deposition from the existing A66, which will decrease with increasing distance from the road (Truscott, et al. 2005)[48].

6.10.442 Soil microorganisms, mychorrhizal fungi and fungi antagonistic to pathogens are significant in the protection of plants against the effects of pollution. Studies have shown that diversity of ectomycorrhiza is low in forests characterised by higher concentrations of nutrients verses forests with low concentrations of nutrients. Furthermore, forests with high concentration of nutrients were also recorded to have the highest microfungal abundance (Stankevičienė & Pečiulytė, 2004)49. Grasslands which have been subject to anthropogenic pressures were also found to have weakened arbuscular mychorrhizal fungi (Koziol and Bever, 2016)50. Therefore, the current management of livestock on the site combined with the improved grassland recorded may result in a low diversity of ectomychorrhizal fungi within the existing site. Subsequently potential impacts from nitrogen deposition as a result of the Project are not predicted to lead to indirect impacts on the functioning of ectomychorrhizal fungi to support the protection of potential veteran or ancient trees.

6.10.443 The frequency of the impact is continual throughout the operational period of the Project.

6.10.444 Based on the evidence outlined above it is predicted that the ecological structure and function of the designated site as a whole would not be significantly impacted by the increase in nitrogen deposition predicted by the modelling. No trees will be lost or disturbed as a result of operation of the Project.

6.10.445 Considering the evidence provided above it is predicted that no significant effect would occur on Rokeby Park and Mortham Wood CWS as a result of air quality impacts. This is classified as a slight adverse (not significant) effect.

Low Coniscliffe Tees Bank LWS

6.10.446 Low Coniscliffe Tees Bank LWS is located within 200m of the ARN adjacent to the A1(M) approximately 8.5km north of A1(M) Junction 53 Scotch Corner.

6.10.447 No citation was provided for this site, but within GIS datasets, the site is described as a narrow strip of woodland with willows (*Salix* sp.) and hawthorn (*Crataegus monogyna*). Woodland ground flora includes primrose (Primula vulgaris), wood anemone (*Anemone nemorosa*), marsh marigold (*Caltha palustris*), ramsons (*Allium ursinum*), dogs mercury (*Mercurialis perennis*), and early dog violet (*Viola reichenbachiana*). It is also designated

for the presence of lesser spotted woodpecker (*Dendrocopos minor)*.

6.10.448 Review of further desk study sources (Tees Valley Nature Partnership, 2022)[64] show this site to be designated for the HoPI deciduous woodland and presence of ancient woodland and ancient replanted woodland, which is supported by the presence of ancient woodland indicator species as ground flora species within the desk data supplied. Review of aerial mapping sources Google Earth, show the site at least at its western periphery with the A1M to support willow species (Salix spp.) and aerial views show broad-leaved woodland habitat to be present. Therefore, the site habitat types of broad-leaved woodland appears consistent with the current habitat provision. It is noted the site boundary and that for the HoPI (Low Coniscliffe and Merribent Neighbourhood Plan, 2018)[65] and from searches of mapped HoPI (*MAGIC map*) show that the deciduous woodland habitat is outside of the 200m buffer (area at which potential significant effects are considered) from the ARN centreline and does not commence until approximately 265m east of the LWS site boundary and 229m from the ARN centreline (at the shortest distance to the ARN).

6.10.449 The anticipated construction operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.450 Insufficient detailed information is available to determine the air quality attribute for this site. As such, in line with *DMRB LA 105* the air quality attribute is set to 'restore', which takes a precautionary approach and the lower critical load value rather than the background rate of nitrogen deposition.

6.10.451 Table 21 (Natural England, 2016) does not provide directly comparable data for woodland habitat. In line with *DMRB LA 105* where designated habitats are not included within Table 21, 'the habitat with the lowest change in nitrogen deposition likely to lead to the loss of one species, excluding nutrient impoverished sand dunes, shall be used to inform the judgement of significant air quality effect'. As such, the threshold utilised for the designated site is 0.4kg.

6.10.452 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 0.4kgN/ha/yr (Table 6-22: Air quality assessment of designated sites). This is at 0m along the transect.

6.10.453 The frequency of the impact is continual throughout the operational period of the Project.

[64] Tess Valley Nature Partnership (2022) Low Coniscliffe, Tees Bank LWS.

[65] Low Coniscliffe and Merrybent Parish Council (2018) Neighbourhood Plan Biodiversity Background Paper.

6.10.454 The area of the designated site which is potentially impacted by the change in nitrogen deposition is up to the 50m transect point. However on review of the increase in nitrogen deposition, this falls below 0.4kgN/ha/yr to 0.2kgN/ha/yr at 10m then falls to 0.1kgN/ha/yr at 30m. In addition, the HoPI deciduous woodland habitat is not recorded within 200m of the ARN.

6.10.455 As such, it is considered that the additional deposition of nitrogen impacting on the area of the designated site adjacent to the existing A1(M) is considered minor, in combination with the fact that this area is not listed as HoPI deciduous woodland habitat, it is predicted that the ecological structure and function of the designated site as a whole would not be significantly impacted by the increase in nitrogen deposition as predicted by the modelling.

6.10.456 Considering the evidence provided above it is predicted that no significant effect would occur on Low Coniscliffe Tees Bank LWS as a result of air quality impacts. This is classified as a neutral effect.

Special Roadside Verges C25 4A and 4B

6.10.457 Special roadside Verges C25 4A and 4B are located within 200m of the ARN approximately 0.9km south-east of Appleby to Brough (Warcop). The entirety of these linear sites are within a 200m buffer of the ARN (with a maximum distance of 47m out from the centreline of the A685, the majority of the site being <20m from the centreline).

6.10.458 No citation detail was provided for the sites but within GIS datasets, there is some limited information regarding the type of habitat: species-rich neutral grassland habitat and their management: safety swathes cut annually before 15th June, with full width cut every two years after 15th August and for the planted trees to be thinned as necessary to prevent degradation of the grassland flora. It is noted this desk data is dated as from 1994. Further species data for this site was sought but was not available, in addition no habitat survey field data is available for this site due to it being situated outside of scheme-based study areas (250m scheme buffer).

6.10.459 Desk study review was undertaken of available data (aerial mapping sources Google Earth, dated June 2021), shows the site to contain broad-leaved to mixed plantation trees including sycamore (*Acer pseudoplatanus*), hawthorn, silver birch (*Betula pendula*), field maple (*Acer campestre*), Scots pine (*Pinus sylvestris*) and larch (*Larix decidua*) and neutral grassland habitat with cow parsley (*Anthriscus sylvestris*), hogweed (*Heracleum sphondylium*), crosswort (*Cruciata laevipes*), red campion (*Silene dioica*), a bluebell species (*Hyacinthoides species*), hedgerow crane's-bill (*Geranium prenaicum*), false oat-grass (*Arrhenatherum elatius*), Yorkshire-fog (*Holcus lanatus*), common nettle (*Urtica dioica*), dandelion aggregate (*Taraxacum officinale* agg.), creeping buttercup (*Ranunculus repens*), meadow buttercup

(*Ranunculus acris*), meadow grass species (*Poa* species) and ladies smock (*Cardamine pratensis*). The habitats within the site appear to be consistent with the neutral grassland habitat. It is unknown whether the condition of this site has degraded over time since the survey in 1994, but the presence of rank grasses (false oat-grass, cock's-foot), the composition of herbs to grasses of 20%:80% and the presence of large patches of common nettle indicate the potential for some degradation to have occurred since the original survey. It also may be that the total original area of neutral grassland is reduced, due to observed scrub and tree encroachment and shading from the adjacent plantation trees, further increased by the presence of self-set shrubs and trees from this source as reviewed from aerial photography.

6.10.460 The anticipated construction operational impacts on the designated site comprise:

- Habitat degradation - air quality impacts on vegetation.

6.10.461 Insufficient detailed information is available to determine the air quality attribute for this site. As such, in line with *DMRB LA 105* the air quality attribute is set to 'restore', which takes a precautionary approach and the lower critical load value rather than the background rate of nitrogen deposition. However, to provide some context, the nitrogen deposition for moorland on APIS (APIS, 2020) is 22.96kgN/ha/yr in 2018 in the grid square which Roadside Verges C25 4a and 4b fall within.

6.10.462 Table 21 (Natural England, 2016) does not provide directly comparable data for grassland habitat. In line with *DMRB LA 105* where designated habitats are not included within Table 21, 'the habitat with the lowest change in nitrogen deposition likely to lead to the loss of one species, excluding nutrient impoverished sand dunes, shall be used to inform the judgement of significant air quality effect'. As such, the threshold utilised for the designated site is 0.4kg.

6.10.463 The modelling output predicts that the increase in nitrogen deposition as a result of the Project is a maximum of 0.2kgN/ha/yr (Table 6-22: Air quality assessment of designated sites). This is at 0m along the transect and is the only point where an exceedance of the 1% critical load is breached however this is below the threshold value of 0.4kgN/ha/yr.

6.10.464 The frequency of the impact is continual throughout the operational period of the Project.

6.10.465 The area of habitat subject to an increase in nitrogen deposition is already subject to high background levels of nitrogen deposition and the level of change does not exceed the threshold. In addition, aerial photography suggests the vegetation community may have become more rank and self-set scrub and trees may be encroaching on grassland areas. It is predicted that the ecological structure and function of the designated site as a

whole would not be significantly impacted by the increase in nitrogen deposition predicted by the modelling.

6.10.466 Considering the evidence provided above it is predicted that no significant effect would occur on the Roadside Verges C25 4a and 4b as a result of air quality impacts. This is classified as a neutral effect.

Table 6-22: Air quality assessment of designated sites

Designated site	Lowest critical load (kgN/ha/yr)	Air quality attribute used in assessment	Nitrogen deposition threshold (kgN/ha/yr) resulting in the theoretical loss of one species 'threshold'	Maximum change in nitrogen deposition (kgN/ha/yr) between Do Minimum and Do Something	Maximum distance (m) along transect where an increase in nitrogen deposition (kgN/ha/yr) between Do Minimum and Do Something exceeds the 'threshold'
North Pennine Moors SAC/SPA and Bowes Moor SSSI	5	Restore	3.3	0.9	Not exceeded
Oglebird Plantation PAWS	10	Restore	0.4	0.6	30m
Augill Bridge Wood ASNW	10	Restore	0.4	1.0	50m
Stainmore Common LWS	5	Restore	3.3	0.8	Not exceeded
Belah to Stainmore Disused Line LWS	20	Restore	0.4	0.8	10m
Augil Valley Pastures SSSI	20	Restore	0.4	0.7	20m
Argill Woods and Pastures SSSI	10	Restore	0.4	0.5	20m
Rokeby Park LWS	10	Restore	0.4	1.4	50m
Low Coniscliffe Tees Bank LWS	10	Restore	0.4	0.4	0m
Roadside Verges C25 4a and 4b	20	Restore	0.4	0.2	Not exceeded

Other designated sites

6.10.467 The designated sites below are scoped out from further assessment due to the following combination of factors:

- the distance of the designated site from the Project
- the designated site falls within 200m of the ARN, however the 1% change in critical load is <1% or was modelled to have a positive change. Subsequently the values does not exceed the 1% threshold where a significant adverse effect may occur and therefore no further assessment is required
- the qualifying features of the designated site and lack of complementary habitat within the Project
- the lack of suitable habitat connecting the designated site and the Project.

6.10.468 Designated sites scoped out from further assessment:

- Helbeck and Swindale Woods SAC, Helbeck Wood SSSI/Helbeck Wood SIS and Swindale Wood SSSI - located 427m north, 427m north and 1.3km north of the Order Limits of Temple Sowerby to Appleby.
- Moor House Upper Teesdale SAC - located 0.9km north of the Order Limits of Temple Sowerby to Appleby
- George Gill SSSI - located 395m north-west of the Order Limits of Temple Sowerby to Appleby.
- Cowraik Quarry SSSI and LNR - located 1.7km north of the Order Limits of M6 Junction 40 to Kemplay Bank.
- Udford Low Moss SSSI - located 0.9km north of the Order Limits of Penrith to Temple Sowerby (Centre Parcs).
- Kilmond Scar SSSI - located 410m south-east of the Order Limits of Bowes Bypass.
- Brignall Banks SSSI - located 571m south of the Order Limits of Cross Lanes to Rokeby.
- Black Scar Quarry SSSI - located 1.2km east of the Order Limits of A1 (M) Junction 53 Scotch Corner.
- Temple Sowerby Moss SSSI - located 143m north of the Order Limits of Temple Sowerby to Appleby.
- Eamont Bridge, Banks of River Eamont SIS - located adjacent to M6 Junction 40 to Kemplay Bank.
- Lowther Bridge SIS - located 392m south of the Order Limits of M6 Junction 40 to Kemplay Bank.
- Skirsgill Wood LWS - located within the Order Limits of M6 Junction 40 to Kemplay Bank.
- Myers Beck LWS - located 444m north of the Order Limits of M6 Junction 40 to Kemplay Bank.
- Yanwath Wood LWS - located 52m south of the Order Limits of M6 Junction 40 to Kemplay Bank. However it is noted that the designated site lies south of the River Eamont and permanent acquisition of land is located 500m north.
- Watersmeet LWS - located 994m north of the Order Limits of Penrith to Temple Sowerby (Center Parcs).

- Tipperary and Dudford Woods PAWS - located 658m north of the Order Limits of Penrith to Temple Sowerby (Center Parcs).
- Whinfell Forest LWS - located 191m south of the Order Limits of Penrith to Temple Sowerby (Center Parcs).
- Salter Wood PAWS - located 191m south of the Order Limits of Penrith to Temple Sowerby (Center Parcs).
- Chapel Wood (Appleby in Westmoorland) LWS and Chapel Wood ASNW - located adjacent to the Order Limits south of Temple Sowerby to Appleby.
- Bolton Shingle Bank (237m west of Order Limits), River.Eden, Oglebird Scar Ers (459m west of the Order Limits), Temple Sowerby Shingle Bank (603m north-west of the Order Limits) Temple Sowerby to Appleby
- Acorn Bank Woods and Garden LWS - located 957m north of the Order Limits of Temple Sowerby to Appleby.
- Roadside Verges C2L (8a and 8b) - located 976m south-west of the Order Limits of Temple Sowerby to Appleby.
- Ross Wood ASNW and PAWS - located 207m south of the Order Limits of Temple Sowerby to Appleby.
- Dowpits Wood LWS and ASNW - located 941m south of the Order Limits of Temple Sowerby to Appleby.
- Roadside Verges C25 (6a, 6b, 4a and 4b) - located more than 650m south of the Order Limits of Temple Sowerby to Appleby.
- Swindale Wood LWS - located 515m south of the Order Limits of Temple Sowerby to Appleby.
- Kiln Hill Wood ASNW - located 623m north-east of the Order Limits of Temple Sowerby to Appleby.
- Yosgill Wood ASNW north of the Order Limits of Temple Sowerby to Appleby.
- Teesbank Woods, Rokeby LWS - located 328m north of the Order Limits of Temple Sowerby to Appleby.
- Thorsgill Wood LWS and PAWS - located 734m north of the Order Limits of Temple Sowerby to Appleby.
- Sandford Mire CWS - located 7m south of the Order Limits of Appleby to Brough (Warcop).
- Waterfall Wood ASNW - located 331m north of the Order Limits of Cross Lanes to Rokeby.
- Mill Wood ASNW - located 470m south of the Order Limits of Cross Lanes to Rokeby.
- Rokeby Park and Mortham Woods LWS - located within the Order Limits of Cross Lanes to Rokeby.
- Tees Bank Plantation ASNW - located 617m north of the Order Limits of Cross Lanes to Rokeby.
- Aske Estate Woodlands SINC and Hartforth Wood PAWS - located 937m south of the Order Limits of Stephen Bank to Carkin Moor (Layton).
- Veteran and Notable trees.

6.10.469 Designated sites scoped out from further assessment which are located within 200m of the ARN:

- Asby Complex SAC
- Crosby Ravensworth Fell SSSI
- Augill Beck ASNW
- Disused Campsite near Houghton LWS
- Roadside Verge C3U (1) - B6264
- Newbiggin Wood CWS
- Disused Railway Line near Newbiggin CWS
- Roadside Verges: C2D_(2) - Melkinthorpe Rd, C2D_(3) - Buckholme Wood Rd.
- Roadside Verges: C2J_(2) - Sleagill Rd
- Roadside Verges: C2K_(A), C2K_(B) both on road between Shap and Crosby Ravensworth.
- Shap Hay Meadow 2 LWS
- Roadside Verges: C2S_(3A), C2S_(3B) both on road north of Tebay Services.
- Roadside Verges: C2S_(2A), C2S_(2B) - both on Pikestone Lane.
- Roadside Verges: C26_(1), C2S_(1) on road south of Borrowdale.
- Borrowdale Wood (Low Borrowbridge) LWS
- High Carlingill Wet Holme CWS
- High Fleetholme Wood LWS
- Deep Gill LWS
- Two roadside verges: 1.2.2_(10A), 1.2.2_(10B) - both on Old Scotch Road at Beck Foot.
- Firbank Verge LWS
- Roadside Verges (1.2.2_(6A), 1.2.2_(6B) - both on Old Scotch Road at Beck Foot.
- Firbank Fell LWS
- Killington Reservoir LWS
- Long Moss (Ewebank) LWS
- Bendrigg Mire LWS
- Eskrigg Tarn LWS
- Camsgill Wood LWS
- Lancaster Canal LWS
- Sexton Hagg Wood LWS
- Lancaster Canal Biodiversity Heritage Site (BHS)
- Two roadside verges: 1.1.3_(2A), 1.1.3_(2B) - both on Tarn Lane.
- Dock Acres North BHS at Borwick Lakes
- Whiley Hill Sandpit LWS
- Coatham Grange Marsh LWS
- Burtree Gate Marsh LWS
- Pallet Hill LWS
- Great Raygill Dike SINC
- Brickyard Farm, Roecliffe SINC

Habitats

6.10.470 The impact of operation of relevance to habitats is:

- habitat degradation.

Habitat degradation

6.10.471 Habitats immediately adjacent to the Project may be degraded as a result of the operational impacts associated with an increase in traffic and pollution emitting vehicles.

6.10.472 Increases in nitrogen deposition may occur, particularly on habitats within close proximity of the Project, and this in-turn may cause soil eutrophication and support the more vigorous and pollution tolerant species and habitats to outcompete native flora, altering vegetation and habitat composition.

6.10.473 However, as the habitats being considered are already subject to a high background level of nitrogen deposition and the anticipated change does not represent a significant increase from the baseline level, it is anticipated that this habitat degradation would cause a negligible, non-significant effect.

Watercourses

6.10.474 Descriptions of watercourses interacting with the project are described in Section6.7: Baseline conditions. The importance and corresponding sensitivity of watercourses as a biodiversity resource ranges from International (very high sensitivity) to Local (low sensitivity).

6.10.475 The impacts of operation of relevance to watercourses are:

- Habitat degradation.

Habitat degradation

6.10.476 Road runoff during operation has the potential to generate additional water-borne pollution which could, if untreated, give rise to an adverse effect on watercourses. However, the highways design of the Project directs runoff from the alignment into a drainage system, which a combination of includes vegetated ditches, vortex separators and attenuation ponds that are designed to treat run-off prior to discharge to watercourses, as outlined in Chapter 14: Road drainage and the water environment (Application Document 3.2) and ES Appendix 14.3: Water Quality Assessment (Application Document 3.4).

6.10.477 There is also potential for watercourse crossings, if poorly designed, to adversely affect fluvial geomorphological process leading to habitat degradation during operation. Watercourse crossing design in the Temple Sowerby to Appleby and Appleby to Brough scheme has been informed by and tested through detailed fluvial geomorphology modelling as outlined in Chapter 14: Road drainage and the water environment (Application Document 3.2) and ES Appendix 14.9: Detailed Geomorphological Modelling (Application Document 3.4) is secured through the Project Design Principles (Application Document 5.11). The results of the detailed fluvial geomorphology modelling, as described in ES Appendix 14.9: Detailed Geomorphological Modelling (Application Document 3.4)

demonstrates negligible impacts to fluvial geomorphological processes and as a result habitat degradation, as a result of watercourse crossings during operation is not anticipated.

6.10.478 Open span watercourse crossings that will avoid the loss of aquatic habitat within the River Eden SAC (Trout Beck) or functionally linked watercourses in Appleby to Brough have been designed. This design feature has minimised the potential for habitat loss and is secured through the Project Design Principles (Application Document 5.11). Further detailed information on the impact assessment for the River Eden SAC is provided within Habitats Regulations Assessment Stage 1: Likely Significant Effects Report (Application Document 3.5).

6.10.479 When considering the successful implementation of the proposed avoidance and essential mitigation measures, the effect on watercourses during operation is assessed as neutral and not significant.

Red squirrel

6.10.480 The impact of operation of relevance to red squirrel is:

- Species mortality.

Species mortality

6.10.481 Direct mortality resulting from operation of the road will occur due to collisions with traffic as red squirrel attempt to cross the live carriageway.

6.10.482 As a result of the incorporation of several green bridges into the design of the Project, which comprise stretches of habitat suitable to support red squirrel commuting, it is considered that the effect will be neutral and not significant.

Bats

6.10.483 The impacts of operation of relevance to bats are:

- Habitat fragmentation
- Habitat damage
- Disturbance
- Species mortality.

Habitat fragmentation

6.10.484 The Project, in particular the offline sections, will fragment commuting and foraging routes for bats north to south on a permanent basis. Key flight routes between foraging resources and important roost locations could be affected in the long term.

Habitat damage

6.10.485 The operation of the Project will likely result in an increase in vehicle emissions which could affect habitats used as a foraging resource by bats. This potential degradation could adversely influence invertebrate biomass and species composition in the local area.

Disturbance

6.10.486 Operational noise and lighting (predominantly vehicular) together with increased human disturbance from changes in land use will likely affect how bats use the landscape, including the potential abandonment of roosting locations and reduction in use of foraging resource which may negatively impact the Core Sustenance Zones (CSZ) of the species present.

Species mortality

6.10.487 Bats habituated to established flight routes connecting roosting and foraging resources, even when the flight paths have been severed, would be highly susceptible to collisions with operational road traffic in locations where they will follow the new land contour profile at an historic crossing point that bisects the live carriageway.

Breeding birds

6.10.488 The impacts of operation of relevance to breeding birds are:

- Habitat degradation
- Disturbance.

Habitat degradation

6.10.489 Air pollution from increased traffic volume may degrade adjacent retained habitats. Changes in plant and invertebrate communities caused by air pollution can occur over time. These can then have secondary effects including loss of foraging resource and possible reduction in breeding success.. Studies on both point source (industrial) and diffuse source (traffic exhaust) pollution have been found to have direct impacts on birds (Feva et al., 1996)[66]. Habitat degradation such as increases ub dust and vehicle emissions, degradation of habitats used by breeding birds for foraging such as aquatic habitats may reduce the availability of invertebrate food sources and is likely to impact all species recorded using habitats within the Order Limits of the Project. Loss of foraging resources may reduce the breeding success of all species recorded in the Order Limits.

6.10.490 Within the area where the Project departs from the existing A66 to the north of Kirkby Thore, degradation may cause a greater effect on breeding birds. Degradation will impact and potentially contribute to the decrease in, loss or displacement of, relatively small numbers of notable bird species.

6.10.491 Effects arising from habitat degradation will be mitigated by the establishment of replacement habitats with the Order Limits. Part of the mitigation proposals encompass targeted ornithological mitigation in the form of short, grazed damp grassland which will be incorporated in areas where the Project departs offline around

[66] Eeva, T., Lehikoinen and Ronka, M. (1996) Air pollution fades the plumage of the Great tit. Functional Ecology 12: 607-612.

the Kirkby Thore area. The replacement habitats will, as a minimum, provide equal opportunities for breeding birds.

6.10.492 However, the inclusion of the mitigation during operation outlined in Section 6.9: Essential mitigation and enhancement and the LEMP (see the Annex B1: LEMP of the EMP (Application Document 2.7)), it is considered that habitat degradation would result in a slight adverse effect and is not considered significant.

Disturbance

6.10.493 The operational phase of the Project may raise noise and vibration levels from the existing baseline, however as the majority of the Project follows the existing A66 small increases in traffic volume and speeds are unlikely to cause notable increases in noise levels.

6.10.494 As described in Chapter 12: Noise and Vibration, ten areas recognised to be of value for breeding bird were subject to analysis to ascertain changes in baseline noise levels. The noise sampling data identified no significant increases from the current baseline for the majority of the Project. However, where the Project diverts from the existing A66 offline north of Kirby Thore, noise levels will increase notably from the baseline.

6.10.495 The majority of the Project follows or is adjacent to the existing A66 and species present within the Survey Area are anticipated to be habituated to ambient noise, vibration and air pollution. Increases in operation disturbance are likely to be minimal from the existing baseline and impacts to breeding birds are unlikely to be significantly affected. Whilst some bird species may be discouraged from breeding within or adjacent to the Project, the abundance of further suitable habitat present in the local area and the creation of additional habitat is considered to offset impacts from degradation.

6.10.496 It is considered that disturbance would result in a slight adverse effect and is not considered significant (for further details relating to individual schemes refer to ES Appendix 6.1: Non-significant Effects (Application Document 3.4)).

Wintering birds

6.10.497 The impacts of operation of relevance to wintering birds are:

- Habitat degradation
- Disturbance.

Habitat degradation

6.10.498 Air pollution from increased traffic may degrade adjacent retained habitats. Changes in plant and invertebrate communities caused by air pollution can occur over time. These can then have secondary effects on some bird species. Studies on both point source (industrial) and diffuse source (traffic exhaust) pollution

have been found to have direct impacts on birds (Feva, et al., 1996)[67].

6.10.499 Habitat degradation is considered likely to have various impacts, such as increases in dust and vehicle emissions, degradation of habitats used by breeding birds for foraging such as aquatic habitats may reduce the availability of invertebrate food sources and is likely to impact on all species recorded using habitats within the Order Limits of the Project. In the Kirkby Thore area where the Project departs significantly from the existing A66, degradation may have a greater effect on wintering birds. Whilst golden plover was not recorded in this area, species such as lapwing and skylark were present. Degradation will affect and potentially contribute to the decrease in, loss or displacement of, relatively small numbers of notable bird species such as lapwing.

6.10.500 The effects arising from habitat degradation during operation would be mitigated by the incorporation of targeted habitats specifically for gulls, waders and wildfowl. Mitigation will take the form of short, grazed damp grassland which will be incorporated in areas where the Project departs significantly offline around the Kirkby Thore area and elsewhere, where lapwing and golden plover were abundant.

Disturbance

6.10.501 The operational phase of the Project may raise noise and vibration levels from the existing baseline. However, as described in Chapter 12: Noise and Vibration no significant effects are anticipated.

6.10.502 The majority of the Project follows or is adjacent to the existing A66 and species present within the Survey Area are anticipated to be habituated to some level of noise, vibration and air pollution. Increases in operation disturbance are likely to be minimal from the existing baseline and impacts to wintering birds are unlikely to be significantly affected. Whilst some bird species may be discouraged from foraging within or adjacent to the Project, the abundance of further suitable habitat present in the local area and the creation of additional habitat creation is considered to offset impacts from degradation.

6.10.503 It is considered the degradation of any habitat would result in a minor adverse effect and is not considered significant.

Barn owl

6.10.504 The population of barn owl within the survey area have been assessed as being of National Importance/ High Value.

6.10.505 The impact of operation of relevance to barn owl is:

[67] Eeva, T., Lehikoinen and Ronka, M. (1996) Air pollution fades the plumage of the Great tit. Functional Ecology 12: 607-612.

- Species mortality.

Species mortality

6.10.506 Major roads can result in the complete absence of breeding barn owls within 0.5 km of a road and it is not until 25 km from a major road that its effect on barn owl population cannot be detected. A study of BTO ringing data found that of juvenile owls dispersing from the natal area, 77% were killed by a major road if they encountered one (Ramsden, 2003)[68].

6.10.507 The following risk factors associated with barn owl mortality on major roads in descending order of importance are:

- Absence of continuous low flight obstructions
- Elevation of the carriageway (sunken, or level)
- Presence/absence of rough grass verges
- Traffic density
- Traffic speed
- Vehicle size
- Number of traffic lanes/width of the road.

6.10.508 The two main types of mitigation which are considered to be the most effective for reducing barn owl mortality on roads are:

- Inclusion of obstacle planting or other barriers which encourage or force barn owls to fly at least 3m above the road
- Managing grass verges to keep grass short which reduces vole numbers, therefore reducing the suitability and appeal of habitat immediately adjacent to the road for barn owl.

6.10.509 Obstacle planting (planting continuous hedges or lines of closely spaced trees) and a grass fly-way (Shawyer 2019) at key crossing points encourages barn owl to fly up and over the road, above the height of traffic, reducing the potential occurrence of collisions with road traffic (Ramsden 2007). The height of obstacle planting will be a minimum of 3m high to help barn owls avoid Heavy Goods Vehicles (HGVs). Where obstacle planting is possible, the location of obstacle planting will be as close as safely practicable to the carriageway (specifically where departures can be agreed with National Highways and implemented safely) and final planting plans will be confirmed during detailed design with the ECoW for all barn owl crossing locations.

6.10.510 Obstacle planting will be undertaken up to 4.5m away from the carriageway, however in some locations obstacle planting would be required closer to the carriageway in order to minimise the effect upon barn owls. In these locations departures need to be agreed with National Highways prior to agreement and implementation.

[68] Ramsden, D.J. (2003) Barn Owls and Major Roads: results and recommendations form a 15-year research project. The Barn Owl Trust, Ashburton.

6.10.511 A total of 29 traffic accident blackspots (TABS) have been identified and will be prioritised for obstacle planting, however departures have not yet been agreed with National Highways for those locations where obstacle planting is required closer than 4.5m to the carriageway. In the absence of this commitment, this assessment takes a precautionary approach and assumes departures cannot be agreed.

6.10.512 In the absence of obstacle planting at specific locations, it is likely that there will be a residual moderate significant effect. This is caused by the lack of safe flight paths across the Project at specific locations within Temple Sowerby to Appleby and Stephen Bank to Carkin Moor. This is due to the deviation of the Project from the existing carriageway into areas known to be used by foraging barn owl, locations close to known barn owl nesting sites, and/or the road being out of cutting/slightly raised therefore providing a greater barrier to flight.

6.10.513 Managing long sections of road verges by mowing the grass to a short sward would discourage small mammals and reduce the risks of barn owl mortality through traffic collisions. In some cases, where continuous screening is not provided and the loss of verge grassland is acceptable, ground cover plants such as dense bramble (*Rubus fruticosus* agg.) or gorse (*Ulex europaeus)* could be used across the entire width of both verges. Reducing the width of verges can also be used to deter barn owls from hunting due to the poorer quality of prey habitat.

6.10.514 In any cases where the Project requires the loss of a nest site, a nest box should not be considered as a direct replacement for the removed nest. Nest boxes should be located at least 1km from a major road to avoid the risks associated with encouraging nesting near a major road - these individuals are likely to become road casualties otherwise.

6.10.515 With the implementation of the proposed mitigation, the Project is likely to result in a residual moderate adverse effect on barn owl. This effect is considered significant.

Otter

6.10.516 The impact of operation of relevance to otter is:

- Species mortality.

Species mortality

6.10.517 Direct mortality resulting from operation of the road will occur due to collisions with traffic as otter attempt to cross the live carriageway.

6.10.518 As set out previously, the Project design includes crossing points for otter in the form of culverts and ledges, which improve connectivity and reduce mortality risk, as well as the provision of otter fencing to prevent access to the road network and direct otter to the safe crossing points.

6.10.519 As a result, it is considered that the effect will be neutral and not significant.

Fish

Routewide

6.10.520 The impacts during operation of relevance to fish are consistent with those described for watercourses (i.e. habitat degradation as result of road runoff and altered fluvial geomorphological processes).

6.10.521 In addition, poorly designed watercourse crossing have the potential to restrict the movement of fish due to insufficient water depth and/or unsuitable flow velocity.

M6 Junction 40 to Kemplay Bank

6.10.522 The extension of the Thacka Beck culvert is not considered to adversely affect fish passage, as the reach is heavily culverted under the baseline scenario, as a result of the A686, the A66 and of the Cumbria Constabulary buildings. The culvert extension will be designed such that the potential for fish passage is not reduced and opportunities to improve fish passage through the culvert.

6.10.523 The highways design of the scheme directs runoff from the alignment into a drainage system, which a combination of includes vegetated ditches, vortex separators and attenuation ponds that are designed to treat run-off prior to discharge to watercourses.

6.10.524 The fish assemblage of Thacka Beck is assessed as being of National importance (high value) as it supports salmon, a qualifying species of the River Eden SAC. The fish assemblage of the River Eamont is assessed as being of International importance (very high value) as this river forms part of the River Eden SAC.

6.10.525 When considering the essential design mitigation outlined in ES Appendix 6.1: Non-Significant Effects and the EMP (Application Document 2.7) to protect fish during operation, the effect on the fish assemblage of Thacka Beck is assessed as Neutral. The effect on the fish assemblage of the River Eamont is also assessed as Neutral (Negligible) and not significant.

Penrith to Temple Sowerby

6.10.526 The key features of this scheme in relation to fish are consistent with those described for watercourses. The potential impacts during operation in this scheme of relevance to fish are consistent with those described on a route-wide basis.

6.10.527 The extension of the Light Water culvert and additional minor crossing is not considered to adversely affect fish passage during operation, as the culvert extension will be designed such that the potential for fish passage is not reduced and opportunities to

improve fish passage through the culvert will investigated at detailed design (see EMP (Application Document 2.7) for further details.

6.10.528 In addition, an undersized and failed culvert associated with a farm track was identified on Light Water and will be remediated as part of essential mitigation, improving fish passage between Light Water and the River Eamont.

6.10.529 When considering the successful implementation of the proposed mitigation measures, the scheme is expected to result in a Slight beneficial effect on Light Water during operation.

6.10.530 The effect on all other tributaries in this scheme (Unnamed Tributary of River Eamont 3.3, Unnamed Tributary of River Eamont 3.5 and Swine Gill) is assessed as Neutral (Negligible - Minor) and not significant.

Temple Sowerby to Appleby

6.10.531 The key features of this scheme in relation to fish are consistent with those described for watercourses. The potential impacts during operation in this scheme of relevance to fish are consistent with those described on a route-wide basis.

6.10.532 Detailed Geomorphological Modelling (Application Document 3.4) demonstrates negligible impacts to fluvial geomorphological processes in this scheme as a result of the Trout Beck viaduct and as a result impacts to fish during operation are considered negligible. This design feature is secured through the Project Design Principles (Application Document 5.11).

6.10.533 When considering the embedded design mitigation, the effect on the fish assemblage of Trout Beck (and the wider River Eden SAC) during operation is assessed as Neutral (Negligible) and not significant.

Appleby to Brough

6.10.534 The key features of this scheme in relation to fish are consistent with those described for watercourses. The potential impacts during operation in this scheme of relevance to fish are consistent with those described on a route-wide basis.

6.10.535 Detailed Geomorphological Modelling (Application Document 3.4) demonstrates negligible impacts to fluvial geomorphological processes in this scheme as a result of the additional watercourse crossings which are typically open span bridges and viaducts. These design features are secured through the Project Design Principles (Application Document 5.11).

6.10.536 When considering the embedded design mitigation, the effect on the fish assemblage of Trout Beck (and the wider River Eden SAC) during operation is assessed as Neutral (Negligible) and not significant.

Bowes Bypass

6.10.537 The key features of this scheme in relation to fish are consistent with those described for watercourses. The potential impacts during operation in this scheme of relevance to fish are consistent with those described on a route-wide basis.

6.10.538 When considering the embedded design mitigation, the effect on the fish assemblage during operation is assessed as Neutral (Negligible) and not significant.

Cross Lanes to Rokeby

6.10.539 The key features of this scheme in relation to fish are consistent with those described for watercourses. The potential impacts during operation in this scheme of relevance to fish are consistent with those described on a route-wide basis.

6.10.540 When considering the embedded design mitigation, the effect on the fish assemblage during operation is assessed as Neutral (Negligible) and not significant.

Stephen Bank to Carkin Moor

6.10.541 The key features of this scheme in relation to fish are consistent with those described for watercourses. The potential impacts during operation in this scheme of relevance to fish are consistent with those described on a route-wide basis.

6.10.542 When considering the embedded design mitigation, the effect on the fish assemblage during operation is assessed as Neutral (Negligible) and not significant.

A1(M) Junction 53 Scotch Corner

6.10.543 This scheme does not interact with any watercourses.

White-clawed crayfish

6.10.544 The impacts during operation of relevance WCC are consistent with those described for watercourses (i.e. habitat degradation as result of road runoff and altered fluvial geomorphological processes).

6.10.545 In addition, poorly designed watercourse crossings have the potential to restrict the movement and migration of WCC.

6.10.546 When considering the successful implementation of the proposed avoidance and embedded mitigation measures, the effect on WCC during operation is assessed as Neutral (Negligible) and significant.

In-combination climate effects

6.10.547 The in-combination climate change impact 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.

Construction

6.10.548 Compared to the current climate baseline, the UKCP18 projections suggest that changes to the climate by the 2020s (construction period) are unlikely to have a significant impact on ecological receptors through either climate-related hazards or changes to habitat distribution due to climate change.

Operation

6.10.549 The in-combination climate effects for the operation phase are summarised in Table 6-23: In Combination Climate Effects for the Operation Phase.

Table 6-23: In Combination Climate Effects for the Operation Phase.

Receptor	Effect impacted by climate change	Climate hazard(s)	Impact of climate hazard(s)	Impact on significance of the effect	Embedded mitigation or additional mitigation/enhancement
Designated sites & habitats	Habitat degradation	Increase in dry spells	Increased frequency and severity of dry spells has the potential to negatively impact a range of plant communities, including marsh and fen habitats, as well as woodlands. This could increase the likelihood of wildfire and therefore loss of habitat.	Drier conditions and drought can exacerbate the degradation of habitats on designated sites, by increasing the likelihood of wildfires, as well as cause drying up of wetland and moorland habitats.	The occurrence of wildfires in the vicinity of the route will be monitored. If the frequency of wildfire events starts to increase, it is proposed in the Climate Change Resilience Assessment (ES Appendix 7.2 Climate Change Resilience Assessment (Application Document 3.4)) that National Highways should engage landowners/land managers to discuss adaptive management techniques to reduce wildfire risk.
Amphibians	N/A	N/A	Scoped out of wider assessment, therefore impacts as a result of projected climate change are considered to be negligible.	N/A	N/A
Reptiles	Species mortality	Average temperature increases	The future climate projections used in the assessment indicate that future temperature along the scheme could increase by up to 4.7 degrees C by the 2080s/through the period of operation. Increased temperatures may lead to	The A66 presents a significant barrier for foraging and commuting north to south in the landscape. Routes across the A66 to migrate north in response to climate change may increase the likelihood of	Embedded existing mitigation: Greening of the proposed overbridges detailed in Table 6-12 will maintain north-south connectivity, reduce the barrier effect of the Project and avoid species mortality that could

Receptor	Effect impacted by climate change	Climate hazard(s)	Impact of climate hazard(s)	Impact on significance of the effect	Embedded mitigation or additional mitigation/enhancement
			colonisation and migration of species towards higher latitudes and altitudes.	species mortality due to road vehicle collisions.	otherwise be caused by potential road traffic collisions.
Terrestrial invertebrates	N/A	N/A	No climate-hazard impacts on terrestrial invertebrates are likely during operation of the Project.	No climate-hazard impacts on terrestrial invertebrates are likely during operation of the Project.	N/A
Badger	Disturbance and species mortality	N/A	N/A	Significant impacts for badger are related to noise disturbance and species mortality from collisions with vehicles. These effects are unlikely to be influenced by future climate change.	N/A
Red squirrel	Species mortality	Average temperature increases	The future climate projections used in the assessment indicate that future temperature along the scheme could increase by up to 4.7 degrees C by the 2080s/through the period of operation. Increased temperatures may lead to colonisation and migration of species towards higher latitudes and altitudes.	The A66 presents a significant barrier for foraging and commuting north to south in the landscape. Routes across the A66 to migrate north in response to climate change may increase the likelihood of species mortality due to road vehicle collisions.	Embedded existing mitigation: As a result of the incorporation of several green bridges into the design of the Project, which comprise stretches of habitat suitable to support red squirrel commuting, it is considered that the effect will be neutral and not significant.
Bats	Habitat fragmentation	Average temperature increases	The future climate projections used in the assessment indicate that future temperature along the scheme could increase by up to 4.7 degrees	The A66, in particular offline areas, will fragment commuting and foraging routes for bats north to south on a permanent basis. Key flight routes	Embedded existing mitigation: Greening of the proposed overbridges detailed in Table 6-12will maintain north-south connectivity, reduce the barrier

Receptor	Effect impacted by climate change	Climate hazard(s)	Impact of climate hazard(s)	Impact on significance of the effect	Embedded mitigation or additional mitigation/enhancement
			C by the 2080s/through the period of operation. Increased temperatures may lead to migrations of species towards higher latitudes and altitudes to mitigate increased temperatures at lower latitudes and altitudes.	between foraging resources and important roost locations could be affected in the long term, limiting species' ability to migrate north in response to climate change.	effect of the Project and avoid species mortality that could otherwise be caused by potential road traffic collisions.
Other terrestrial mammals	Species mortality	Average temperature increases	The future climate projections used in the assessment indicate that future temperature along the scheme could increase by up to 4.7 degrees C by the 2080s/through the period of operation. Increased temperatures may lead to colonisation and migration of species towards higher latitudes and altitudes.	The A66 presents a significant barrier for foraging and commuting north to south in the landscape. Routes across the A66 to migrate north in response to climate change may increase the likelihood of species mortality due to road vehicle collisions.	Embedded existing mitigation: Greening of the proposed overbridges detailed in Table 6-12will maintain north-south connectivity, reduce the barrier effect of the Project and avoid species mortality that could otherwise be caused by potential road traffic collisions.
Breeding birds	Habitat degradation and disturbance	N/A	N/A	Significant impacts for breeding birds are related to noise disturbance and habitat degradation due to air pollution from road traffic. These effects are unlikely to be influenced by future climate change.	N/A
Wintering birds	Habitat degradation and disturbance	N/A	N/A	Likely significant impacts for wintering birds are related to noise disturbance and habitat degradation due to air pollution	N/A

Receptor	Effect impacted by climate change	Climate hazard(s)	Impact of climate hazard(s)	Impact on significance of the effect	Embedded mitigation or additional mitigation/enhancement
				from road traffic. These effects are unlikely to be influenced by future climate change.	
Barn Owl	Fragmentation and species mortality	N/A	N/A	Likely significant effects for barn owl are directly related to the construction of the Project and the resulting increased risk in vehicle collisions due to characteristic barn owl behaviour near roads. These effects are unlikely to be affected by projected climate change.	N/A
Otter	Species mortality	Average temperature increases	The future climate projections used in the assessment indicate that future temperature along the scheme could increase by up to 4.7 degrees C by the 2080s/through the period of operation. Increased temperatures may lead to colonisation and migration of species towards higher latitudes and altitudes.	The A66 presents a significant barrier for foraging and commuting north to south in the landscape. Routes across the A66 to migrate north in response to climate change may increase the likelihood of species mortality due to road vehicle collisions as otter attempt to cross the live carriageway.	Embedded existing mitigation: the Project design includes crossing points for otter in the form of culverts and ledges, which improve connectivity and reduce mortality risk, as well as the provision of otter fencing to prevent access to the road network and direct otter to the safe crossing points. It is considered that the effect will be neutral and not significant.
Fish, white-clawed crayfish	N/A	N/A	N/A	There are no significant impacts related to fish and white-clawed crayfish.	N/A

Receptor	Effect impacted by climate change	Climate hazard(s)	Impact of climate hazard(s)	Impact on significance of the effect	Embedded mitigation or additional mitigation/enhancement
Aquatic macrophyte, aquatic invertebrates	N/A	N/A	Scoped out of wider assessment, therefore impacts as a result of projected climate change are considered to be negligible.	N/A	N/A

Table 6-24: Summary of significant effects (construction)

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/enhancement	Impact magnitude	Residual effect
Routewide						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
M6 Junction 40 to Kemplay Bank						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Penrith to Temple Sowerby						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Temple Sowerby to Appleby						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Appleby to Brough						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bowes Bypass						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cross Lanes to Rokeby						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stephen Bank to Carkin Moor						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
A1(M) Junction 53 Scotch Corner						

Receptor	Attribute	Receptor sensitivity	Potential impact before essential mitigation	Essential mitigation/enhancement	Impact magnitude	Residual effect
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-25: Summary of significant effects (operation)

Receptor	Attribute	Receptor sensitivity	Potential Impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Routewide						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
M6 Junction 40 to Kemplay Bank						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Penrith to Temple Sowerby						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Temple Sowerby to Appleby						
Barn owl	Individual barn owl	Medium	Mortality and/or injury of individuals due to collisions with road traffic	Assuming departures to include obstacle planting within 4.5m of the carriageway cannot be agreed with National Highways or implemented safely.	Moderate	Moderate adverse
Appleby to Brough						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bowes Bypass						
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Receptor	Attribute	Receptor sensitivity	Potential Impact before essential mitigation	Essential mitigation/ enhancement	Impact magnitude	Residual effect
Cross Lanes to Rokeby						
N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stephen Bank to Carkin Moor						
Barn owl	Individual barn owl	Medium	Mortality and/or injury of individuals due to collisions with road traffic	Assuming departures to include obstacle planting within 4.5m of the carriageway cannot be agreed with National Highways or implemented safely.	Moderate	Moderate adverse
A1(M) Junction 53 Scotch Corner						
N/A	N/A	N/A	N/A	N/A	N/A	N/A

6.11 Monitoring

6.11.1 This section provides a summary of monitoring required for both construction and operation. The EMP (Application Document 2.7) and LEMP (Annex B1 of the EMP (Application Document 2.7) provide full details of all required monitoring and should be read in conjunction with the outline measures below.

Designated sites

Construction

6.11.2 No specific monitoring in relation to designated sites is required.

Operation

6.11.3 No specific monitoring in relation to designated sites is required, although it should be noted that habitat creation will be monitored as described below.

Habitats

Construction

6.11.4 A monitoring visit will be carried out prior to the commencement of construction works at each location to ensure appropriate protective fencing and other required mitigation measures are in place.

6.11.5 Monitoring visits will be carried out on a six-monthly basis throughout the construction phase. The visits will monitor the application of appropriate protective measures for areas of retained habitat, and off-site habitat, throughout the duration of the construction phase. Where appropriate measures are not being taken, corrective action will be taken.

6.11.6 The results of monitoring visits, observations, recommended corrective actions and implementation of these actions will be recorded within a monitoring log held within the EMP (Application Document 2.7). This will be held by National Highways and available for stakeholder inspection upon request.

Operation

6.11.7 For the impacts of the Project to be successfully mitigated a monitoring programme for habitats for up to a 30 year period within the Order Limits will be implemented post-construction. The monitoring will aim to identify effectiveness of the habitat creation, early warnings of failure or deterioration, and any remedial actions that may be required (See Annex B1: LEMP of the EMP (Application Document 2.7) for further details of the monitoring programme set out for habitats.

6.11.8 The success of habitat establishment will be assessed using the condition assessments criteria set out by Natural England (*The Biodiversity Metric 3.0*) and UK Habitat Classification habitat

definitions (Butcher et al., 2020)[69] (or appropriate prevailing guidance at the time of monitoring). Failure of the habitats to fulfil the appropriate criteria, or failure to show natural succession towards the targeted habitat type and condition (in the earlier years of establishment) will trigger remedial action to be taken.

6.11.9 Remedial action will seek to correct points of failure and maximise opportunities for biodiversity, in line with the original habitat mitigation objectives.

6.11.10 Results of the monitoring surveys will be recorded within an appropriate long term monitoring report. This will be held by National Highways and available for stakeholder inspection upon request.

6.11.11 Monitoring visits of all areas of created habitat will be carried out between April and September by an appropriately qualified ecologist. As a minimum, monitoring visits will be carried out in years 1, 2, 3, 5, 10, 15, 20, 25 and 30 following completion of the construction phase. These prescriptions are adaptive and, in the event remedial action is required to address habitat creation failures, additional visits may be required.

Reptiles

Construction

6.11.12 Monitoring required during construction will be detailed within the Reptile Method Statement to be produced prior to site clearance and construction works commencing. This will comprise reptile surveys in areas suitable for reptile which will be adversely affected by construction in order to facilitate translocation when necessary.

Operation

6.11.13 A monitoring programme will be developed and included within the Reptile Method Statement to be produced prior to site clearance and construction works commencing. This will detail monitoring of reptile populations for at least five years post-construction within the receptor sites used for reptile translocations.

Badger

Construction

6.11.14 During construction, and in accordance with the requirements of a Natural England mitigation licence, monitoring of abandonment of closed setts and of badger activity around artificial setts will be carried out. The specific methods and requirements of such

[69] Butcher, B., Carey, P., Edmonds, R., Norton, L. and Treweek, J. (2020) UK Habitat Classification - Habitat Definitions Version 1.1.

monitoring will be detailed within the development licence and agreed with Natural England.

6.11.15 For badger protection in the form of fencing to remain effective, it must be properly maintained. Badger fencing installed during construction should be monitored regularly, especially during the first two years after installation when badgers will be adjusting to new pathways and crossing points. Should badger casualties resulting from road traffic collisions be noticed in previously unaffected areas, a thorough check should be made of the badger fencing in the vicinity.

Operation

6.11.16 A monitoring programme will be developed to record evidence of use of badger culverts, for at least three years after operation commences. Surveys will include the use of camera traps or clay matts at the entrance to the culverts to record activity and understand the effectiveness of the mitigation.

Bats

Construction

6.11.17 During construction, roost activity surveys will be undertaken of the maternity roosts at Eden View Cottages (Roost 11), Old Stone Barn (Roost 23), Streetside Farm (Roost 29) and Rokeby Grove (Roosts 30 to 32) to monitor the effects of the Project on these sensitive maternity roosts. It is expected that the mitigation measures used will create equally suitable roosting provision for bats when compared to the baseline.

6.11.18 In the unlikely event that a notable drop in bat numbers, or roost abandonment, is observed during construction further restrictive working measures will need to be employed under the direction of the ECoW. These may include, but are not limited to, changing construction hours or months of the year when works are undertaken, increasing the protection zone around the roost feature, amending lighting, noise, or vibration management plans, or altering equipment and machinery used. This would be likely to result in amendments to the mitigation licence working method.

Operation

6.11.19 The effectiveness of the embedded and essential mitigation for roosting, commuting and foraging bats, including project-wide habitat replacement, will be monitored for bat activity post-construction by undertaking the following surveys:

- Bat activity surveys of features of District importance or greater, in line with current best practice, to include surveys at the crossing points identified during the radiotracking studies (notably RTCP4 and RTCP5)
- Roost monitoring surveys of any replacement roosts created, to comply with EPSL conditions

- Roost activity surveys for a minimum of three years post-construction for the maternity roosts at Eden View Cottages (Roost 11), Old Stone Barn (Roost 23), Streetside Farm (Roost 29) and Rokeby Grove (Roosts 30 to 32).

6.11.20 Where bat numbers drop or roost abandonment is observed following construction, and cannot be attributed to external factors, retroactive action would be required to maintain activity at its pre-construction levels. Interventions may include but are not limited to creating or increasing additional roosting provision, adjusting environmental conditions within the roosting provision, checking that suitable access/egress is maintained and creating new access/egress points as necessary, enhancing nearby roosting provision, enhancing or planting habitat adjacent to the roosting provision or promoting habitat links between known roosts. These actions should be recorded within the activities undertaken on the mitigation licence.

Red squirrel

Construction

6.11.21 Monitoring of red squirrel feeding locations is recommended to ensure that there is ample food supply to sustain the red squirrel present impacted by loss of habitat.

Operation

6.11.22 The effectiveness of the embedded and essential mitigation for breeding, commuting and foraging red squirrel, including project-wide habitat replacement, will be monitored for red squirrel activity post-construction by undertaking the following surveys:

- Camera trap surveys of Animex wildlife bridges or equivalent to establish whether or not they are utilised by red squirrels
- Long term population monitoring of retained and newly created red squirrel habitat along with red squirrel feeding locations.

Other species

Construction

6.11.23 No specific monitoring for amphibians, other terrestrial mammals (brown hare, hedgehog and polecat) or terrestrial invertebrates is required, although it is recommended that during monitoring being undertaken by the ECoW across construction areas, any incidental sightings are recorded.

Operation

6.11.24 No specific monitoring for amphibians, other terrestrial mammals (brown hare, hedgehog and polecat) or terrestrial invertebrates is required, although it is recommended that during monitoring of created and enhanced habitats, any incidental sightings are recorded.

Breeding and wintering birds

Construction

6.11.25 No specific monitoring measures are required for breeding or wintering birds during construction.

Operation

6.11.26 All mitigation measures require monitoring and management to assess how successful they are and maintain their integrity. Areas of habitat incorporated specifically as ornithological mitigation, should be monitored to ensure they reach their optimal condition and support target bird species in accordance with the measures set out within the LEMP (Annex B1 of the EMP (Application Document 2.7).

Barn owl

Construction

6.11.27 No specific monitoring measures are required for barn owl during construction, however, given the sensitivity of this species, as a Schedule 1 bird, and it's known presence within the Order Limits, a precautionary approach is being taken. Therefore it is recommended that during monitoring being undertaken by the ECoW across construction areas, any incidental sightings of barn owl are recorded. This will allow any unexpected finds to be identified, communicated to the on site workforce and for works to be carried out in a compliant manner.

Operation

6.11.28 All mitigation measures require monitoring to assess how successful they are. It is recommended that nest are monitored for at least five years post construction. Annual monitoring visits undertaken in July and August would be most suitable. Once obstacle planting has reached at least 3m in height, it should be monitored on an annual basis for the following five years to ensure the integrity of these features. Should any feature fail and not be capable of delivering its aim, interventions will be required such as re-planting or additional enhancements.

Otter

Construction

6.11.29 A monitoring programme will be developed to record evidence of regular use of the two newly created artificial holts and abandonment of the existing natal holt, located within the Appleby to Brough scheme. This natal holt will, depending on the specific impacts of the Project need to be closed under licence by an ECoW. This will be confirmed and assessed following detailed design once the working area and methods in the location of the

natal holt has been finalised. Surveys will include the use of a camera-trap and recording field signs.

Operation

6.11.30 A monitoring programme will be developed to record evidence of regular use of newly created otter culverts and ledges within existing culverts, especially in the first two years. Surveys will include the use camera-traps and clay matts at the entrance of the crossing points to record prints.

6.11.31 For otter protection to remain effective, it is essential that fencing is properly maintained. Regular checks should be made, especially during the first two years when otters will be adjusting to new pathways and crossing points, to ensure that the fencing has not been vandalised or damaged to the extent that otters can gain access to the carriageway. Where otter casualties are noticed in previously unaffected areas, a thorough check should be made of the fencing in the vicinity.

Fish

Construction

6.11.32 No specific monitoring measures are required for fish during construction, however of translocation of fish will be undertaken where dewatering is required.

Operation

6.11.33 No specific monitoring measures are required for fish during operation.

Aquatic macrophyte

Construction

6.11.34 No specific monitoring measures are required for aquatic macrophytes during construction.

Operation

6.11.35 No specific monitoring measures are required for aquatic macrophytes during operation.

Aquatic invertebrates

Construction

6.11.36 During construction, a programme of macroinvertebrate surveys will be developed and overseen by the ECoW. Surveys will be undertaken at key locations to monitor the effects of the Project on macroinvertebrate assemblages and the efficacy of the pollution prevention measures.

6.11.37 These surveys will be complemented by the programme of water quality monitoring being undertaken during construction outlined in ES Chapter 14: Road Drainage and Water Environment.

Operation

6.11.38 No specific monitoring measures are required for aquatic invertebrates during operation.

White-clawed crayfish

Construction

6.11.39 No specific monitoring measures are required for WCC during construction, however of translocation of WWC will be undertaken where dewatering is required.

Operation

6.11.40 No specific monitoring measures are required for WCC during operation.

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