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Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

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Chapter 9B: Aquatic Ecology

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Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

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9.1 Introduction

1) This chapter presents the approach and findings of the ecological impact assessment (EcIA) of potential impacts on nature conservation features arising from the Proposed Marl Hill Section on Aquatic Ecology (terrestrial ecology is covered in Chapter 9A (RVBC-MH-ES-009-01)).

2) The chapter begins by reviewing the legislation and planning policies relevant to Aquatic Ecology. The study area and methodology for the assessment are then outlined. The nature, value and sensitivity of the existing baseline environment are then identified before an assessment is made of the potential effects on the Aquatic Ecology for the Proposed Marl Hill Section. Mitigation measures have been proposed to avoid, reduce or offset any potential effects and these embedded mitigation measures have been taken into account in the assessment, which are mentioned in Chapter 3: Design Evolution & Development Description. Additional mitigation measures are further outlined in Section 9.7.

9.2 Scoping and Consultations

9.2.1 Scoping

3) An Ecology chapter was included within the EIA Scoping Report which was submitted to the relevant planning authorities for comment in November 2019. Scoping report responses were provided by each of the local authorities and these have been reviewed and incorporated into the assessment. An EIA Scoping Addendum was submitted to the relevant planning authorities in February 2021 to capture changes in the proposed development and EIA approach since November 2019. Scoping comments and responses are outlined in Section 4.3 in Chapter 4: EIA methodology.

9.2.2 Consultation

4) During the course of this assessment, consultation has taken place with relevant statutory and non-statutory consultees, stakeholders and third parties, through both correspondence and face-to-face meetings. This has been summarised in Section 4.3 in Chapter 4: EIA methodology.

9.3 Key Legislation and Guidance

5) Table 9.1 introduces relevant Aquatic Ecology legislation.

Table 9.1: Ecology Key Legislation and Guidance

Applicable Legislation	Description
International legislation	
The Conservation of Habitats and Species Regulations 2017 (as amended) Including by: The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019	*The Conservation of Natural Habitats and of the Wild Fauna and Flora (the Habitats Directive 1992, EC Directive 92/43/EEC) is implemented in England by the Conservation of Natural Habitats and Species (Amendment) (EU Exit) Regulations 2019.* Notably Regulation 9 requires every competent authority in the exercise of any of its functions to have regard to the requirements of the Habitats Directive. Provide for the designation and protection of a network of 'European Sites' (also termed Natura 2000), including Special Areas of Conservation (SAC) and Special Protection Areas (SPA). Regulation 43 creates the following offences relating to European Protected Species (EPS): • deliberately capture, injure or kill any wild animal of a European Protected Species;

Applicable Legislation	Description
	• deliberately disturb animals of any such species in such a way as to be likely to: o impair their ability to survive, breed, rear or nurture their young, hibernate or migrate, or o significantly affect the local distribution or abundance of the species to which they belong; • deliberately take or destroy the eggs of such an animal; or • damage or destroy a breeding site or resting place of such an animal. The Regulations also make it an offence (subject to exceptions) to deliberately pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 5. However, the actions listed above can be made lawful through the granting of licences (European Protected Species Licence) by the appropriate authorities (Natural England in England). Licences may be granted for a number of purposes, but only after the appropriate authority has determined that the regulations are satisfied.
Bonn Convention on the Conservation of Migratory Species of Wild Animals 1979	Pertains to migratory species and those that regularly cross the political boundaries of countries. Appendix I includes critically threatened species (those in danger of extinction). Appendix II lists migratory species whose conservation status is unfavourable and which would benefit from coordinated conservation measures. The obligations of the Convention are transposed in the UK into national law by means of the Wildlife and Countryside Act 1981 as amended, with the Countryside and Rights of Way Act 2000 strengthening the protection of certain species in England and Wales.
Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971	Intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Convention has several mechanisms to help Contracting Parties designate their most significant wetlands as Ramsar Sites, and to take the steps necessary to manage them effectively, maintaining their ecological character.
The Water Environment (England and Wales) Regulations 2017 (WFD Regulations)	The Water Framework Directive (WFD) Regulations require that Environmental Objectives are set for every groundwater and surface waterbody where the Regulations have jurisdiction (England and Wales), to enable them to reach “Good” status by 2015. Where achieving this is not possible (e.g. due to disproportionate costs) , less stringent targets are placed, enabling waterbodies to reach “Good” status either by 2021 or 2027
National legislation	
Natural Environment and Rural Communities (NERC) Act 2006	Imposes a duty on all public bodies to have regard for biodiversity conservation when carrying out their functions. This extends the duty imposed upon Government and Ministers by CROW. Section 41 provides for the establishment of a list of habitat and species that are considered to be of ‘*principal importance for the for the purpose of conserving biodiversity*’ for which biodiversity conservation should be prioritised. These are referred to hereafter as habitat of principal importance (HPI) and species of principal importance (SPI).
Wildlife and Countryside Act 1981 (as amended)	A number of species are fully protected under the Wildlife and Countryside Act 1981 (as amended), in particular those listed on Schedule 5 (animals).

Applicable Legislation	Description
Countryside and Rights of Way Act 2000 (CROW)	Part III deals specifically with wildlife protection and nature conservation, requiring Government Departments to have regard for the conservation of biodiversity, in accordance with the Convention on Biological Diversity, and that The Secretary of State publishes a list of living organisms and habitat types that are considered to be of principal importance in conserving biodiversity. It also amends and strengthens certain protections afforded by the WCA.
The Eel (England and Wales) Regulations 2009	The Eel (England and Wales) Regulations 2009 implement Council Regulation (EC) No 1100/2007 (OJ No L 248) establishing measures for the recovery of the stock of European eel, which has been classified as "Critically Endangered" on the International Union for Conservation of Nature (IUCN) Red List.

6) National and Local Planning Policies are covered in Chapter 5.

9.4 Assessment Methodology and Assessment Criteria

9.4.1 Assessment Methodology

7) The assessment of aquatic ecology features undertaken to inform this Environmental Statement comprises an EcIA undertaken in accordance with current best practice methods including the Guidelines for Ecological Impact Assessment in the United Kingdom1 (CIEEM, 2018). The method was agreed with relevant stakeholders as outlined above in Section 9B.2.2.

9.4.2 Establishing the Baseline

8) The desk study and field survey methodologies are presented in full in Appendices 9B.1 - 9B.3 for WFD communities and white clawed crayfish (*Austropotamobius pallipes*), otter (*Lutra lutra*), and water vole (*Arvicola amphibious*) respectively.

9) The detailed methodology and results of the ecological surveys undertaken to provide baseline data in support of the aquatic ecology EcIA are provided within Appendices 9B.1 to 9B.3:

- Appendix 9B.1: HARP Proposed Marl Hill Section - Aquatic ecology (WFD communities and white clawed crayfish) baseline information (RVBC-MH-TA-09-02-01)
- Appendix 9B.2: HARP Proposed Marl Hill Section - Otter baseline information (RVBC-MH-TA-09-02-02)
- Appendix 9B.3: HARP Proposed Marl Hill Section - Water vole ecology baseline information (RVBC-MH-TA-09-02-03)

9.4.2.1 Study Area

10) A study area has been defined for the aquatic ecology EcIA assessment as a 500 m buffer around all project development envelopes. This allowed for an understanding of the potential direct and /or indirect impacts of the activities associated with the Proposed Marl Hill Section.

11) Measuring approximately 18.9 km in length, three WFD surface water bodies were crossed by the study area. In addition, any WFD water bodies which lay immediately up- and downstream of the study area were also considered for assessment, to ensure that potentially wider reaching impacts of the Proposed Marl Hill Section were considered.

[1] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester. Updated September 2019.

12) The watercourses within the study area, the associated WFD waterbody, and the component of the Proposed Marl Hill Section with hydrological connectivity to the Bonstone Compound and Braddup Compound are shown in Table 9.2.

Table 9.2: Watercourse summary and associated scheme component.

Watercourse	WCID	WFD waterbody	Relevant scheme component
Bashall Brook	W556	Bashall Brook (GB112071065520)	Overflow
Unnamed Watercourse 430	W520	Bashall Brook (GB112071065520)	Access track (Braddup Compound)
Unnamed Watercourse 431	W521	Bashall Brook (GB112071065520)	Access track (Braddup Compound)
Unnamed Watercourse 433	W523	Bashall Brook (GB112071065520)	Access track (Braddup Compound)
Unnamed Watercourse 436	W526	Bashall Brook (GB112071065520)	Access track (Braddup Compound)
Sandy Ford Brook	W530	Bashall Brook (GB112071065520)	Braddup Compound and access track
Cow Hey Brook	W535	Bashall Brook (GB112071065520)	Braddup Compound
Unnamed Watercourse 444	W536	Bashall Brook (GB112071065520)	Braddup Compound
Unnamed Watercourse 463	W1663	Bashall Brook (GB112071065520)	Access track (Braddup Compound)
Unnamed Watercourse 388	W466	Hodder – conf Easington Bk to conf Ribble	Bonstone Compound (indirect impacts)
Unnamed Watercourse 402	W483	Hodder – conf Easington Bk to conf Ribble	Bonstone Compound

13) Upon further assessment of all watercourses within the study area there is justification to scope a number of these out based on the following reasons:

- catchment and/or watercourses located within the proposed tunnel envelope but not associated with any above ground construction, operational, commissioning and/or decommissioning activities;
- watercourse located out with the drainage catchment of the construction area and;
- although located within the study area, a number of watercourses are up gradient of proposed construction areas and are therefore unaffected by construction related activities.

14) In the Hodder (confluence Easington Beck to confluence Ribble) catchment Unnamed Watercourse 404 and Bonstone Brook are scoped out from the impact assessment related to the Bonstone Compound.

15) In the Bashall Brook catchment Unnamed Watercourse 447 is scoped out from the impact assessment in relation to the Braddup Compound:

9.4.3 Valuation of Aquatic Ecology Features

16) The level of importance of an ecological feature is determined within a defined geographical context (see Table 9.3); international and European, national, regional, metropolitan, county, vice-county or other local authority-wide area, River Basin District, estuarine system/coastal cell, or local[2]. When

[2] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester. Updated September 2019.

determining the importance of a defined site, habitat, ecosystem or species population, contextual information about legal status, distribution and abundance has been provided where available, including trends based on historical records. For example, a population of white clawed crayfish potentially affected by the proposed development could be considered important at a national level as these species are afforded statutory legal protection, are rare and their population is in decline.

Table 9.3: Geographic context of **ecological features**

Geographic importance	Criteria/examples
International and European	Internationally designated sites Features of internationally designated sites (SAC, SPA, Ramsar) Habitats or species listed on Annex I of the Habitats Directive. Habitat types that are considered priorities for conservation where over 1% of the international population or habitat extent is located within the affected area.
National	Designated or proposed SSSI, NNR, Marine Conservation Zones ('MCZ') and their qualifying features, some of which may depend on land outside the designation boundaries. Supporting habitats or populations which contribute to internationally designated sites (e.g. salmonid spawning habitat outside of a hydrologically connected SAC designated for Atlantic salmon) Species populations of national importance due to relative size, rarity or quality (including, but not exclusively, species listed on Schedules 5 or 8 of the W&C Act 1981 or occurring on UK Red Data lists).
Regional	Designated or proposed sites or species populations which exceed the County level designations but fall short of SSSI selection criteria. Over 1% of the regional population or habitat extent is located within the affected area.
Metropolitan, County, vice-county or other local authority-wide area or River Basin District	Designated or proposed County Wildlife Sites (CWS) or other Local Wildlife Site (LWS) and their qualifying features where they occur within the designation boundaries. A viable area of ASNW or local BAP habitat which meets County significant criteria or smaller areas that are essential to maintain the viability of the whole at a county level. Regularly occurring species populations (including, but not exclusively protected species, SPI or other species of conservation concern) or habitat areas of County (or District) importance due to relative size, rarity or quality.
	Habitats or species within a catchment that contribute to local population/extent within the catchment but do not form above 1% of the wider population or extent within the region.
Estuarine system/Coastal cell	Not applicable
Local.	Local Nature Reserves (LNR), other reserves owned/managed by e.g. Local Wildlife Trust, Local Authority, RSPB (unless also designated at a higher level) and other non-designated sites which may not meet any of the above criteria but which appreciably enrich the local ecological network.

Geographic importance	Criteria/examples
	Regularly occurring species populations which may include protected species, SPI, or County notable species which are of local significance due to relative size, quality or critical life stage supported. Features that do not meet any of the above criteria but which appreciably enrich the local ecological network, although these may themselves be common and widespread, such as small stream or rivers which support common species.
Less than local	Populations of common and widespread species or habitats without protection or conservation designation but which contribute to the diversity, ecological function, or interest of the immediate local area. Isolated and small fragments of HPI or populations of SPI (only where better representative examples of such habitats or species are common nearby).
Immediate site	Habitats of little or no ecological value or function

9.4.4 Assessment of Impact Significance

17) Effects of the Proposed Marl Hill Section on an ecological feature are assessed as significant within a geographical context; international, national, regional, county, district, local or site level, or not significant if the impact is not appreciable. A significant effect is an effect that either supports or undermines the integrity or conservation status of an ecological feature. The significant effect has been evaluated by considering the residual effect with mitigation in place.

18) The level of significance of an effect may not be the same as the level of importance of the feature. For example, a white clawed crayfish population identified within the study area may be assessed as important at a national level, however the effect on the species as a result of a proposed development may be significant only at a local level as the actual impact is temporary, minor in extent and mitigated through a specific working methodology designed to reduce the effect on the species.

19) To determine likely significance of impact, the following parameters are used as appropriate:

- impact type - direct or indirect, positive or negative.
- magnitude of impact – the 'amount' or intensity of an impact. This may sometimes be synonymous with 'extent' (see below) for certain receptors, such as habitats loss. For mortality it may be the number of individuals killed.
- extent of impact – the area over which the impact would be felt. It is noted that indirect effects such as habit fragmentation and pollution can affect a wider area of habitat, for example by limiting movement of fish to spawning, feeding and nursey areas present upstream of the crossing or by causing pollution downstream of the crossing.
- duration of impact – how long it would occur. CIEEM 2018 Guidelines suggest that ecological impact durations should be described in terms of ecological characteristics (e.g. species lifecycles/longevity) rather than human timeframes. Therefore, as an indicative guide for this assessment, for species receptors:
  - short-term is up to one season (e.g. migration, spawning, flowering and univoltine life cycles associated with fly life, etc.) – as a rough guide, 6 months to a year for fauna;
  - medium-term is up to one typical reproductive life-span (in the wild). This varies greatly depending on species, but generally anything from one year to 5 years as a rough guide for fauna; and
  - long-term is over several (species) generations.

- permanent is where no reasonable chance of recovery/restoration is evident within the foreseeable future.

20) The ecological construction impacts refer to the actions resulting in changes to an ecological feature during construction. The main construction activities, programme, establishment of the proposed development construction working area and reinstatement are described in Chapter 3 Design Evolution & Development Description (RVBC-MH-ES-003).

21) With regard to the duration of construction effects; a temporary effect is taken to mean within the scheme construction period with an additional five-year establishment period for new planting.

9.4.5 Assumptions and Limitations

22) Constraints and or limitation to survey methodology and establishment of the baseline of specific ecological receptors (including desk study data) are identified in Appendices 9B.1 – 9B.3.

23) Surveys were completed within appropriate seasons over appropriate periods in accordance with industry standards for the specific survey. Nevertheless, the surveys only identify habitats and plants present at the time of survey. Additionally, most species investigated are mobile and move into and out of areas over time. For these reasons a precautionary approach has been taken in the prediction of impacts. Where there is any doubt, except where specifically noted, species are assumed present and the impact is given the higher level of significance.

24) White clawed crayfish surveys were undertaken between the showers during the days when there was precipitation. The number of available refuges was a constraint in some surveys in 2019 where opportunities to search for crayfish were limited by the number of suitable refuges.

25) The water vole surveys were undertaken within the recommended period for water vole surveys, there were no seasonal constraints to the surveys. The weather conditions during the 2019 surveys were considered suitable for undertaking the survey, however the river conditions were considered sub-optimal.

26) No limitations were encountered during the water vole surveys.

9.5 Baseline Conditions

9.5.1 Information Sources

27) Information from the following sources have been used to inform this EcIA for the Proposed Marl Hill Section:

- Lancashire Environmental Records Network (LERN), including pre-existing records of aquatic species within 2 km of the Proposed Marl Hill Section
- Ecological datasets for the period 2009 – 2019 were obtained via the Environment Agency Ecology and Fish Data Explorer website
- Environment Agency Catchment Data Explorer to determine the extent and condition of WFD waterbodies and catchments.
- North West River Basin Management Plan (Environment Agency, 2018)
- Natural England habitat and species inventories including:

- land-based statutory designated wildlife sites in England, including Ramsar sites, proposed Ramsar sites, Special Areas of Conservation (SAC), Possible SACs, Special Protection Areas (SPA), Potential SPAs, Sites of Special Scientific Interest (SSSI), SSSI units, SSSI Impact Risk Zones (IRZ), National Nature Reserves (NNR) and Local Nature Reserves (LNR)

- European Protected Species Licences (EPSL)

- Ecology Survey Data Reports produced by Ricardo Energy and Environment for the Proposed Marl Hill Section:

- Technical Appendix 9B.1: HARP Proposed Marl Hill Section - Aquatic ecology (WFD communities and white clawed crayfish) baseline information (RVBC-MH-TA-009-02-001)
- Technical Appendix 9B.2: HARP Proposed Marl Hill Section - Otter baseline information (RVBC-MH-TA-009-02-002)
- Technical Appendix 9B.3: HARP Proposed Marl Hill Section - Water vole ecology baseline information (RVBC-MH-TA-009-02-003)

28) The desk study and field survey methodologies are presented in full in Technical Appendix 9B.1 for WFD communities and white clawed crayfish (*Austropotamobius pallipes*), Technical Appendix 9B.2 for otter (*Lutra lutra*), and Technical Appendix 9B.3 for water voles (*Arvicola amphibio*us).

9.5.1.1 Desk study methodology

29) The MAGIC website mapping tool[3] was used to help identify any statutory or non-statutory designated sites for freshwater fish, macrophyte and aquatic macroinvertebrate species within the Proposed Marl Hill Section study area.

30) Historic records of otter and water vole from within 2km of the proposed scheme were requested from the local environmental records centre Lancashire Environmental Records Network (LERN) in 2019.

31) Ecological datasets for the period 2009 – 2019 were obtained via the Environment Agency Ecology and Fish Data Explorer website[4], this data included:

- National Fish Populations Database (NFPD): Freshwater Fish Counts for all Species for all Areas and all years. NFPD consists of information collected from fisheries monitoring work on rivers and lakes. This monitoring work is undertaken by the Environment Agency.
- Data for freshwater and marine biological surveys for macroinvertebrates, diatoms and macrophytes in England. The Environment Agency undertakes freshwater and marine biological monitoring in England. Freshwater and Marine Biological Surveys England is a large dataset containing taxonomic level species data for biological surveys carried out in freshwater and marine environments. This archive is more commonly known as BIOSYS.

32) Additional data sources utilised during the desk study:

- Aerial photography (MAGIC, 2020);
- Environment Agency Catchment Data Explorer (CDE) (Environment Agency, 2019)[5];
- Designated areas (Natural England, 2020)[6]; and
- North West River Basin Management Plan (Environment Agency, 2018).

[3] Multi-Agency Geographical Information for the Countryside (MAGIC) [Accessed May 2020] https://magic.defra.gov.uk/MagicMap.aspx. Accessed May-July 2020.
[4] Environment Agency Ecology and Fish Data Explorer website https://environment.data.gov.uk/ecology-fish/. Accessed May-July 2020.
[5] Environment Agency Catchment Data Explorer website https://environment.data.gov.uk/catchment-planning/. Accessed May-July 2020.
[6] Natural England Designated Sites View website https://designatedsites.naturalengland.org.uk/SiteSearch.aspx. Accessed May-July 2020.

9.5.1.2 Field survey methodologies

33) The desk study data, consultations, and habitat suitability assessment undertaken as part of the Phase 1 Habitat survey were used to inform the scope of further ecological surveys including the distribution of the white clawed crayfish, otter and water vole populations within the zone of influence. Details of species-specific methodologies and the results of the surveys are summarised in Table 9.4 and detailed in Appendices 9B.1 (RVBC-MH-TA-009-02-01), 9B.2 (RVBC-MH-TA-009-02-02), and 9B.3 (RVBC-MH-TA-009-02-03) to Chapter 9B of the ES.

34) Watercourse Walk-over habitat surveys were undertaken in April and May 2020 for watercourses within and adjacent to the Bonstone Compound and Braddup Compound which contain the launch and receptor sites for the tunnelling works, open cut sections, compounds, and access tracks. The walk-over habitat survey methodology was based on the Environment Agency's 'Restoration of Riverine Salmon Habitats' guidance manual (Hendry & Cragg-Hine, 1997). The Hendry & Cragg-Hine method was developed to be used to inform habitat restoration, fish survey site selection, and fish population studies. Details of the watercourse walkover methodology and the results of the surveys are summarised in Table 9.4 and detailed in Appendix 9B.1.

Table 9.4: Surveys undertaken to inform the aquatic ecology impact assessment.

Protected Species Survey	Survey Extent	Date of Surveys
Otter	Presence/absence survey were undertaken at seven watercourses with suitable habitat to support otter within the zone of influence	October 2019 and April 2020
Water vole	Presence/absence survey were undertaken at nine watercourses with suitable habitat to support water vole within the zone of influence	October 2019 and April 2020
White clawed crayfish	White clawed crayfish manual search surveys were undertaken at five watercourses surrounding the Marl Hill compounds and access tracks.	April 2020
Watercourse walkover surveys	The watercourse walkover surveys were undertaken to obtain a detailed representation of the location, extent, and condition of habitat features within watercourses and the riparian zone. This was done by walking the riverbank of the selected survey stretch and entering the river when necessary. The habitats and features were present mapped. Incidental findings were also recorded during the walk-over surveys including Invasive Non-native Species (INNS), pollution sources, field boundaries, land use, and bank modifications.	April and May 2020

9.5.2 Designated Sites

35) The presence of sites designated for terrestrial ecology features and any associated impacts are discussed in Chapter 9A (RVBC-MH-TA-009-02-01). No statutory designated sites that are designated for aquatic habitats or species were identified within the zone of influence of the Proposed Marl Hill Section.

9.5.3 Macrophytes and Diatoms

36) The available baseline phytobenthos survey data from the Environment Agency monitoring sites associated with the Hodder (confluence Easington Beck to confluence Ribble) catchment WFD surface waterbodies are indicative of moderate to high nutrient conditions, while the moderate percentage motile taxa are indicative of elevated siltation and disturbed waters.

37) No baseline phytobenthos survey data from the Environment Agency monitoring sites associated with the Bashall Brook WFD were available. Bashall Brook is classified as 'Moderate' for combined macrophytes and diatoms in 2016, Cycle 2. Walkover surveys of the watercourses within the zone of influence identified several watercourses supported filamentous algae populations, ranging from 10-60% cover. Walkover surveys also indicated that several watercourses did not support macrophyte communities with significant percentage cover within the catchment.

38) Further details are provided in Appendix 9B.1.

9.5.4 Fish

39) The Environment Agency monitoring data from sites in the Hodder (confluence Easington Beck to confluence Ribble) catchment WFD waterbodies indicate the fish communities present within the watercourses are typical of fast flowing watercourses dominated by salmonid species and comprises brown trout (*Salmo trutta*), Atlantic salmon (*Salmo salar*), Bullhead (*Cottus gobio*), and European eel (*Anguilla anguilla*). Atlantic salmon, brown trout and bullhead have low tolerance for environmental disturbance. However due t the small size of eth potentially impacts watercourses and limited supporting habitat for designated and notable species the fish communities of Unnamed Watercourse 388 and Unnamed Watercourse 402 in eth River Hodder waterbody are considered to be of site value.

40) The Environment Agency monitoring data from sites in the Bashall Brook WFD waterbodies indicate the fish communities present within the watercourses are typical of fast flowing watercourses dominated by salmonid species and comprises brown trout, Atlantic salmon, bullhead, and European eel. Atlantic salmon, brown trout, and bullhead have low tolerance for environmental disturbance. However due to the small size of the potentially impacts watercourses and limited supporting habitat for designated and notable species the fish communities of Bashall brook and tributaries are considered to be of site to local value,

41) Further details are provided in Appendix 9B.1.

9.5.5 Aquatic Macroinvertebrates

42) The average LIFE score from Environment Agency monitoring sites in the Hodder – conf Easington Bk to conf Ribble GB112071065560 and Bashall Brook GB112071065520 indicates a community with a preference for moderate flow velocities and a high sensitivity to low flows. No notable or protected macroinvertebrate species were identified in the available Environment Agency monitoring data for either the River Hodder or Bashall Brook WFD waterbodies. The WHPT and WHPT average score per taxon (ASPT) data indicates that, in general, the macroinvertebrate community associated with these water bodies are representative of good to very good water quality with a number of pollution sensitive families present. Any impacts on water quality as a result of the implementation of the scheme could therefore result in changes in the macroinvertebrate community structure.

9.5.6 White Clawed Crayfish

43) Unnamed watercourse 402 in the River Hodder waterbody was assessed as being unsuitable for white clawed crayfish during the initial preliminary ecological appraisal and was scoped out of further surveys for white clawed crayfish. Unnamed Watercourse 388 was not surveyed, however white clawed crayfish are highly likely to be absent due to an absence of evidence of presence in wider catchment. No white clawed crayfish were identified during a survey of the downstream watercourse the River Hodder undertaken in April 2020.

44) No evidence of white clawed crayfish was identified in the five watercourses that were surveyed in the Bashall Brook catchment. Bashall Brook was considered to support suitable habitats for crayfish

although a weir at the upstream limit of the surveyed section was identified as a physical barrier to upstream white clawed crayfish movements if they were present. Unnamed watercourse 431, Unnamed watercourse 433, Unnamed watercourse 463 are small streams/ditches that appear to dry annually under low flows as such they are considered unsuitable to support white clawed crayfish. Unnamed watercourse 430, Sandy Ford Brook, and Cow Hey Brook were assessed as being unsuitable for white clawed crayfish during the initial preliminary ecological appraisal and were scoped out of further surveys for white clawed crayfish.

45) Although the surveys cannot confirm absence of white clawed crayfish and there remains the possibility that a few individuals could be present, it is highly likely that the survey effort employed, using three different survey techniques, would have established if a substantial population was present.

46) Further details are provided in Appendix 9B.1.

9.5.7 Otter

47) Otter field signs were identified at one (Bashall Brook) of the seven watercourses surveyed in the Bashall Book waterbody. Multiple field signs were identified at Bashall Brook which indicates this watercourse is used regularly by foraging otters. No otter holts or lie-up sites were identified. Due to the presence of otter within the Bashall Brook catchment and the large home range of otters it is likely that all suitable watercourses in the catchment are intermittently used by foraging otters. Cow Hey Brook was assessed as being unsuitable for otters during the preliminary ecological appraisal and was not subject to further surveys.

48) Unnamed Watercourse 402 was screened out for otter surveys during the preliminary ecological appraisal due a lack of suitable habitat to support otters. Unnamed Watercourse 388 was not surveyed but is assumed to be used intermittently by foraging otter due to their presence in the wider catchment as identified by the presence of otter on the River Hodder during surveys in April 2020.

49) Further details are provided in Appendix 9B.2.

9.5.8 Water Vole

50) No evidence of water vole was identified within the two watercourses surveyed within the Bashall Brook waterbody (Sandy Ford Brook and Unnamed Watercourse 430). Although potential burrows were identified at Unnamed Watercourse 430 given the absence of definitive evidence of water vole i.e. latrines, and the presence of bank vole at the site it is unlikely that water vole are present at the site.

51) Five watercourses in the Bashall Brook waterbody were assessed as being unsuitable for water vole during the preliminary ecological appraisal and were not subject to further surveys including: Unnamed watercourse 431, Unnamed watercourse 433, Cow Hey Brook, Unnamed watercourse 463, and Bashall Brook.

52) Unnamed watercourse 402 in the River Hodder waterbody was assessed as being unsuitable for water vole during the preliminary ecological appraisal and was not subject to further surveys.

53) Due to the absence of definitive evidence of water vole identified at watercourses within the Bashall Brook and River Hodder WFD waterbodies they are assumed to absent and are not considered further as part of this assessment.

54) Further details are provided in Appendix 9B.3.

9.5.9 Summary and Valuation of Ecological Receptors

55) A summary of the value of aquatic ecology receptors within each watercourse is shown in Table 9.5.

Table 9.5 Importance of **aquatic ecology receptors in each potentially impacted watercourse**

Watercourse	Unnamed Watercourse 388	Unnamed Watercourse 402	Bashall Brook	Unnamed Watercourse 430	Unnamed Watercourse 431	Unnamed Watercourse 433	Unnamed Watercourse 436	Sandy Ford Brook	Cow Hey Brook	Unnamed Watercourse 444	Unnamed Watercourse 463
WCID	W466	W483	W556	W520	W521	W523	W526	W530	W535	W536	W557
WFD waterbody	Hodder – conf Easington Bk to conf Ribble (GB112071065560)	Hodder – conf Easington Bk to conf Ribble (GB112071065560)	Bashall Brook (GB112071065520)	Bashall Brook (GB112071065520)	Bashall Brook (GB112071065520)	Bashall Brook (GB112071065520)	Bashall Brook (GB112071065520)	Bashall Brook (GB112071065520)	Bashall Brook (GB112071065520)	Bashall Brook (GB112071065520)	Bashall Brook (GB112071065520)
Designated sites	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site	Not applicable – watercourse is not within a designated site
Macrophytes	Immediate site	Immediate site	Local	Immediate site	Immediate site	Immediate site	Immediate site	Local	Local	Immediate site	Immediate site
Fish	Immediate site	Immediate site	Local	Immediate site	Immediate site	Immediate site	Immediate site	Local	Local	Immediate site	Immediate site
Macro-invertebrates	Immediate site	Immediate site	Local	Immediate site	Immediate site	Immediate site	Immediate site	Local	Local	Immediate site	Immediate site
White clawed crayfish	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present
Otter	Immediate site	Not applicable-not suitable	Local	Immediate site	Immediate site	Immediate site	Immediate site	Immediate site	Not applicable-not suitable	Immediate site	Immediate site
Water vole	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present	Not applicable-not present

9.6 Assessment of Likely Significant Effects

56) The impact assessments undertaken for the Environmental Statement consider the mitigation measures that have been incorporated into the proposed development design as well as best practice construction management activities which would be incorporated into the Construction Code of Practice (CCoP). These embedded mitigation measures to reduce / avoid development impacts include, for example, site drainage, sediment management, water quality monitoring etc.; the embedded mitigation is outlined in the relevant sections of the CCoP. The assessment methodology involved the identification of the nature conservation value of each potentially affected important aquatic ecology receptor using a geographical framework. Those that were found to have at least local value have been subject to systematic impact assessment.

57) The aquatic ecology features scoped out of the assessment of likely significant effects based on the available baseline information are summarised in Table 9.6.

Table 9.6: Features and Effects Scoped Out

Aquatic Ecology Feature	WFD waterbody	Value	Reason
Water vole (all watercourses)	Bashall Brook (GB112071065520)	Not applicable	Not present on any watercourses during baseline surveys no potential for adverse effects from enabling works
	Hodder - conf Easington Bk to conf Ribble (GB112071065560)		
Invasive non-native species	Bashall Brook (GB112071065520)	Not applicable	Terrestrial invasive species are assessed as part of the terrestrial ecology assessment in Chapter 9A (RVBC-MH-ES-009-01). No aquatic invasive species were identified within the red line boundary for the enabling works and the embedded mitigation in the CCoP are considered sufficient to prevent the introduction of aquatic or riparian invasive species.
	Hodder - conf Easington Bk to conf Ribble (GB112071065560)		
White clawed crayfish	Bashall Brook (GB112071065520)	Not applicable	Not present on any watercourses during baseline surveys no potential for adverse effects from enabling works
	Hodder - conf Easington Bk to conf Ribble (GB112071065560)		
Otter (Unnamed Watercourse 402)	Hodder - conf Easington Bk to conf Ribble (GB112071065560)	Not applicable	No habitats with suitability to support otter were identified during the initial survey. Screened out of the assessment due to absence of suitable habitats.
Otter (Cow Hey Brook)	Bashall Brook (GB112071065520)	Not applicable	No habitats with suitability to support otter were identified during the initial survey. Screened out of the assessment due to absence of suitable habitats.

9.6.1 Enabling Works Phase

58) The following section describes the effects of the Proposed Marl Hill Section on Aquatic Ecology during the enabling works phase.

59) The enabling phase of the Proposed Marl Hill Section is anticipated to last a duration of three months and would include the following activities that have potential to result in biophysical changes to important aquatic ecological features:

- Construction of site compounds (including vegetation removal, earthworks, provision for compound drainage and SuDS, and creating areas of hardstanding) to provide a working area for construction phase activities
- Construction of temporary access routes (including vegetation removal, earthworks, and associated drainage)
- Earthworks associated with the upgrade of an existing access route to the proposed Braddup Compound
- Construction of culverts for temporary access routes
- Fencing (comprising stock-proof post and wire around open-cut working areas and taller 'heras' type around compounds and lay-down areas).

60) Effects during the Enabling works phase have been summarised in Table 9.7. Likely nature conservation impacts include:

- Habitat loss (both temporary and permanent)
- Habitat fragmentation (temporary)
- Management changes to habitats (leading to habitat degradation)
- Disturbance of individuals or groups of animals
- Direct injury or mortality of individual animals and plants
- Pollution (a cause of habitat degradation and injury / mortality to species)
- Impacts from water level changes (a cause of habitat loss, degradation and / or injury / mortality to species)
- Invasive species (a cause of mortality or habitat degradation impacts).

61) These general types and sources of impact are described in generic terms below and then applied specifically to each valued receptor in Table 9.7.

9.6.1.1 Habitat Loss

62) Loss of habitat can directly affect the integrity of individual designated sites and the conservation status of notable habitats and associated protected or notable species if the overall area is reduced, thereby increasing its rarity. Habitat loss can also create a greater edge effect, whereby interior portions of a site or habitat, even if not directly impacted, may become more vulnerable to disturbance, physical damage or colonisation by non-native species.

63) Loss of notable habitat adjacent to a designated or otherwise important site (the importance may be for an associated species) may also adversely affect the integrity of that site or conservation status of the associated species if such habitat performs a supporting or buffering function that helps to preserve the qualifying habitats or species.

64) The upgrade to the access route to Braddup Compound would require the removal of riparian vegetation on Sandy Ford Brook, Unnamed Watercourse 430 and Unnamed Watercourse 463. The riparian vegetation at the proposed crossing location on Sandy Ford Brook included continuous trees at the proposed crossing location and may contain suitable habitats for otter holts or resting areas. However due to the absence of otter activity and small scale of vegetation loss this is not considered to be

significant for otter on Sandy Ford Brook. The riparian vegetation along Unnamed Watercourse 430 and Unnamed Watercourse 463 is of limited ecological value, and although the watercourse may be intermittently used by foraging otters no otter holts or resting places were identified at this location. Therefore, habitat loss from construction of the access track culvert and associated riparian vegetation clearance would not result in a significant impact for otter.

65) Culvert construction could cause compaction of bed substrate and disturbance of channel features on Sandy Ford Brook, Unnamed Watercourse 430, Unnamed Watercourse 431 and Unnamed Watercourse 433, and Unnamed Watercourse 463. The installation of the culvert would result in permanent loss of habitat within the footprint of the culvert for fish, macroinvertebrates, otter, and macrophytes in Sandy Ford Brook, Unnamed Watercourse 430, Unnamed Watercourse 431 and Unnamed Watercourse 433, and Unnamed Watercourse 463. The baseline ecology data for the watercourses indicates that they are of site value for macroinvertebrates, macrophytes, fish, and otter and have limited supporting habitat for nationally or internationally designated species. White clawed crayfish and water vole are absent from the watercourses. The impact of the temporary habitat loss would be restricted to the culvert footprint, low magnitude, and permanent. However due to the limited suitability of the watercourses and small scale of the habitat loss construction of the access track culverts for the Braddup Compound and associated habitat loss and geomorphological impacts would not result in a significant impact for macroinvertebrates, macrophytes, or fish within the tributaries of Bashall Brook.

66) Clearance of riparian vegetation would be required for the construction of the temporary outfalls on Unnamed Watercourse 402 and Cow Hey Brook. These watercourses were assessed as being unsuitable to support otter and have been screened out of the assessment. Outfall construction could disturb bed and bank features and cause compaction of bed substrate. Baseline data indicates that both Unnamed Watercourse 402 and cow Hey Brook are of immediate site value for macrophytes, macroinvertebrates, and fish. Impacts from habitat loss from construction of the outfall for the Bonstone Compound (Unnamed Watercourse 402) and Braddup compound (Cow Hey Brook) would not result in a significant impact for macroinvertebrates, macrophytes, or fish.

67) The temporary outfalls at the Bonstone and Braddup Compounds would be removed at the end of the construction phase. It is assumed that these areas would be returned to the baseline conditions with appropriate landscaping therefore impacts associated with habitat loss at these locations are considered to be temporary, medium term and reversible. The improvements to the existing track that would be used for access to the Braddup Compound would be permanent, additional vegetation removal outside of the footprint of the culvert to facilitate proposed earth works would be restored to the existing condition following completion for the construction phase.

9.6.1.2 Habitat Fragmentation

68) Habitat fragmentation generally results in a reduction in habitat connectivity and the increasing isolation of remaining areas. Fragmentation can occur through removal of habitat that creates a gap between two retained areas of habitat on either side. Such fragmentation becomes ecologically significant when species associated with that habitat type are then unable or unwilling to cross this gap, thus creating a barrier effect. Physical barriers to species movement such culverts can also cause habitat fragmentation within aquatic environment. Fragmentation can also sever a habitat's connection with the physical processes necessary to sustain that habitat. If the habitat reliant on such processes suffers degradation or loss as a result, then the habitat's conservation status is affected. The any impacts associated with fragmentation of habitats through installation of culverts and fencing in the enabling phase is considered to continue through to the end of the construction phase but will only be considered in the enabling phase to avoid duplication of potential impacts.

69) The construction of the culvert at Sandy Ford Brook, Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, and Unnamed Watercourse 463. for the access track to the Braddup Compound could result in habitat fragmentation if they prevent fish and otter from reaching upstream habitats. However, the watercourses are considered to be of limited value for foraging and commuting otters due to the small size, lack of connectivity to notable upstream food sources, and limited availability of suitable prey within the channel. The watercourses are likely to support limited populations

of non-migratory fish species due to the small size of the watercourses and presence of downstream barriers to movement on Unnamed Watercourse 430, Unnamed Watercourse 433, Sandy Ford Brook, and Unnamed Watercourse 463 Therefore, impacts to otter and fish from habitat fragmentation due to upgrades / installation of the access track culverts to the Braddup Compound would not result in a significant effect on the Bashall Brook tributaries.

70) The improvements to the existing track that would be used for access to the Braddup Compound would be permanent, although additional vegetation removal outside of the footprint of the culvert to facilitate proposed earth works would be restored to the existing condition following completion for the construction phase. Therefore, impacts associated with habitat loss at these locations are considered to be permanent.

9.6.1.3 Disturbance

71) Enabling works activities can result in increased levels of visual, noise, olfactory and vibration disturbance which could impact on designated sites, habitats or species. Disturbance could impact different habitats and species in different ways at different times of the year. For example, disturbance to fish would be most acute during the migratory or breeding period for migratory fish such as Atlantic salmon in Bashall Brook and tributaries.

72) Increased levels of disturbance are likely to increase the effects of habitat loss, fragmentation and isolation, with habitats beyond the red line boundary effectively 'lost' due to increases in human disturbance. Increased disturbance levels whilst creating the compounds and the access track could act as a barrier to dispersal for species sensitive to increased levels of disturbance. This would only be relevant to occasional use of the tributaries of Bashall Brook and in Unnamed Watercourse 402 in the river Hodder catchment adjacent to the Bonstone Compound. Lighting and noise during the creation of the Bonstone and Braddup construction Compounds without the embedded mitigation relating to direction and shielding of site lighting could disturb Atlantic salmon and eels in the Bashall Brook and River Hodder catchments. However, this is unlikely to occur to any significant extent for fish communities in either catchment due to the distance to the main rivers, barriers to movement (Bashall Brook tributaries), and limited suitability of the habitats for salmon adjacent to the compounds and access tracks. Therefore, impacts to fish communities within the Bashall Brook tributaries or Unnamed Watercourse 402 from noise and lighting during the enabling works would not result in a significant effect. Due to the distance to Bashall Brook from the Braddup compound, 0.85 km, no disturbance to the fish communities or otter are anticipated for the waterbody during the enabling works.

73) Disturbance of valued species is a risk associated with the proposed Marl Hill Section within certain areas during times of the year when species such as salmonid fish are breeding, or during the night when species like otters and salmonid fish are more active. Due to the proposed embedded mitigation in the CCoP related to lighting direction and shielding this is not considered to be significant for the fish communities or otter of the Bashall Brook tributaries or Unnamed Watercourse 402 and Unnamed Watercourse 388 in the River Hodder waterbody.

74) Due to the nature of the impact pathways from noise and lighting during the enabling works the impacts associated with habitat loss at these locations are considered to be temporary, medium term and reversible.

9.6.1.4 Direct Mortality or Injury

75) Enabling works for compounds and access track could represent a significant impact to protected or notable species. Direct mortality or injury could occur during enabling works through habitat clearance, by traffic (either site traffic or road traffic), or indirect mortality or injury through stress. Of particular concern for the Proposed Marl Hill Section are enabling works activities which may force species to leave favoured cover / habitat and navigate around or away from the disturbance where they become more prone to death or injury from predation or anthropogenic influences. This could occur for otter at the proposed culvert in Unnamed Watercourse 847, however as described above the potential for this impact to occur is low due to the low level of otter use on the watercourse and the limited habitat suitability

above the scheme. The proposed fencing along the access track and surrounding compounds further reduce the risk of collision from vehicles or plant during the enabling works.

76) Mortality or injury of valued species is a risk associated with the proposed Marl Hill Section both directly within the red line boundary, and indirectly if otters are displaced by disturbance and fragmentation into more hazardous environments. However, due to the intermittent use of the adjacent watercourses by otters the proposed embedded mitigation included as part of the CCoP relating to pre-clearance checks of riparian vegetation and installation of fencing around the access tracks and compounds is considered sufficient to mitigate the risk of adverse impacts. Therefore, impacts to otter of direct mortality during installation of the compounds, access track, and culverts would not result in a significant effect.

77) Due to the low likelihood of direct mortality of otter during the enabling works impacts are considered to be low magnitude but permanent if mortality was to occur.

9.6.1.5 Impacts from Pollution and Sedimentation

78) Pollution involves the introduction of a novel substance to the environment which causes harm to organisms (e.g. toxic chemicals such as fuel). It can also arise from an already-present substance that is increased to harmful levels or mobilised in air or water to become more of a risk to organisms (e.g. nutrients, sediments, etc.). The effects are generally seen through mortality, reduced reproduction and habitat degradation. Where pollution occurs in hydrologically-influenced habitats (such as rivers), there is a higher potential for pollution to impact a larger area.

79) The enabling works including topsoil stripping, vegetation clearance, and other related earthworks required to construct the access tracks and formation of the site compounds and associated laydown areas have potential to result in increased sediment laden runoff which may lead to degradations in surface water quality. In addition, increased coverage of impermeable areas associated with the creation of the access roads and compounds increases the potential for larger runoff volumes to carry suspended solids to nearby water features. During the enabling phase, several potential pollutants would be present, including oils, fuels, chemicals, cement, and wastewater. There is the potential for pollution to occur along the access tracks caused by spillages or within compounds. This may have a detrimental impact on the aquatic communities that are present should the pollutant reach a watercourse. The magnitude of any chemical pollution incident on surface water quality would be dependent on the volume of the spill/leak as well as conditions on site at the time, specifically related to how effectively the water environment would be able to buffer the discharge.

80) In the absence of mitigation, pollution is a key risk associated with the Proposed Marl Hill Section, in particular to the water environment, which includes a number of ecological receptors located adjacent to, crossed by, or downstream of the Proposed Marl Hill Section compounds and access tracks.

81) The tributaries of Bashall Brook that would be crossed by the access route to the Braddup Compound include Sandy Ford Brook, Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, and Unnamed Watercourse 463. These watercourses are likely to support macroinvertebrates and macrophytes that are sensitive to increased fine sediment input and siltation. The watercourses have limited supporting habitat for salmonid fish and bullhead however the fish communities are likely to be sensitive to increased sedimentation. The impacts on aquatic communities of the tributaries of Bashall Brook due to degradation of water quality during the enabling works would be medium magnitude, medium term, temporary and reversible. The impact of changes in supply of fine sediment would result in a significant effect on fish, macrophytes, and macroinvertebrate communities.

82) Cow Hey Brook would receive run off from the Braddup Compound via the temporary outfall, this watercourse is likely to support macroinvertebrates and macrophytes that are sensitive to increased fine sediment input and siltation. The watercourse has limited supporting habitat for salmonid fish and bullhead however the fish communities are likely to be sensitive to increased sedimentation or decreases in water quality. The impacts on aquatic communities of Cow Hey Brook due to degradation of water quality during the enabling works would be medium magnitude, medium term, temporary and reversible. The impact of changes in supply of fine sediment would result in a significant effect on fish, macrophytes, and macroinvertebrate communities in Cow Hey Brook.

83) The Water Environment assessment of the enabling works (Chapter 7 Section 7.6.1) identifies that impacts to water quality from sedimentation and chemical pollution in Bashall Brook during the enabling works would be negligible due to the overall distance from the site compound (1.9 km via Cow Hey Brook) and the cumulative dilution capacity of the tributaries and the Bashall Brook itself. Therefore, impacts to macrophytes, macroinvertebrates, fish and otter in Bashall Brook would not be significant.

84) Unnamed Watercourse 402 would receive run off from the Bonstone Compound via the temporary outfall, this watercourse is likely to support macroinvertebrates and macrophytes that are sensitive to increased fine sediment input and siltation. The watercourse has limited supporting habitat for salmonid fish and bullhead however the fish communities are likely to be sensitive to increased sedimentation or decreases in water quality. The impacts on aquatic communities of Unnamed Watercourse 402 due to degradation of water quality during the enabling works would be medium magnitude, medium term, temporary and reversible. The impact of changes in supply of fine sediment would result in a significant effect on fish, macrophytes, and macroinvertebrate communities in Unnamed Watercourse 402.

85) Impacts from increased sedimentation and a reduction in water quality during site clearance, installation of culverts, access track and compounds at all watercourses are considered to be temporary, medium term and reversible following cessation of enabling works.

9.6.1.6 Impacts from Water Level Changes

86) Changes in water levels and flow regimes caused by changes to site drainage during enabling works can affect the quality and quantity of water-dependant habitats and associated species. Therefore, the effects are normally manifested as some form of habitat degradation (such as changes geomorphological processes in rivers) or habitat loss (i.e. reduction in wetted width) and can affect the conservation status of habitats or dependent species. Hydrological changes can arise from causes located within or outside of the scheme boundary during the enabling works process. Hydrological change is a risk associated with the Proposed Marl Hill Section, as its zone of influence includes a number of aquatic ecological receptors sensitive to changes in hydrology and includes discharges from site drainage.

87) Drainage (construction and surface water run-off) from Bonstone Compound would discharge into Unnamed Watercourse 402 through a temporary outfall, the potential impacts of installation of the outfall are assessed above. Drainage (construction and surface water run-off) from Braddup Compound would discharge into Cow Hey Brook through an existing outfall. The operation of the temporary outfall at Unnamed Watercourse 402 and Cow Hey Brook and potential changes to water level are assessed as part of the Construction Phase assessment.

9.6.1.7 Invasive Species

88) Enabling works activity may cause or facilitate the spread of (normally non-native) invasive species. Invasive plant species can colonise new areas of land from seeds contained in the parent plant or the soil, or from fragments of living root or stem. Such reproductive materials can be inadvertently transferred from enabling works areas outside of the scheme boundary if they adhere to vehicles, machinery, tools or clothing. They can also be inadvertently transferred in waste. Seeds and plant fragments can also be transported by watercourses and surface water runoff to areas not directly impacted by the work but with a hydrological connection.

89) Once present, invasive species can spread rapidly and out-compete the native vegetation that characterises the notable non-designated habitat. Habitat loss and fragmentation can also encourage the colonisation of invasive species by providing a pathway of suitable environmental conditions for invasive species to move closer to areas currently free from these species, this could affect the conservation status of a site, habitat, or species.

90) Terrestrial invasive species are assessed as part of the terrestrial ecology assessment in Chapter 9A. No aquatic invasive species were identified within the red line boundary for the enabling works and the embedded mitigation in the CCoP are considered sufficient to prevent the introduction of aquatic or riparian invasive species.

9.6.1.8 Summary of Enabling Works Effects

91) The assessment methodology involved the identification of the nature conservation value of each potentially affected important aquatic ecology receptor using a geographical framework. Those that were found to have at least local value have been subject to systematic impact assessment. A summary of the impact assessment of the enabling works phase effects prior to specific mitigation is provided below in Table 9.7.

Table 9.7 Summary of Enabling Phase Effects

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Macrophytes (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Direct loss through installation of temporary outfall	Direct, negative, low magnitude, temporary (medium term), reversible	Not significant
			Pollution and increased sedimentation from creation of Bonstone construction compound, access track, and site drainage.	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Fish (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Direct loss through installation of temporary outfall	Direct, negative, low magnitude, temporary (medium term), reversible	Not significant
			Pollution and increased sedimentation from creation of Bonstone construction compound, access track, and site drainage.	Indirect (from upstream works), negative, medium magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Significant Adverse Local
			Noise and light disturbance during enabling works activities	Indirect, negative, low magnitude, temporary (medium term), reversible	Not significant
Aquatic macroinvertebrates (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Direct loss through installation of temporary outfall	Direct, negative, low magnitude, temporary (medium term), reversible	Not significant
			Pollution and increased sedimentation from creation of Bonstone construction compound, access track, and site drainage.	Indirect (from upstream works), negative, medium magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Significant Adverse Local

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Otter (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Direct loss through installation of temporary outfall	Direct, negative, low magnitude, temporary (medium term), reversible	Not significant
			Disturbance during watercourse crossings of access track, lighting, and noise	Indirect, negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Degradation of prey resource due to sedimentation and reduction in water quality	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Noise and light disturbance during enabling works activities	Indirect, negative, low magnitude, temporary (medium term), reversible	Not significant
Macrophytes (Bashall Brook)	Bashall Brook	Local	Downstream pollution and increased sedimentation from creation of the Braddup construction compound, access track, and site drainage.	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant
Fish (Bashall Brook)	Bashall Brook	Local	Downstream pollution and increased sedimentation from creation of the Braddup construction compound, access track, and site drainage.	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant
Aquatic macroinvertebrates (Bashall Brook)	Bashall Brook	Local	Downstream pollution and increased sedimentation from creation of the Braddup construction compound, access track, and site drainage.	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Otter (Bashall Brook)	Bashall Brook	Local	Degradation of habitat through pollution	Indirect (from upstream works), negative, Low magnitude, temporary (up to medium term), reversible	Not significant
Macrophytes (Bashall Brook tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Bashall Brook	Immediate site	Direct loss of habitat through culverting watercourses for access track to Braddup Compound (Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, Unnamed Watercourse 436, and Sandy Ford Brook,)	Direct, negative, low magnitude, permanent	Not significant
			Direct loss through installation of temporary outfall in Cow Hey Brook	Direct, negative, low magnitude, temporary (medium term), reversible	Not significant
			Pollution and increased sedimentation from creation of Braddup construction compound, access track, and site drainage.	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Fish (Bashall Brook tributaries: Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Bashall Brook	Immediate site	Direct loss of habitat through culverting watercourses for access track to Braddup Compound (Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, Unnamed Watercourse 436, and Sandy Ford Brook,)	Direct, negative, low magnitude, permanent	Not significant
			Direct loss through installation of temporary outfall in Cow Hey Brook	Direct, negative, low magnitude, temporary (medium term), reversible	Not significant

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
			Pollution and increased sedimentation from creation of Braddup construction compound, access track, and site drainage.	Direct, negative, medium magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Significant Adverse Immediate site
			Habitat fragmentation through culverting of watercourses for access track to Braddup Compound (Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, Unnamed Watercourse 436, and Sandy Ford Brook,)	Direct, negative, low magnitude, temporary (medium term), reversible	Not significant
			Noise and light disturbance during enabling works activities	Indirect, negative, low magnitude, temporary (medium term), reversible	Not significant
Aquatic macroinvertebrates (Bashall Brook tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Bashall Brook	Immediate site	Direct loss of habitat through culverting watercourses for access track to Braddup Compound (Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, Unnamed Watercourse 436, and Sandy Ford Brook,)	Direct, negative, low magnitude, permanent	Not significant
			Direct loss through installation of temporary outfall in Cow Hey Brook	Direct, negative, low magnitude, temporary (medium term), reversible	Not significant
			Pollution and increased sedimentation from creation of Braddup construction compound, access track, and site drainage.	Direct, negative, medium magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Significant Adverse Immediate site

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Otter (Bashall Brook tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Bashall Brook	Immediate site	Direct loss of habitat through culverting watercourses for access track to Braddup Compound (Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, Unnamed Watercourse 436, and Sandy Ford Brook,)	Direct, negative, low magnitude, permanent	Not significant
			Temporary habitat fragmentation from culverting of watercourses and fencing for access track to Braddup Compound (Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, Unnamed Watercourse 436, and Sandy Ford Brook,)	Direct, negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Disturbance during enabling works from lighting and noise	Indirect, negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Degradation of prey resource due to sedimentation and reduction in water quality	Indirect (impacts on prey resource), negative, low magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Not significant

9.6.2 Construction Phase

92) The following section describes the effects of the Proposed Marl Hill Section on Aquatic Ecology during the construction phase.

93) Tunnelling activities are anticipated to continue for approximately 18 months (Q2 2024 to Q3 2025) and habitat reinstatement approximately 12 months, commencing after completion of the commissioning phase (timing of which is dependent on outage periods, which may be as late as 2029).

94) Activities anticipated during the construction phase which have the potential to give rise to significant ecological effects are summarised as follows:

- Operation of the Braddup Compound, the launch facility (above ground activities may require 24 hrs per working day once tunnelling is underway) with activities including delivery and storage of tunnel sections, operation and storage of plant, machinery and equipment, use and access to welfare facilities and offices, although vehicle movements to and from site would be restricted outside normal construction site working hours
- Storage and treatment of tunnel arisings at the Braddup Compound before removal from site to Waddington Fell Quarry via the strategic road network) and storage of other stockpiles
- Operation of the Bonstone Compound, the reception facility (recovery and dismantling of tunnel boring machine (TBM) requiring temporary construction works of a smaller scale and duration compared with the Braddup Compound)
- Vehicle movements and traffic management along temporary haulage routes between strategic road network and the Braddup and Bonstone Compounds and lay-down areas, including but not limited to the delivery and removal of plant, machinery or equipment and removal of tunnel arisings
- Open cut sections comprising multi-line siphon (MLS) connections between new tunnel and existing aqueduct
- De-watering operations (temporary attenuation and discharge of surface waters)
- Operation of power supply comprising generators, required 24 hr a day
- Operation of artificial lighting for safety reasons and where 24 hr working is required (lights would be located to minimise light spill towards sensitive locations)
- Construction of permanent new valve house buildings (single storey approximately 11 m wide and 12 m long) and associated maintenance tracks
- Construction of permanent new air valves provided at high points on the aqueduct to release trapped air, installed into buried chambers with localised ground raising and grass banking around an access cover
- Decommissioning of existing aqueduct sections including flushing out and subsequent discharge of waters used (effects discussed under decommissioning phase)
- Removal of all temporary surfaces and structures
- Habitat reinstatement, including installation of a slab cover over the tunnel shafts and backfilling for habitat reinstatement above (excepting for access covers). Methods and timing of habitat reinstatement would vary according to the target habitat and would be agreed with the LPA.

95) Likely nature conservation impacts in the absence of mitigation include:

- Management changes to habitats (leading to habitat degradation)
- Disturbance of individuals or groups of animals
- Direct injury or mortality of individual animals and plants
- Pollution (a cause of habitat degradation and injury / mortality to species)

- Impacts from water level changes (a cause of habitat loss, degradation and/or injury/mortality to species)
- Invasive species (a cause of mortality or habitat degradation impacts).

96) These general types and sources of impact are described in generic terms below and then applied specifically to each valued receptor in Table 9.8.

9.6.2.1 Habitat Fragmentation

97) Potential impacts to aquatic ecology receptors from fragmentation of habitats during the use of the construction compounds and site access have been assessed as part of the enabling phase impact assessment in Section 9.6.1.

9.6.2.2 Disturbance

98) Construction activities can result in increased levels of visual, noise, olfactory and vibration disturbance which could impact on designated sites, habitats or species. Disturbance would impact different sites, habitats and species in different ways at different times of the year. For example, disturbance to fish would be most acute during the migratory or breeding period for migratory fish such as Atlantic salmon.

99) Increased levels of disturbance are likely to increase the effects of habitat loss, fragmentation and isolation, with habitats beyond the red line boundary effectively 'lost' due to increases in human disturbance. Increased disturbance levels within the construction corridor can also act as a barrier to dispersal for species sensitive to increased levels of disturbance.

100) Disturbance of valued species is a risk associated with the Proposed Marl Hill Section within certain areas during times of year when species such as salmonid fish are breeding, or during the night when species like otters and salmonid fish are more active. Due to the distance to the Bashall Brook from the Braddup Compound and the proposed embedded mitigation in the CCoP related to lighting direction and shielding this is not considered to be significant for salmonid fish or otter in Bashall Brook.

101) Due to the intermittent use of the Bashall Brook tributaries or Unnamed Watercourse 402 by otter or migratory fish, presence of barriers to movement for fish species, and the proposed embedded mitigation in the CCoP related to lighting direction and shielding this is not considered to be significant for salmonid fish or otter in Unnamed Watercourse 402 or the tributaries of Bashall Brook.

102) Due to the nature of the impact pathways from noise and lighting and cessation of the lighting and activity at the site following removal of the compounds and access track the impacts associated with habitat loss at these locations are considered to be temporary, medium term, and reversible.

9.6.2.3 Direct Mortality or Injury

103) Construction of the Proposed Marl Hill Section could represent a significant impact to protected or notable species. Direct mortality or injury could occur during construction through habitat clearance, by traffic (either site traffic or road traffic), or indirect mortality or injury through stress. Of particular concern for this Proposed Marl Hill Section is where particular construction activities may force species to leave favoured cover/habitat and navigate around or away from the disturbance where they become more prone to death or injury from predation or anthropogenic influences.

104) Mortality or injury of valued species is a risk associated with the Proposed Marl Hill Section both directly within the red line boundary, and indirectly if otters are displaced by disturbance and fragmentation into more hazardous environments. However, due to the intermittent use of the adjacent watercourses by otters and the proposed embedded mitigation included as part of the CCoP relating to pre-clearance check for riparian vegetation and installation of fencing around the access tracks and compounds is considered sufficient to mitigate the risk of adverse impacts.

105) Due to the low likelihood of direct mortality of otter during the construction phase activities impacts are considered to be low magnitude but permanent if mortality was to occur.

9.6.2.4 Water quality impacts from pollution

106) Pollution involves the introduction of a novel substance to the environment which causes harm to organisms (e.g. toxic chemicals such as fuel). It can also arise from an already-present substance that is increased to harmful levels or mobilised in air or water to become more of a risk to organisms (e.g. nutrients, sediments, etc.). Where such organisms are species that are key features of a designated site or habitat, the site's integrity or habitat's conservation status can be affected. The effects are generally seen through mortality, reduced reproduction, and habitat degradation. Pollution can arise from within or outside of the boundary of designated site, notable habitat, or habitats supporting designated or notable species. Where pollution occurs in hydrologically-influenced habitats (such as rivers), there is a higher potential for pollution to impact a larger area. The majority of these potential pollutants would be located or stored within the construction compounds. In addition, there is the potential for chemical pollution caused by spillages along the access tracks and construction areas. The CCoP provides an overview of embedded mitigation measures related to chemical pollution which have been accounted for within this assessment (Sections 4.1.8-10 of the CCoP).

107) The construction of shafts and (minimal) open cut sections of tunnel at both TBM entry (Braddup Compound) and exit (Bonstone Compound) points are activities which have the potential to create sediment which could enter watercourses. Chapter 7 Water Environment, Section 7.6.2: Construction Phase outlines the potential impact pathways for surface water quality from sediment sources during construction activities. Potential sources of increased sediments in watercourses include use of the access track to the Braddup Compound, use of the Construction Compounds, excavation of tunnel shafts, open cut pipe connection, storage of excavated materials, removal of access track and culvert, and habitat reinstatement.

108) Embedded mitigation outlined in relevant sections of CCoP (Sections 4.1.7 outlining the controls for the production of fine sediment and 7.4-7.8 outlining soil resources on site, including soil stripping, storage of soil, excavations from soil mounds, and soil reinstatement and reuse) would aim to minimise impacts of sediment laden runoff associated with soil storage, top soil stripping, and soil reinstatement and reuse.

109) There is potential for discharge of sediments during use of the access track and reinstatement / demobilisation activities associated with the culverts of Unnamed Watercourse 430, Unnamed Watercourse 431, Unnamed Watercourse 433, Unnamed Watercourse 436, and Sandy Ford Brook. Following removal of the culvert the banks structure and bed substrate would be reinstated to pre-construction conditions with a sensitivity to bed and bank disturbance. The aquatic features of the Bashall Brook tributaries are associated with coarse sediment and fast flowing water and are considered sensitive to fine sediment deposition which could reduce habitat suitability or breeding success through smothering eggs or young such as for salmonid spawning gravels or bullhead breeding habitat under coarse sediment. A reduction in the quality or extent of suitable breeding habitat could reduce the abundance or distribution of sensitive species within the catchment. Cow Hey Brook would receive run off from the Braddup Compound via the temporary outfall, this watercourse is likely to support macroinvertebrates and macrophytes that are sensitive to increased fine sediment input and siltation. The watercourse has limited supporting habitat for salmonid fish and bullhead however the fish communities are likely to be sensitive to increased sedimentation or decreases in water quality. The impacts on aquatic communities of Cow Hey Brook due to degradation of water quality during the enabling works would be medium magnitude, medium term, temporary and reversible. The impact of changes in supply of fine sediment would result in a significant effect on fish, macrophytes, and macroinvertebrate communities in Cow Hey Brook.

110) Although the scale of the enabling and construction works and the multiple sources capable of producing sediment laden runoff has potential for medium magnitude effects for the aquatic ecology features in the receiving waterbodies this would be minimised by the embedded mitigation for sediment control outlined in the CCoP. The construction phase works within the Braddup Compound would result in a significant impact at the site scale due to associated water quality impacts from increased sedimentation for macroinvertebrates, macrophytes, and fish in Cow Hey Brook, Sandy Ford Brook, and Unnamed Watercourse 463. The impacts from water quality degradation from increased sedimentation is not considered significant for Unnamed Watercourse 430, Unnamed Watercourse 431, and Unnamed

Watercourse 433 due to the lower sensitivity of the aquatic receptors and low magnitude of effect identified by the Water Environment surface water quality assessment (Chapter 7 Section 7.6.2).

111) The Water Environment assessment of the enabling works (Chapter 7 Section 7.6.2) identifies that impacts to water quality from sedimentation and chemical pollution in Bashall Brook during the construction works would be negligible due to the overall distance from the site compound (1.9 km via Cow Hey Brook) and the cumulative dilution capacity of the tributaries and the Bashall Brook itself. Therefore, in the absence of significant water quality impacts, impacts to macrophytes, macroinvertebrates, fish and otter in Bashall Brook would not be significant.

112) Unnamed Watercourse 402/388 would receive run off from the Bonstone Compound via the temporary outfall, this watercourse is likely to support macroinvertebrates and macrophytes that are sensitive to increased fine sediment input and siltation. The watercourse has limited supporting habitat for salmonid fish and bullhead however the fish communities are likely to be sensitive to increased sedimentation or decreases in water quality. The impacts on aquatic communities of Unnamed Watercourse 402 due to degradation of water quality. The impact of changes in supply of fine sediment and / or contaminants would result in a significant effect at the site scale on fish, macrophytes, and macroinvertebrate communities in Unnamed Watercourse 402.

113) The compounds would be removed at the end of the construction phase. It is assumed that these areas would be returned to the baseline conditions with appropriate landscaping therefore impacts associated with reduction in water quality and increased sedimentation at these locations are considered to be temporary, medium term and reversible. The access road at the Braddup compound is an existing track and upgrades to the tracks for the works would be permanent.

9.6.2.5 Impacts from Water Level Changes

114) Changes in water levels and flow regimes caused by changes to site drainage during construction can affect the quality and quantity of water-dependant habitats and associated species. Therefore, the effects are normally manifested as some form of habitat degradation (such as changes in geomorphological processes in rivers) or habitat loss and can affect the conservation status of habitats or dependent species. Hydrological changes can arise from causes located within or outside of the scheme boundary during the construction process.

115) Hydrological change is a risk associated with the Proposed Marl Hill Section, as its zone of influence includes a number of aquatic ecological receptors and includes discharges from site drainage to watercourses adjacent to the construction compounds.

116) The Water Environment Chapter 7 Section 7.6.2 identifies that drainage (construction and surface water run-off) from Bonstone Compound into Unnamed Watercourse 402 through a temporary outfall, would be attenuated to 6 l/s, which is less than would be encountered under average baseline conditions. Therefore, as flow from the outfall is within the current baseline flow rate for Unnamed Watercourse 402 there is no potential impact to macrophytes, fish, macroinvertebrate communities or otter as a result of hydrological changes from the proposed discharge.

117) The Water Environment Chapter 7 Section 7.6.2 assessment identifies that drainage (construction and surface water run-off) from Braddup Compound discharged into Sandy Ford Brook through a temporary outfall, would be attenuated to 9 l/s, which is less than would be encountered under average baseline conditions. Therefore, as flow from the outfall is within the current baseline flow rate for Cow Hey Brook there is no potential impact to macrophytes, fish, macroinvertebrate communities or otter as a result of hydrological changes from the proposed discharge.

118) The culvert crossings for the access route to Braddup Compound would be extensions to the existing culverts. It is assumed that the culvert extensions would have the same cross sectional area and shape as the existing culverts and would have a minimal impact on flow. Therefore, the effect of changes in flow on the aquatic ecology receptors of Sandy Ford Brook, Unnamed Watercourse 430, Unnamed Watercourse 463, Unnamed Watercourse 431, and Unnamed Watercourse 433 would not be significant.

119) The temporary culvert and compounds would be removed at the end of the construction phase. It is assumed that these areas would be returned to the baseline conditions with appropriate landscaping

therefore impacts associated with hydrological changes at these locations are considered to be temporary, medium term and reversible. The extensions to culverts on the Braddup Compound access track are permanent so any identified impacts would be permanent.

9.6.2.6 Invasive Species

120) Construction activity may cause or facilitate the spread of (normally non-native) invasive species. Invasive plant species can colonise new areas of land from seeds contained in the parent plant or the soil, or from fragments of living root or stem. Such reproductive materials can be inadvertently transferred from construction areas outside of the scheme boundary if they adhere to vehicles, machinery, tools or clothing. They can also be inadvertently transferred in waste. Seeds and plant fragments can also be transported by watercourses and surface water runoff to areas not directly impacted by the work but with a hydrological connection.

121) Once present, invasive species can spread rapidly and out-compete the native vegetation that characterises the notable non-designated habitat. Habitat loss and fragmentation can also encourage the colonisation of invasive species by providing a pathway of suitable environmental conditions for invasive species to move closer to areas currently free from these species, this could affect the conservation status of a site, habitat or species.

122) Terrestrial invasive species are assessed as part of the terrestrial ecology assessment in Chapter 9A (document reference: RVBC-MH-ES-009-01). No aquatic invasive species were identified within the red line boundary for the enabling works and the embedded mitigation in the CCoP are considered sufficient to prevent the introduction of aquatic or riparian invasive species. No impacts are anticipated for aquatic ecology receptors within the Bashall Brook and River Hodder waterbodies due to introduction or spread of aquatic or riparian invasive non-native species during the construction phase.

9.6.2.7 Summary of Construction Effects

123) The assessment methodology involved the identification of the nature conservation value of each potentially affected important aquatic ecology receptor using a geographical framework. Those that were found to have at least local value have been subject to systematic impact assessment. The findings of the construction phase effects prior to mitigation is provided below in Table 9.8.

Table 9.8: Summary of Construction Phase Effects

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Macrophytes (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Hydrological impacts from discharge of site drainage and changes to flow during construction and reinstatement of banks.	Negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Pollution and increased sedimentation from use of Bonstone construction compound, access track, and site drainage.	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Fish (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Hydrological impacts from discharge of site drainage and changes to flow during construction and reinstatement of banks.	Negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Pollution and increased sedimentation from use of Bonstone construction compound, access track, and site drainage.	Indirect (from upstream works), negative, medium magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Significant Adverse Local
			Noise and light disturbance during construction works activities	Indirect, negative, low magnitude, temporary (medium term), reversible	Not significant
Aquatic macroinvertebrates (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Hydrological impacts from discharge of site drainage and changes to flow during construction and reinstatement of banks.	Negative, low magnitude, temporary (up to medium term), reversible	Not significant

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
			Pollution and increased sedimentation from use of Bonstone construction compound, access track, and site drainage.	Indirect (from upstream works), negative, medium magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Significant Adverse Local
Otter (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Disturbance during watercourse crossings of access track, lighting, and noise	Indirect, negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Degradation of prey resource due to sedimentation and reduction in water quality	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Noise and light disturbance during construction works activities	Indirect, negative, low magnitude, temporary (medium term), reversible	Not significant
Macrophytes (Bashall Brook)	Bashall Brook	Local	Downstream pollution and increased sedimentation from use of the Braddup construction compound, access track, and site drainage.	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant
Fish (Bashall Brook)	Bashall Brook	Local	Downstream pollution and increased sedimentation from use of the Braddup construction compound, access track, and site drainage.	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant
Aquatic macroinvertebrates (Bashall Brook)	Bashall Brook	Local	Downstream pollution and increased sedimentation from use of the Braddup construction	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
			compound, access track, and site drainage.		
Otter (Bashall Brook)	Bashall Brook	Local	Degradation of habitat through pollution	Indirect (from upstream works), negative, Low magnitude, temporary (up to medium term), reversible	Not significant
Macrophytes (Bashall Brook tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Bashall Brook	Immediate site	Hydrological impacts from discharge of site drainage (Cow Hey Brook) and changes to flow from presence of culverts during construction and reinstatement of banks.	Negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Pollution and increased sedimentation from use of Braddup construction compound, access track, and site drainage.	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Fish (Bashall Brook tributaries: Unnamed Watercourse 430, Unnamed Watercourse 431,	Bashall Brook	Immediate site	Hydrological impacts from discharge of site drainage (Cow Hey Brook) and changes to flow from presence of culverts during construction and reinstatement of banks.	Negative, low magnitude, temporary (up to medium term), reversible	Not significant

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)			Pollution and increased sedimentation from use of Braddup construction compound, access track, and site drainage.	Direct, negative, medium magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Significant Adverse Immediate site
			Noise and light disturbance during construction works activities	Indirect, negative, low magnitude, temporary (medium term), reversible	Not significant
Aquatic macroinvertebrates (Bashall Brook tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Bashall Brook	Immediate site	Hydrological impacts from discharge of site drainage (Cow Hey Brook) and changes to flow from presence of culverts during construction and reinstatement of banks.	Negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Pollution and increased sedimentation from use of Braddup construction compound, access track, and site drainage.	Direct, negative, medium magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Significant Adverse Immediate site

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Otter (Bashall Brook tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Bashall Brook	Immediate site	Hydrological impacts from discharge of site drainage (Cow Hey Brook) and changes to flow from presence of culverts during construction and reinstatement of banks.	Negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Disturbance during construction works from lighting and noise	Indirect, negative, low magnitude, temporary (up to medium term), reversible	Not significant
			Degradation of prey resource due to sedimentation and reduction in water quality	Indirect (impacts on prey resource), negative, low magnitude (especially in case of silt pollution), temporary (up to medium term), reversible	Not significant

9.6.3 Commissioning Phase

124) The following provides an overview of the potential effects on aquatic ecology as a result of the commissioning phase. A summary of commissioning phase effects is shown in Table 9.9.

125) During the commissioning phase of the project it is assumed that the site compound and infrastructure created would still be utilised. Activities unique to the commissioning phase would largely take place in the subsoil environment and the assessment of specific impacts are more pertinent to groundwater receptors rather those related to surface water quality and the associated effects on aquatic ecology.

126) As it is assumed that the site compounds would be in use during the commissioning phase, it is anticipated that all the same potential impacts outlined in the previous section would be active during commissioning. As such, the assessment of magnitude of impacts and significance for all aquatic ecology features during commissioning is anticipated to be the same or less as those identified for the enabling (Section 9.6.1 and construction (Section 9.6.2) phases.

127) Changes in water levels and flow regimes caused by discharge of the commissioning flows could affect the quality and quantity of water-dependant habitats and associated species. Therefore, the effects are normally manifested as some form of habitat degradation (such as changes in geomorphological processes in rivers) or habitat loss and can affect the conservation status of habitats or dependent species. Hydrological changes can arise from causes located within or outside of the scheme boundary during the commissioning process.

128) The commissioning flow at the northern end of the Marl Hill Section would be discharged via the temporary outfall to Unnamed Watercourse 402. The discharge would be at a rate of 25 l/s, whilst the estimated greenfield runoff rate for the catchment and hence flow received by the watercourse in baseline conditions is 6.2 l/s. Therefore, the flow increase due to the proposed commissioning discharge represents a significant increase in flow volume and velocity within the watercourse. The Water Environment Chapter 7 Section 7.6.3 assessment identifies the discharge would have a significant effect on fluvial geomorphology and is likely to increase bank erosion within Unnamed Watercourse 402 and increase sediment transport to the downstream Unnamed Watercourse 388. The baseline aquatic ecology data identifies that macrophyte, fish and macroinvertebrate communities within the wider waterbody are sensitive to changes in flow velocity and increased sedimentation. The increased erosion, turbidity, and sediment deposition would result in a significant adverse effect on the macrophyte, fish and macroinvertebrate communities of Unnamed Watercourse 402, Unnamed watercourse 483 and the downstream Foulscales Brook.

129) The Water Environment Chapter 7 Section 7.6.3 (document reference: RVBC-MH-ES-007) assessment identifies that the commissioning flow of 25 l/s from the Braddup Compound discharged into Sandy Ford Brook via a temporary outfall would have a significant effect on the geomorphology of Sandy Ford Brook. The increased flow volume and velocity within the watercourse has potential to increase bank erosion resulting changes to existing habitats and increased turbidity and sediment mobilisation. The baseline aquatic ecology data identifies that macrophyte, fish and macroinvertebrate communities within the wider waterbody are sensitive to changes in flow velocity and increased sedimentation. The increased erosion, turbidity, and sediment deposition would result in a significant adverse effect on the macrophyte, fish and macroinvertebrate communities of Sandy Ford Brook and Bashall Brook.

130) The commissioning discharges are temporary, and all associated infrastructure would be removed following cessation of the commissioning phase (removal of temporary infrastructure was assessed as part of the construction phase in Section 9B.62). It is assumed that these areas would be returned to the baseline conditions with appropriate landscaping therefore impacts associated with hydrological changes at these locations are considered to be temporary, medium term and reversible.

9.6.3.1 Summary of commissioning effects

131) The assessment methodology involved the identification of the nature conservation value of each potentially affected important aquatic ecology receptor using a geographical framework. Those that were found to have at least local value have been subject to systematic impact assessment. The findings of the commissioning phase effects prior to mitigation is provided below in Table 9.9.

Table 9.9 Summary of Commissioning Phase Effects

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Macrophytes (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Hydrological and Geomorphological impacts from discharge of discharge of commissioning flows to Unnamed Watercourse 402	Negative, medium magnitude, temporary (up to medium term), reversible	Significant Adverse Immediate site
			Changes in Water quality from discharge of commissioning flows to Unnamed Watercourse 402	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Fish (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Hydrological and Geomorphological impacts from discharge of discharge of commissioning flows to Unnamed Watercourse 402	Negative, medium magnitude, temporary (up to medium term), reversible	Significant Adverse Immediate site
			Changes in Water quality from discharge of commissioning flows to Unnamed Watercourse 402	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Aquatic macroinvertebrates (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	Hydrological and Geomorphological impacts from discharge of discharge of commissioning flows to Unnamed Watercourse 402	Negative, medium magnitude, temporary (up to medium term), reversible	Significant Adverse Immediate site
			Changes in Water quality from discharge of commissioning flows to Unnamed Watercourse 402	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Otter	River Hodder - conf Easington	Immediate Site	Degradation of prey resource due to sedimentation and reduction in	Indirect (from upstream works), negative, low magnitude,	Not significant

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
(Unnamed Watercourse 402 and Unnamed watercourse 388)	Bk to conf Ribble		water quality from discharge of commissioning flows	temporary (up to medium term), reversible	
Macrophytes (Sandy Ford Brook and Bashall Brook)	Bashall Brook	Local	Hydrological and Geomorphological impacts from discharge of discharge of commissioning flows to Sandy Ford Brook	Negative, medium magnitude, temporary (up to medium term), reversible	Significant Adverse Immediate site
Fish (Sandy Ford Brook and Bashall Brook)	Bashall Brook	Local	Hydrological and Geomorphological impacts from discharge of discharge of commissioning flows to Sandy Ford Brook	Negative, medium magnitude, temporary (up to medium term), reversible	Significant Adverse Immediate site
Aquatic macroinvertebrates (Sandy Ford Brook and Bashall Brook)	Bashall Brook	Local	Hydrological and Geomorphological impacts from discharge of discharge of commissioning flows to Sandy Ford Brook	Negative, medium magnitude, temporary (up to medium term), reversible	Significant Adverse Immediate site
Otter (Sandy Ford Brook and Bashall Brook)	Bashall Brook	Local	Degradation of prey resource due to sedimentation and reduction in water quality from discharge of commissioning flows	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant

9.6.4 Operational Phase

132) Activities during the operational phase (including the use of the new aqueduct and effects from the decommissioned asset) which may potentially give rise to effects on aquatic ecology features are anticipated to be limited to:

- De-watering of the decommissioned sections of aqueduct, requiring permanent discharge into surface waters
- Routine maintenance at air valves and valve houses with access by foot or light vehicle (via permanent access track at the Braddup Compound)

133) De-watering of the decommissioned, but retained sections of aqueduct, would require discharges into surface water features via existing outfall structures this is assessed as part of the decommissioning effects in Section 9.6.5.

134) At the Braddup Compound at the south end of the Proposed Marl Hill Section, there would be a permanent access route to the valve house for maintenance of the Haweswater Aqueduct. This access route would make use of an existing access track, but the upgrades made during the enabling works are permanent, so would be present during the operational phase. The potential impacts relating to habitat fragmentation and changes in flow from increased culvert size at watercourses along the Braddup compound were assessed as part of the construction phase assessment as the changes undertaken during that phase are permanent. Potential impacts relating to habitat fragmentation for otters would be reduced due to removal of construction related fencing and no increase in disturbance above baseline conditions during the operation phase.

135) At the Bonstone Compound routine maintenance activities at Valve House Buildings would require access by foot or light vehicle using existing access points and existing access routes. Maintenance events would be very short term. Temporary disturbance effects that might result upon aquatic habitats and species would be no greater than experienced during existing agricultural practices in the landscape or routine maintenance of existing above-ground infrastructure for the retained sections of the aqueduct. Potential ecological effects arising from routine maintenance of new above-ground structures associated with the Proposed Marl Hill Section are therefore unlikely to be of a scale, duration or nature that would give rise to significant ecological effects. These activities are scoped out from the EcIA for Aquatic Ecology.

136) The overflow from the Proposed Marl Hill Section would discharge at the existing outfall location on Bashall Brook. The discharge of water during the operation of the proposed aqueduct would be the same as the operational regime for the existing aqueduct (i.e. emergency discharges as required). Operational discharges from the existing aqueduct would stop and be replaced by discharges from the proposed aqueduct. There would be no change in flow conditions or water quality from the existing baseline conditions due to operation of the Proposed Marl Hill Section. Therefore, there is no potential for impacts on the aquatic ecology features of Bashall Brook from operational discharges.

9.6.4.1 Summary of operational effects

137) The assessment methodology involved the identification of the nature conservation value of each potentially affected important aquatic ecology receptor using a geographical framework. Those that were found to have at least local value have been subject to systematic impact assessment. The findings of assessment of the commissioning phase effects prior to mitigation is provided below in Table 9.10.

Table 9.10: Summary of Operational **Phase Effects**

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Macrophytes (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Fish (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Aquatic macroinvertebrates (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Otter (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Macrophytes (Sandy Ford Brook and Bashall Brook)	Bashall Brook	Local	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Fish (Sandy Ford Brook and Bashall Brook)	Bashall Brook	Local	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Aquatic macroinvertebrates (Sandy Ford Brook and Bashall Brook)	Bashall Brook	Local	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Otter (Sandy Ford Brook and Bashall Brook)	Bashall Brook	Local	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant

9.6.5 Decommissioning Phase

138) The following section describes the effects of the Proposed Marl Hill Section on Aquatic Ecology during the decommissioning works phase. These impacts and significance of effects on aquatic ecology features are summarised in Table 9.11.

139) Following decommissioning of the existing aqueduct structure it is likely that groundwater would enter the decommissioned aqueduct over time as the structure is left in-situ. The existing aqueduct creates a flow pathway for groundwater ingress to reach the surface through the redundant tunnel structure. It is proposed this groundwater ingress would be discharged to the Bashall Brook watercourse through the existing outfall location (at approximately E:370127 N:444224). This outfall would remain in place after the commissioning of the Proposed Marl Hill Section.

140) The Water Environment Chapter assessment on decommissioning effects (Chapter 7 Section 7.6.5, document reference: RVBC-MH-ES-007) identifies that the discharged groundwater has the potential to be polluted with a range of potential contaminates related to natural bedrock geology and, current and historical land uses. Should groundwater be contaminated and discharged to Bashall Brook it has the potential to impact surface water quality downstream from the discharge location.

141) The impact from any chemical pollution from groundwater discharge on aquatic ecology features would be dependent on the, concentration of contaminants, volume and rate of the discharge, as well as pH and buffering capacity of the receiving watercourse. The aquatic macroinvertebrate and fish communities present within Bashall Brook are sensitive to reductions water quality particularly from changes in dissolved oxygen which could be reduced by the dissolved oxygen levels in the discharge or through and increase in chemical oxygen demand of the watercourse. A reduction in water quality would reduce habitat suitability or cause direct mortality for sensitive species. This would result in changes to species composition and a reduction in abundance and distribution of sensitive species such as Atlantic salmon or sensitive macroinvertebrates species within Bashall Brook. The groundwater discharge has potential to adversely affect the fish and macroinvertebrate communities of Bashall Brook this would be significant at the Local level in the absence of specific mitigation. Therefore, discharge of groundwater and the associated water quality impacts would result in a significant effect at the local scale. Due to a reduction in habitat suitability or direct mortality of macroinvertebrates, macrophytes, and fish within Bashall Brook.

142) The discharge would occur permanently throughout the life of the scheme therefore impacts due to a reduction in water quality are considered to be permanent and irreversible.

143) There would be no discharges to watercourses within the River Hodder waterbody (Unnamed Watercourse 402 and Unnamed Watercourse 483) no impacts are anticipated during the decommissioning phase. The effect of decommissioning activities on aquatic ecology features of the River Hodder waterbody (Unnamed Watercourse 402 and Unnamed Watercourse 483) have been scoped out of the assessment due to absence of potential impact pathways during the decommissioning phase.

9.6.5.1 Summary of decommissioning effects

144) The assessment methodology involved the identification of the nature conservation value of each potentially affected important aquatic ecology receptor using a geographical framework. Those that were found to have at least local value have been subject to systematic impact assessment. The findings of the decommissioning phase effects prior to mitigation is provided below in Table 9.11.

Table 9.11 Summary of Decommissioning impacts

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Macrophytes (Bashall Brook)	Bashall Brook	Local	Hydrological and Geomorphological impacts from discharge of discharge of decommissioning discharge.	Negative, medium magnitude, temporary (up to medium term), reversible	Significant Adverse Immediate site
			Changes in Water quality from discharge of decommissioning discharge.	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Fish (Bashall Brook)	Bashall Brook	Local	Hydrological and Geomorphological impacts from discharge of discharge of decommissioning discharge.	Negative, medium magnitude, temporary (up to medium term), reversible	Significant Adverse Immediate site
			Changes in Water quality from discharge of decommissioning discharge.	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Aquatic macroinvertebrates (Bashall Brook)	Bashall Brook	Local	Hydrological and Geomorphological impacts from discharge of discharge of decommissioning discharge.	Negative, medium magnitude, temporary (up to medium term), reversible	Significant Adverse Immediate site
			Changes in Water quality from discharge of decommissioning discharge.	Direct, negative, medium magnitude, temporary (medium term), reversible	Significant Adverse Immediate site
Otter (Bashall Brook)	Bashall Brook	Local	Degradation of prey resource due to sedimentation and reduction in water quality from discharge of decommissioning discharge.	Indirect (from upstream works), negative, low magnitude, temporary (up to medium term), reversible	Not significant

Environmental / Community Asset	WFD waterbody	Value	Potential Effect(s) Prior to Specific Mitigation	Nature of effects	Significance of Effect (Pre-Specific Mitigation)
Macrophytes (Tributaries of Bashall Brook)	Bashall Brook	Local	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Fish (Tributaries of Bashall Brook)	Bashall Brook	Local	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Aquatic macroinvertebrates (Tributaries of Bashall Brook)	Bashall Brook	Local	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Otter (Tributaries of Bashall Brook)	Bashall Brook	Local	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Macrophytes (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Fish (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Aquatic macroinvertebrates (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant
Otter (Unnamed Watercourse 402 and Unnamed watercourse 388)	River Hodder - conf Easington Bk to conf Ribble	Immediate Site	No change in flow or water quality or disturbance- no potential for impacts	Not applicable	Not significant

9.7 Mitigation and Residual Effects

145) Mitigation is most effective if considered as an integral part of the Proposed Marl Hill Section design in order to avoid, reduce or offset any adverse effects on the aquatic ecology or wider environment.

146) There is potential for adverse effects to macrophytes, fish, aquatic macroinvertebrates, and otter in the River Hodder and Bashall Brook waterbodies from a reduction in water quality during the enabling works, construction, and decommissioning phases. Therefore, additional mitigation would be required to further reduce the surface water quality impacts from the Proposed Marl Hill Section.

147) The proposed additional mitigation measures consider current best practice, legislation, and guidance during both construction and operational phases of the Proposed Marl Hill Section. Additional mitigation measures to reduce impacts to geomorphology, surface water quality, and sediment management are identified in Water Environment Chapter 7 Section 7.7. These include:

- Construction Method Statements (CMS) for each construction activity.
- A site Pollution Prevention Plan for enabling and construction activities.
- Modification of existing drainage systems to reduce potential for sediment run off
- A suitably qualified and experienced Environment Clerk of Work (EnvCow) would be appointed by the Contractor to oversee the implementation of mitigation and monitoring of the water environment (Mitigation Item WE14)
- Timing restrictions for in channel works (i.e. when flows are at or below the mean average) to reduce the potential for sediment release and scour.
- To mitigate against the uncertainty in the groundwater quality and potential impacts on Bashall Brook from decommissioning flows on surface water quality, it was recommended that further assessment is undertaken (Mitigation Item WE15).
- A water quality monitoring programme would be implemented to help ensure groundwater ingress discharges from the decommissioned aqueduct pass the required discharge standards. To provide reassurance that the decommissioning flows entering Bashall Brook are not having a significant adverse impact upon surface water quality (Mitigation Item WE15)
- Hydrological and geomorphological impacts the commissioning discharges to Unnamed Watercourse 402 and Sandy Ford Brook (Mitigation Item WE1 to WE12).

148) Reinstatement of terrestrial habitats described in Chapter 9A Section 9A.7 would also reduce the potential for sediment transfer during site restoration in the commissioning and operation phases.

9.7.1 Fish

149) Additional mitigation above that described in the CCoP required to reduce the potential for adverse effects from increased sedimentation from use of the proposed success tracks and compounds, and in river working for the installation of the culverts and temporary outfalls.

150) In locations identified as important for salmonid fish, tributaries of Bashall Brook (Mitigation Item EA1) or the River Hodder (Mitigation Item EA2) no in-river work would be undertaken during the main breeding season between October and May inclusive. In-river works between May and September inclusive also have the potential to result in effects on salmonid fry and parr but are less likely to result in significant effects on recruitment as whole and good practices in terms of construction methodologies and pollution prevention are likely to offer adequate protection.

151) Timing restrictions for in river works in combination with the mitigation outlined the Water Environment Chapter 7 Section 7.7 are considered to be sufficient to reduce the significance of potential impacts from sedimentation and water quality deterioration on the fish communities of Bashall Brook tributaries, Unnamed Watercourse 402 and Unnamed Watercourse 483.

9.7.2 Aquatic Macroinvertebrates

152) The additional mitigation measures to reduce impacts to geomorphology, water quality, and sediment management are identified in Water Environment Chapter 7 Section 7.7. These mitigation measures are considered to be sufficient to reduce the significance of potential impacts to aquatic macroinvertebrates communities of Bashall Brook and tributaries, Unnamed Watercourse 402 and Unnamed Watercourse 483, from increased sediments during the enabling, construction, and commissioning phases and water quality degradation during the decommissioning phase.

153) No further site specific measures are therefore required for aquatic macroinvertebrates.

9.7.3 Aquatic Macrophytes

154) The additional mitigation measures to reduce impacts to geomorphology, water quality, and sediment management are identified in Water Environment Chapter 7 Section 7.7. These mitigation measures are considered to be sufficient to reduce the significance of potential impacts to aquatic macrophyte communities of Bashall Brook and tributaries, Unnamed Watercourse 402 and Unnamed Watercourse 483, from increased sediments during the enabling, construction, and commissioning phases and water quality degradation during the decommissioning phase.

155) No further site specific measures are therefore required for aquatic macrophytes.

9.7.4 Otter

156) The additional mitigation measures to reduce impacts to geomorphology, water quality, and sediment management are identified in Water Environment Chapter 7 Section 7.7. These mitigation measures are considered to be sufficient to reduce the significance of potential impacts to otters at Bashall Brook and tributaries, Unnamed Watercourse 402, and Unnamed Watercourse 483, from increased sediments during the enabling, construction, and commissioning phases and water quality degradation during the decommissioning phase.

157) Pre enabling works checks for otter resting places are specified as part of the CCoP. If otter resting places are confirmed in any areas requiring vegetation removal/disturbance of riverbanks, mitigation under licence from Natural England would be implemented as appropriate to the location and status resting place. If pre-commencement surveys or evidence collected during watching briefs identify potential for significant disturbance risk, then visual/sound screening or exclusion buffers would be employed.

9.7.5 Residual Effects

158) Following the application of additional mitigation measures, the residual significant impacts likely to occur during any of the project phases: enabling, construction, commissioning, operation, or decommissioning, are identified in Table 9.12 In summary, no residual significant impacts of are expected related to aquatic ecology features of the Bashall Brook and River Hodder waterbodies, for the phases assessed.

Table 9.12: Summary of Mitigation and Residual Effects

Environmental / Community Asset	Specific Mitigation	Magnitude (With Mitigation)	Residual Effect and Significance
Macrophytes Unnamed Watercourse 402 and Unnamed Watercourse 483 (River Hodder waterbody)	Surface water quality and fluvial geomorphology mitigation measures identified in the Water Environment Chapter 7 Section 7.7.	Low	Not significant
Fish Unnamed Watercourse 402 and Unnamed Watercourse 483 (River Hodder waterbody)	Surface water quality and fluvial geomorphology mitigation measures identified	Low	Not significant

Environmental / Community Asset	Specific Mitigation	Magnitude (With Mitigation)	Residual Effect and Significance
	in the Water Environment Chapter 7 Section 7.7. Timing of in river works (May to September).		
Aquatic macroinvertebrates Unnamed Watercourse 402 and Unnamed Watercourse 483 (River Hodder waterbody)	Surface water quality and fluvial geomorphology mitigation measures identified in the Water Environment Chapter 7 Section 7.7. Timing of in river works (July to September).	Low	Not significant
Otter Unnamed Watercourse 402 and Unnamed Watercourse 483 (River Hodder waterbody)	Surface water quality and fluvial geomorphology mitigation measures identified in the Water Environment Chapter 7 Section 7.7.	Low	Not significant
Macrophytes (Bashall Brook and tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Surface water quality and fluvial geomorphology mitigation measures identified in the Water Environment Chapter 7 Section 7.7.	Low	Not significant
Fish (Bashall Brook and tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Surface water quality and fluvial geomorphology mitigation measures identified in the Water Environment Chapter 7 Section 7.7. Timing of in river works (May to September).	Low	Not significant
Aquatic macroinvertebrates (Bashall Brook and tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Surface water quality and fluvial geomorphology mitigation measures identified in the Water Environment Chapter 7 Section 7.7. Timing of in river works (July to September).	Low	Not significant
Otter (Bashall Brook and tributaries: Unnamed Watercourse 430, Unnamed Watercourse 43, Unnamed Watercourse 433, Unnamed Watercourse 436, Sandy Ford Brook, and Cow Hey Brook)	Surface water quality and fluvial geomorphology mitigation measures identified in the Water Environment Chapter 7 Section 7.7.	Low	Not significant

9.8 Cumulative Effects

159) The following section provides an overview of the potential cumulative effects from different developments, in combination with the Proposed Marl Hill Section (inter-project). For cumulative effects related to the combined action of a number of different environmental topics (intra-project), see Chapter 19: Cumulative Effects. Refer also to Figure 19.1.

160) Cumulative effects have been assessed in terms of the additional and combined effects. No committed developments with potential for cumulative effects on the aquatic ecology receptors of the Bashall Brook or Hodder – conf Easington Bk to conf Ribble waterbodies were identified during the assessment. Therefore, there is no potential for cumulative effects in combination with the construction operation or decommissioning of the Proposed Marl Hill Section.

9.9 Conclusion

161) This chapter of the ES considered the potential aquatic ecology impacts associated with enabling works, construction, commissioning, operation, and decommissioning impacts at nearby watercourses within 500 m with hydrological connectivity from the route of the Proposed Marl Hill Section.

162) After undertaking the assessment of the likely impact of the Proposed Scheme on the aquatic ecology receptors considered in this chapter potential impacts were identified for fish, macroinvertebrates, macrophytes, and otter during the enabling works, construction, and decommissioning phases. Therefore, it was necessary to identify mitigation measures to minimise the potential impacts.

163) Following incorporation of all mitigation measures the magnitude, probability, scale, and duration of the impacts to aquatic ecology receptors would be reduced to minor for the residual effects for aquatic ecology receptors during all phases of the proposed Marl Hill Section.

164) No significant cumulative effects on aquatic ecology receptors were identified from concurrent construction or operation of the proposed Marl Hill Section and different developments within the study area.

9.9.1 Off-Site Highways Works and Proposed Ribble Crossing

165) As explained in Chapter 1, off-site highways works and the Proposed Ribble Crossing were developed at a late stage in the EIA programme, and are therefore assessed in Volume 5 and Volume 6 respectively.

166) This section summarises the likely significant effects associated with enabling works and construction activities required for off-site highways works and the enabling, construction, operation, and decommissioning phases of the Proposed Ribble Crossing. It is also worth noting that likely significant effects have been identified for the proposed off-site highways works. While the overall cumulative effects of each EIA topic are summarised in Chapter 19 it is worth noting here that cumulative effects are envisaged when taking account of the main construction compounds, construction access routes on the local public highway, and the off-site highways works.

167) A total of 16 highways improvement areas for the proposed TR3 access routes associated with nine watercourses (Unnamed Watercourse 2078, Mears Beck, Unnamed Watercourse 2082, Unnamed Watercourse 2081, Hunt's Gill Beck, Cod Gill, River Hindburn, River Wenning, and Unnamed Watercourse 157) were screened into the assessment but no potential significant effects to aquatic ecology features were identified due to the proposed works. Therefore, no additional mitigation measures for aquatic ecology receptors were proposed for the highways improvement area. An additional 21 highways improvement areas were screened out of the assessment due to an absence of potential impact pathways to aquatic receptors.

168) The Proposed Ribble Crossing has potential for significant effects to the macrophyte, fish, and macroinvertebrate communities, and otter populations in the River Ribble and River Ribble tributaries (Coplow Brook, Greg Sike, and Unnamed Watercourse 2097), during the enabling works, construction, and decommissioning phases in the absence of additional mitigation. Potential impacts identified include pollution from increased sediment mobilisation, habitat loss, disturbance and habitat

fragmentation from noise and vibration, and disturbance during site clearance. Therefore, it was necessary to identify mitigation measures to minimise the potential impacts.

169) The proposed mitigation identified for works at the watercourses that would be affected by the highways works and the Proposed Ribble crossing with potential for significant effects to aquatic ecology includes silt and pollution control measures, best practice biosecurity measures, timing of works to avoid sensitive periods for spawning and migratory fish, pre-works checks for protected species, ECoW supervision for vegetation clearance and in river works, and bank reinstatement and or realignment to prevent instability following completion of the works. Following incorporation of all mitigation measures the magnitude, probability, scale, and duration of the impacts to aquatic ecology receptors would be reduced to minor for the residual effects to aquatic ecology receptors of the River Ribble and Ribble tributaries (Coplow Brook, Greg Sike, and Unnamed Watercourse 2097).

9.10 Glossary and Key Terms

170) Key phrases and terms used within this technical chapter relating to Terrestrial Ecology are defined within Appendix 1.2: Glossary and Key Terms.