

**A66 Northern Trans-Pennine Project  
TR010062**

**3.4 Environmental Statement  
Appendix 6.22 White Clawed Crayfish**

**APFP Regulations 5(2)(a)**

**Planning Act 2008**

**Infrastructure Planning (Applications: Prescribed Forms and  
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A66 Northern Trans-Pennine Project  
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**3.4 ENVIRONMENTAL STATEMENT  
APPENDIX 6.22 WHITE CLAWED CRAYFISH**

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## 6.22 White Clawed Crayfish

### 6.22.1 Introduction

- 6.22.1.1 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.
- 6.22.1.2 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.
- 6.22.1.3 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).

### 6.22.2 Legislation and Policy Framework

#### Legislation

- 6.22.2.1 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 of the Environmental Statement (ES), ES Volume 1, Application Document Number 3.2. Legislation relevant to white-clawed crayfish (*Austropotamobius pallipes*), hereafter referred to as WCC, discussed in this report are:

- Natural Environment and Rural Communities (NERC) Act 2006
- EC Directive Conservation of Natural Habitats & Flora (92/43/EEC)
- Wildlife and Countryside Act 1981.

#### *Natural Environment and Rural Communities Act 2006*

- 6.22.2.2 The Natural Environment and Rural Communities (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.
- 6.22.2.3 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.”
- 6.22.2.4 WCC are listed as a Species of Principal Importance (SoPI) under S41. WCC are also listed as a criterion level A species in Annex 1 of UK Biodiversity Action Plan Priority Habitat Descriptions for rivers (Joint

Nature Conservation Committee, 2011)<sup>1</sup> This means the presence of WCC in a watercourse or management unit triggers priority river habitat.

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

- 6.22.2.5 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).
- 6.22.2.6 WCC are listed on Annex II of the Habitats Directive; core areas of habitat for species listed on Annex II 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.
- 6.22.2.7 WCC and the habitats that support them are therefore protected under the Habitats Directive when associated with Natura 2000 sites. Outside of a Natural 2000 site, these species are still considered to be of conservation value.

#### *Wildlife and Countryside Act 1981*

- 6.22.2.8 WCC are afforded protection nationally under the Wildlife and Countryside Act 1981. The species was added to the act (Schedule 5) in 1986; this makes it an offence to intentionally or recklessly disturb, capture, sell, injure or kill any white-clawed crayfish or to cause damage to their habitat.

#### *National level policy*

- 6.22.2.9 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)<sup>2</sup>, 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)

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<sup>1</sup> Joint Nature Conservation Committee (2011) UK Biodiversity Action Plan Priority Habitat Descriptions "Rivers",]

<sup>2</sup> Department for Transport (2014) National Policy Statement for National Networks

6.22.2.10 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 <i>NPSNN</i> paragraph reference	Requirement of the <i>NPSNN</i> (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.
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

- 6.22.2.11 The *National planning policy framework (NPPF)* (Ministry of Housing, Communities & Local Government, 2021)<sup>3</sup> 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*"<sup>4</sup>.

## Regional and local level policy

- 6.22.2.12 WCC are listed in the *Cumbria Biodiversity Action Plan species list* (Cumbria Wildlife Trust, 2018)<sup>5</sup>. WCC are also listed as a priority species in the Durham White-clawed Crayfish Action Plan, which set out conservation targets for this species (North East England Nature Partnership, 2016)<sup>6</sup>.

## Other relevant policy and guidance

### *IUCN Red List of Threatened Species*

- 6.22.2.13 Established in 1964, the International Union for Conservation of Nature (IUCN) Red List of Threatened Species has evolved to become the world's most comprehensive information source on the global conservation status of animal, fungi and plant species.
- 6.22.2.14 WCC are listed as Endangered on the IUCN Red List due the rapid decline in numbers witnessed in the latter half of the 20th century.

## 6.22.3 Methodology

### Desk study

- 6.22.3.1 For the purposes of the desk study, data was sought for any watercourses within the Order Limits plus a 2km buffer.

### *Local records centre data*

- 6.22.3.2 Desk study data relating to protected or otherwise notable species within 2km of the Order Limits of the Project was requested from the following Local Record Centres (LRC):
- Environmental Records Information centre (ERIC) North East
  - Cumbria Biodiversity Data Centre (CBDC)
  - North and East Yorkshire Ecological Data Centre (NEYEDC).

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<sup>3</sup> Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework

<sup>4</sup> Nationally Significant Infrastructure Projects (NSIP)

<sup>5</sup> Cumbria Wildlife Trust (2018) Cumbria Biodiversity Action Plan species list

<sup>6</sup> North East England Nature Partnership (2016) White clawed crayfish action plan

### *Eden Rivers Trust*

- 6.22.3.3 Desk study WCC survey data was also provided by the Eden Rivers Trust. Data received was screened to identify records of WCC within the Order Limits plus a 2km buffer.
- 6.22.3.4 WCC records were included from all watercourses within the 2km search area, whether they were hydraulically connected to watercourses that interact with the project or not.

### *Field survey*

- 6.22.3.5 Field surveys consisted of manual search surveys (24 sites) and environmental DNA (eDNA) surveys (22 sites) during summer 2020 and 2021. Sampling covered all schemes with the exception of the A1(M) Junction 53 Scotch Corner scheme as this scheme does not interact with any watercourses. Sampling locations are shown in Figure 6.18: River Corridor Survey, Macrophyte Survey, Aquatic Invertebrate Survey and White-clawed Crayfish Survey and listed in Table 3: WCC survey location, timing and methodology.

### *Manual search surveys*

- 6.22.3.6 Manual search surveys were undertaken in compliance with *Monitoring the White-clawed Crayfish* (Peay, 2003)<sup>7</sup> and the updated Common Standards Monitoring protocol for rivers (JNCC, 2016)<sup>8</sup>. The latter requires searching up to 250 potential crayfish refuges, where white-clawed crayfish are not recorded in the previous (50, 100, 150, or 200) searches. This approach increases the chances of identifying low density crayfish populations. Manual search surveys involved the surveyors walking the river channel in an upstream direction and manually searching potential crayfish refuges for presence of crayfish.
- 6.22.3.7 The types of refuges searched was site specific, but typically in-stream refuges searched were cobble or boulders; where hand-search was not feasible (e.g. macrophytes, tree roots or woody debris), a kick sampling hand net was used.
- 6.22.3.8 Each patch/refuge was chosen by a suitably qualified and experienced surveyor, who based the decision on the availability of optimal refuge habitat at each site.
- 6.22.3.9 In line with best practice, care was taken to ensure that stones moved were returned to the river in the position they were found.
- 6.22.3.10 Where crayfish were identified, they were measured (carapace length), sexed and any evidence of disease established. On completion of the survey crayfish were released at the point of capture.
- 6.22.3.11 Habitat information, in line with the standard Crayfish Habitat Survey (Peay, 2003), was recorded directly into a GIS using a GPS-enable tablet.

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<sup>7</sup> Peay S (2003) *Monitoring the White-clawed Crayfish Austropotamobius pallipes*. Conserving Natura 2000 Rivers Monitoring Series No. 1, English Nature, Peterborough.

<sup>8</sup> JNCC (2016) Common Standards Monitoring Guidance for Rivers (v. September 2016)..



### Data analysis

6.22.3.12 At sites where crayfish were caught, analysis to determine the population abundance was undertaken in line with the methods prescribed in monitoring guidance (Peay, 2003). Table 2: WCC population abundance categories; adapted from (Peay, 2003) to include eDNA provides population abundance categories based on the number of crayfish caught per ten refuges. The table has been adapted to include eDNA analysis.

Table 2: WCC population abundance categories; adapted from (Peay, 2003) to include eDNA

Average no. per 10 refuges	Population Abundance
>5	Very high
>=3, <5	High
>=1, <3	Moderate
>0, <1 or positive eDNA	Low
0	Absent or undetected

### eDNA survey

- 6.22.3.13 eDNA was collected from river water samples to determine the presence of native and/or signal crayfish (*Pacifastacus leniusculus*) at each site. This method was used to maximise the potential of confirming crayfish presence at each site. Samples were collected on a single occasion in September 2021 and sent to Nature Metrics Ltd. for laboratory analysis; 400ml of river water was filtered on site to obtain a sample.
- 6.22.3.14 DNA from each filter was extracted in the laboratory using a commercial DNA extraction kit, with a protocol modified to increase DNA yields. An extraction blank was also processed for the extraction batch. DNA was purified to remove polymerase chain reaction (PCR)<sup>9</sup> inhibitors using a commercial purification kit.
- 6.22.3.15 DNA yields were as expected, and the DNA was tested with a 16S bacterial PCR to determine the presence of PCR inhibitors and/or DNA degradation in the samples. The samples successfully amplified, indicating no inhibition or degradation.
- 6.22.3.16 PCR amplification targeting WCC and signal crayfish were carried out in 12 replicates per sample per target, using species-specific primers and probes, in the presence of both positive controls and negative controls (template and extraction). Results are provided as a score for the number of positive replicates out of 12. All laboratory controls behaved as expected.

<sup>9</sup> Polymerase chain reaction is a process by which millions of copies of a particular DNA segment are produced through a series of heating and cooling steps, known as an ‘amplification’ process. One of the most common processes in molecular biology and a precursor to most sequencing-based analyses.

*eDNA analysis*

6.22.3.17 Positive and negative eDNA records were used as an indication of native or signal crayfish presence. There was generally a good correlation between positive records resulting from eDNA and traditional manual search techniques, as described in Section 6.22.5 (Table 5); this adds weight to the negative records being robust and likely representing absence.

*Biosecurity*

6.22.3.18 The surveyors adhered to strict biosecurity protocols to prevent the threat of introducing disease, or the spread of Invasive Non-Native Species (INNS) between watercourses. There were known white-clawed crayfish populations associated with many of the watercourses in the western schemes (i.e. M6 Junction 40 to Kemplay Bank, Penrith to Temple Sowerby, Temple Sowerby to Appleby, Appleby to Brough) and the potential for presence of signal crayfish in watercourses in the eastern schemes (Bowes Bypass, Cross Lanes to Rokeby and Stephen Bank to Carkin Moor). Therefore, in addition to standard biosecurity protocol and disinfection, the surveyors moved between the sites in a west to east direction to reduce the risk of spreading this particular INNS, or pathogens associated with it. Surveys sites within the same watercourse were sampled from an upstream to downstream direction.

Table 3: WCC survey location, timing and methodology

Scheme	Site name	Watercourse	Survey location (National Grid Reference)	Methodology & Survey
M6 Junction 40 to Kemplay Bank (S0102)	WCP_01	Thacka Beck	NY 52740 29209	Manual search & eDNA (01/09/2021)
Penrith to Temple Sowerby (S03)	WCP_03	Light Water	NY 54974 29285	Manual search (22/09/2020) & eDNA (01/09/2021)
	WCP_04	Unnamed Trib. of River Eamont 3.3	NY 55634 29098	eDNA only (01/09/2021)
Temple Sowerby to Appleby (S0405)	WCP_08_ORANGE	Trout Beck	NY 63521 25265	Manual search & eDNA (01/09/2021)
	WCP_08_US	Trout Beck	NY 64974 24472	Manual search & eDNA (02/09/2021)
	WCP_08_US_RED-KS	Keld Sike	NY 65389 24682	Manual search & eDNA (02/09/2021)
	WCP_08_US_RED	Trout Beck	NY 65480 24142	Manual search & eDNA (02/09/2021)

Scheme	Site name	Watercourse	Survey location (National Grid Reference)	Methodology & Survey
Appleby to Brough (S06)	WCP_11_US	Unnamed Trib. of Mire Sike	NY 73554 16936	Manual search only (01/09/2020)
	WCP_11_DS	Unnamed Trib. of Mire Sike	NY 73519 16852	Manual search (22/09/2020) & eDNA (01/09/2021)
	WCP_13	Cringle Beck	NY 74463 16493	Manual search (23/09/2020) & eDNA (02/09/2021)
	WCP_15	Moor Beck	NY 75045 16076	Manual search & eDNA (03/09/2021)
	WCP_16	Moor Beck	NY 75099 15939	Manual search & eDNA (02/09/2021)
	WCP_17_US	Eastfield Sike	NY 75464 15783	Manual search & eDNA (03/09/2021)
	WCP_17_DS	Eastfield Sike	NY 75371 15781	Manual search (29/09/2020) & eDNA (03/09/2021)
	WCP_18	Unnamed Trib. of Lowgill Beck	NY 77298 15158	eDNA only (03/09/2021)
	WCP_19_ORANGE	Lowgill Beck	NY 78060 15033	Manual search & eDNA (03/09/2021)
	WCP_19_WS	Woodend Sike	NY 78340 15202	Manual search & eDNA (03/09/2021)
	WCP_19_YS	Yosgill Sike	NY 78393 15189	Manual search & eDNA (03/09/2021)
Bowes Bypass (S07)	WCP_20	Unnamed Trib. of River Greta	NZ 00037 13328	Manual search only (15/09/2021)
Cross Lanes to Rokeby (S08)	WCP_24_BLUE	Punder Gill	NZ 04732 13685	Manual search & eDNA (15/09/2021)
	WCP_24	Tutta Beck	NZ 05260 13686	Manual search & eDNA (15/09/2021)
Stephen Bank to Carkin Moor (S09)	WCP_28	Unnamed Trib. of Dalton Beck	NZ 14378 09487	Manual search & eDNA (15/09/2021)
	WCP_30	Mains Gill	NZ 15701 08704	Manual search (29/09/2020) & eDNA (15/09/2021)
	WCP_33	Unnamed Trib. of Holme Beck	NZ 16104 07584	Manual search & eDNA (15/09/2021)

## 6.22.4 Assumptions and Limitations

### *Survey constraints*

- 6.22.4.1 There were a limited number of sites where manual search surveys were not practical at the time of survey. This was either due to the channel being heavily overgrown and choked with vegetation or the riparian vegetation (e.g. dense scrub) resulting in the channel being inaccessible. These sites were as follows:
- WCP\_04 (Unnamed Trib. of River Eamont 3.3); dense in-channel vegetation and areas of dry riverbed made manual search techniques impractical
  - WCP\_18 (Unnamed Tributary of Lowgill Beck 6.1); dense in-channel and riparian vegetation made manual search techniques impractical
- 6.22.4.2 There were a limited number of sites where the manual search survey was compromised due to the channel substrate being dominated by fine substrate (gravel and smaller), which limited the number or searchable refuges. These sites were as follows:
- WCP\_08\_US-RED\_KS (Keld Sike); limited in-stream refuges could be searched due to the channel substrate being dominated by fine substrate (gravel and smaller). 250 refuges could not be searched
  - WCP\_33 (Unnamed Tributary of Holme Beck 9.2) limited in-stream refuges could be searched due to the channel substrate being dominated by fine substrate (gravel and smaller). 250 refuges could not be searched.
- 6.22.4.3 Conditions for manual search techniques at WCP\_20 (Unnamed Tributary of River Greta 7.3) was considered sub-optimal due to dense in-channel vegetation, which limited the number refuges that could be searched. 250 refuges could not be searched.
- 6.22.4.4 It should be noted that, with the exception of Unnamed Tributary of River Greta 7.3, eDNA samples were collected at all the sites outlined above, where site conditions impacted the use of manual search techniques.

### *Missed crayfish*

- 6.22.4.5 At some sites crayfish were observed during the manual search survey but evaded capture. Crayfish that evaded capture have been included in the total catches and corresponding density estimate for each site, but where this occurred it has been noted in the reporting.

### *eDNA*

- 6.22.4.6 eDNA results are based on the samples as supplied to the laboratory. Incorrect sampling methodology as a result of human error has the potential to affect the results. Note that a negative result does not preclude the presence of crayfish at a level below the limits of detection.

## 6.22.5 Results

### Desk Study

#### Routewide

##### *River Eden SAC and River Eden and Tributaries SSSI*

- 6.22.5.1 The following schemes interact with the River Eden SAC/SSSI or cross watercourses that are hydraulically linked to the SAC/SSSI (Figure 6.1: Statutory and Non-Statutory Designated Sites (Application Document 3.3)): M6 Junction 40 to Kemplay Bank, Penrith to Temple Sowerby, Temple Sowerby to Appleby and Appleby to Brough.
- 6.22.5.2 WCC are a primary reason for the designation of the River Eden SAC (Joint Nature Conservation Committee, 2015)<sup>10</sup> and therefore there is potential for watercourses in these schemes to support WCC; this informed the field survey design and survey site selection.
- 6.22.5.3 Table 4: Desk study crayfish records within 2km of the Order Limits shows the records of white-clawed and invasive crayfish identified within the desk study search area.
- 6.22.5.4 WCC records were identified within the desk study search area for the following schemes: M6 Junction 40 to Kemplay Bank, Penrith to Temple Sowerby, Temple Sowerby to Appleby and Appleby to Brough. A single signal crayfish was returned in the desk study search area for the Cross Lanes to Rokeby scheme.

Table 4: Desk study crayfish records within 2km of the Order Limits

Scheme	Watercourse and EA Site ID	Species	Record date	Location	Approximate distance and direction from the Order Limits
M6 Junction 40 to Kemplay Bank (S0102)	River Eamont (LRC)	WCC	26/07/2002	NY536829 08	950m east
	River Eamont (LRC)	WCC	26/07/2002	NY538429 08	1.0km east
	River Lowther (LRC)	WCC	26/07/2002	NY525628 60	255m south
	River Eamont (LRC)	WCC	26/07/2002	NY526428 65	255m south
	River Eamont (LRC)	WCC	26/07/2002	NY535029 09	706m east
	River Eamont (ERT)	WCC	17/09/2014	NY 54000 29200	760m east
	River Eamont (ERT)	WCC	30/09/2014	NY 55200 29700	1.9km east

<sup>10</sup> Joint Nature Conservation Committee (2015) Natura 2000 Standard Data Form (2015): River Eden SAC (UK0012643),.

Scheme	Watercourse and EA Site ID	Species	Record date	Location	Approximate distance and direction from the Order Limits
Penrith to Temple Sowerby (S03)	River Eamont (LRC)	WCC	26/07/2002	NY53682908	215m west
	River Eamont (LRC)	WCC	26/07/2002	NY53842908	115m west
	River Lowther (LRC)	WCC	26/07/2002	NY52562860	1.4km west
	River Eamont (LRC)	WCC	26/07/2002	NY52642865	1.4km west
	River Eamont (LRC)	WCC	26/07/2002	NY53502909	455m west
	River Eamont (ERT)	WCC	17/09/2014	NY 5400029200	60m north
	River Eamont (ERT)	WCC	30/09/2014	NY 5520029700	283m north
	River Eamont (ERT)	WCC	30/09/2014	NY 5590029800	500m north
	River Eamont (ERT)	WCC	25/09/2014	NY 5780030490	1.3km north
Temple Sowerby to Appleby (S0405)	River Eden (LRC)	WCC	04/07/2006	NY612258	305m south
	Colby Beck (LRC)	WCC	18/09/2008	NY6649721008	812m south
	Nether Hoff Sike (LRC)	WCC	18/09/2008 18/10/2007	NY6664020002	1.7km south west
	Hoff Beck (LRC)	WCC	09/10/2008	NY6690120007	1.5km south west
	River Lyvenne (LRC)	WCC	16/10/2007	NY6096025473	847m south west
	Hoff Beck (LRC)	WCC	22/10/2007	NY6649721008	813m south
Appleby to Brough (S06)	Mire Sike (LRC)	WCC	23/06/2006	NY733167	10m south
	Helm Beck (LRC)	WCC	09/07/2002	NY702165	1.7km south west
	Hayber Beck (LRC)	WCC	23/07/2002	NY754174	1.1km north
	River Eden (LRC)	WCC	12/08/2002	NY74401500	682m south west
	Helm Beck (LRC)	WCC	22/10/2007 02/10/2008	NY7066116876	1.3km south west

Scheme	Watercourse and EA Site ID	Species	Record date	Location	Approximate distance and direction from the Order Limits
	Helm Beck (ERT)	WCC	30/09/2008	NY 70162 16457	1.9km south west
	Helm Beck (ERT)	WCC	30/10/2007	NY 70661 16876	1.2km south west
	Crooks Beck (ERT)	WCC	01/09/2010	NY 74776 15454	160m west
	Hayber Beck (ERT)	WCC	01/09/2010	NY 74927 16373	10m north
	Moor Beck (ERT)	WCC	01/09/2010	NY 75133 15920	within
	Eastfield Sike (ERT)	WCC	23/09/2014	NY 75361 15779	within
Cross Lanes to Rokeby (S08)	Thorsgill Beck / River Tees (LRC)	Signal crayfish	2003	NZ063152	1.2km north

## Field Survey

### Routewide

#### Survey results

- 6.22.5.5 A total of 21 manual search and 23 eDNA surveys were completed. A summary of the survey results (presence/absence) is presented in Table 5: Crayfish survey results; x = absent, ✓ = present. For eDNA data the number of replicates (out of 12) that returned a positive result is provided in brackets.
- 6.22.5.6 Where crayfish were recorded, either during manual search or eDNA surveys, the population density and corresponding population abundance categories for each site is provided in Table 6: WCC populations densities.
- 6.22.5.7 Based on the abundance categories adapted from (Peay, 2003), all sites where WCC were recorded had a low population density of WCC.
- 6.22.5.8 WCC were recorded during surveys of the following schemes: Temple Sowerby to Appleby (Trout Beck and Keld Sike) and Appleby to Brough (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).
- 6.22.5.9 No invasive non-native crayfish species were identified during the manual search survey of any site; however, signal crayfish DNA was identified in Mains Gill (WCP\_30) in the Stephen Bank to Carkin Moor scheme. This INNS is therefore considered to be present in this watercourse at a low population density.



Table 5: Crayfish survey results; x = absent, ✓ = present. For eDNA data the number of replicates (out of 12) that returned a positive result is provided in brackets.

Scheme	Site name	Watercourse	WCC manual search	WCC eDNA	SCF manual search	SCF eDNA
M6 Junction 40 to Kemplay Bank (S0102)	WCP_01	Thacka Beck	x	x (0)	x	x (0)
Penrith to Temple Sowerby (S03)	WCP_03	Light Water	x	x (0)	x	x (0)
	WCP_04	Unnamed Trib. of River Eamont 3.3	n/a	x (0)	x	x (0)
Temple Sowerby to Appleby (S0405)	WCP_08_O RANGE	Trout Beck	x	✓ (12)	x	x (0)
	WCP_08_U S	Trout Beck	x	x (0)	x	x (0)
	WCP_08_U S_RED-KS	Keld Sike	n/a	✓ (1)	x	x (0)
	WCP_08_U S_RED	Trout Beck	x	x (0)	x	x (0)
Appleby to Brough (S06)	WCP_11_U S	Unnamed Trib. of Mire Sike 6.12	✓	n/a	x	x (0)
	WCP_11_D S	Unnamed Trib. of Mire Sike 6.12	✓	✓ (12)	x	x (0)
	WCP_13	Cringle Beck	x	x (0)	x	x (0)
	WCP_15	Moor Beck	✓	✓ (12)	x	x (0)
	WCP_16	Moor Beck	x	✓ (12)	x	x (0)
	WCP_17_U S	Eastfield Sike	✓	✓ (12)	x	x (0)
	WCP_17_D S	Eastfield Sike	x	✓ (12)	x	x (0)
	WCP_18	Unnamed Trib. of Lowgill Beck 6.1	n/a	✓ (12)	x	x (0)
	WCP_19_O RANGE	Lowgill Beck	x	✓ (11)	x	x (0)
	WCP_19_W S	Woodend Sike	✓	✓ (12)	x	x (0)
	WCP_19_Y S	Yosgill Sike	x	✓ (12)	x	x (0)



Scheme	Site name	Watercourse	WCC manual search	WCC eDNA	SCF manual search	SCF eDNA
Bowes Bypass (S07)	WCP_20	Unnamed Trib. of River Greta 7.3	×	n/a	×	n/a
Cross Lanes to Rokeby (S08)	WCP_24_B LUE	Punder Gill	×	× (0)	×	× (0)
	WCP_24	Tutta Beck	×	× (0)	×	× (0)
Stephen Bank to Carkin Moor (S09)	WCP_28	Unnamed Trib. of Dalton Beck 9.2	×	× (0)	×	× (0)
	WCP_30	Mains Gill	×	× (0)	×	× (4)
	WCP_33	Unnamed Trib. of Holme Beck 9.2	n/a	× (0)	×	× (0)

Table 6: WCC populations densities

Scheme	Site name	Watercourse	No of WCC recorded (manual search)	WCC Abundance (WCC / 10 refuges)
Temple Sowerby to Appleby (S0405)	WCP_08_ORANGE	Trout Beck	0 (250)	Low (eDNA only)
	WCP_08_US_RED-KS	Keld Sike	n/a (no survey)	Low (eDNA only)
Appleby to Brough (S06)	WCP_11_US	Unnamed Trib. of Mire Sike 6.12	7 (50) <sup>11</sup>	Low (0.14)
	WCP_11_DS	Unnamed Trib. of Mire Sike 6.12	5 (50)	Low (0.10)
	WCP_15	Moor Beck	3 (50)	Low (0.06)
	WCP_16	Moor Beck	No catch	Low (eDNA only)
	WCP_17_US	Eastfield Sike	3 (50)	Low (0.06)
	WCP_17_DS	Eastfield Sike	No catch	Low (eDNA only)
	WCP_18	Unnamed Trib. of Lowgill Beck 6.1	No catch	Low (eDNA only)
	WCP_19_ORANGE	Lowgill Beck	No catch	Low (eDNA only)
	WCP_19_WS	Woodend Sike	3 (50)	Low (0.06)
WCP_19_YS	Yosgill Sike	No catch	Low (eDNA only)	

<sup>11</sup> Note that three of the WCC recorded at WCP\_11\_US were dead but had clearly only recently deceased. They have therefore been included in the data to provide a precautionary population density estimate.

Table 7: Signal crayfish populations densities

Scheme	Site name	Watercourse	No of signal crayfish recorded (manual search)	WCC Abundance (WCC / 10 refuges)
Stephen Bank to Carkin Moor (S09)	WCP_30	Mains Gill	No catch	Low (eDNA only)

## M6 Junction 40 to Kemplay Bank

### *WCP\_01 (Thacka Beck)*

6.22.5.10 No crayfish of any species were recorded during manual search surveys of this site. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the eDNA sample from this site.

6.22.5.11 Based on the results of the manual search (no catch) and eDNA (negative) surveys, WCC are considered to be absent from this site.

## Penrith to Temple Sowerby

### *WCP\_03 (Light Water)*

6.22.5.12 No crayfish of any species were recorded during manual search surveys of this site. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the eDNA sample from this site.

6.22.5.13 Based on the results of the manual search (no catch) and eDNA (negative) surveys, WCC are considered to be absent from this site.

### *WCP\_04 (Unnamed Tributary of River Eamont 3.3)*

6.22.5.14 No crayfish of any species were recorded during manual search surveys of this site. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the eDNA sample from this site.

6.22.5.15 Based on the results of the manual search (no catch) and eDNA (negative) surveys, WCC are considered to be absent from this site.

## Temple Sowerby to Appleby

### *WCP\_08\_DS (Trout Beck) WCP\_08\_ORANGE*

6.22.5.16 No crayfish of any species were recorded during manual search surveys of this site, despite the presence of abundant habitat considered optimal for manual search techniques. However, the presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the eDNA sample at this site.

6.22.5.17 Based on the results of the manual search (no catch) and eDNA (positive) surveys, this site is considered to have a WCC population of low abundance.

#### *WCP\_08\_US (Trout Beck)*

- 6.22.5.18 No crayfish of any species were recorded during manual search surveys of this site, despite the presence of abundant habitat considered optimal for manual search techniques. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the eDNA sample from this site.
- 6.22.5.19 Based on the results of the manual search (no catch) and eDNA (negative) surveys, WCC are considered to be absent from this site.

#### *WCP\_08\_US\_RED-KS (Keld Sike)*

- 6.22.5.20 No crayfish of any species were recorded during manual search surveys of this site, however, site conditions and the availability of searchable habitat meant the site was considered sub-optimal for manual search techniques. The presence of WCC was detected (1/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the sample from this site.
- 6.22.5.21 Based on the results of the manual search (no catch) and eDNA (positive) surveys, this site is considered to have a WCC population of low abundance.

#### *WCP\_08\_US\_RED (Trout Beck)*

- 6.22.5.22 No crayfish of any species were recorded during manual search surveys of this site, despite the presence of abundant habitat considered optimal for manual search techniques. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the sample from this site.
- 6.22.5.23 Based on the results of the manual search (no catch) and eDNA (negative) surveys, WCC are considered to be absent from this site

#### *Appleby to Brough*

##### *WCP\_11\_US (Unnamed Tributary of Mire Sike 6.12)*

- 6.22.5.24 A total of seven WCC were recorded from 50 refuges searched at this site. The habitat at this site was considered optimal for manual search techniques, however the surveyors noted a distinct absence of larger, cobble-sized refuges that may be limiting the availability of instream habitat for larger individuals at this site. The presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the sample from this site.
- 6.22.5.25 Based on the results of the manual search surveys, this site is considered to have a WCC population of low abundance (0.14 WCC / 50 refuges).

##### *WCP\_11\_DS (Unnamed Tributary of Mire Sike 6.12)*

- 6.22.5.26 A total of seven WCC were recorded from 50 refuges searched at this site. Like upstream, the habitat at this site was considered optimal for manual search techniques, however the surveyors noted a distinct absence of larger, cobble-sized refuges that may be limiting the availability of instream habitat for larger individuals at this site. The

presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the eDNA sample at this site.

- 6.22.5.27 Based on the results of the manual search surveys, this site is considered to have a WCC population of low abundance (0.10 WCC / 50 refuges).

*WCP\_13 (Cringle Beck)*

- 6.22.5.28 No crayfish of any species were recorded during manual search surveys of this site. The site was largely dry at the time the eDNA sample, which was collected from a few remnant pools. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the eDNA sample from this site.

- 6.22.5.29 Based on the results of the manual search (no catch) and eDNA (negative) surveys and the fact that the site is known to be ephemeral, WCC are considered to be absent from this site.

*WCP\_15 (Moor Beck)*

- 6.22.5.30 A total of three WCC were recorded from 50 refuges searched at this site. The site is predominantly characterised by gravel substrate and the surveyors noted a distinct absence of larger, cobble-sized refuges that may be limiting the availability of instream habitat for larger individuals at this site. The presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the sample from this site.

- 6.22.5.31 Based on the results of the manual search surveys, this site is considered to have a WCC population of low abundance (0.06 WCC / 50 refuges).

*WCP\_16 (Moor Beck)*

- 6.22.5.32 No crayfish of any species were recorded during manual search surveys of this site. The presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the eDNA sample from this site.

- 6.22.5.33 Based on the results of the manual search (no catch) and eDNA (positive) surveys, this site is considered to have a WCC population of low abundance.

*WCP\_17\_US (Eastfield Sike)*

- 6.22.5.34 A total of three WCC were recorded from 50 refuges searched at this site. The presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the sample from this site.

- 6.22.5.35 Based on the results of the manual search surveys, this site is considered to have a WCC population of low abundance (0.06 WCC / 50 refuges).

#### *WCP\_17\_DS (Eastfield Sike)*

- 6.22.5.36 No crayfish of any species were recorded during manual search surveys of this site. The presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the sample from this site.
- 6.22.5.37 Based on the results of the manual search (no catch) and eDNA (positive) surveys, this site is considered to have a WCC population of low abundance

#### *WCP\_18 (Unnamed Tributary of Lowgill Beck 6.1)*

- 6.22.5.38 A manual search was not practical at this site at the time of survey as the channel was heavily overgrown and choked with vegetation, however, a single WCC was noted in the spring invertebrate survey. The individual crayfish was safely removed from the sample and returned to the river prior to sample preservation.
- 6.22.5.39 The presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the sample from this site.
- 6.22.5.40 Based on results of the eDNA (positive) surveys (no manual search was undertaken), this site is considered to have a WCC population of low abundance.

#### *WCP\_19\_ORANGE (Lowgill Beck)*

- 6.22.5.41 No crayfish of any species were recorded during manual search surveys of this site, despite the presence of abundant habitat considered optimal for manual search techniques. The presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the eDNA sample at this site.
- 6.22.5.42 Based on the results of the manual search (no catch) and eDNA (positive) surveys, this site is considered to have a WCC population of low abundance.

#### *WCP\_19\_WS (Woodend Sike)*

- 6.22.5.43 A total of three WCC were recorded from 50 refuges searched at this site (although two individuals evaded capture). The presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the sample from this site.
- 6.22.5.44 Based on the results of the manual search surveys, this site is considered to have a WCC population of low abundance (0.06 WCC / 50 refuges).

#### *WCP\_19\_YS (Yosgill Sike)*

- 6.22.5.45 No crayfish of any species were recorded during manual search surveys of this site. However, the presence of WCC was detected (12/12) in the eDNA sample. Signal crayfish eDNA was not detected (0/12) in the sample from this site.

6.22.5.46 Based on the results of the manual search (no catch) and eDNA (positive) surveys, this site is considered to have a WCC population of low abundance.

#### **Bowes Bypass**

##### *WCP\_20 (Unnamed Tributary of River Greta 7.3)*

6.22.5.47 No crayfish of any species were recorded during manual search surveys of this site. Based on the results of the manual search survey, WCC are considered to be absent from this site.

#### **Cross Lanes to Rokeby**

##### *WCP\_24\_BLUE (Punder Gill)*

6.22.5.48 No crayfish of any species were recorded during manual search surveys of this site, despite the presence of abundant habitat considered optimal for manual search techniques. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the eDNA sample from this site.

6.22.5.49 Based on the results of the manual search (no catch) and eDNA (negative) surveys, WCC are considered to be absent from this site.

##### *WCP\_24 (Tutta Beck)*

6.22.5.50 No crayfish of any species were recorded during manual search surveys of this site, despite the presence of abundant habitat considered optimal for manual search techniques. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the eDNA sample from this site.

6.22.5.51 Based on the results of the manual search (no catch) and eDNA (negative) surveys, WCC are considered to be absent from this site.

#### **Stephen Bank to Carkin Moor**

##### *WCP\_28 (Unnamed Tributary of Holme Beck 9.6)*

6.22.5.52 No crayfish of any species were recorded during manual search surveys of this site, however it should be noted that the availability of searchable refuges was limited as the watercourse is culverted immediately downstream of the existing A66. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the eDNA sample from this site.

6.22.5.53 Based on the results of the manual search (no catch) and eDNA (negative) surveys, WCC are considered to be absent from this site.

##### *WCP\_30 (Mains Gill)*

6.22.5.54 No crayfish of any species were recorded during manual search surveys of this site, despite the presence of abundant habitat considered optimal for manual search techniques.

6.22.5.55 Whilst the presence of WCC was not detected (0/12) in the eDNA sample, signal crayfish eDNA was detected (12/12) in the sample from this site.



6.22.5.56 Based on the results of the manual search (no catch) and eDNA (positive for signal crayfish) surveys, WCC are considered to be absent from this site, but signal crayfish are considered to be present in low abundance. 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 route-wide.

#### *WCP\_33 (Unnamed Tributary of Holme Beck 9.2)*

6.22.5.57 A manual search was not suitable at this site as the in-channel substrate was characterised by silt and silt, however, an eDNA sample was collected. Neither WCC (0/12) or signal crayfish (0/12) eDNA was detected in the eDNA sample from this site.

6.22.5.58 Based on the results of the eDNA (negative) surveys, WCC are considered to be absent from this site.

#### **A1(M) Junction 53 Scotch Corner**

6.22.5.59 This scheme does not interact with any watercourses.

#### **Future baseline**

6.22.5.60 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)<sup>12</sup>, potential changes in baseline conditions also need to be identified in order to assess impacts.

6.22.5.61 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.

## **6.22.6 Discussion**

### *WCC*

6.22.6.1 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).

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

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<sup>12</sup> Chartered Institute of Ecology and Environmental Management (2019) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater Coastal and Marine

- 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).

6.22.6.3 These rivers therefore qualify as priority river habitat.

6.22.6.4 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.

#### *Signal crayfish*

6.22.6.5 A positive record for signal crayfish 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.

#### *Legal implications and mitigation recommendations*

6.22.6.6 WCC and the habitats that support them are protected under the Habitats Directive when associated with a Natura 2000 site (in this case the River Eden SAC).

6.22.6.7 WCC are afforded protection nationally under the Wildlife and Countryside Act 1981, making it an offence to intentionally or recklessly disturb, capture, sell, injure or kill any white-clawed crayfish or to cause damage to their habitat.

6.22.6.8 Strict biosecurity measures will be taken to avoid the spread of various invasive and non-native plants and aquatic species; however, signal crayfish is of particular relevance to WCC. Strict biosecurity measures to reduce the risk of introducing/spreading signal crayfish, or pathogens associated with this species will be required during construction in and around watercourses.

6.22.6.9 Works affecting watercourses where WCC were encountered will need to have adequate mitigation in place to protect WCC and their habitats. Where works are undertaken in close proximity to watercourses containing WCC, or at the top of slopes which lead down to such watercourses, silt screens/matts should be installed to minimise the risk of fine sediment being washed downstream. Suitable spill kits / bunds should also be made available on site to manage chemical / fuel spills. Loose spoil heaps should also be covered and positioned as far from the watercourse as is reasonably practicable.

6.22.6.10 Where watercourses containing a WCC population are to be temporarily drained or realigned a WCC translocation will be required prior to works under the appropriate Natural England licence, by appropriately certified crayfish specialists.

6.22.6.11 The design of new watercourse crossings should facilitate the free movement of WCC and aim to maintain or enhance aquatic habitats and



the fluvial geomorphological processes that control their distribution and quality.

### 6.22.7 References

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