

**A66 Northern Trans-Pennine Project
TR010062**

**3.4 Environmental Statement
Appendix 6.21 Aquatic Invertebrate**

APFP Regulations 5(2)(a)

Planning Act 2008

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

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Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning
(Applications: Prescribed
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A66 Northern Trans-Pennine Project
Development Consent Order 202x

**3.4 ENVIRONMENTAL STATEMENT
APPENDIX 6.21 AQUATIC INVERTEBRATE**

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6.21 Aquatic Invertebrate

6.21.1 Introduction

- 6.21.1.1 The A66 Northern Trans-Pennine project is a programme of works to improve the A66 between the M6 at Penrith and A1 at Scotch Corner.
- 6.21.1.2 Between the M6 and the A1(M) the existing A66 is approximately 80km in length. Along this length it is intermittently dualled, with approximately 30km of single carriageway, in six separate sections, making the route accident prone and unreliable.
- 6.21.1.3 The route carries high levels of freight traffic and is an important route for tourism and connectivity to local communities. The variable road standards, together with the lack of available diversionary routes when incidents occur, affects road safety, reliability, resilience and attractiveness of the route. For a full project description see Chapter 2: The Project (Application Document 3.2).

6.21.2 Legislation and Policy Framework

Legislation

- 6.21.2.1 A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. This legislation is listed in full within Chapter 6: Biodiversity (Application Document 3.2). Aquatic macroinvertebrates (referred to hereafter as macroinvertebrates) receive limited protection from conservation legislation. However, a limited number of species are cited as features of protected areas under the Habitat Directive, listed on the International Union for Conservation of Nature (IUCN) red list and/or designated as Species of Principal importance for biodiversity in accordance with Section 41 of the NERC Act 2006. Legislation relevant to invertebrates and discussed within this report are:

- Natural Environment and Rural Communities (NERC) Act 2006
- EC Directive Conservation of Natural Habitats & Flora (92/43/EEC)
- The Water Framework Directive (WFD) 2000/60/EC.

- 6.21.2.2 White-clawed crayfish (*Austropotamobius pallipes*) are protected under various national and international legislation and are present in the project area. A separate, white-clawed crayfish survey report (ES Appendix 6.22: White Clawed Crayfish (Application Document 3.4) has been prepared for the project; this species is not discussed in detail in this report, but observations of this species during the kick sampling are noted.

Natural Environment and Rural Communities Act 2006

- 6.21.2.3 The NERC Act 2006 is designed to help achieve a rich and diverse natural environment and thriving rural communities. Section 41 (S41) of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The S41 list is used to guide decision-makers

such as public bodies, including local and regional authorities, in implementing their duty under Section 40.

- 6.21.2.4 Under Section 40 there is a Duty to conserve biodiversity; specifically, Subsection (1) states “Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.”

EC Directive Conservation of Natural Habitats & Flora (92/43/EEC)

- 6.21.2.5 The Conservation of Habitats and Species Regulations 2017 consolidated and updated the Conservation of Habitats and Species Regulations 2010 (as amended). They are the British response to the Habitats and Species Directive 1992 issued by the European Community (EC) (which is now the European Union (EU)). They offer protection to a number of plant and animal species throughout the EC via the designation of Special Areas of Conservation (SACs).
- 6.21.2.6 Core areas of habitat for species listed on Annex II of the Habitats Directive are designated as sites of Community importance (SCIs) and included in the Natura 2000 network. These sites must be managed in accordance with the ecological needs of the species for which they are designated.

The Water Framework Directive (WFD) 2000/60/EC

- 6.21.2.7 The WFD is a legal framework for the protection and restoration of inland surface waters, transitional water, coastal waters and groundwater. The WFD introduced a comprehensive river basin management planning system to help protect and improve the ecological health of the water environment. This is underpinned by the use of environmental standards to help assess risks to the ecological quality of the water environment and to identify the scale of improvements that would be needed to bring waters under pressure back into a good condition.
- 6.21.2.8 Under WFD many activities need approval before they can go ahead. A WFD assessment is required to enable the public body that regulates and grants permissions for the activity concerned to provide consent.
- 6.21.2.9 The WFD aim is for all water bodies to be at good status. A WFD assessment must demonstrate that a proposed activity will not:
- Cause or contribute to deterioration of status
 - Jeopardise the water body achieving good status in future.
- 6.21.2.10 Macroinvertebrates is one of the biological quality elements (along with "fish" and "macrophytes and phytobenthos combined") typically used to provide WFD status in rivers and form part of the WFD assessment.

National level policy

- 6.21.2.11 The primary policy basis for deciding whether or not to grant a Development Consent Order (DCO) 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. 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 coherent ecological networks that are more resilient to current and future pressures...” (NPSNN paragraph 5.20)

6.21.2.12 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)

Table 1: NPSNN policies.

Relevant NPSNN paragraph reference	Requirement of the NPSNN (paraphrase)
5.22	Outline any likely significant effects on internationally, nationally and locally designated sites of ecological or geological conservation importance 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.
5.23	Demonstrate how the project has taken advantage of opportunities to conserve and enhance biodiversity conservation interests.
5.29	Ensure proposals mitigate the harmful aspects of the development and, where possible, to ensure the conservation and enhancement of the site’s biodiversity are acceptable.
5.33	Development proposals potentially provide many opportunities for building in beneficial biodiversity features. Opportunities to maximise beneficial biodiversity features should be considered. Planning obligations can be used where appropriate in order to ensure that such beneficial features are delivered.
5.34 and 5.35	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. Undertake 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.

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

Relevant NPSNN paragraph reference	Requirement of the NPSNN (paraphrase)
5.36	Include appropriate mitigation measures as an integral part of their proposed development, including identifying where and how these will be secured
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.
5.38	Take account of what mitigation measures may have been agreed between the applicant and Natural England and/or the Marine Management Organisation (MMO), and whether Natural England and/or the MMO has granted or refused, or intends to grant or refuse, any relevant licences, including protected species mitigation licences.

National planning policy framework

6.21.2.13 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.

Regional and local level policy

6.21.2.14 Although the UK Biodiversity Action Plan (BAP) has been superseded, BAPs are still widely used at county level to support Biodiversity 2020 (Department for Environment Food and Rural Affairs, 2011)⁴.

6.21.2.15 Mud snail is listed as priority species on the Durham County Council BAP (2012/13) now listed on North East England Nature Partnership (North East England Nature Partnership, 2013)⁵.

6.21.2.16 The mud snail (*Omphiscola glabra*), freshwater pearl mussel (*Margaritifera margaritifera*), medicinal leech (*Hirudo medicinalis*), iron blue mayfly (*Nigrobaetis niger*), variable damselfly (*Coenagrion pulchellum*), white-faced dragonfly (*Leucorrhinia dubia*), oxbow diving beetle (*Hydroporus rufifrons*), zircon reed beetle (*Donacia aquatica*), *Glossosoma intermedium*, river-shore crane fly (*Rhabdomastix japonica*), southern silver stiletto-fly (*Clorismia rustica*), northern silver stiletto-fly (*Dyschirius angustatus*) are listed as priority species on the *Cumbria BAP* (Cumbria Biodiversity Partnership, 2001)⁶.

6.21.2.17 The following local planning policies are relevant to this report:

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

³ Nationally Significant Infrastructure Projects (NSIP)

⁴ Department for Environment Food and Rural Affairs (2011) Biodiversity 2020: A Strategy for England’s Wildlife and Ecosystem Services. Department for Environment, Food and Rural Affairs, London.

⁵ North East England Nature Partnership (2013) Biodiversity Priorities

⁶ Cumbria Biodiversity Partnership (2001) The Cumbria Biodiversity Action Plan]

- *Eden Local Plan (2014-2032) (Eden District Council, 2014)⁷ Policy ENV1 and Policy ENV4*
- *County Durham Plan (Adopted 2020) (Durham County Council, 2020)⁸ Policy 26, Policy 40, Policy 41, Policy 42 and Policy 43*
- *Richmondshire Local Plan (2012-2028) adopted 2014 (Richmondshire District Council, 2014)⁹ Core Policy CP12*
- *Richmondshire District Councils BAP (Richmond County Council, 2014)¹⁰.*

Other relevant policy and guidance

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

- *Guidance for Ecological Impact Assessment in the United Kingdom Third Edition (Chartered Institute of Ecology and Environmental Management, 2018)¹¹*

6.21.3 Methodology

Desk study

Environment Agency Data

6.21.3.1 The Environment Agency ecology and fish data explorer (Environment Agency, 2021)¹² and a GIS were used to identify Environment Agency macroinvertebrate survey sites located within the Order Limits plus a 2km buffer (the study area). Data from between 2010 and 2021 was included in the desk study.

6.21.3.2 Macroinvertebrate survey data were included from all watercourses within the study area, whether they were hydraulically connected to watercourses that interact with the project or not.

6.21.3.3 Taxa lists from the surveys identified were screened for notable and/or protected macroinvertebrate species, as defined by Joint Nature Conservation Committee (JNCC) Conservation Designations for *UK taxa 2020* (Joint Nature Conservation Committee, 2021)¹³.

Field survey

6.21.3.4 Aquatic macroinvertebrate sampling was undertaken at 22 proposed watercourse crossing points in spring 2021 and at 22 watercourse crossing points in autumn 2021. Sampling locations are shown in Figure

⁷ Eden District Council (2014) Eden Local Plan 2014 to 2032]

⁸ Durham Council (2020) County Durham Plan – Adopted 2020]

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

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

¹¹ Chartered Institute of Ecology and Environmental Management (2018) Guidance for Ecological Impact Assessment in the United Kingdom Third Edition

¹² Environment Agency (2021) Ecology and Fish Data Explorer

¹³ Joint Nature Conservation Committee (2020) Conservation Designations for UK Taxa 2020..

6.16: Aquatic Invertebrates (Application Document 3.3) and listed in Table 2: Macroinvertebrate sampling sites.

Field sampling

6.21.3.5 The method used to sample macroinvertebrates followed the standard four-minute combined kick sampling technique, adhering to Environment Agency guidelines (Environment Agency, 2017a)¹⁴. Briefly, the sampling methodology comprised:

- 30 seconds of netting of any surface-active insects, such as pond skaters (*Hemiptera: Gerridae*) and whirligig beetles (*Coleoptera: Gyrinidae*)
- 30 seconds of hand searching for macroinvertebrates, such as those adhering to submerged logs, stones or other debris, for example leeches (*Hirudinea*) and caddisfly (*Trichoptera*)
- 3 minutes of active kicking and disturbing substrates and sediment within the watercourse, with additional sweeping of vegetation where present.

6.21.3.6 In line with guidance, care was taken to ensure that all available mesohabitats were proportionately included in the sampling and that surface-active insects and species adhered to submerged logs and stones were also included.

6.21.3.7 Samples were transferred to rigid plastic containers and preserved in Industrialised Denatured Alcohol (IDA) for later identification in the laboratory.

Habitat data and physico-chemical parameters

6.21.3.8 Environmental variables were recorded in accordance with 'UK Invertebrate sampling and analysis procedure for STAR project, RIVPACS Macro-invertebrate sampling protocol' (STAR project, 2004)¹⁵. At each sampling location the following information was collected/measured:

- Substrate (expressed as percentage coverage of the riverbed)
- Estimated flow velocity (ms⁻¹)
- Depth (m)
- Wetted and full channel width (m)
- Land use
- Bankside vegetation
- Instream vegetation (expressed as percentage coverage of sampling location)
- Shading.

6.21.3.9 Measurements of basic physico-chemical parameters including temperature, pH, dissolved oxygen concentration, salinity and conductivity were also measured and recorded using a YSI multi-parameter probe. Upstream and downstream photographs were taken at

¹⁴ Environment Agency (2017a) Freshwater macroinvertebrate sampling in rivers: Operational Instruction 018 08 Issued 09/012/017 Environment Agency, Bristol.

¹⁵ STAR project (2004) UK Invertebrate sampling and analysis procedure for STAR project..

each sampling location to provide a visual record of the habitat surveyed.

Table 2: Macroinvertebrate sampling sites

Scheme	Site name	Watercourse	Survey location (National Grid Reference)	Dates sampled
M6 Junction 40 to Kemplay Bank (S0102)	WCP_01	Thacka Beck	NY 52740 29209	17/05/21 & 20/09/21
Penrith to Temple Sowerby (S03)	WCP_03	Light Water	NY 54894 29120	17/05/21 & 20/09/21
	WCP_04	Unnamed Trib. of River Eamont 3.3	NY 55634 29098	17/05/21 & 20/09/21
	WCP_07	Swine Gill	NY 58269 28785	17/05/21
Temple Sowerby to Appleby (S0405)	WCP_08_DS	Trout Beck	NY 64719 24437	18/05/21 & 23/09/21
	WCP_08_US	Trout Beck	NY 65017 24493	18/05/21 & 23/09/21
	WCP_08_US_RED-KS	Keld Sike	NY 65389 24682	23/09/21
	WCP_08_US_RED	Trout Beck	NY 65706 24152	18/05/21 & 20/09/21
Appleby to Brough (S06)	WCP_11	Unnamed Trib. of Mire Sike	NY 73519 16852	18/05/21 & 20/09/21
	WCP_13	Cringle Beck	NY 74463 16493	18/05/21 & 20/09/21
	WCP_15	Moor Beck	NY 75045 16076	18/05/21 & 21/09/21
	WCP_16	Moor Beck	NY 75099 15939	18/05/21 & 21/09/21
	WCP_17	Eastfield Sike	NY 75464 15783	18/05/21 & 21/09/21
	WCP_18	Unnamed Trib. of Lowgill Beck	NY 77298 15158	18/05/21 & 21/09/21
	WCP_19	Lowgill Beck	NY 77977 14999	18/05/21 & 21/09/21
Bowes Bypass (S07)	WCP_20	Unnamed Trib. of River Greta	NY 99282 14159	19/05/21 & 21/09/21
Cross Lanes to Rokeby (S08)	WCP_23	Unnamed Trib. of Tutta Beck	NZ 05127 13590	19/05/21
	WCP_24_BLUE	Punder Gill	NZ 05381 13683	23/09/21
	WCP_24	Tutta Beck	NZ 04517 13667	19/05/21 & 22/09/21

Scheme	Site name	Watercourse	Survey location (National Grid Reference)	Dates sampled
	WCP_25	Unnamed Trib. of Tutta Beck	NZ 05559 13662	19/05/21
Stephen Bank to Carkin Moor (S09)	WCP_28	Unnamed Trib. of Dalton Beck	NZ 14367 09445	19/05/21 & 22/09/21
	WCP_29	Unnamed Trib. of Dalton Beck	NZ 15033 09188	19/05/21
	WCP_30	Mains Gill	NZ 15701 08704	19/05/21 & 22/09/21
	WCP_33	Unnamed Trib. of Holme Beck	NZ 16288 08089	19/05/21 & 22/09/21

Data analysis

Laboratory sample analysis

6.21.3.10 Sample analysis was undertaken by Watson Ecology in accordance with *BS EN 17136:2019* (British Standard, 2019)¹⁶. Samples were analysed to species/mixed taxon level (TL5). For each given sample, the taxa present and their abundance were recorded. Two samples from the spring sampling round and two from the autumn sampling round were externally audited for quality assurance.

6.21.3.11 The average number of family level errors across these four samples was within the Environment Agency's sample pass threshold.

Biological indices

6.21.3.12 The following biological indices were calculated from the macroinvertebrate data:

- WHPT (Whalley Hawkes Paisley Trigg)
- ASPT (Average Score Per Taxon)
- NTAXA (Number of Scoring Taxa)
- LIFE (Lotic-invertebrate Index for Flow Evaluation)
- PSI (Sediment-sensitive Invertebrates Index)
- CCI (Conservation Index Valuation).

CCI conservation value analysis

6.21.3.13 The *Community Conservation Index* (Chadd and Extence, 2004)¹⁷ represents the national rarity and diversity of species within a site and gives a total conservation score to the whole community. CCI score boundaries and corresponding conservation categories are provided in Table 3: Conservation categories in relation to CCI scores..

¹⁶ British Standard (2019) BS EN 17136:2019 Water quality - Guidance on field and laboratory procedures for quantitative analysis and identification of macroinvertebrates from inland surface waters.

¹⁷ Chadd and Extence (2004) Community Conservation Index

Table 3: Conservation categories in relation to CCI scores.

CCI Score	Conservation category
0 – 5.0	Low conservation value
>5.0 – 10.0	Moderate conservation value
>10.0 – 15.0	Fairly high conservation value
>15.0 – 20	High conservation value
>20.0	Very high conservation value

Water Framework Directive analysis

6.21.3.14 RICT2 (River Invertebrate Classification Tool 2) was used to calculate the EQR (Ecological Quality Ratio) for survey locations. This provides a baseline WFD classification status for the surveyed watercourses.

6.21.3.15 WFD EQRs were calculated through RICT2 using the spring and autumn 2021 data. For sites where only a sample from only one season was collected, an EQR and WFD classification was calculated. Single season classifications are for indicative purposes only (see limitations described below for more information). The WFD classification boundaries are shown in Table 4: WFD class boundaries for macroinvertebrates..

Table 4: WFD class boundaries for macroinvertebrates.

Class	WHPT NTAXA EQR	WHPT ASPT EQR	Description
High	≥0.80	≥0.97	Near natural conditions
Good	0.68 – 0.80	0.86 – 0.97	Slight change from natural conditions as a result of human activity
Moderate	0.56 – 0.68	0.72 – 0.86	Moderate change from natural conditions as a result of human activity
Poor	0.47-0.56	0.59 – 0.72	Major change from natural conditions as a result of human activity
Bad	<0.47	<0.59	Severe change from natural conditions as a result of human activity.

JNCC Screening

6.21.3.16 Species recorded in the samples were screened against the JNCC Conservation Designations for *UK Taxa list* to identify the presence of protected and/or notable species.

6.21.4 Assumptions and Limitations

Dry sites

6.21.4.1 During the spring sampling round, a macroinvertebrate sample could not be taken from WCP_29 at the planned survey location of NZ 15117 09216. This location was a dry grass-lined ditch. A sample for WCP_29 was instead taken at NZ 15033 09188; this site was located on a small a watercourse approximately 80m west and downstream of the planned survey location.

6.21.4.2 Sites WCP_23, WCP_25 and WCP_29 were dry during the autumn sampling round and therefore a sample could not be obtained. The original survey location for site WCP_30 was dry during the autumn sampling round so a sample was instead taken at NZ 15735 08792, located approximate 100 m north of the original survey location.

Access

6.21.4.3 Site WCP_07 could not be accessed during the autumn sampling as landowner permission was not granted.

Additional sites

6.21.4.4 Sites WCP_08_US_RED-KS and WCP_24_BLUE were screened in for survey after the spring sampling had already taken place and therefore only autumn samples were taken at these survey locations.

RICT

6.21.4.5 RICT analysis was performed using environmental parameters collected from two seasons (spring and autumn) compared to the prescribed of three seasons where summer is also included. RICT is routinely performed with environmental data from two seasons, and this is not expected to impact the EQR output.

6.21.4.6 There were six sites where samples from only one season (either spring or autumn) were taken due to the constraints described above. The tool has been used to calculate an EQR for these sites based on the data from a single season, therefore the classification outputs for these sites are considered indicative only.

6.21.5 Results

Desk Study

Routewide

6.21.5.1 Table 5: Macroinvertebrate records of conservation value within 2km of draft DCO boundary. ERT denotes Eden Rivers Trust datashows the macroinvertebrate species of conservation value identified within the desk study search area.

6.21.5.2 Macroinvertebrate species of conservation value were identified within the desk study search area for all schemes, with the exception of the Stephen Bank to Carkin Moor and A1 (M) Junction 53 Scotch Corner schemes.

Table 5: Macroinvertebrate records of conservation value within 2km of draft DCO boundary. ERT denotes Eden Rivers Trust data

Scheme	Watercourse and EA Site ID	Species	Conservation status	Record date	Location	Approximate distance and direction from DCO order limits
M6 Junction 40 to Kemplay Bank (S0102)	River Eamont (63641)	Black-legged water water-snipefly <i>(Ibis marginata)</i>	Nationally Scarce	18/03/2013	NY5226128759	25m south
	River Eamont (ERT)	Caddisfly <i>Ceraclea albimacula</i>	Nationally Scarce	11/07/2009	NY508283	60m south west
	River Lowther (64165)	Black-legged water water-snipefly	Nationally Scarce	22/10/2015 16/04/2015	NY5245628221	580m south
Penrith to Temple Sowerby (S03)	River Eden (65489)	Yellow-legged water-snipe <i>(Atherix ibis)</i>	Nationally Scarce	2010 - 2019	NY6039128147	960m east
	River Eamont (64086)	Yellow-legged water-snipe	Nationally Scarce	08/09/2016 24/03/2014 01/04/2011	NY5780030500	1.3km north
	River Eden (65489)	March brown mayfly <i>(Rhithrogena germanica)</i>	Nationally Scarce	01/04/2011	NY6039128147	960m east
	River Eden (65489)	Whirligig beetle <i>Gyrinus aeratus</i>	Nationally Scarce	23/10/2012	NY6039128147	960m east
	River Eden (ERT)	Caddisfly <i>Limnephilus ignavus</i>	Nationally Scarce	15/07/2010	NY6050027800	1.2km south east

Scheme	Watercourse and EA Site ID	Species	Conservation status	Record date	Location	Approximate distance and direction from DCO order limits
	River Lowther (64165)	Black-legged water water-snipefly	Nationally Scarce	22/10/2015 16/04/2015	NY5245628221	1.6km south west
	River Eamont (63641)	Black-legged water water-snipefly	Nationally Scarce	18/03/2013	NY5226128759	1.7km west
	River Eamont (65489)	Black-legged water water-snipefly	Nationally Scarce	09/09/2014	NY5780030500	960m east
	River Eden (65489)	Black-legged water water-snipefly	Nationally Scarce	25/04/2016 26/06/2018 09/09/2014 20/08/2014	NY6039128147	960m east
	River Eden (65489)	Caddisfly <i>Allotrichia pallicornis</i>	Nationally Scarce	16/05/2019	NY6039128147	960m east
Temple Sowerby to Appleby (S0405)	Trout Beck (ERT)	Caddisfly <i>Hydroptila occulta</i>	Nationally Scarce	03/07/201	NY65600024100	315m north east
	River Eden (ERT)	Caddisfly <i>Hydroptila occulta</i>	Nationally Scarce	26/06/2009	NY6200024800	1.3km south
	River Eden (65489)	Caddisfly <i>Allotrichia pallicornis</i>	Nationally Scarce	16/05/2019	NY6039128147	1.6km north
	River Eden (65489)	Yellow-legged water-snipe	Nationally Scarce	01/04/2011	NY6039128147	1.6km north
	River Eden (65489)	March brown mayfly	Nationally Scarce	01/04/2011	NY6039128147	1.6km north
	River Eden (65489)	Riffle beetle <i>Riolus subviolaceus</i>	Nationally Scarce	27/10/2011	NY6039128147	1.6km north
	River Eden (64927)	Riffle beetle	Nationally Scarce	12/10/2016	NY6829920619	525m south

Scheme	Watercourse and EA Site ID	Species	Conservation status	Record date	Location	Approximate distance and direction from DCO order limits
		<i>Riolus subviolaceus</i>				
	River Eden (65489)	Whirligig beetle <i>Gyrinus aeratus</i>	Nationally Scarce	23/10/2012	NY6039128147	1.7km north
	River Eden (65489)	Black-legged water water-snipefly	Nationally Scarce	25/04/2016 26/06/2018 09/09/2014 20/08/2014	NY6039128147	1.7km north
	Trout Beck (65110)	Black-legged water water-snipefly	Nationally Scarce	04/10/2016	NY6353625294	within
	River Eden (65489)	Large-mouthed valve snail <i>(Valvata macrostoma)</i>	Section 41 SoPI Nationally Rare	15/05/2018	NY6039128147	1.7km north
	River Eden (65489)	Smooth ramshorn snail <i>(Gyraulus laevis)</i>	Nationally Scarce	28/08/2019 26/06/2018	NY6039128147	1.7km north
	River Eden (65489)	Caddisfly <i>Allotrichia pallicornis</i>	Nationally Scarce	16/05/2019	NY6039128147	1.7km north
Appleby to Brough (S06)	Woodend Sike (ERT)	Caddisfly <i>Tinodes dives</i>		04/08/2013	NY7793716382	1.0km north
	Helm Beck (65387)	Riffle beetle <i>Riolus subviolaceus</i>	Nationally Scarce	12/09/2016 17/05/2016	NY7069916867	1.2km south west
	Hitlon Beck (65111)	Caddisfly <i>Potamophylax rotundipennis</i>	Nationally Scarce	12/10/2016	NY7110520082	1.8km north

Scheme	Watercourse and EA Site ID	Species	Conservation status	Record date	Location	Approximate distance and direction from DCO order limits
	Highclose Sike (ERT)	<i>Caddisfly</i> <i>Psychomyia fragilis</i>		07/07/2013	NY76751759	1.9km north east
Bowes Bypass (S07)	Greta Burn (2003)	<i>Caddisfly</i> <i>Allotrichia pallicornis</i>	Nationally Scarce	16/05/2014	NY9949913240	354m south
Cross Lanes to Rokeby (S08)	River Greta (2002)	<i>Caddisfly</i> <i>Allotrichia pallicornis</i>	Nationally Scarce	16/05/2014	NZ0865413253	228m south east
	River Tees (1917)	Yellow-legged water-snipe	Nationally Scarce	19/03/2015	NZ0644315087	1.3km north

Desk Study

M6 Junction 40 to Kemplay Bank

- 6.21.5.3 This scheme crosses Thacka Beck, a tributary of the River Eamont, south of Pategill in a section that is culverted as a result of the existing A686, the A66 and the Cumbria Constabulary buildings. The watercourse is a main river and forms part of the Eamont (Upper) WFD waterbody (GB102076071020).
- 6.21.5.4 No desk study data was identified for Thacka Beck; however, five Environment Agency macroinvertebrate monitoring sites were identified within the desk study search area on the River Eamont and the River Lowther. No protected or otherwise notable macroinvertebrate species were identified, with the exception of the black-legged water-snipefly and the caddisfly (*Ceraclea albimacula*) which are Nationally Scarce (Table 5: Macroinvertebrate records of conservation value within 2km of draft DCO boundary. ERT denotes Eden Rivers Trust data).

Penrith to Temple Sowerby

- 6.21.5.5 This scheme crosses five ordinary watercourses (Unnamed Tributary of Light Water 3.1, Light Water, Unnamed Tributary of River Eamont 3.3, Unnamed Tributary of River Eamont 3.4 and Unnamed Tributary of River Eamont 3.5) that form part of the Eamont (Lower) WFD waterbody (GB102076070990) and one ordinary watercourse (Swine Gill) that forms part of the Eden Lyvennet to Eamont waterbody (GB102076070980) (ES Figure 6.18: River Corridor Survey, Macrophyte Survey, Aquatic Invertebrate Survey and White-clawed Crayfish Survey (Application Document 3.3)).
- 6.21.5.6 No desk study data was identified for watercourses crossed by this scheme; however, eight Environment Agency invertebrate monitoring sites were identified within the desk study search area on the River Eamont, River Lowther, River Eden and Crowdundle Beck. The following species of conservation value (Nationally Scarce) were recorded on the River Eden, River Eamont and River Lowther between 2010 and 2021: black-legged water-snipefly, yellow-legged water-snipe fly, March brown mayfly, the whirligig beetle (*Gyrinus aeratus*) and the caddisflies (*Allotrichia pallicornis* and *Limnephilus ignavus*) (Table 5: Macroinvertebrate records of conservation value within 2km of draft DCO boundary. ERT denotes Eden Rivers Trust data).

Temple Sowerby to Appleby

- 6.21.5.7 This scheme crosses one main river (Trout Beck) and two ordinary watercourses (Unnamed Tributary of Trout Beck 4.2 and Unnamed Tributary of Trout Beck 4.6) that form part of the Trout Beck WFD waterbody (GB102076070930).
- 6.21.5.8 Desk study data was identified for Trout Beck where the black-legged water-snipefly and the caddisfly (*Hydroptila occulta*) which are Nationally Scarce was recorded.

6.21.5.9 A further six Environment Agency invertebrate monitoring sites were identified within the desk study search area for the scheme on the River Eden, Crowdundle Beck, Hoff Beck and Brampton Beck. Species of conservation value were recorded (2010 - 2021) from the River Eden; the large-mouthed valve snail is a Nationally Rare, UK BAP species and a NERC Act Section 41 Species of Principal Importance. In addition, the following species of conservation value (Nationally Scarce) were recorded: the caddisfly (*Allotrichia pallicornis*), yellow-legged water-snipe, March brown mayfly, the riffle beetle (*Riolus subviolaceus*), the whirligig beetle (*Gyrinus aeratus*), black-legged water water-snipefly and smooth ramshorn snail (Table 5: Macroinvertebrate records of conservation value within 2km of draft DCO boundary. ERT denotes Eden Rivers Trust data).

Appleby to Brough

6.21.5.10 This scheme crosses three ordinary watercourses (Unnamed Tributary of Mire Sike 6.12, Unnamed Tributary of Cringle Beck 6.1 and Cringle Beck) that form part of the Eden - Scandal Beck to Lyvennet WFD waterbody (GB102076070880) and five watercourses (Hayber Beck, Moor Beck, Eastfield Sike, Unnamed Tributary of Lowgill Beck 6.1 and Lowgill Beck) that form part of the Low Gill (Crooks Beck) WFD waterbody (GB102076070750).

6.21.5.11 Desk study data was identified for Woodend Sike, where the caddisfly (*Tinodes dives*) which are Nationally Scarce was recorded.

6.21.5.12 A further six Environment Agency macroinvertebrate monitoring sites were identified within the desk study search area for the scheme on Helm Beck, Hitlon Beck, Crooks Beck, Swindale Beck and Augill Beck. The following species of conservation value (Nationally Scarce) were recorded (2010 - 2021) from Helm Beck and Hitlon Beck: the riffle beetle (*Riolus subviolaceus*) and the caddisfly (*Potamophylax rotundipennis*) (Table 5: Macroinvertebrate records of conservation value within 2km of draft DCO boundary. ERT denotes Eden Rivers Trust data).

6.21.5.13 An ERT record for the Nationally Scarce caddisfly (*Psychomyia fragilis*) was also identified from the Highclose Sike.

Bowes Bypass

6.21.5.14 This scheme crosses two minor ordinary watercourses (Unnamed Tributary of River Greta 7.3 and Unnamed Tributary of River Greta 7.4) that flow into section of the River Greta which forms part of the Greta from Sleightholme Beck to Eller Beck WFD waterbody (GB103025072140). It should be noted that the alignment crosses Unnamed Tributary of River Greta 7.3 in a section that is already culverted associated with the existing road. Unnamed Tributary of River Greta 7.4 is associated with existing A66 drainage.

6.21.5.15 No desk study data was identified for watercourses crossed by this scheme; however Environment Agency invertebrate monitoring sites were identified within the desk study search area on the River Greta, Sleightholme Burn and Greta Burn. The only species of conservation

value (Nationally Scarce) recorded (2010 - 2021) was the caddisfly (*Allotrichia pallicornis*) from the Greta Burn (Table 5: Macroinvertebrate records of conservation value within 2km of draft DCO boundary. ERT denotes Eden Rivers Trust data).

Cross Lanes to Rokeby

- 6.21.5.16 This scheme crosses one main river (Punder Gill) and two ordinary watercourses (Unnamed Tributary of Punder Gill 8.1). Punder Gill and its associated tributaries flow into the River Greta, which forms part of the Greta from Gill Beck to River Tees WFD waterbody (GB103025072130).
- 6.21.5.17 No desk study data was identified for watercourses crossed by this scheme, but Environment Agency macroinvertebrate monitoring sites were identified within the desk study search area on the River Tees and River Greta. The following species of conservation value (Nationally Scarce) were recorded (2010 - 2021): the caddisfly (*Allotrichia pallicornis*) and the yellow-legged water-snipe which are Nationally Scarce (Table 5: Macroinvertebrate records of conservation value within 2km of draft DCO boundary. ERT denotes Eden Rivers Trust data).

Stephen Bank to Carkin Moor

- 6.21.5.18 This scheme crosses six ordinary watercourses (Unnamed Tributary of Holme Beck 9.6, Unnamed Tributary of Holme Beck 9.3, Unnamed Tributary of Mains Gill 9.1, Mains Gill, Unnamed Tributary of Holme Beck 9.8 and Unnamed Tributary of Holme Beck 9.2) that flow into Holme Beck and form part of the Skeeby/Holme/Dalton Bk from Source to River Swale WFD waterbody (GB104027069180).
- 6.21.5.19 No Environment Agency desk study data was identified for watercourses crossed by this scheme and no Environment Agency invertebrate monitoring sites were identified within the desk study search area.

A1(M) Junction 53 Scotch Corner

- 6.21.5.20 This scheme does not interact with any watercourses.

Field Survey

Routewide

Macroinvertebrate analysis

- 6.21.5.21 A total of 22 macroinvertebrate samples were collected during the spring sampling and a total of 20 during the autumn sampling. A full list of the macroinvertebrate assemblages for each sampling location is presented in section 0: Raw macroinvertebrate data.
- 6.21.5.22 The calculated biological indices are presented in Table 6: Summary of biological indices scores for each survey location during the spring field sampling and Table 7: Summary of biological indices scores for each survey location during the autumn field sampling.

6.21.5.23 The CCI scores and corresponding conservation value category for each site are presented in Table 8: CCI scores and conservation category values of macroinvertebrate sampling points. Nationally scarce and notable species and the sites where they were recorded are presented in Table 9: Nationally Scarce, Nationally Rare and Notable species.

Raw macroinvertebrate data are detailed in Raw macroinvertebrate data. Site characteristics and recorded physico-chemical parameters are presented in section Site photographs are presented in

6.21.5.24 Site photographs.

6.21.5.25 No invasive non-native macroinvertebrate species were identified.

6.21.5.26 Macroinvertebrate species assemblages of high conservation value (based on CCI) were recorded in Keld Sike (WCP_08_US_RED-KS), Moor Beck (WCP_16 and WCP_17), Lowgill Beck (WCP_19), Tutta Beck (WCP_24) and Unnamed Tributary of Tutta Beck 8.2 (WCP_25).

6.21.5.27 A number of notable species (Nationally Scarce, Nationally Rare and Notable) were recorded in the Temple Sowerby to Appleby (Trout Beck and Keld Sike), Appleby to Brough (Unnamed Tributary of Mire Sike 6.12, Moor Beck, Eastfield Sike, Unnamed Tributary of Lowgill Beck 6.1 and Lowgill Beck), Cross Lanes to Rokeby (Tutta Beck, Unnamed Tributary of Tutta Beck 8.1, Punder Gill) and Stephen Bank to Carkin Moor (Mains Gill) schemes (Table 8: CCI scores and conservation category values of macroinvertebrate sampling points).

Table 6: Summary of biological indices scores for each survey location during the spring field sampling

Site	WHPT Total	WHPT NTAXA	WHPT ASPT	LIFE (species score)	PSI (mixed)	PSI (mixed) assessment
WCP_01	78.3	20	3.92	6.68	43.18	Moderately sedimented
WCP_03	164.1	27	6.08	7.56	56.76	Moderately sedimented
WCP_04	74.2	18	4.12	6.82	30.23	Sedimented
WCP_07	62.7	15	4.18	6.73	36.11	Sedimented
WCP_08_DS	165.3	26	6.36	8.27	77.78	Slightly sedimented
WCP_08_US	197.4	29	6.81	8.50	78.57	Slightly sedimented
WCP_08_US_RED-KS	N/A	N/A	N/A	N/A	N/A	N/A
WCP_08_US_RED	124.0	20	6.20	118	8.24	Unsedimented
WCP_11	151.0	22	6.86	8.71	78.125	Slightly sedimented
WCP_13	131.4	20	6.57	8.33	73.21	Slightly sedimented
WCP_15	213.6	29	7.37	8.54	92.31	Unsedimented
WCP_16	213.6	31	6.89	8.49	81.82	Unsedimented
WCP_17	181.8	28	6.49	8.11	68.42	Slightly sedimented
WCP_18	111.7	19	5.88	8.05	63.27	Slightly sedimented
WCP_19	185.1	29	6.38	8.19	71.43	Slightly sedimented

Site	WHPT Total	WHPT NTAXA	WHPT ASPT	LIFE (species score)	PSI (mixed)	PSI (mixed) assessment
WCP_20	123.1	21	5.86	7.92	64.44	Slightly sedimented
WCP_23	83.0	16	5.19	7.70	58.06	Moderately sedimented
WCP_24_BLUE	N/A	N/A	N/A	N/A	N/A	N/A
WCP_24	162.8	26	6.26	7.96	68.52	Slightly sedimented
WCP_25	125.9	22	5.72	7.36	58.33	Moderately sedimented
WCP_28	62.1	15	4.14	7.10	35.71	Sedimented
WCP_29	61.3	12	5.11	6.29	13.64	Heavily sedimented
WCP_30	102.4	21	4.88	7.19	42.22	Moderately sedimented
WCP_33	79.4	17	4.67	7.75	50.00	Moderately sedimented

Table 7: Summary of biological indices scores for each survey location during the autumn field sampling

Site	WHPT Total	WHPT NTAXA	WHPT ASPT	LIFE (species score)	PSI (mixed)	PSI (mixed) assessment
WCP_01	70.2	18	3.90	6.33	33.33	Sedimented
WCP_03	142	27	5.26	7.36	50.00	Moderately sedimented
WCP_04	110.6	26	4.25	6.38	19.57	Heavily sedimented
WCP_07	N/A	N/A	N/A	N/A	N/A	N/A
WCP_08_DS	114.8	20	5.74	8.13	75.00	Slightly sedimented
WCP_08_US	149.8	24	6.24	8.25	75.93	Slightly sedimented
WCP_08_US_R ED-KS	142.8	25	5.71	7.68	63.49	Slightly sedimented
WCP_08_US_R ED	95.8	16	5.99	8.27	66.67	Slightly sedimented
WCP_11	114	18	6.33	8.33	67.57	Slightly sedimented
WCP_13	76.2	15	5.08	6.88	20.59	Sedimented
WCP_15	183.7	25	7.35	8.53	85.71	Unsedimented
WCP_16	195.8	30	6.53	8.24	67.42	Slightly sedimented

Site	WHPT Total	WHPT NTAXA	WHPT ASPT	LIFE (species score)	PSI (mixed)	PSI (mixed) assessment
WCP_17	214.8	31	6.93	8.25	72.37	Slightly sedimented
WCP_18	100.1	18	5.56	7.86	61.29	Slightly sedimented
WCP_19	205	32	6.41	8.18	67.37	Slightly sedimented
WCP_20	85.8	18	4.77	6.92	35.14	Sedimented
WCP_23	N/A	N/A	N/A	N/A	N/A	N/A
WCP_24_BLUE	78.6	14	5.61	8.10	64.00	Slightly sedimented
WCP_24	136.3	23	5.93	7.83	72.22	Slightly sedimented
WCP_25	N/A	N/A	N/A	N/A	N/A	N/A
WCP_28	59.2	13	4.55	7.25	33.33	Sedimented
WCP_29	N/A	N/A	N/A	N/A	N/A	N/A
WCP_30	73.1	17	4.30	6.54	20.00	Heavily sedimented
WCP_33	93.6	19	4.93	7.79	59.57	Moderately sedimented

Table 8: CCI scores and conservation category values of macroinvertebrate sampling points

Site Name	CCI (spring)	Conservation value	CCI (autumn)	Conservation value
WCP_01	7.81	Moderate	11.25	Fairly high
WCP_03	8.33	Moderate	9.42	Moderate
WCP_04	4.80	Low	8.93	Moderate
WCP_07	4.13	Low	N/A	N/A
WCP_08_DS	7.96	Moderate	10.00	Moderate
WCP_08_US	14.75	Fairly high	8.81	Moderate
WCP_08_US_RED-KS	N/A	N/A	18.50	High
WCP_08_US_RED	8.70	Moderate	8.41	Moderate
WCP_11	14.95	Fairly high	6.00	Moderate
WCP_13	9.50	Moderate	5.20	Moderate
WCP_15	14.57	Fairly high	12.66	Fairly high
WCP_16	13.79	Fairly high	16.26	High
WCP_17	14.81	Fairly high	19.60	High
WCP_18	14.37	Fairly high	8.75	Moderate
WCP_19	11.10	Fairly high	16.76	High
WCP_20	5.00	Low	5.14	Moderate
WCP_23	11.88	Fairly high	N/A	N/A

Site Name	CCI (spring)	Conservation value	CCI (autumn)	Conservation value
WCP_24_BLUE	N/A	N/A	14.00	Fairly high
WCP_24	13.65	Fairly high	17.00	High
WCP_25	19.09	High	N/A	N/A
WCP_28	3.38	Low	1.17	Low
WCP_29	5.00	Low	N/A	N/A
WCP_30	13.46	Fairly high	4.64	Low
WCP_33	9.44	Moderate	5.25	Moderate

Table 9: Nationally Scarce, Nationally Rare and Notable species.

Species	JNCC designation	Site(s) present
<i>Amphinemura standfussi</i>	Nationally scarce	WCP_23, WCP_24
<i>Atherix ibis</i>	Nationally scarce	WCP_08_US
<i>Hydatophylax infumatus</i>	Nationally scarce	WCP_15
<i>Nemoura dubitans</i>	Nationally rare	WCP_18
<i>Rhyacophila fasciata</i>	Notable	WCP_11, WCP_24, WCP_24_BLUE
<i>Riolus cupreus</i>	Nationally scarce	WCP_08_US_RED-KS, WCP_17
<i>Riolus subviolaceus</i>	Nationally scarce	WCP_08_US_RED-KS, WCP_16, WCP_17, WCP_19
<i>Sialis nigripes</i>	Notable	WCP_24
<i>Tinodes unicolor</i>	Notable ¹⁸	WCP_30

Table 10: Ecological Quality Ratios and indicative WFD classifications

Site Name	WHPT NTAXA EQR	WHPT ASPT EQR	WFD Status
WCP_01	0.86	0.60	Poor
WCP_03	1.16	0.85	Moderate
WCP_04	1.01	0.64	Poor
WCP_07	0.78	0.68	Poor ¹⁹
WCP_08_DS	0.95	0.89	Good
WCP_08_US	1.08	0.96	Good
WCP_08_US_RED-KS	0.84	0.92	Good ¹⁹
WCP_08_US_RED	1.00	0.84	Moderate
WCP_11	0.92	0.99	High
WCP_13	0.84	0.86	Moderate
WCP_15	1.21	1.05	High
WCP_16	1.35	0.95	Good

¹⁸ Formerly Nationally Notable, (JNCC Designation, 2020).

¹⁹ Calculated from a single season sample.

Site Name	WHPT NTAXA EQR	WHPT ASPT EQR	WFD Status
WCP_17	1.35	0.99	High
WCP_18	1.06	0.92	Good
WCP_19	1.37	0.92	Good
WCP_20	1.14	0.86	Moderate
WCP_23	0.99	0.90	Good ¹⁹
WCP_24_BLUE	0.72	0.87	Moderate ¹⁹
WCP_24	1.11	0.92	Good
WCP_25	1.00	0.87	Good ¹⁹
WCP_28	0.84	0.72	Poor
WCP_29	0.58	0.87	Moderate ¹⁹
WCP_30	1.08	0.76	Moderate
WCP_33	1.19	0.80	Moderate

M6 Junction 40 to Kemplay Bank

WCP_01 (Thacka Beck)

6.21.5.28 Site WCP_01 produced CCI scores of 7.81 and 11.25 indicating that this watercourse supports macroinvertebrate communities of moderate to fairly high conservation value. The WFD classification was poor, indicating that this watercourse has undergone major changes from natural conditions as a result of human activity. No notable or protected species were found at this site during the macroinvertebrate field surveys.

Penrith to Temple Sowerby

WCP_03 (Light Water)

6.21.5.29 Site WCP_03 produced CCI scores of 8.33 and 9.42 indicating that this watercourse supports macroinvertebrate communities of moderate conservation value. The WFD classification was moderate, indicating that this watercourse has undergone moderate changes from natural conditions as a result of human activity. No notable or protected species were found at this site during the macroinvertebrate field surveys.

WCP_04 (Unnamed Tributary of River Eamont 3.3)

6.21.5.30 Site WCP_04 produced CCI scores of 4.80 and 8.93 indicating that this watercourse supports macroinvertebrate communities of low to moderate conservation value. The WFD classification was poor, indicating that this watercourse has undergone major changes from natural conditions as a result of human activity. No notable or protected species were found at this site during the macroinvertebrate field surveys.

WCP_07 (Swine Gill)

6.21.5.31 Site WCP_07 produced CCI scores of 7.96 and 10.00 indicating that this watercourse supports macroinvertebrate communities moderate conservation value. The WFD classification was poor, indicating that this watercourse has undergone major changes from natural conditions as a result of human activity. This classification is indicative only, as it was calculated from a single season sample, further details are provided in the constraints listed above. No notable or protected species were found at this site during the macroinvertebrate field surveys.

Temple Sowerby to Appleby

WCP_08_DS (Trout Beck)

6.21.5.32 Site WCP_08_DS produced CCI scores of 7.96 and 10.00 indicating that this watercourse supports macroinvertebrate communities of moderate conservation value. The WFD classification was good, indicating that this watercourse has only undergone slight changes in natural conditions as a result of human activity. No notable or protected species were found at this site during the macroinvertebrate field surveys.

WCP_08_US (Trout Beck)

6.21.5.33 Site WCP_08_US produced CCI scores of 8.81 and 14.75 indicating that this watercourse supports macroinvertebrate communities of moderate to fairly high conservation value. The WFD classification was good, indicating that this watercourse has only undergone slight changes in natural conditions as a result of human activity. The nationally scarce (JNCC designation) *Atherix ibis* (yellow-legged water-snipefly) was identified at this site during the autumn field survey.

WCP_08_US_RED-KS (Keld Sike)

6.21.5.34 Site WCP_08_US_RED-KS was only sampled in autumn. The CCI score produced was 18.50, indicating that this watercourse supports macroinvertebrate communities of high conservation value. The WFD classification was good, indicating that this watercourse has only undergone slight changes in natural conditions as a result of human activity. This classification is indicative only, as it was calculated from a single season sample, further details are provided in the constraints listed above. Two species categorised as nationally scarce under JNCC designations for UK taxa were identified at this site. These were *Riolus cupreus* and *Riolus subviolaceus*, which are both riffle beetle species.

WCP_08_US_RED (Trout Beck)

6.21.5.35 Site WCP_08_RED produced CCI scores of 8.70 and 8.41 indicating that this watercourse supports macroinvertebrate communities of moderate conservation value. The WFD classification was moderate, indicating that this watercourse has undergone moderate changes from natural conditions as a result of human activity. No notable or protected

species were identified at this site during the macroinvertebrate field surveys.

Appleby to Brough

WCP_11 (Unnamed Tributary of Mire Sike 6.12)

6.21.5.36 Site WCP_11 produced CCI scores of 6.00 and 14.95 indicating that this watercourse supports macroinvertebrate communities of moderate (spring) to fairly high (autumn) conservation value. The WFD classification was high, indicating that this watercourse supports macroinvertebrate communities indicative of a near natural state. The nationally notable (JNCC designation) *Rhyacophila fasciata*, a caddis fly species, was found at this site during the spring field surveys. One white-clawed crayfish (*Austropotamobius pallipes*) was observed at this site during both the spring and autumn field sampling; on both occasions the crayfish were returned unharmed to the watercourse.

WCP_13 (Cringle Beck)

6.21.5.37 Site WCP_13 produced CCI scores of 9.50 and 5.20 indicating that this watercourse supports macroinvertebrate communities of moderate conservation value. The WFD classification was moderate, indicating that this watercourse has undergone moderate changes from natural conditions as a result of human activity. No notable or protected species were identified at this site during the macroinvertebrate field surveys.

WCP_15 (Moor Beck)

6.21.5.38 Site WCP_15 produced CCI scores of 14.57 and 12.66 indicating that this watercourse supports macroinvertebrate communities of fairly high conservation value. The WFD classification was high, indicating that this watercourse supports macroinvertebrate communities indicative of a near natural state. The nationally scarce (JNCC designation) *Hydatophylax infumatus*, a caddis fly species, was identified during the autumn field sampling.

WCP_16 (Moor Beck)

6.21.5.39 Site WCP_16 produced CCI scores of 13.79 and 16.26 indicating that this watercourse supports macroinvertebrate communities of fairly high (spring) to high (autumn) conservation value. The WFD classification was good, indicating that this watercourse has only undergone slight changes in natural conditions as a result of human activity. The nationally scarce (JNCC designation) riffle beetle *Riolus subviolaceus* was identified during the spring field sampling.

WCP_17 (Eastfield Sike)

6.21.5.40 Site WCP_17 produced CCI scores of 14.81 and 19.60 indicating that this watercourse supports macroinvertebrate communities of fairly high to high conservation value. The WFD classification was high, indicating that this watercourse supports macroinvertebrate communities indicative of a near natural state. The nationally scarce (JNCC designation) riffle

beetles *Riolus cupreus* and *Riolus subviolaceus* were identified at this site during the autumn field sampling. One white-clawed crayfish was observed at this site during the autumn field sampling.

WCP_18 (Unnamed Tributary of Lowgill Beck 6.1)

6.21.5.41 Site WCP_18 produced CCI scores of 8.75 and 14.37 indicating that this watercourse supports macroinvertebrate communities of moderate (spring) to fairly high (autumn) conservation value. The WFD classification was good, indicating that this watercourse has only undergone slight changes from natural conditions as a result of human activity. The nationally rare (JNCC designation) *Nemoura dubitans*, a stonefly species, was identified at this site during the spring field sampling. One white-clawed crayfish was identified at this site during the autumn field sampling.

WCP_19 (Lowgill Beck)

6.21.5.42 Site WCP_19 produced CCI scores of 11.10 and 16.76 indicating that this watercourse supports macroinvertebrate communities of fairly high (spring) to high (autumn) conservation value. The WFD classification was good, indicating that this watercourse has only undergone slight changes from natural conditions as a result of human activity. The nationally scarce (JNCC designation) riffle beetle *Riolus subviolaceus* was identified at this site during the autumn field sampling.

Bowes Bypass

WCP_20 (Unnamed Tributary of River Greta 7.3)

6.21.5.43 Site WCP_20 produced CCI scores of 5.00 and 5.14 indicating that this watercourse supports macroinvertebrate communities of low (spring) to moderate (autumn) conservation value. The WFD classification was moderate, indicating that this watercourse has undergone moderate changes from natural conditions as a result of human activity. No notable or protected species were identified at this site during the macroinvertebrate field surveys.

Cross Lanes to Rokeby

WCP_23 (Unnamed Tributary of Tutta Beck 8.1)

6.21.5.44 Site WCP_23 was dry during the autumn visit so only one CCI score has been produced. The spring sample CCI score was 11.88 indicating that this watercourse supports macroinvertebrate communities of fairly high conservation value. The WFD classification was good, indicating that this watercourse has only undergone slight changes from natural conditions as a result of human activity. This classification is indicative only, as it was calculated from a single season sample, further details are provided in the constraints listed above. The nationally scarce (JNCC designation) species *Amphinemura standfussi*, a stonefly species, was identified at this site during the spring field sampling.

WCP_24_BLUE (Punder Gill)

6.21.5.45 Site WCP_24_BLUE was only sampled in the autumn season so only one CCI score has been produced. The spring sample CCI score was 14.00 indicating that this watercourse supports macroinvertebrate communities of fairly high conservation value. The WFD classification was moderate, indicating that this watercourse has undergone moderate changes from natural conditions as a result of human activity. This classification is indicative only, as it was calculated from a single season sample, further details are provided in the constraints listed above. The nationally notable (JNCC designation) *Rhyacophila fasciata*, a caddis fly, was identified at this site during the autumn field sampling.

WCP_24 (Tutta Beck)

6.21.5.46 Site WCP_24 produced CCI scores of 13.65 and 17.00 indicating that this watercourse supports macroinvertebrate communities of fairly high (spring) to high (autumn) conservation value. The WFD classification was good, indicating that this watercourse has only undergone slight changes from natural conditions as a result of human activity. The nationally scarce (JNCC designation) species *Amphinemura standfussi*, a stonefly species, was identified at this site during the spring field sampling. Two species categorised as nationally notable under JNCC designations for UK taxa were identified at this site; *Sialis nigripes*, an alderfly species, identified during the autumn field sampling and *Rhyacophila fasciata*, a caddis fly species, identified during both the spring and autumn field sampling.

WCP_25 (Unnamed Tributary of Tutta Beck 8.2)

6.21.5.47 Site WCP_25 was dry during autumn visit so only one CCI score has been produced. The spring sample CCI score was 19.09 indicating that this watercourse supports macroinvertebrate communities of high conservation value. The WFD classification was good, indicating that this watercourse has only undergone slight changes from natural conditions as a result of human activity. This classification is indicative only, as it was calculated from a single season sample, further details are provided in the constraints listed above. No notable or protected species were identified at this site during the field surveys.

Stephen Bank to Carkin Moor

WCP_28 (Unnamed Tributary of Holme Beck 9.6)

6.21.5.48 Site WCP_28 produced CCI scores of 1.17 and 3.38 indicating that this watercourse supports macroinvertebrate communities of low conservation value. The WFD classification was poor, indicating that this watercourse has undergone major changes from natural conditions as a result of human activity. No notable or protected species were identified at this site during the macroinvertebrate field surveys.

WCP_29 (Unnamed Tributary of Holme Beck 9.3)

6.21.5.49 Site WCP_29 was dry during the autumn visit so only one CCI score has been produced. The spring sample CCI score was 5.00 indicating that this watercourse supports macroinvertebrate communities of low conservation value. The WFD classification was moderate, indicating that this watercourse has undergone moderate changes from natural conditions as a result of human activity. No notable or protected species were identified at this site during the macroinvertebrate field surveys.

WCP_30 (Mains Gill)

6.21.5.50 Site WCP_30 produced CCI scores of 4.64 and 13.46 indicating that this watercourse supports macroinvertebrate communities of low (spring) to fairly high (autumn) conservation value. The WFD classification was moderate, indicating that this watercourse has undergone moderate changes from natural conditions as a result of human activity. This classification is indicative only, as it was calculated from a single season sample, further details are provided in the constraints listed above. The formerly nationally notable (JNCC designation) species *Tinodes unicolor*, a caddis fly species, was identified during the spring field sampling.

WCP_33 (Unnamed Tributary of Holme Beck 9.2)

6.21.5.51 Site WCP_33 produced CCI scores of 9.44 and 5.25 indicating that this watercourse supports macroinvertebrate communities of moderate conservation value. The WFD classification was moderate, indicating that this watercourse has undergone moderate changes from natural conditions as a result of human activity. No notable or protected species were identified at this site during the field surveys.

Future baseline

6.21.5.52 The ecological baseline conditions described above represent those which currently exist in the absence of the scheme and at the time of writing. As stated in section 3 of Chartered Institute Ecology and Environmental Management (CIEEM)'s Guidelines for Ecological Impact Assessment in the UK and Ireland (Chartered Institute of Ecology and Environmental Management, 2019)²⁰, potential changes in baseline conditions also need to be identified in order to assess impacts.

6.21.5.53 Based on the above information and current land use, the future baseline in the absence of the scheme is unlikely to change significantly. Subtle changes are expected due to climate change, such as some movements of certain species and local population changes, however, the overall habitats and species composition in the study area are expected to be broadly similar to that of the existing baseline. Therefore, the future baseline would remain the same as set out in the existing baseline.

²⁰ Chartered Institute of Ecology and Environmental Management (2019) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater Coastal and Marine

6.21.6 Discussion

- 6.21.6.1 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.
- 6.21.6.2 White-clawed crayfish 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).
- 6.21.6.3 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).
- 6.21.6.4 No invasive non-native macroinvertebrates were recorded during the surveys.
- 6.21.6.5 Construction and post-development surveys are recommended to determine whether construction and operation phase mitigations have been successful in preventing impacts to the watercourses and have not led to adverse effects on macroinvertebrate biodiversity and WFD classifications.

6.21.7 References

BS EN 17136:2019 Water quality - Guidance on field and laboratory procedures for quantitative analysis and identification of macroinvertebrates from inland surface waters.

Environment Agency (2017). Freshwater macroinvertebrate sampling in rivers: Operational Instruction 018 08 Issued 09/012/017 Environment Agency, Bristol.

Environment Agency (2021) Ecology and Fish Data Explorer

JNCC (2020) Conservation Designations for UK Taxa 2020.

River Invertebrate Classification Tool (RICT 2) (2021) User Guide V1.7 (2021).

STAR project (2004) UK Invertebrate sampling and analysis procedure for STAR project.

Raw macroinvertebrate data

Site characteristics and recorded physico-chemical parameters

Site photographs