A66 Northern Trans-Pennine Project
TR010062

3.4 Environmental Statement Appendix 6.18 Fish Habitat Assessment and MorPh

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3.4 ENVIRONMENTAL STATEMENT APPENDIX 6.18 FISH HABITAT ASSESSMENT AND MORPH

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6.18 Fish Habitat Assessment and MorPH

6.18.1 Introduction

6.18.1.1 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.

6.18.1.2 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.

6.18.1.3 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).

6.18.2 Legislation and Policy Framework

Legislation

6.18.2.1 A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. Legislation relevant to fish and discussed within this report are:

- Salmon and Freshwater Fisheries Act 1975 (as amended)
- 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
- Eels (England and Wales) Regulations 2009.

Salmon and Freshwater Fisheries Act 1975 (as amended)

6.18.2.2 All species of freshwater fish are protected under the Salmon and Freshwater Fisheries Act (SaFFA) 1975 (as amended). SaFFA aims to protect freshwater fish and their habitats, with a particularly strong focus on salmonid species. The legislation covers a broad range of topics, but of particular relevance to development are those sections covering water pollution, habitat disturbance and fish migration routes. Under Section 2 (4) it is an offence to wilfully disturb spawn, spawning fish or spawning areas, and under Section 4 (1) it is an offence to knowingly permit the flow of poisonous matter and polluting effluents into river courses that are poisonous or injurious to fish or the spawning grounds, spawn or food of fish.

6.18.2.3 Sections 9 to 15 are concerned with fish passage and migration routes. It is the duty of the waterway owner that when constructing dams, screens or sluices to provide and maintain a facilitating fish pass for migrating salmon or trout.

Natural Environment and Rural Communities Act 2006

6.18.2.4 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.

6.18.2.5 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.”

6.18.2.6 The following freshwater fish are listed as Species of Principal Importance (SoPI) under S41: common sturgeon (*Acipenser sturio*), allis ahad (*Alosa alosa*), twaite shad (*Alosa fallax),* European eel (*Anguilla anguilla*), spined loach (*Cobitis taenia*), vendace (*Coregonus albula*), whitefish (*Coregonus lavaretus*), burbot (Lota lota), Atlantic salmon (*Salmo salar*), brown/sea trout (*Salmo trutta*), Arctic charr (*Salvelinus alpinus*), river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*).

6.18.2.7 Numerous species of macrophytes, bryohoytes, lichens and vascular plants associated with watercourses are listed as Species of Principal Importance (SoPI) under S41. Annex I habitat: H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and other river habitat types qualify as priority river habitat under NERC, as defined by the criteria in the UK Biodiversity Action Plan Priority Habitat Descriptions for rivers (Joint Nature Conservation Committee, 2011)[1].

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

6.18.2.8 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).

6.18.2.9 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.

6.18.2.10 UK freshwater fish species listed on Annex II are: allis shad, brook lamprey (*Lampetra planeri*), twaite shad, sea lamprey, spined loach, river lamprey, European bullhead and Atlantic salmon. These species and the habitats that support them are protected under the Habitats

[1] Joint Nature Conservation Committee (2011) UK Biodiversity Action Plan Priority Habitat Descriptions "Rivers" (ver. 2011),.

Directive when associated with Natura 2000 site. Outside of a Natural 2000 site, these species are still considered to be of conservation value. Annex IV species are afforded a strict protection across their entire natural range within the EU, both within and outside Natura 2000 sites; common sturgeon are listed on Annex IV.

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

6.18.2.11 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.

6.18.2.12 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 your activity to provide consent.

6.18.2.13 The WFD aim is for all water bodies to be at good status. A WFD assessment must demonstrate that an activity will not:

- Cause or contribute to deterioration of status
- Jeopardise the water body achieving good status in future.

6.18.2.14 Fish is one of the biological quality elements (along with "macroinvertebrates" and "macrophytes and phytobenthos combined") typically used to provide WFD status in rivers and form part of the WFD assessment.

Eels (England and Wales) Regulations 2009

6.18.2.15 The Eels (England and Wales) Regulations 2009 implement Council Regulation (EC) No 1100/2007 of the Council of the European Union, establishing measures for the recovery of the stock of European eel. The Regulations are focussed on the management of commercial eel fisheries (licences, catch returns and restocking) and the passage/migration of eels. The regulations afford powers to the regulators (Environment Agency and Natural Resources Wales) to implement recovery measures in all freshwater and estuarine waters in England and Wales.

Part 4 of the regulations is concerned with the passage of eels and makes it a legal requirement to notify the regulator of the construction, alteration or maintenance of any structure likely to affect the passage of eels. This includes water intakes and outfalls, dams and weirs, sluices or any other in-river obstruction. Where any such structure exists, the owner, occupier or person in charge of the land on which the dam, structure or obstruction lies may be required to construct and operate an eel pass to allow the free passage of eels.

National level policy

6.18.2.16 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)[2], 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)

6.18.2.17 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

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

Relevant *NPSNN* paragraph reference	Requirement of the *NPSNN* (paraphrase)
	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 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

6.18.2.18 The *National planning policy framework (NPPF)* (Ministry of Housing, Communities & Local Government, 2021)[3] 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[4]".*

Regional and local level policy

6.18.2.19 A number of fish species including, sea lamprey, river lamprey, salmon, brown trout and European eel are listed in the *Cumbria Biodiversity Action Plan species list* (Cumbria Wildlife Trust, 2009)[5]. Salmon, wild brown trout and European eel are listed as priority species in the *Durham Freshwater Fish Action Plan* (North East England Nature Partnership, 2013)[6].

Other relevant policy and guidance

6.18.2.20 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:

[3] Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework
[4] Nationally Significant Infrastructure Projects (NSIP)
[5] Cumbria Wildlife Trust (2009) Cumbria Biodiversity Action Plan Species list
[6] North East England Nature Partnership (2012) Freshwater Fish Action Plan

- *Guidance for Ecological Impact Assessment in the United Kingdom Third Edition* (Chartered Institute of Ecology and Environmental Management, 2018)[7].

6.18.3 Methodology

Desk study

Designated sites

6.18.3.1 A search for designated sites, where fish are a qualifying feature, was undertaken as part of the desk study. Potential sites were identified using *Magic Map* (Department for Environment, Food and Rural Affairs, 2022)[8]

EA Fisheries Data

6.18.3.2 The Environment Agency *Ecology and Fish Data Explorer* (Environment Agency, 2021)[9] and GIS were used to identify Environment Agency fish survey (electric fishing) sites located within the Order Limits plus a 2km buffer. Data from between 2010 and 2021 was included in the desk study.

6.18.3.3 Fish survey data were included from all watercourses within Order Limits plus a 2km search area, whether they were hydraulically connected to watercourses that interact with the project or not to provide context.

6.18.3.4 The Environment Agency survey species lists identified were screened for protected and/or notable fish species as defined in Appendix 6.19: Fish (Application Document 3.4).

6.18.3.5 This information was used to provide context for the fish habitat assessment screening.

Eden Rivers Trust

6.18.3.6 In addition to Environment Agency fish records, desk study electric fishing information was also kindly provided by the Eden Rivers Trust. Data received was screened to identify survey sites within the desk study search area.

6.18.3.7 Survey species lists identified were screened for protected and/or notable fish species as defined in Appendix 6.19: Fish (Application Document Number 3.4).

Wild Trout Trust

6.18.3.8 The Wild Trout Trust have undertaken fish habitat and catchment pressure walk over surveys of Light Water (Penrith to Temple Sowerby) and Trout Beck (Temple Sowerby to Appleby). These

[7] Chartered Institute of Ecology and Environmental Management (2018) Guidance for Ecological Impact Assessment in the United Kingdom Third Edition
[8] Department for Environment, Food and Rural Affairs (2022) Magic Map.
[9] Environment Agency (2021) Ecology and Fish Data Explorer.

reports were interrogated to identify baseline information with respect to watercourses interacting with the project.

Field survey

Survey aims

6.18.3.9 Fish Habitat Assessment and Modular River Physical Survey (MoRPh) were undertaken in spring and summer 2021. The surveys were required to:

- Characterise the baseline habitat in rivers that interact with the scheme and identify suitable habitats for protected and notable aquatic species, including the qualifying features of the River Eden Special Area of Conservation (SAC) and the River Eden and Tributaries Special Site of Scientific Interest (SSSI)
- Identify opportunities for mitigation and/or enhancement
- Characterise the River Condition (according to MoRPh) in the precise location of all new watercourse crossings and existing crossings subject to extension as a project.

Screening

6.18.3.10 A total of 34 watercourse crossing points were screened in for Fish Habitat Assessment and MoRPh survey, based on the proposed route alignments at the time of survey and desk study information. The survey locations are presented in Table 3 and ES Figure 6.17: Fish Habitat Assessment, Fish Survey and River Condition Survey (MoRPh) . Where possible a 500m (250m upstream and 250m downstream) survey was undertaken.

6.18.3.11 Given the conservation value of Trout Beck, which forms part of the River Eden SAC/SSSI, the survey length was extended approximately 2km downstream to the confluence with the River Eden.

Fish Habitat Assessment

6.18.3.12 An assessment of the fish habitat present within the vicinity of each watercourse crossing was undertaken. The habitat assessment method comprised mapping fish habitats onto high resolution maps.

6.18.3.13 Habitat descriptions (Table 2: Fish habitat types adapted from Hendry and Cragg-Hine (1997) and Harvey and Cowx (2003)) were adapted from the Environment Agency Fisheries Technical Manual 4 - Restoration of riverine salmon habitats (Hendry and Cragg-Hine, 1997)[10]. Juvenile lamprey habitat definitions were based on descriptions in Conserving Natura 2000 Rivers: Monitoring the River, Brook and Sea Lamprey (Harvey and Cowx, 2003).[11]

[10] Hendry, K. and Cragg-Hine, D. (1997) 'Restoration of riverine salmon habitats'. Fisheries Technical Manual 4. Bristol: Environment Agency.
[11] Harvey, J. and Cowx, I. (2003) 'Monitoring the River, Brook and Sea Lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*'. Conserving Natura 2000 Rivers Monitoring Series No. 5. Peterborough: English Nature.

6.18.3.14 The main objective of the method is to obtain a detailed representation of the precise location, extent, condition and juxtaposition of habitats within the wetted width of the river. This is recorded by walking the riverbank and annotating high resolution maps with the habitats present. Crucially, the 'habitat' types for salmonids (e.g. fry, parr, mixed juvenile etc.), as opposed to 'flow' types, are recorded. Fish habitat types are defined by the interaction of the following variables: water depth; water velocity; substrate composition; and cover as described in Table 2: Fish habitat types adapted from Hendry and Cragg-Hine (1997) and Harvey and Cowx (2003).

Table 2: Fish habitat types adapted from Hendry and Cragg-Hine (1997) and Harvey and Cowx (2003)

Habitat type	Definition
Spawning gravel	Ideally stable (but not compacted) gravel. Mean grain size ≤ 25mm for trout and up to 80mm for salmon. 'Fines' (< 2mm grain size) to be less than 20% by weight. Water depth 17-76cm. Velocity 25-90cm/s.
Fry habitat	Shallow fast flowing (50-65cm/s) water (predominantly run and riffle). Water depth ≤ 20cm. Substrate pebble and cobble dominated.
Parr habitat	Fast flowing water generally with a broken surface (predominantly run and riffle). Water depth 20-40cm. Substrate cobble and boulder dominated.
Mixed juvenile (parr/fry)	Sections of river with varied depth and substrate, with localised habitat areas meeting the definition of both fry and parr habitat.
Run (adult)	Fast flowing water with a broken surface that is deeper than 40cm. Water depth >40cm. Substrate varied, often not visible.
Pools (adult)	No perceptible flow, smooth surface. Water depth usually > 0.6m. Substrate typically fine; often not visible.
Glides (adult)	Smooth surface with little turbulence. Water depth typically < 30cm. Substrate generally fine dominated by pebbles and fines
Juvenile lamprey habitat	*Optimal habitat*: stable fine sediment or sand > 15cm deep, low water velocity and the presence of organic detritus. *Sub-optimal habitat*: shallow sediment, often patchy and interspersed among coarser substrate. Also includes areas of organic detritus overlying bedrock, submerged tree roots trapping organic material, submerged silt banks, silt-dominated cattle drinks, and submerged bankside vegetation rooted in sand/silt.

6.18.3.15 Further to in-stream habitat, additional features of the watercourse were recorded and mapped to provide a broader understanding of the watercourse, anthropogenic modifications and any pressures which

may alter the suitability of the river for fish. Where present, this included:

- In-stream and riparian habitat features such as width-depth measurements, exposed substrate, bars, macrophytes, redds and coarse woody debris
- In-stream obstacles to fish passage including natural obstacles, weirs, sluices, dams, flap gates, culverts and fords. These obstacles were observed for fish passability based on professional judgement
- Point and diffuse sources of catchment pollution including domestic and industrial discharges or runoff, arable fields, livestock fields and forestry plantations
- River abstractions and details on fish screening facilities.

6.18.3.16 The assessment of in-stream obstacles was based on criteria defined in the original 2015 'River Obstacles' mobile data application. This method uses professional judgement in the application was devised by the Scottish Environment Protection Agency, the Rivers and Fisheries Trust for Scotland (RAFTS) and the Environment Agency (Plate 1: Decision tree for recording obstacles using the 'River Obstacles' methodology (After: EA, SEPA, 2015)). It assesses the passability of instream structure for each species under low flow and high flow conditions based on professional judgement of the surveyor.

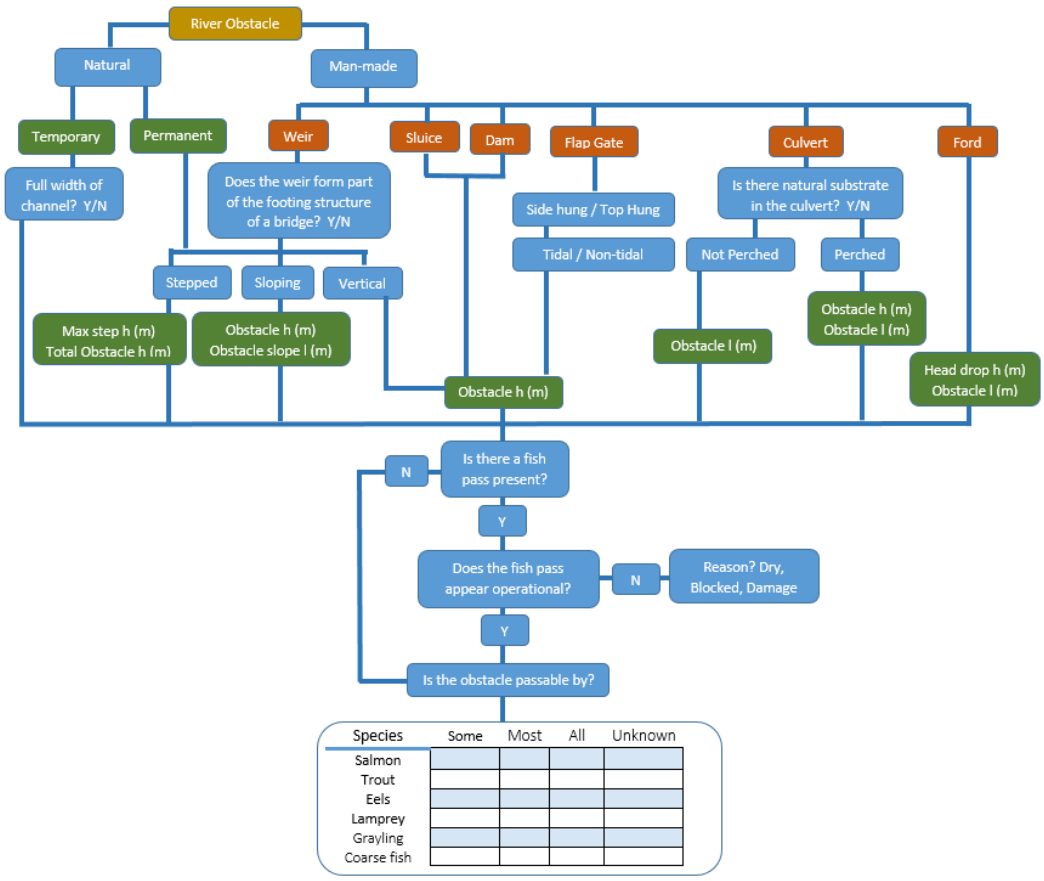


Plate 1: Decision tree for recording obstacles using the 'River Obstacles' methodology (After: EA, SEPA, 2015)

6.18.3.17 Macrophyte beds were noted as part of the assessment, however detailed surveys of the instream and riparian vegetation are presented in the ES Appendix 6.20: Aquatic Macrophyte and River Corridor Survey (Application Document Number 3.4).

MoRPh (River Condition) Survey

6.18.3.18 MoRPh surveys (Gurnell et al., 2012)[12] were undertaken to characterise the river condition in the precise location of all new watercourse crossings and existing crossings subject to extension as a project, to gather a baseline value for habitat with the potential to be impacted.

6.18.3.19 The MoRPh survey has two elements, the reach scale assessment and the sub-reach scale assessment. Both elements are combined within the online information system (Cartographer, 2022)[13] to provide a final river condition score and class for the surveyed section of river. The resulting river condition class considers the river type (as determined by the reach scale assessment) to contextualise the data recorded at each site.

6.18.3.20 The reach scale assessment is largely desk-based and is used to identify the indicative river type[14] of the watercourse. The assessment captures information including river sinuosity, extent of meandering, gradient and valley confinement to assign the river to one of 13 possible river types. The desk-based information, along with the maximum and average size of the bed material (derived from the sub reach scale assessment), is entered into the Cartographer information system which then assigns an appropriate river type.

6.18.3.21 The subreach assessment followed the MoRPh field survey methodology.[12] Within each subreach five contiguous MoRPh (MoRPh5) modules were surveyed, capturing data on the local physical structure and vegetation morphotypes from the river channel. MoRPh survey length is dictated by river width; with the exception of the surveys of Trout Beck which were 100m (as this river is >10 wide), all surveys were 50m in length.

6.18.3.22 River Condition (according to MoRPh) is expressed on a five-point scale ranging from Good to Poor (5-Good, 4-Fairly Good, 3-Moderate, 2-Fairly Poor, 1-Poor).

6.18.4 Assumptions and Limitations

6.18.4.1 Surveys could not be undertaken at certain sites, either as watercourses were dry, culverted or were classified as ditches and unsuitable for supporting fish and/or unsuitable for the MoRPh methodology. A summary of surveys undertaken at each site and

[12] Gurnell, A., England, J., Shuker, L., Wharton, G. (2012) MoRPh Survey Technical Reference Manual (2020 version).
[13] Cartographer (2022) Online information system, available at: [redacted] Accessed 11th February 2022]
[14] Gurnell, A., England, J., Scott., S., Shuker, L (2020) A Guide to Assessing River Condition. Available: [redacted] [Accessed 11.02.2022]

limitations is denoted in Table 3: Summary of surveys completed at each site.

Table 3: Summary of surveys completed at each site

Scheme	Site name	Watercourse	Fish Habitat Assessment	MoRPh	Comments
M6 Junction 40 to Kemplay Bank (S0102)	WCP_01	Thacka Beck	✓	✓	
Penrith to Temple Sowerby (S03)	WCP_02	Unnamed Tributary of Light Water 3.1	✓	✓	
	WCP_03	Light Water	✓	✓	
	WCP_04	Unnamed Tributary of River Eamont 3.3	✓	✓	
	WCP_06	Unnamed Tributary of River Eamont 3.5	✓	×	MoRPh survey, ephemeral ditch.
	WCP_07	Swine Gill	✓	✓	
Temple Sowerby to Appleby (S0405)	WCP_08_ORANGE	Trout Beck	✓	✓	
	WCP_08_DS	Trout Beck	✓	✓	
	WCP_08_US	Trout Beck	✓	✓	
	WCP_08_US_RED	Trout Beck	✓	✓	
	WCP_08_KS	Keld Sike	✓	✓	
	WCP_09	Unnamed Tributary of Trout Beck 4.5	✓	×	MoRPh survey, ephemeral ditch, significantly culverted.
	WCP_10	Unnamed Tributary of Trout Beck 4.5	✓	×	Watercourse is culverted at this location.
Appleby to Brough (S06)	WCP_11	Unnamed Tributary of Mire Sike 6.12	✓	✓	
	WCP_12	Unnamed Tributary of Cringle Beck 6.1	✓	×	No MoRPh survey. No defined channel.
	WCP_13	Cringle Beck	✓	✓	

Scheme	Site name	Watercourse	Fish Habitat Assessment	MoRPh	Comments
	WCP_14	Moor Beck (Offtake)	✓	×	No MoRPh survey, ephemeral ditch.
	WCP_15	Hayber Beck & Moor Beck	✓	✓	
	WCP_16	Moor Beck	✓	✓	
	WCP_17	Eastfield Sike	✓	✓	
	WCP_18	Unnamed Tributary of Lowgill Beck 6.1	✓	✓	
	WCP_19	Lowgill Beck/ Woodend Sike/ Yosgill Sike	✓	✓	
Bowes Bypass (S07)	WCP_20	Unnamed Tributary of River Greta 7.3	✓	×	No MoRPh survey. No loss of open channel.
Cross Lanes to Rokeby (S08)	WCP_23	Unnamed Tributary of Tutta Beck 8.1	✓	✓	
	WCP_24	Tutta Beck	✓	×	
	WCP_24_BLUE	Punder Gill	✓	×	No MoRPh survey. Condition derived from adjacent site (WCP_24)
	WCP_25	Unnamed Tributary of Tutta Beck 8.2	✓	×	No MoRPh survey, ephemeral stream.
Stephen Bank to Carkin Moor (S09)	WCP_28	Unnamed Tributary of Holme Beck 9.6	✓	×	Reach dry when MoRPh survey attempted.
	WCP_29	Unnamed Tributary of Holme Beck 9.3	✓	×	No MoRPh survey, ditch.
	WCP_30	Mains Gill	✓	✓	
	WCP_31	Unnamed Tributary of Mains Gill 9.1	✓	×	No MoRPh survey. Condition

Scheme	Site name	Watercourse	Fish Habitat Assessment	MoRPh	Comments
					derived from adjacent site (WCP_30)
	WCP_32	Unnamed Tributary of Holme Beck 9.8	✓	×	No MoRPh survey, shallow ditch, likely ephemeral.
	WCP_33	Unnamed Tributary of Holme Beck 9.2	✓	✓	
	WCP_34	Unnamed Tributary of Holme Beck 9.2	✓	×	River Condition derived from adjacent site (WCP_33)

6.18.5 Results

Routewide

Desk-study

Designated sites

6.18.5.1 Trout Beck forms part of SSSI unit 211. The unit was last assessed 12/01/2022 and was found to be in unfavourable (no change) condition. The assessment was desk based and used existing available Environment Agency data. Atlantic salmon are considered to be in unfavourable condition for the whole site, with barriers to migration cited as potentially adversely affecting upstream and downstream migration and ultimately spawning success. Environment Agency electrofishing data shows that there are poor to fair numbers of fry and parr. For brook lamprey, river lamprey and bullhead the CSM guidance for rivers states that the condition of this notified species should be the same as the supporting habitat. For this unit, the river is in unfavourable condition due to poor water quality and modified geomorphology, therefore these species are also unfavourable.

EA Fisheries Data

6.18.5.2 Fish species of conservation value were identified within the desk study search area for all schemes, with the exception of the A1 (M) Junction 53 Scotch Corner scheme. This included the following species of conservation value: Atlantic salmon (*Salmo salar*) (referred to hereafter as salmon), European bullhead (*Cottus gobio*) (referred to hereafter as bullhead), brown trout (*Salmo trutta*), European eel

(*Anguilla anguilla*) (referred to hereafter as eel) and river or brook lamprey (*Lampetra fluviatili / Lampetra planeri*).

6.18.5.3 Full desk study records of fish of conservation value, along with electric fishing survey data are outlined in ES Appendix 6.19: Fish (Application Document 3.4).

Eden River Trust Fisheries Data

6.18.5.4 Screening of the Eden River Trust data identified the presence the following species of conservation value in Hayber Beck (Appleby to Brough): salmon and brown trout.

Wild Trout Trust walkover reports

6.18.5.5 The Wild Trout Trust (WTT) have undertaken fish habitat and catchment pressure walk over surveys of Light Water (Wild Trout Trust, 2018)[15] (Penrith to Temple Sowerby) and Trout Beck (Wild Trout Trust, 2019)[16] (Temple Sowerby to Appleby) for the Eden Rivers Trust and the Environment Agency respectively.

6.18.5.6 The survey report highlighted significant pressures (significant length of culverted channel and perched pipe culverts, livestock poaching and farm tracks/fords, evidence of dredging, disposal of garden waste and culverts, septic tank overflows/nutrient rich discharges).

6.18.5.7 However, the report highlighted the potential value of Light Water downstream of the A66, in terms of juvenile salmonid habitat and potential (degraded) spawning habitat.

6.18.5.8 The Light Water report concluded that:

- *Light Water is likely to have been a key lower River Eamont spawning tributary in the past; however, straightening and dredging have rendered habitat severely degraded*
- *Sections of the watercourse now flow within pipes, below ground, in areas throughout much of its length. Without further investigation, it is hard to ascertain what extent of the dry channels observed were due to the particularly dry conditions and how much was down to alternative land drainage conduits taking the flow*
- *Light Water only currently appears to be a permanent surface watercourse in middle to lower reaches. The lower perennial section provides good potential invertebrate and salmonid spawning and juvenile habitat but remains degraded by past channel modifications and is further impacted by fine sediment inputs upstream*.

6.18.5.9 The Trout Beck report covers a wide area; however, the report highlights that towards the downstream end of the Trout Beck, agricultural pressure appears to intensify in several fields, with a corresponding impact upon the adjacent land and watercourse. The following specific observations were made with respect to the river and instream habitats in the vicinity of the proposed new crossing

[15] Wild Trout Trust (2018) Walkover assessment - Light Water, Cumbria.
[16] Wild Trout Trust (2019) Walkover assessment - Trout Beck Catchment; Trout Beck (Kirkby Thore) & Trout Beck.

(WCP_08) following assessment (by the WTT) in summer/autumn 2019:

- A reasonable buffer strip and stockproof fencing is present and working in places. However, in other areas livestock have access to the river banks and is exacerbating the bank erosion; in addition, arable fields have a minimal buffer strip and have been ploughed too close to the river.
- Lack of riparian planting also exacerbates the level of bank erosion in places.
- Instream habitat remains good in places despite pressures.
- Numerous pressures including a combined sewer overflow and pollution source associated with the farm infrastructure downstream of the existing A66 including piped discharges and poor farm management in terms of adequate buffer strips and the storage of waste/spoil too close to the river.

Routewide

Field Survey

Fish Habitat Assessment

6.18.5.10 Fish habitat assessment was undertaken at 34 sites where new watercourse crossings are or were previously proposed, or existing watercourse crossings are, or were previously proposed, to be widened.

6.18.5.11 Rivers surveyed with habitats with the potential to support protected and/or notable fish species were recorded the following schemes:

- M6 Junction 40 to Kemplay Bank (Thacka Beck)
- Penrith to Temple Sowerby (Light Water)
- Temple Sowerby to Appleby (Trout Beck and Keld Sike)
- Appleby to Brough (Unnamed Tributary of Mire Sike 6.12, Cringle Beck, Moor Beck, Eastfield Sike, Lowgill Beck, Woodend Sike and Yosgill Sike)
- Cross Lanes to Rokeby (Tutta Beck)

6.18.5.12 In addition, the following watercourses conform to Annex I habitat 3260: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation:

- Light Water, downstream of the existing A66 (WCP_03)
- Trout Beck, the entire of the surveyed reach (From WCP_08_US_RED to the confluence with the River Eden).

6.18.5.13 Areas of riparian woodland adjacent to Light Water (upstream and downstream of the A66) and Crooks Beck (south of the disused railway near Warcop) also conforms to the Annex I habitat: 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*.

6.18.5.14 These habitat types are qualifying features of the River Eden SAC. A full description of the floral assemblage of all rivers surveyed is provided in ES Appendix 6.20: Aquatic Macrophytes and River Corridor Survey (Application Document 3.4).

MoRPh (River Condition) Survey

6.18.5.15 The River Condition scores and corresponding condition class for each of the 21 sites subject to MoRPh survey are shown in Table 4: River Condition (MoRPh derived) for each site.

6.18.5.16 Condition class ranged from, Fairly Poor (2) to Fairly Good (4). No sites surveyed were found to be in Good (5) or Poor (1) condition, potentially reflecting the historically modified, but rural, non-urban landscape.

Table 4: River Condition (MoRPh derived) for each site

Scheme	Site name	Watercourse	NGR	MoRPh (Condition Score/ Class)
M6 Junction 40 to Kemplay Bank (S0102)	WCP_01	Thacka Beck	NY5272029216	2 - Fairly Poor
Penrith to Temple Sowerby (S03)	WCP_02	Unnamed Tributary of Light Water 3.1	NY5468728935	4 - Fairly Good
	WCP_03	Light Water	NY5487329032	4 - Fairly Good
	WCP_04	Unnamed Tributary of River Eamont 3.3	NY5561028986	3 - Moderate
	WCP_07	Swine Gill	NY5827028791	4 - Fairly Good
Temple Sowerby to Appleby (S0405)	WCP_08_US_RED	Trout Beck	NY6575224120	3 - Moderate
	WCP_08_US	Trout Beck	NY6499024484	4 - Fairly Good
	WCP_08_DS	Trout Beck	NY6481724397	4 - Fairly Good
	WCP_08_ORANGE	Trout Beck	NY6347825210	2 - Fairly Poor
	WCP_08_KS	Keld Sike	NY6539024664	3 - Moderate
Appleby to Brough (S06)	WCP_11	Unnamed Tributary of Mire Sike 6.12	NY7350216848	3 - Moderate
	WCP_13	Cringle Beck	NY7445916484	3 - Moderate
	WCP_15	Moor Beck	NY7505116073	3 - Moderate
	WCP_16	Moor Beck	NY7517815896	3 - Moderate
	WCP_17	Eastfield Sike	NY7546815788	4 - Fairly Good
	WCP_18	Unnamed Tributary of Lowgill Beck 6.1	NY7734115180	2 - Fairly Poor
	WCP_19	Lowgill Beck	NY7811315056	3 - Moderate
	WCP_23	Unnamed Tributary of Tutta Beck 8.1	NZ0512413557	3 - Moderate

Scheme	Site name	Watercourse	NGR	MoRPh (Condition Score/ Class)
Cross Lanes to Rokeby (S08)	WCP_24	Tutta Beck/Punder Gill	NZ0527113689	3 - Moderate
Stephen Bank to Carkin Moor (S09)	WCP_30	Mains Gill	NZ1570008692	3 - Moderate
	WCP_33	Unnamed Tributary of Holme Beck 9.2	NZ1628708101	3 - Moderate

Field Survey

6.18.5.17 The Fish Habitat Assessment survey extents and the MoRPh survey site midpoints are shown in ES Figure 6.17: Fish Habitat Assessment, Fish Survey and River Condition Survey (MoRPh) .

M6 Junction 40 to Kemplay Bank

Thacka Beck (WCP_01)

6.18.5.18 The habitat in Thacka Beck upstream of the existing A66 was typically characterised by fry habitat interspersed with shallow glides and pools and some areas of parr habitat. Both banks were predominantly reinforced with stone blocks. The lower section of the surveyed reach was significantly modified by a number of large culverts associated with the A686, the A66 and of the Cumbria Constabulary buildings.

6.18.5.19 Downstream of the Cumbria Constabulary buildings, the river was deeply incised and was uniformly trapezoid in section (Plate 1, A). The channel width was 3.00m and the water depth was 0.15 to 0.20m and flowed through heavily grazed, improved grassland. The instream habitat was characterised by mixed juvenile and fry habitat with a predominately cobble substrate, with some gravel and sand present. Optimal spawning habitat was absent from this reach.

6.18.5.20 There is potential for habitats upstream and downstream of the existing culverts to support fish of conservation value, including the qualifying species of the River Eden SAC/SSSI. However, the longitudinal connectivity of these habitats is likely to be adversely impacted by the presence of the large culverts that have the potential to act as barriers to fish migration.

6.18.5.21 The entire of Thack Beck is considered to be disconnected from the River Eamont under low flow conditions as it is significantly perched at the confluence with the River Eamont, which restricts fish migration between the two rivers. It appear that the River Eamont has eroded to a lower level and the historic boulder bank protection has created a step (Plate 1, C). Under medium to high flows the two watercourse will be connected.

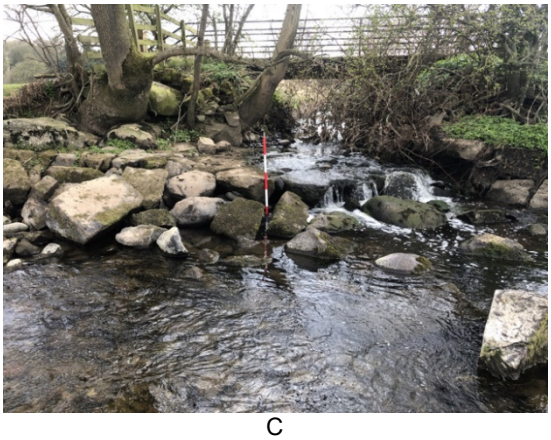
6.18.5.22 No areas of lamprey habitat were recorded during the survey.

6.18.5.23 Based on habitat assessment, Thacka Beck was considered likely to support fish of conservation value, despite the pressures identified. This was confirmed during fish surveys (electric fishing and eDNA) which recorded the presence of eel, minnow, salmon and stone loach, as outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.24 The MoRPh survey of Thacka Beck resulted in a river condition class of Fairly Poor

A

B



C

Plate 1: Thacka Beck (WCP_01) downstream of the existing A66. Cumbria Constabulary buildings culvert (A), trapezoidal channel (B), perched bed at confluence with River Eamont (C)

Penrith to Temple Sowerby

Unnamed Tributary of Light Water 3.1 (WCP_02)

6.18.5.25 This tributary of Light Water is considered to be of limited value for fish due to being extensively culverted. A section of open channel originates from a small culvert (NGR: NY5462328901) south of the A66; the channel between here and the A66 is characterised by slow flowing shallow glide habitat, with a silt dominated substrate. The channel width is ~2m, with a wetted width of ~1.5m. The watercourse enters a culvert upstream of the A66 and remains culverted until its confluence with Light Water. The culvert is considered to be a barrier to fish migration.

6.18.5.26 Despite its modified nature, the MoRPh survey of Unnamed Tributary of Light Water 3.1 resulted in a river condition class of Fairly Good, due to the absence of hard engineered in-channel and riparian structures within the 50m survey reach.

A

B

Plate 2: Unnamed Tributary of Light Water 3.1 (WCP_02). Section of open channel upstream of the A66 (A) and the confluence with Light Water (B).

Light Water (WCP_03)

6.18.5.27 The upper section of the surveyed reach was characterised by shallow glide habitat with sand dominated substate. The river is well-connected to it's floodplain through riparian woodland (NGR: NY5508728615) adjacent to the right bank, which conforms to the

Annex I habitat: 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*.

6.18.5.28 The stretch between the woodland and the A66 culvert flows through improved grassland; the banks are earth and steep throughout due to the incised channel. The instream habitat was characterised by shallow glides with cobble substrate, interspersed with patches of fry habitat with a coarse gravel dominated substrate offering suboptimal spawning opportunities. Others features of note through this stretch was a track bridge crossing (NGR: NY5496228793) and a patch of *Ranunculus* sp. upstream of the A66. The existing A66 culvert (NGR: NY5491528970) is considered passable for all fish species under normal flow conditions. Significant sand deposits were observed in the base of the culvert which is wider than the local channel width.

6.18.5.29 Downstream of the A66 culvert the habitat was more varied with developed riffle-pool sequences. The habitat was typically characterised by fry habitat interspersed with shallow glides and pools and some areas of parr and mixed juvenile habitat. Marginal silt banks in areas of slow flow were recorded offering optimal and suboptimal juvenile lamprey habitat and gravel offered potential spawning opportunities.

6.18.5.30 *Ranunculus* sp. beds were common, particularly closer to the confluence with the River Eamont were channel shading less extensive and Light Water (downstream of the existing A66) conforms to the Annex I habitat 3260: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

6.18.5.31 The riparian woodland downstream (NY5492529146) of the A66 also conforms to the Annex I habitat: 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*. A full description of the floral assemblage of all rivers surveyed is provided in ES Appendix 6.20: Aquatic Macrophyte and River Corridor Survey (Application Document 3.4).

6.18.5.32 An undersized and failed culvert (NGR: NY5524129403) associated with a farm track was identified ~200m upstream of the River Eamont confluence. The culvert was blocked, creating a step under low flows; under high flows the velocity through the pipe could also restrict fish movement.

6.18.5.33 Based on habitat assessment, Light Water was considered likely to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA) which recorded the presence of brown trout (eDNA only), eel, minnow, salmon (eDNA only), stone loach and three-spined stickleback, as outlined in Appendix 6.19: Fish (Application Document 3.4). The watercourse likely act as an important nursery zone and refuge area during period of high flow.

6.18.5.34 The MoRPh survey of Light Water resulted in a river condition class of Fairly Good.

A

B

c

Plate 3: Light Water (WCP_03) upstream of the existing A66 crossing. 91E0 alluvial forest (A), straightened trapezoidal channel (B), existing A66 culvert looking upstream (C).

A

B

C

D

Plate 4: Light Water (WCP_03) downstream of the existing A66 crossing. Riffle / fry habitat downstream of the existing A66 (A), *Ranunculus* sp. beds / 3260 habitat (B), failed and undersized culvert (C) and confluence with River Eamont (D).

Unnamed Tributary of River Eamont 3.3 (WCP_04)

6.18.5.35 With the exception of a short meandering section near the confluence with the River Eamont, this minor tributary is considered to be of limited value for fish of conservation value due to the lack of flow and stagnant nature.

6.18.5.36 The watercourse is fed by the overflow of an online lake (NGR: NY5558428846) and no flow was observed through the A66 culvert on the day of the survey. Habitat upstream is considered disconnected to the River Eamont due to the A66 culvert structure and the overflow pipe from the lake which represent a compete barriers to fish movement.

6.18.5.37 Downstream of the A66, the watercourse flows through improved grassland. The instream habitat is degraded due to lack of flow with duckweeds (Lemna sp). colonising the stagnant pools. Riparian habitats were heavily poached, likely a result of intensive sheep-grazing.

6.18.5.38 Despite its location adjacent to the River Eamont, based on habitat assessment, the watercourse was considered unlikely to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA). No fish were recorded during electric fishing and only minnow and stone loach were recorded in the eDNA sample, as outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.39 Despite its modified and degraded nature, the MoRPh survey of Unnamed Tributary of River Eamont 3.3 resulted in a river condition class of Moderate due to the absence of hard engineered in-channel and riparian structures within the 50m survey reach.

Plate 5: Unnamed Tributary of River Eamont 3.3 (WCP_04). Online pond upstream of the existing A66 (A), immediately downstream of the A66 culvert (B), channel downstream of the A66 (C)

Unnamed Tributary of River Eamont 3.5 (WCP_06)

6.18.5.40 Unnamed Tributary of River Eamont 3.5 is a ditch. The upper section was dry when surveyed. The lower section was flowing (downstream of NRG: NY5629029149) with a silt dominated substrate, however, there is no connectivity with the River Eamont for fish, due to steep bedrock ravine and associated waterfall. This watercourse is therefore considered unsuitable habitat for fish.

A

B

Plate 6: Unnamed Tributary of River Eamont 3.5 (WCP_06). Ephemeral ditch (A) and bedrock ravine acting as a natural barrier to fish movement to and from the River Eamont (B)

Swine Gill (WCP_07)

6.18.5.41 The surveyed area of Swine Gill is characterised by slow moving shallow glide with a silt dominated substrate. Upstream of the road, the watercourse appears to have been modified and is a perched ditch on the side of a slope adjacent to an area of standing water / wet woodland to the east.

6.18.5.42 The watercourse flows through a culvert under the A66 (NGR: NY5826228744) which is considered a barrier to fish migration. Whilst Swine Gill offers a potentially valuable aquatic habitat and is well connected to its floodplain, specifically an area of wet plantation woodland, the watercourse is considered unsuitable for fish of conservation value due to lack of flow and substrate other than sand and silt.

6.18.5.43 The MoRPh survey of Swine Gill resulted in a river condition class of Fairly Good.

Plate 7: Swine Gill (WCP_07). Ditch habitat upstream of the existing A66 (A), downstream of the A66 culvert looking upstream(B), silt dominated shallow glide habitat with adjacent wetted plantation woodland (C).

Temple Sowerby to Appleby

6.18.5.44 Trout Beck was surveyed from NGR: NY6593924042 to the confluence with the River Eden at NGR: NY6331225137. For the purposes of reporting the survey stretch has been divided into sections, which are described from an east to west (upstream to downstream) direction.

WCP_08_US_RED

6.18.5.45 Diverse and varied habitats were recorded in this section of Trout Beck, with typical riffle, glide, pool sequences offering habitat capable

of supporting all life stages of salmonids and other species of conservation value. Extensive areas of habitat meeting the flow, depth and substrate requirements of fry, parr and adult stage salmonid species was recorded, as were marginal areas of optimal and suboptimal juvenile lamprey habitat. The riverbed and banks were characterised by bedrock in some sections, which is of note as bedrock sections are absent in the reaches further downstream.

6.18.5.46 *Ranunculus* sp. beds were common where channel shading was less extensive; the watercourse conforms to the Annex I habitat 3260: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, as provided in Appendix 6.20: Aquatic Macrophyte and River Corridor Survey (Application Document 3.4).

6.18.5.47 Greatest habitat diversity was associated with the *Ranunculus* sp. beds and depositional features such as mid-channel bars. The quality of salmonid spawning opportunities varied; some gravel sections were silted, potentially an indication of poor land-use practices upstream. No definitive spawning redds were identified, but areas of clean gravel offering potential spawning opportunities for salmonid and lamprey sp. were commonplace.

6.18.5.48 The riparian buffer was typically wide through this section, unlike some areas downstream where riparian vegetation is limited to a single line of trees or was entirely absent. A cut off meander bend (NGR: NY6535824340) that was dry on the day of the survey likely offers important backwater refuge habitat for juvenile fish during periods of spate.

6.18.5.49 No barriers to fish migration or obvious bank protection was recorded in this stretch. Two piped discharges (NRG: NY6536924296 and NY6532424335), likely surface water drains were recorded, one of which was active (flowing with clear water).

6.18.5.50 The MoRPh survey of this section of Trout Beck (NGR: NY6575224120) resulted in a river condition class of Moderate.

A

B

C

Plate 8: Trout Beck (WCP_08_US_RED), Pool-pool sequence and marginal lamprey sp. habitat (A), vegetated bar (B), backwater refuge habitat (C), *Ranunculus* sp. beds and silted spawning (D)

WCP_08_US (upstream of the proposed Trout Beck Crossing)

6.18.5.51 Similar to upstream, diverse and varied habitats were recorded in this section of Trout Beck, with typical riffle, glide, pool sequences offering habitat capable of supporting all life stages of salmonids and other species of conservation value. Extensive areas of habitat meeting the flow, depth and substrate requirements of fry, parr and adult stage salmonid species was recorded, as were marginal areas of optimal and suboptimal juvenile lamprey habitat. Lamprey sp. habitat was often associated with bank erosion and subsequent depositor upstream of riparian trees. Bedrock was absent in this stretch and the river appeared incised and historically straightened. Re-naturalisation of the channel is occurring with extensive area of bank erosion recorded on both banks through the straightened section.

6.18.5.52 The riparian buffer was narrower in this section, often limited to a single line of tree, which likely was likely exacerbates the bank erosion. Features of note in this section include the confluence with Keld Sike with appear to deliver fine sediment to Trout Beck, but also likely offers important refuge habitat for juvenile fish during periods of spate.

6.18.5.53 *Ranunculus* sp. beds were common where channel shading was less extensive and the watercourse conforms to the Annex I habitat 3260: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, as provided in Appendix 6.20: Aquatic Macrophyte and River Corridor Survey (ES Volume 3, Application Document 3.4).

6.18.5.54 No definitive spawning redds were identified, but areas of clean gravel offering potential spawning opportunities for salmonid and lamprey sp. were commonplace.

6.18.5.55 No barriers to fish migration or discharges were recorded.

6.18.5.56 The MoRPh survey of this section of Trout Beck (NGR: NY6499024484) resulted in a river condition class of Fairly Good.

A

B

C

D

Plate 9: Trout Beck (WCP_08_US)

WCP_08_DS (downstream of the proposed Trout Beck crossing)

6.18.5.57 The river in this section is very similar in characteristics to that upstream, with a narrow riparian buffer and extensive bank erosion present through this section which has been historically straightened. Re-naturalisation of the channel is occurring; remains of some historical bank protection, consisting of wooden boards with cobble sized substrate behind, is failing in places delivering cobble sized substrate to the channel.

6.18.5.58 Despite its modified nature, the instream habitats are diverse and varied, with typical riffle, glide, pool sequences offering habitat capable of supporting all life stages of salmonids and other species of conservation value. Extensive areas of habitat meeting the flow, depth and substrate requirements of fry, parr and adult stage salmonid species was recorded, as were marginal areas of optimal and suboptimal juvenile lamprey habitat.

6.18.5.59 *Ranunculus* sp. beds were common where channel shading was less extensive and the watercourse conforms to the Annex I habitat 3260: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, as provided in Appendix 6.20: Aquatic Macrophyte and River Corridor Survey (Application Document 3.4).

6.18.5.60 Three cut off meanders were recorded in the riparian zone through this section (at NGR: NY6453824596, NY6447324810 and NY6444924924). Unlike the meander feature noted upstream, these features are typically disconnected from the channel, which is deeply incised, and would only be charged in very high flow events.

6.18.5.61 No definitive spawning redds were identified, but areas of clean gravel offering potential spawning opportunities for salmonid and lamprey sp. were commonplace.

6.18.5.62 No barriers to fish migration or discharges were recorded in this section.

6.18.5.63 The MoRPh survey of this section of Trout Beck (NGR: NY6481724397) resulted in a river condition class of Fairly Good.

A

B

C

D

Plate 10: Trout Beck (WCP_08_DS). *Ranunculus* sp. beds and clean gravels (A), extensive bank erosions (B), failed bank protection and silted gravel (C), perched remnant meander bend (D).

WCP_08_ORANGE

6.18.5.64 Evidence of modification and catchment pressure increase in the lower reaches of Trout Beck and the confluence with the River Eden. The riparian buffer strip is absent at times and extensive bank erosion evident. Despite this, the instream habitats remain diverse and varied, with typical riffle, glide, pool sequences offering habitat capable of supporting all life stages of salmonids and other species of conservation value.

6.18.5.65 Like upstream, *Ranunculus* sp. beds were common where channel shading was less extensive and the watercourse conforms to the Annex I habitat 3260: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, as provided in Appendix 6.20: Aquatic Macrophyte and River Corridor Survey (Application Document 3.4).

6.18.5.66 No definitive spawning redds were identified, but areas of clean gravel offering potential spawning opportunities for salmonid and lamprey sp. were commonplace.

6.18.5.67 No barriers to fish migration were identified, although a minor step was observed at NGR: NY6391925440 where a weir appears to have been removed. A surface water drain or combined sewer overflow (NRG: NY6391125443) was recorded as was a farmyard discharge (NGR: NY6335025135), the latter that was associated with the dairy farm located downstream of the existing A66 crossing, was actively discharging a white liquid to Trout Beck immediately upstream of the confluence with the River Eden.

6.18.5.68 The MoRPh survey of this section of Trout Beck (NGR: NY6347825210) resulted in a river condition class of Fairly Poor.

6.18.5.69 Despite the pressures noted, based on habitat assessment, the entire of Trout Beck was considered likely to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA) which across all sites recorded the presence of bullhead, brown trout, eel, minnow, river/brook lamprey ammocoetes, river/brook lamprey transformers, salmon, stone loach and three-spined stickleback. Full analysis of the fish surveys are outlined in Appendix 6.19: Fish (Application Document 3.4).

A

B

C

D

Plate 11: Trout Beck (WCP_08_ORANGE)

Keld Sike (WCP_08_KS)

6.18.5.70 Keld Sike was characterised by shallow glide habitat with gravel dominated substate interspersed with short sections of riffle and some pools. The river is heavily shaded and does not conform to the Annex I habitat 3260: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, as provided in ES Appendix 6.20: Aquatic Macrophyte and River Corridor Survey (Application Document 3.4).

6.18.5.71 No barriers to fish migration were identified, although two culverts (pre-cast concrete pipes) were note at NRG: NY6516024562 and NY6538924605. Both culverts were considered passable for all species under all flow conditions.

6.18.5.72 Based on the habitat assessment, Keld Sike was considered to have the potential to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA). Whilst no fish were recorded during electric fishing, bullhead, brown trout, minnow and three-spined stickleback DNA was recorded from the water sample, as outlined in ES Appendix 6.19: Fish (Application Document 3.4).

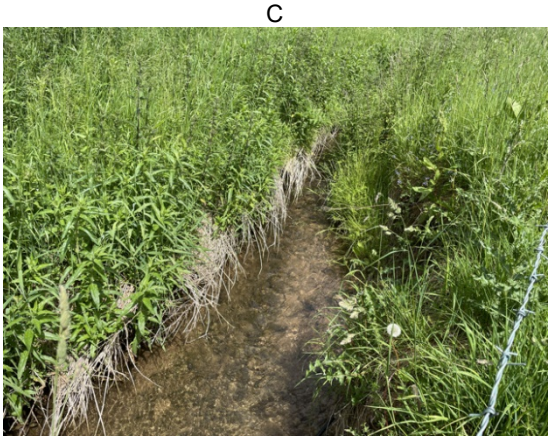
6.18.5.73 No definitive spawning redds were identified, but gravel substrate dominated in many areas, offering potential spawning opportunities for salmonid and lamprey sp. migrating form Trout Beck during higher flows. In addition, the watercourse likely acts as an important nursery zone and refuge area during period of high flows.

6.18.5.74 The MoRPh survey Keld Sike (NGR: NY6539024664) resulted in a river condition class of Moderate.

A

B

C



D

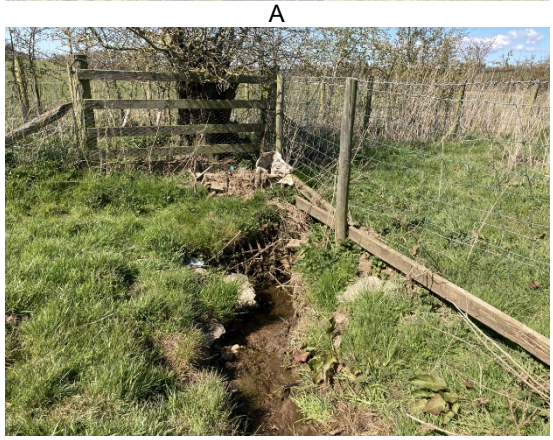
Plate 12: Keld Sike (WCP_08_KS)

Unnamed Tributary of Trout Beck 4.5 (WCP_09 & WCP09)

6.18.5.75 Unnamed Tributary of Trout Beck 4.5 is a ditch. The ditch enters a culvert at NGR: NY6501424207 and remains culverted until its confluence with Trout Beck (NGR: NY6489424414). Little or no flow was entering Trout Beck on the day of the survey. The culvert is considered to be a barrier to fish migration and the ditch is considered unsuitable habitat for fish.

6.18.5.76 A MoRPh survey was not conducted at this site.

A



B

Plate 13: Unnamed Tributary of Trout Beck 4.5 (WCP_09 & WCP09). Ditch habitat, likely ephemeral (A), culvert entrance upstream of Trout Beck (B), confluence with Trout beck (C)

Appleby to Brough

Unnamed Tributary of Mire Sike 6.12 (WCP_11)

6.18.5.77 The habitat in Unnamed Tributary of Mire Sike 6.12 upstream of the existing A66 was typically characterised by fry and mixed juvenile habitat. The stream which appears to have been historically straightened, flows from the lake (NGR: NY7363317226).

6.18.5.78 Downstream of the A66 culvert was typically fry habitat with coarse gravel dominated substrate interspersed with sections of shallow glide. A shallow pool was present immediately downstream of weir /

sediment trap associated with a works access track. The weir was assessed as likely to be impassable by all species in normal flow conditions.

6.18.5.79 Based on habitat assessment, this watercourse was considered to have the potential to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA) where bullhead, eel, minnow, stone loach and three-spined stickleback were recorded, as outlined in Appendix 6.19: Fish (Application Document 3.4).

A

B

C

D

Plate 14: Unnamed Tributary of Mire Sike 6.12 (WCP_11). Upstream of existing A66 culvert (A), existing A66 culvert (B), barrier to fish migration at access road (C), channel downstream of A66 and access road.

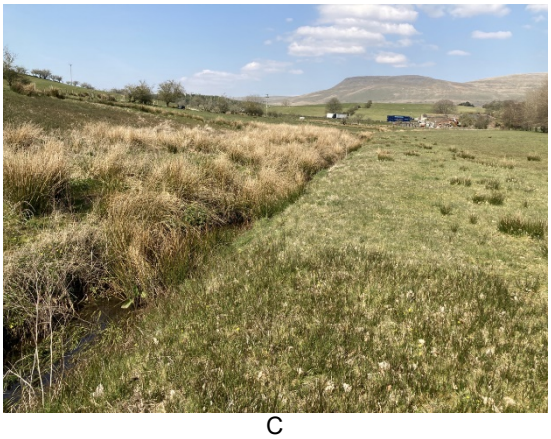
Unnamed Tributary of Cringle Beck 6.1 (WCP_12)

6.18.5.80 Unnamed Tributary of Cringle Beck 6.1 is a ditch / wetland features with no defined channel in some sections. The is no connectivity between the ditch and Cringle Beck, which flows into an area of boggy land upstream of the disused railway line (NGR: NY7431316280). The ditch is considered unsuitable habitat for fish.

6.18.5.81 A MoRPh survey was not conducted at this site.

A

B



C

Plate 15: Unnamed Tributary of Cringle Beck 6.1 (WCP_12).

Cringle Beck (WCP_13)

6.18.5.82 Optimal juvenile salmonid habitat exists upstream of the existing A66 crossing, with extensive areas of habitat meeting the flow, depth and

substrate requirements of fry and parr stage salmonid species. Obvious areas of juvenile lamprey habitat was absent.

6.18.5.83 The existing A66 culvert (NGR: NY7453216607) is considered passable for all fish species under normal flow conditions and has a natural cobble-dominated substrate.

6.18.5.84 Downstream of the road the watercourse is characterised by fry habitat with a coarse gravel dominated substrate. Significant sand deposits were noted in the section immediately upstream of the disused railway line.

6.18.5.85 It should be noted that the watercourse was not flowing in September 2021, when the eDNA sample was collected, but was flowing in August 2021 during the electric fishing surveys. It remains unclear if this was due to natural conditions or as a result of an abstraction upstream.

6.18.5.86 Based on habitat assessment, this watercourse was considered to have the potential to support fish of conservation value, including qualifying features of the River Eden SAC. This was confirmed during fish surveys (electric fishing and eDNA) where bullhead, brown trout, minnow, salmon and three-spined stickleback were recorded, as outlined in Appendix 6.19: Fish (Application Document 3.4).

A

B

C

D

Plate 16: Cringle Beck (WCP_13). Optimal juvenile salmonid habitat upstream of the A66 (A & B), existing A66 culvert considered passable for all species (C), fry habitat with significant sand deposition upstream of the disused railway (D)

Moor Beck (Offtake) (WCP_14)

6.18.5.87 The Moor Beck offtake diverts water from a weir (NY7494816241) on Moor Beck. The channel is understood to feed a pond used for fire water at the MOD barracks. The channel is ditch-like, choked with terrestrial vegetation and ephemeral (the ditch was dry during a site visit in January 2022). The substrate was entirely sand near the weir and silt further downstream.

6.18.5.88 There appears to be no connectivity for fish between Crooks Beck and the offtake channel / barracks pond (NGR: NY7496715843) and the ditch is considered unsuitable habitat for notable fish.

6.18.5.89 A MoRPh survey was not conducted at this site.

A

B

Plate 17: Moor Beck (Offtake) (WCP_14). Diversion / offtake at weir on Moor Beck (A), ditch habitat (B).

Hayber Beck and Moor Beck (WCP_15)

6.18.5.90 The upper section of the surveyed reach (Hayber Beck upstream of the existing A66) was characterised by fry habitat with a coarse gravel-dominated substrate, interspersed with deeper mixed juvenile and parr habitat with a cobble-dominated substrate. Whilst the banks had been significantly modified through a private garden, with riparian trees and vegetation completely absent, instream habitat was varied and of good quality.

6.18.5.91 A potential barrier to fish migration under low flow conditions was recorded at NGR: NY7496316416 and the banks of the river had been reinforced in places to prevent bank erosion.

6.18.5.92 No definitive spawning redds were identified, but areas of clean gravel offering potential spawning opportunities for salmonid and lamprey sp. were commonplace.

6.18.5.93 The existing A66 culvert (NGR: NY7493916292) is considered passable for all fish species under normal flow conditions and has a natural cobble-dominated substrate.

6.18.5.94 Downstream of the existing A66 culvert habitats were deeper in part, due to a reduction in gradient, but also due to the impounding effect of a weir (NY7494816241) which serves the MOD offtake. Siltation was evident upstream of the weir. Fish passage improvements of the weir had been made through the addition of steps with notches downstream of the weir. During consultation it was confirmed that the Eden Rivers Trust had undertaken the fish passage improvements.

6.18.5.95 Downstream of the weir optimal adult salmonid habitat associated with deep pool, downstream of the pool was a section of optimal mixed juvenile habitat with good cover provided by the woodland. Downstream of the woodland the channel is more sinuous and actively migrating across the floodplain with extensive bank erosion and bar formation adding habitat heterogeneity. The habitat in this reach is varied, with extensive areas of habitat meeting the flow, depth and substrate requirements of fry, mixed juvenile, parr and adult stage salmonid species.

6.18.5.96 No definitive spawning redds were identified, but areas of clean gravel offering potential spawning opportunities for salmonid and lamprey sp. were commonplace.

6.18.5.97 With the exception of the weir, no barriers to fish migration were recorded in this section. A surface water discharge (not flowing on the day of the survey) was recorded at NRG: NY7496616242.

6.18.5.98 Based on habitat assessment, this section of Hayber Beck and Moor Beck (downstream of the weir and offtake the watercourse is mapped as Moor Beck) was considered likely to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA) of this site recorded the presence of bullhead, brown trout, eel, gudgeon, river/brook lamprey ammocoetes, river/brook lamprey transformers, salmon and three-spined stickleback. Full analysis of the fish surveys are outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.99 Despite the quality of instream habitat, the MoRPh survey of Moor Beck (NGR: NY7505116073) resulted in a river condition class of only Moderate, driven by the lack of riparian vegetation structure.

A

B

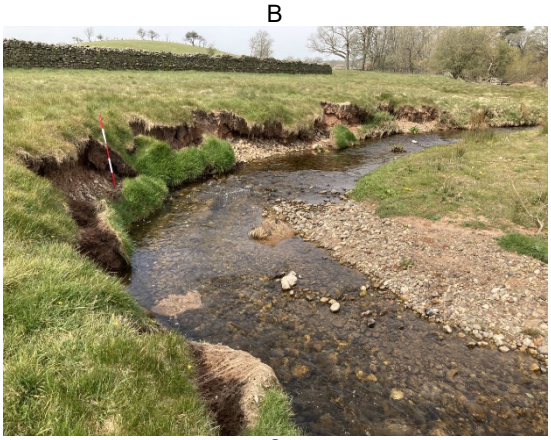
C

D

Plate 18: Moor Beck (WCP_15) upstream of the existing A66 crossing.

A

B



C

D

Plate 19: Moor Beck (WCP_15). Downstream of A66 and upstream of weir (A), offtake weir with fish passage improvements (B), sinuous and dynamic channel (C) mixed juvenile habitat (D).

Moor Beck (WCP_16)

6.18.5.100 This section of Moor Beck lacks the habitat diversity of upstream. The channel appears to have been historically straightened, is incised and less connected with the floodplain. Significant lengths of the bank were eroding.

6.18.5.101 Despite this, mixed juvenile, with a cobble dominated substrate, and fry habitat with a coarse gravel-dominated substrate is present throughout, interspersed with shallow glides. Habitat diversity improves downstream, between the road culvert at NGR: NY7524115863 and the confluence with Eastfield Sike.

6.18.5.102 Based on habitat assessment, this section of Moor Beck was considered likely to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA) of this site which recorded the presence of bullhead, brown trout, eel, gudgeon, river/brook lamprey ammocoetes, salmon and three-spined stickleback. Full analysis of the fish surveys are outlined in ES Appendix 6.19: Fish (ES Volume 3, Application Document 3.4).

6.18.5.103 The MoRPh survey of this section of Moor Beck (NGR: NY7517815896) resulted in a river condition class of Moderate.

6.18.5.104 Moor Beck and Eastfield Sike converge to form Crooks Beck upstream of the disused railway culvert at NGR: NY7528615765. The river is deeper in this section and characterised by parr habitat interspersed with glides and pools. The riparian woodland downstream of the disused railway (NGR: NY7524315737) conforms to the Annex I habitat: 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*. A full description of the floral assemblage of all rivers surveyed is provided in ES Appendix 6.20: Aquatic Macrophyte and River Corridor Survey (Application Document 3.4).

A

B

C

D

Plate 20: Moor Beck (WCP_16). Eroding bank in straightened section of Moor Beck (A), culvert on Warcop access road (B), sinuous section of Moor Beck upstream of the Eastfield Sike confluence (C), Crooks Beck downstream of disused railway (D)

Eastfield Sike (WCP_17)

6.18.5.105 The upper section of the surveyed reach (Eastfield Sike upstream of the existing A66) was characterised by mixed juvenile habitat with a coarse gravel-dominated substrate, interspersed with area of shallow glide. The channel has been modified by a series of culverts associated with two MOD tracks (north of the existing A66), the existing A66, and the tank turning area (south of the existing A66); these culverts were all considered to be passable for all fish species under normal flow conditions.

6.18.5.106 Between the existing A66 culvert and the MOD tank turning area, the river was more sinuous and actively migrating across its floodplain. This section was characterised by mixed juvenile habitat and parr habitat with a cobble-dominated substrate, interspersed with shallow pools.

6.18.5.107 Downstream of the MOD tank turning area to the confluence with Moor Beck (the two watercourses converge to form Crooks Beck immediate upstream of the heritage railway) was characterised by fry habitat with a cobble-dominated substrate. Significant poaching by grazing sheep was recorded.

6.18.5.108 No definitive spawning redds were identified, but areas of clean gravel offering potential spawning opportunities for salmonid and lamprey sp. were commonplace.

6.18.5.109 Based on habitat assessment, this section of Eastfield Sike was considered likely to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA) of this site recorded the presence of bullhead, brown trout, eel, river/brook lamprey ammocoetes, river/brook lamprey transformers, salmon and three-spined stickleback. Full analysis of the fish surveys are outlined in ES Appendix 6.19: Fish (Application Document 3.4).

6.18.5.110 The MoRPh survey of Eastfield Sike resulted in a river condition class of Fairly Good.

A

B

C

D

Plate 21: Eastfield Sike (WCP_17). Modified section upstream of existing A66 (A), existing A66 culvert (B), mixed juvenile habitat between the A66 and tank turning area (C) heavily poached reach upstream of Moor Beck confluence

Unnamed Tributary of Lowgill Beck 6.1 (WCP_18)

6.18.5.111 Unnamed Tributary of Lowgill Beck 6.1 is a minor watercourse. Upstream of the existing A66 the habitat was characterised by shallow, slow flowing glide with a silt/sand substrate. Downstream of the existing A66 the channel was choked with dense vegetation with a generally pooled flow.

6.18.5.112 The existing A66 culvert was considered impassable for all species other than eel under normal low flow condition due to insufficient water depth.

6.18.5.113 Based on habitat assessment, Unnamed Tributary of Lowgill Beck 6 was considered unlikely to support rheophilic fish species. This was confirmed during fish surveys (electric fishing[17] and eDNA) where only three-spined stickleback and eel DNA was recorded; no fish were caught during electric fishing. Full analysis of the fish surveys are outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.114 The MoRPh survey of Unnamed Tributary of Lowgill Beck 6.1 resulted in a river condition class of Fairly Poor.

[17] This river was choked with vegetation and most of the channel could not be accessed a as result. Therefore surveyors were only able to undertake a presence / absence survey in selected accessible areas.

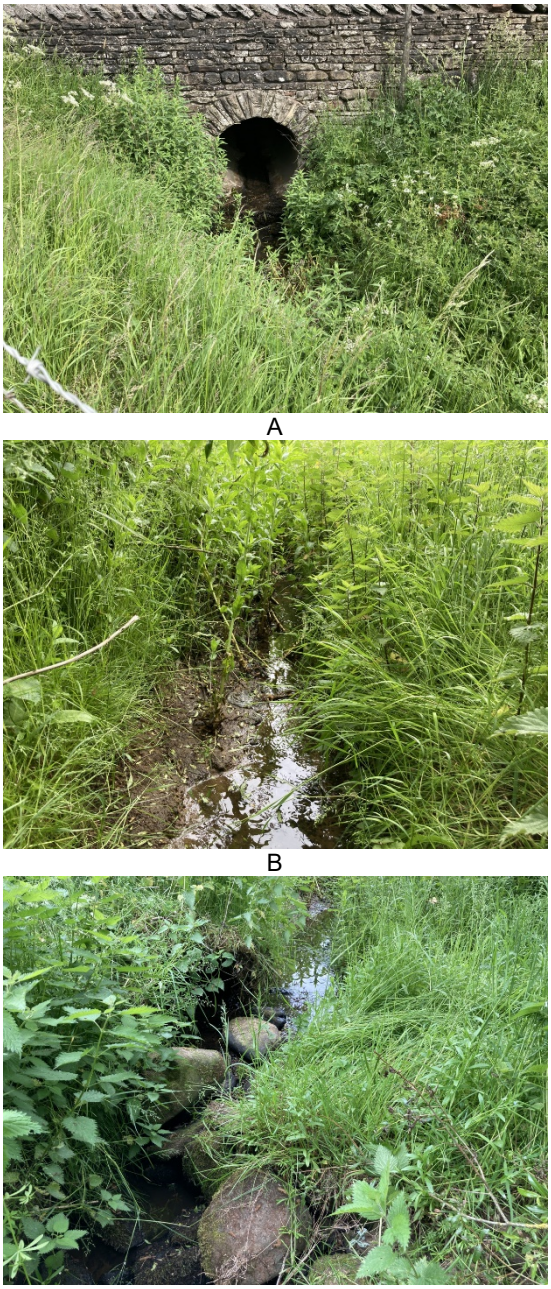


Plate 22: Unnamed Tributary of Lowgill Beck 6.1 (WCP_18). Existing A66 culvert (A), vegetated silt dominated habitat (B), presence of in channel boulders (C).

Lowgill Beck/ Woodend Sike/ Yosgill Sike (WCP_19)

6.18.5.115 Immediately upstream of the existing A66 culvert Woodend Sike and Yosgill Beck converge to form Lowgill Beck. Habitat in Woodend Sike and Yosgill Beck was characterised by mixed juvenile habitat with a predominantly cobble-dominated substate interspersed with shallow pools. Based on habitat assessment, these watercourses were considered likely to support fish of conservation value. This was confirmed later during fish surveys (eDNA only) of these sites. Bullhead, brown trout, eel, minnow, stone loach and three-spined stickleback DNA was recorded in Yosgill Sike. DNA of the same

species (with the exception of three-spined stickleback) were recorded in Yosgill Sike. Full analysis of the fish surveys are outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.116 Baffles within the existing A66 culvert and a baulk/groyne (Plate 23, D) at the downstream end of the culvert (to focus flow and create depth for approaching fish), were recorded. It is unclear whether these features, aimed at facilitating improved fish passage, where installed when the culvert was built or have been retrofitted. The interventions appeared to be successful in creating suitable depth and storing natural bed material within the culvert and downstream. The water depth over the concrete bed at the upstream end of the culvert was very shallow (<2cm depth) and is considered to be a barrier for all fish species with the exception of eel under normal low flow conditions. It should be noted that there had been some recent rainfall on the day of the survey and river levels were slightly elevated, yet depths were still considered insufficient for fish to migrate (Plate 23, C).

6.18.5.117 Downstream of the existing A66 the culvert the habitat in Lowgill Beck the was varied, with extensive areas of habitat meeting the flow, depth and substrate requirements of fry, mixed juvenile, parr and adult stage salmonid species. No definitive spawning redds were identified and clean gravel offering potential spawning opportunities for salmonid and lamprey sp. were typically absent from the survey reach; the dominant substrate types was cobble in faster flowing section and boulder in the pools.

6.18.5.118 Based on habitat assessment, this section of Lowgill Beck was considered likely to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA) of this site recorded the presence of bullhead, brown trout, river/brook lamprey ammocoetes, river/brook lamprey transformers, stone loach and three-spined stickleback. Full analysis of the fish surveys are outlined in ES Appendix 6.19: Fish (Application Document 3.4).

6.18.5.119 Despite the optimal in stream habitat in the surveyed section of Lowgill Beck, the MoRPh survey resulted in a river condition class of Moderate.

A

B

C

D

Plate 23: Lowgill Beck/ Woodend Sike/ Yosgill Sike (WCP_19). Woodend Sike (A), Yosgill Sike (B), very shallow water associated with artificial substrate at Woodend-Yosgill confluence (C), baulk/groyne to focus flow downstream of the existing A66 culvert (D)

Bowes Bypass

Unnamed Tributary of River Greta 7.3 (WCP_20)

6.18.5.120 Unnamed Tributary of River Greta 7.3 is considered to be of limited value for fish in the wider Greta catchment due a natural waterfall approximately 50m upstream (NGR: NZ0016113199) of the River Greta that is considered a barrier for all species. The watercourse has also be extensively culverted, most notably for a 500m section spanning the existing A66.

6.18.5.121 A MoRPh survey was not conducted at this site as the proposed alignment is within an area of land where the watercourse is entirely already culverted.

A

B

C

Plate 24: Unnamed Tributary of River Greta 7.3 Natural barrier to fish migration ~50m upstream of the Greta confluence (A), culvert barrier highlighting modified nature of watercourse (B), section adjacent to B-road (C).

Cross Lanes to Rokeby

Unnamed Tributary of Tutta Beck 8.1 (WCP_23)

6.18.5.122 Unnamed Tributary of Tutta Beck 8.1 was a steep minor watercourse with shallow habitats meeting the characteristics of fry habitat. Based on habitat assessment and the discussions with the landowner, who indicated that the watercourse is dry for significant parts for the year, the watercourse was considered unlikely to support fish of conservation value. Fish surveys (electric fishing and eDNA) could

not be carried out in August as the watercourse site was dry, as outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.123 The MoRPh survey of Unnamed Tributary of Tutta Beck 8.1 resulted in a river condition class of Moderate.

A

B

C

Plate 25: Unnamed Tributary of Tutta Beck 8.1 (WCP_23). (A), (B), (C).

Tutta Beck (WCP_24)

6.18.5.124 Tutta Beck was characterised by diverse and varied habitats, with typical riffle, glide, pool sequences offering habitat capable of supporting all life stages of salmonids and other species of conservation value. Extensive areas of habitat meeting the flow, depth and substrate requirements of fry, parr and adult stage

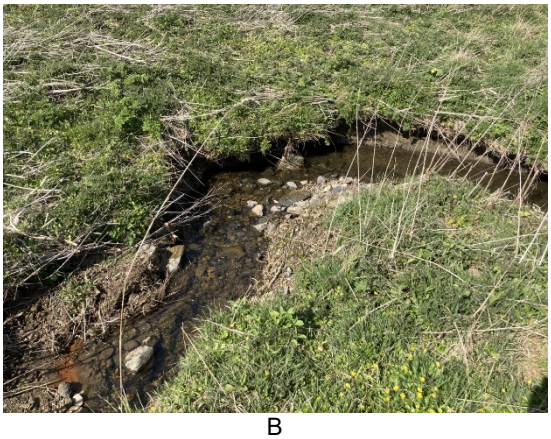
salmonid species was recorded, as were marginal areas of optimal and suboptimal juvenile lamprey habitat. The habitat variability was associated with result of active bank erosion and bar deposition in the sinuous channel.

6.18.5.125 No barriers to fish migration were recorded. No spawning redds were identified, but areas of clean gravel offering potential spawning opportunities for salmonid and lamprey sp. were commonplace.

6.18.5.126 Based on habitat assessment, Tutta Beck was considered to have the potential to support fish of conservation value. This was confirmed during fish surveys (electric fishing and eDNA) which recorded the presence of brown trout (electric fishing only) and eel (eDNA only), as outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.127 The MoRPh survey of Tutta Beck resulted in a river condition class of Moderate.

A



B

Plate 26: Tutta Beck (WCP_24). Sinuous channel with erosion and depiction created varied habitat and subsyared (A), culvert barrier highlighting modified nature of watercourse (B), section adjacent to B-road (C).

Unnamed Tributary of Tutta Beck 8.2 (WCP_25)

6.18.5.128 Unnamed Tributary of Tutta Beck 8.2 was a steep minor watercourse with shallow habitats meeting the characteristics of fry habitat. Based on habitat assessment and the discussions with the landowner, who indicated that the watercourse is dry for significant parts for the year,

the watercourse was considered unlikely to support fish of conservation value.

6.18.5.129 Fish surveys and MoRPh surveys were screened out due to the ephemeral nature of the stream.

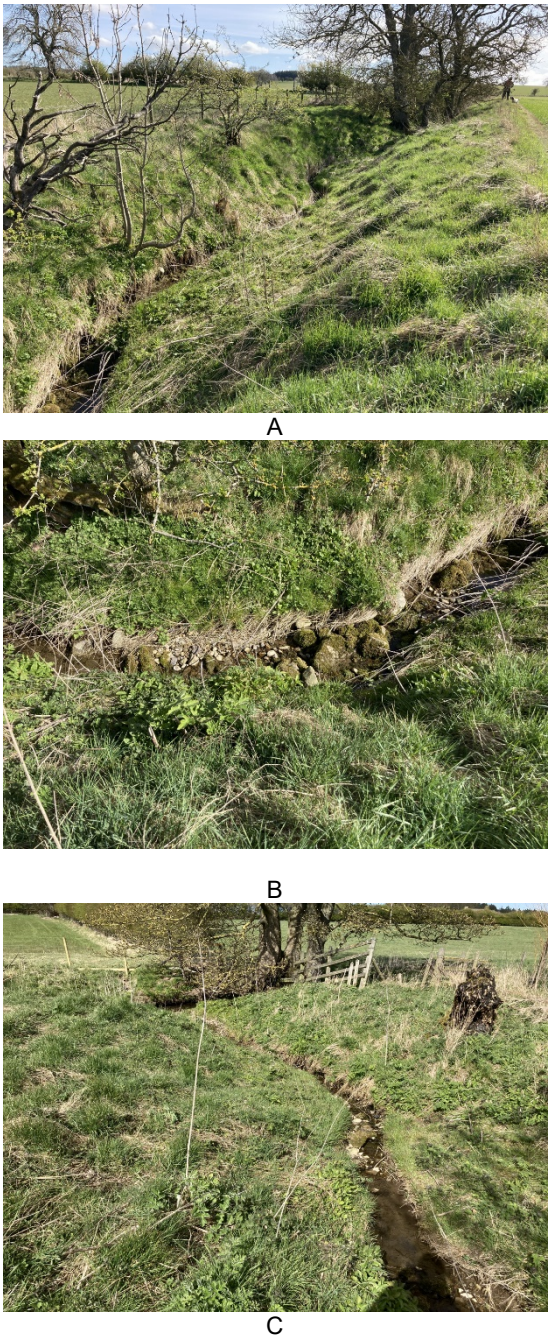


Plate 27: Unnamed Tributary of River Greta 7.3 Natural barrier to fish migration ~50m upstream of the Greta confluence (A), culvert barrier highlighting modified nature of watercourse (B), section adjacent to B-road (C).

Punder Gill (WCP_24_BLUE)

6.18.5.130 Punder Gill forms the upper section of the catchment, from the source to the confluence with Unnamed Tributary of Punder Gill 8.1, downstream of which the watercourse is named Tutta Beck. The

watercourse is steep in the surveyed section and characterised by fry habitat with a cobble and boulder-dominated substrate.

6.18.5.131 No artificial barriers to fish migration were recorded but water depth was very low on the day of the survey creating natural barriers to migration for adult fish. No areas of gravel substrate suitable for spawning were recorded.

6.18.5.132 Based on habitat assessment, Punder Gill was considered to have the potential to support fish of conservation value. However, fish surveys (electric fishing and eDNA) confirmed the absence of all species, as outlined in ES Appendix 6.19: Fish (Application Document 3.4). The electric fish survey retuned a nil catch and no fish DNA was recorded form the water sample collected.

6.18.5.133 No MoRPh survey was conducted at this site as condition was derived from adjacent site (WCP_24).

A

B

C

Plate 28: Punder Gill. Shallow fry habitat with a cobble and boulder-dominated substrate (A, B and C).

Stephen Bank to Carkin Moor

Unnamed Tributary of Holme Beck 9.2 (WCP_28)

6.18.5.134 The surveyed reach of Unnamed Tributary of Holme Beck 9.2 was characterised by fry habitat with a cobble-dominated substrate. The surveyed reach was at the top of the catchment, with only 130m of open channel from the source to the existing A66 culvert. This section of watercourse is considered disconnected to the wider catchment by a series of significant culverts including the existing A66 culvert which

extends downstream of the road under a residential dwelling and arable field.

6.18.5.135 Based on habitat assessment, the watercourse was considered unlikely to support fish of conservation value, this was confirmed by the absence of fish DNA in the water sample collected, as outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.136 A MoRPh survey was not conducted at this site due to the fact that the site was dry when the MoRPH survey was attempted.

A

B

Plate 29: Unnamed Tributary of Holme Beck 9.6 (WCP_28). (A), (B), (C).

Unnamed Tributary of Holme Beck 9.3 (WCP_29)

6.18.5.137 Unnamed Tributary of Holme Beck 9.3 was an ephemeral ditch and was considered unsuitable habitat for fish.

6.18.5.138 A MoRPh survey was not conducted at this site.

A

B

Plate 30: Unnamed Tributary of Holme Beck 9.3 (WCP_29). (A), (B), (C).

Mains Gill (WCP_30)

6.18.5.139 Mains Gill upstream of the A66 was characterised by fry habitat with a gravel-dominated substrate, interspersed with sections of shallow glide. This reach is considered disconnected to the wide catchment as a result of the existing A66 stepped culvert (Plate 31, B), which was considered a barrier to mitigation for all fish species, with the potential exception of eel.

6.18.5.140 Downstream of the existing A66 the channel was open before entering a pipe culvert (~300m in length) adjacent to Mains Gill farm shop. At the downstream end of the culvert the pipe is perched and is considered to be a barrier to migration for all species of fish (Plate 31, C).

6.18.5.141 Based on habitat assessment, the watercourse was considered unlikely to support fish of conservation value in the vicinity of the proposed crossing point. The site was dry when the electric fishing survey was undertaken; three-spined stickleback was the only fish species recorded in the eDNA sample, which was taken immediately upstream of the existing A66 culvert. Full details of the fish surveys are outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.142 The MoRPh survey of Mains Gill resulted in a river condition class of Moderate.

A

B

C

D

Plate 31: Mains Gill (WCP_30). (A), (B), (C).

Unnamed Tributary of Mains Gill 9.1 (WCP_31)

6.18.5.143 Unnamed Tributary of Mains Gill 9.1 was characterised by shallow fry habitat with a fine gravel-dominated substrate. The watercourse appears to have been historically straightened. Based on habitat assessment, the watercourse was considered unlikely to support fish of conservation value. Main Gills, which is downstream of this site was dry when the electric fishing survey was undertaken. Full details of the fish surveys are outlined in Appendix 6.19: Fish (Application Document 3.4).

6.18.5.144 No MoRPh survey was conducted at this site as condition was derived from adjacent site (WCP_30).

A

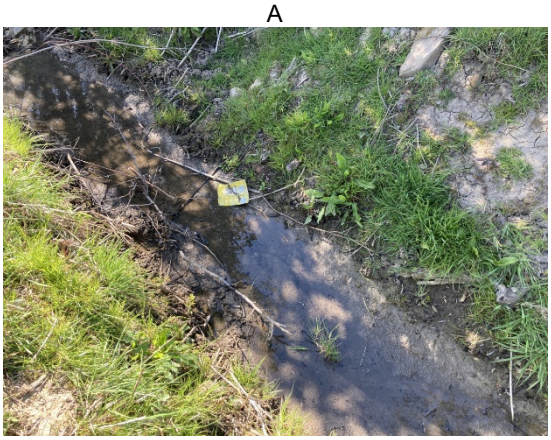
B

Plate 32: Unnamed Tributary of Mains Gill 9.1 (WCP_31). Straightened watercourse with gravel substrate (A and B).

Unnamed Tributary of Holme Beck 9.8 (WCP_32)

6.18.5.145 Unnamed Tributary of Holme Beck 9.8 was an ephemeral ditch with a silt-dominated substrate. The channel was choked with terrestrial vegetation and was considered unsuitable habitat for fish.

A



B

Plate 33: Unnamed Tributary of Holme Beck 9.8 (WCP_32). Channel choked with vegetation (A), silt-dominated substrate (B).

Unnamed Tributary of Holme Beck 9.2 (WCP_33 and WCP_34)

6.18.5.146 Unnamed Tributary of Holme Beck 9.2 has a deeply incised channel and was characterised by fry habitat with a fine gravel-dominated substrate. The existing A66 culvert is considered a barrier to migration for all fish species, with the exception of eel. In addition, a perched pipe culvert (approximately 275m downstream of the existing A66) was considered culvert a barrier to migration for all species, restricting access for fish to the existing A66 culvert.

6.18.5.147 Based on habitat assessment, Unnamed Tributary of Holme Beck 9.2 was considered to have the potential to support fish of conservation value. Surveys (electric fishing and eDNA) from downstream of the perched pipe culvert confirmed the presence bullhead; the electric fish survey retuned a nil catch, but bullhead DNA was returned from the water sample collected.

6.18.5.148 Despite its modified nature, the MoRPh survey of Unnamed Tributary of Holme Beck 9.2 resulted in a river condition class of Moderate.

A

B

C

Plate 34: Unnamed Tributary of Holme Beck 9.2 (WCP_33 and WCP_34). Existing A66 culvert (A), incised channel (B and C), perched pipe culvert considered a barrier to migration for all fish species (C).

6.18.6 Discussion

Habitats supporting protected and/or notable species

6.18.6.1 Based on the habitat assessment, numerous watercourses within the Order Limits were considered to have the potential to support fish of conservation value. This was later confirmed during fish surveys (electric fishing and eDNA), as outlined in Appendix 6.19: Fish (Application Document 3.4).

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

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

Mitigation and recommendations

6.18.6.4 For all habitats considered to support notable fish, mitigation is likely to be required if the watercourses are to be drained or diverted during construction of the Project. Mitigation is likely to include a fish translocation and the presence of an aquatic ecological clerk of works whilst works are being undertaken.

6.18.6.5 Where works are undertaken in close proximity to a watercourse, or at the top of slopes which lead down to 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.

6.18.6.6 It is an offence under the Salmon and Freshwater Fisheries Act 1975 (as amended) to wilfully disturb spawning fish of any species, or habitat in which spawn is likely to be present. Any in-channel works should therefore be timed to avoid spawning periods (1st October to 31st May for salmonid waters) where possible, with appropriate Environment Agency consents in place.

6.18.6.7 The design of new watercourse crossings should facilitate the free movement of fish under a variety of flow conditions and aim to maintain or enhanced aquatic habitats and the fluvial geomorphological processes that control their distribution and quality.

6.18.6.8 A number of pressures and potential enhancement opportunities were identified during surveys and included (from western schemes to eastern schemes):

- Thacka Beck (M6 Junction 40 to Kemplay Bank) is disconnected from the River Eamont under low flow conditions as the watercourse is significantly perched at the confluence with the River Eamont, which restricts fish migration between the two rivers

under low flows. Fish passage improvements could be made locally to address this.

- An undersized and failed culvert associated with a farm track was identified on Light Water, approximately 200m upstream of the River Eamont confluence (Penrith to Temple Sowerby). The culvert was blocked, creating a step under low flows; under high flows the velocity through the pipe could also restrict fish movement. Upgrading this culvert would improve fish passage and migration to and from the River Eamont.
- Poaching (sheep) of the banks was recorded along Light Water and Unnamed Tributary of River Eamont 3.3 (Penrith to Temple Sowerby). Improvements in riparian and instream habitat, as well as water quality improvements through reduced nutrients and fine sediment input, could be achieved through the addition of stockproof fencing and riparian planting.
- A riparian buffer strip and bankside vegetation was absent along sections of Trout Beck (Temple Sowerby to Appleby) within the River Eden SAC. There is potential to enhance the riparian zone through the addition of trees and a riparian buffer strip.
- A small weir on Unnamed Tributary of Mire Sike 6.12 (Appleby to Brough) was assessed as likely to be impassable by all fish species under normal flow conditions. Removal or mitigation of this weir has the potential to improve connectivity of habitats locally.
- Extensive poaching (sheep) was recorded along Eastfield Sike (Appleby to Brough). Improvements in riparian and instream habitat, as well as water quality improvements through reduced nutrients and fine sediment input, could be achieved through the addition of stockproof fencing and riparian planting.
- The existing A66 culvert on Lowgill Beck (Appleby to Brough), immediately downstream of the Woodend Sike and Yosgill Sike confluence, is considered to be a barrier for all fish species with the exception of eel under normal low flow conditions. Extending the baffles to create deeper water over the concrete bed upstream of the culvert and tying this into the natural riverbed will improve fish passage to and from Woodend Sike and Yosgill Sike.
- A 300m length of Mains Gill is within a culvert. There is potential to daylight this section by removing the pipe culvert reconnecting habitats locally. The value of this mitigation, in terms of fish, should be assessed noting that the existing A66 culvert presents a barrier to the upper reaches of Mains Gill and that this section is ephemeral.

6.18.7 References

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LEAFPACS2 surveys and associated EQR values were obtained from adjacent sites in Trout Beck.