MORGAN AND MORECAMBE OFFSHORE WIND FARMS: TRANSMISSION ASSETS

Environmental Statement

Volume 3, Annex 3.5: Aquatic invertebrate survey technical report

September 2024
Rev: ES

MOR001-FLO-CON-ENV-RPT-0072MRCNS-J3303-RPS-10110

PINS Reference: EN020028
APFP Regulations: 5(2)(a)
Document reference: F3.3.5

Document status					
Version	Purpose of document	Approved by	Date	Approved by	Date
ES	For issue	AS	September 2024	IM	September 2024

Prepared by:

Morgan Offshore Wind Project Limited, Morecambe Offshore Windfarm Ltd

Prepared for:

Morgan Offshore Wind Project Limited, Morecambe Offshore Windfarm Ltd

Contents

Tables

Figures

Appendices

Glossary

Term	Meaning
400 kV grid connection cables	Cables that will connect the proposed onshore substations to the existing National Grid Penwortham substation.
Applicants	Morgan Offshore Wind Limited (Morgan OWL) and Morecambe Offshore Windfarm Ltd (Morecambe OWL).
Average Score per Taxon	Represents the average tolerance score of all taxa within the community. Average Score per Taxon is calculated by dividing the number of families/taxa represented in the sample.
Biological Heritage Sites	'Local wildlife sites' in Lancashire which are identified using a set of published guidelines by the Lancashire Environmental Record Network (2023). Biological Heritage Sites may be identified based on the presence of a single species, population size or geographic distribution.
Biological Monitoring Working Party	A procedure for measuring water quality using families of macroinvertebrates as biological indicators.
Expert Working Group	A forum for targeted engagement with regulators and interested stakeholders through the Evidence Plan Process.
Environmental Impact Assessment	The process of identifying and assessing the significant effects likely to arise from a project. This requires consideration of the likely changes to the environment, where these arise as a consequence of a project, through comparison with the existing and projected future baseline conditions.
Environmental Statement	The document presenting the results of the Environmental Impact Assessment process.
Evidence Plan Process	A voluntary consultation process with specialist stakeholders to agree the approach to, and information to support, the EIA and Habitats Regulations Assessment processes for certain topics.
Exuviae	Remains of an exoskeleton.
Hectad	An area 10 km x 10 km square.
Kick sampling	A survey method used to sample aquatic invertebrates in flowing water.
Lancashire Key Species	A collective term to refer to species which have recognised status either (inter)nationally or locally by the Lancashire Environment Records Network.
Morecambe Offshore Windfarm: Transmission Assets	The offshore export cables, landfall and onshore infrastructure required to connect the Morecambe Offshore Windfarm to the National Grid.
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	The offshore and onshore infrastructure connecting the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm to the national grid. This includes the offshore export cables, landfall site, onshore export cables, onshore substations, 400 kV grid connection cables and associated grid connection infrastructure such as circuit breaker compounds. Also referred to in this report as the Transmission Assets, for ease of reading.

Term	Meaning
Morgan Offshore Wind Project: Transmission Assets	The offshore export cables, landfall and onshore infrastructure required to connect the Morgan Offshore Wind Project to the National Grid.
Nationally Scarce	Species occurring in 100 or fewer hectads of the British National Grid.
Onshore Order Limits	See Transmission Assets Order Limits: Onshore (below).
Planning Inspectorate	The agency responsible for operating the planning process for applications for development consent under the Planning Act 2008.
Rapid Assessment	A survey method used to quickly evaluate the ecological health of a waterbody.
Red Data Book	Also known as the IUCN Red List. The world's most comprehensive information source on extinction risk status of animal, fungus and plant species.
Riffle	An area of stream characterized by shallow depths with fast, turbulent water.
Species of Principal Importance	Species that are most threatened, in greatest decline, or where the UK holds a significant proportion of the world's total population.
Study area	This is an area which is defined for each environmental topic which includes the Transmission Assets Order Limits as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each topic is intended to cover the area within which an impact can be reasonably expected.
Survey area	The area within which each survey has been undertaken. This may differ from the Study Area as a Survey Area will be based on species or survey-specific guidance on the extent of survey required, and may be limited by, for example, habitat conditions and access constraints, or be defined in terms of buffer areas around an area of potential impact.
Sweep-netting	A survey method used to collect organisms from standing water or vegetation.
Transmission Assets	See Morgan and Morecambe Offshore Wind Farms: Transmission Assets (above).
Transmission Assets Order Limits	The area within which all components of the Transmission Assets will be located, including areas required on a temporary basis during construction and/or decommissioning (such as construction compounds).
Transmission Assets Order Limits: Onshore	The area within which all components of the Transmission Assets landward of Mean High Water Springs will be located, including areas required on a temporary basis during construction and/or decommissioning (such as construction compounds). Also referred to in this report as the Onshore Order Limits, for ease of reading.

Acronyms

Acronym	Meaning
ASPT	Average Score Per Taxon
BMWP	Biological Monitoring Working Party
Defra	Department for the Environment, Food and Rural Affairs
EIA	Environmental Impact Assessment
ES	Environmental Statement
EWG	Expert Working Group
IUCN	International Union for the Conservation of Nature
JNCC	Joint Nature Conservation Committee
LERN	Lancashire Environmental Records Network
LKS	Lancashire Key Species
MAGIC	Multi-Agency Geographic Information for the Countryside
PEIR	Preliminary Environmental Information Report
RDB	Red Data Book
SPI	Species of Principal Importance
WHPT	Walley Hawkes Paisley Trigg

Units

Unit	Description
%	Percentage
km	Kilometres
m	Metres
ml	Millilitres

1 Aquatic invertebrate survey technical report

1.1 Introduction

1.1.1.1 This document forms Volume 3, Annex 3.5: Aquatic invertebrate survey technical report of the Environmental Statement (ES) prepared for the Morgan and Morecambe Offshore Wind Farms: Transmission Assets (referred to hereafter as 'the Transmission Assets'). The ES presents the findings of the Environmental Impact Assessment (EIA) process for the Transmission Assets.

1.1.1.2 The purpose of this technical report is to present the results of the aquatic invertebrate desk study and site-specific field surveys undertaken between July 2023 to July 2024 to inform Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES.

1.1.1.3 The desk study and site-surveys were designed to determine the presence or likely absence of protected and notable aquatic macroinvertebrate species, and to determine the aquatic invertebrate diversity of each relevant waterbody or watercourse.

1.1.2 Study area

1.1.2.1 The study area is intended to cover the area within which an impact can be reasonably expected and describes the geographical extent subject to desk-based research.

1.1.2.2 The study area is the area subject to desk-based studies for aquatic invertebrates and comprises the Onshore Order Limits and a 1 kilometre (km) buffer ('hereafter referred to as the 'study area').

1.1.2.3 The location and geographic extent of the study area is presented in **Figure 1.1** of this technical report.

1.1.3 Survey area

1.1.3.1 The survey area is defined as the area within which each survey has been undertaken and is based on species or survey-specific guidance on the extent of survey required. The survey area for aquatic invertebrates (hereafter referred to as 'the survey area') is the Onshore Order Limits plus a 150 metre (m) buffer, as shown in **Figure 1.1**.

1.1.3.2 The buffer of 150 m was chosen to capture potential indirect adverse impacts of the Transmission Assets, such as siltation and pollution which some species of aquatic invertebrates can be sensitive to.

1.1.3.3 All the ecological data collected as part of the ES for the Transmission Assets has been made publicly available through the relevant biological records centre (Lancashire Environmental Records Network (LERN)).

1.1.3.4 Adopting a survey area that is greater in extent than the Onshore Order Limits ensures that the ES is accurately informed with data from within the Onshore Order Limits (i.e. that may be subject to direct impacts)

and data from outside the Onshore Order Limits (i.e. that may be subject to indirect impacts).

1.1.4 Contextual data

1.1.4.1 Owing to the iterative design process of the Transmission Assets, some site surveys were undertaken further than 150 m from the Onshore Order Limits. These surveys may have been located within, or within the buffer of, previous iterations of the Onshore Order Limits. Nevertheless, information from these surveys have been included in this technical report because they provide context regarding the ecological sensitivity of the wider area and to inform Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES (where relevant). Any contextual information (based on survey data collected from outside the survey area) is clearly marked throughout this technical report.

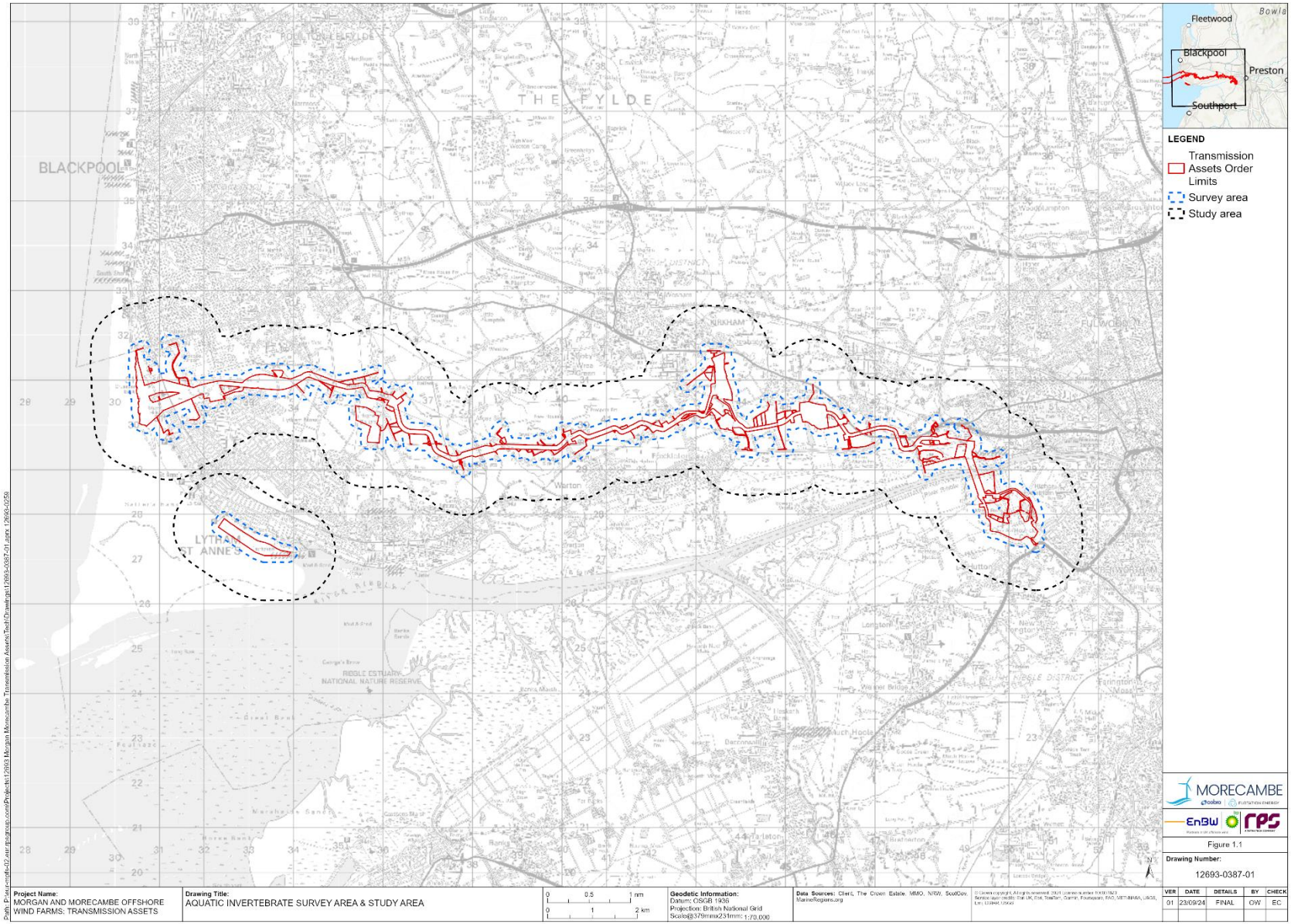

Figure 1.1: Aquatic invertebrate study area and survey area

1.1.5 Relevant legislation

1.1.5.1 The Wildlife and Countryside Act 1981 protects 15 species of aquatic invertebrate listed on Schedule 5 of the Act. The full list is included within **Appendix AB.1.1**. For these species, it is an offence under Section 9 of the Wildlife and Countryside Act 1981 to:

- intentionally kill, injure, or take the animal from the wild;
- damage or destroy any structure used by that species for shelter and protection including obstruction of its use or disturbing the animal;
- possess the species (dead or alive);
- damage or destroy any structure used by that species for shelter and protection. Plus, obstruction of its use or disturbing the animal; or
- trade, advertise or sell the species, dead, alive or any derivatives.

1.1.5.2 Other species of invertebrate are protected against sale only and have no specific habitat protection. These include many species of butterfly and the stag beetle *Lucanus cervus.*

1.1.5.3 Some species of aquatic invertebrate are listed as Species of Principal Importance (SPI) in the Natural Environment and Rural Communities Act 2006 (NERC Act 2006) and Lancashire Key Species (LKS). LKS have a recognised status either nationally (SPI) or locally within Lancashire, and is a collective term used by LERN to cover both situations. Public bodies and Local Planning Authorities have a legal duty to have regard for conserving SPI when exercising their duties.

1.1.6 Consultation

1.1.6.1 In October 2022, the Applicants submitted an EIA Scoping Report to the Planning Inspectorate, which described the scope and methodology for the technical studies being undertaken to provide an assessment of any likely significant effects for the construction, operation and maintenance and decommissioning phases of the Transmission Assets.

1.1.6.2 The scope and methodology of the aquatic invertebrate surveys, including those undertaken beyond the survey area, were discussed, and agreed with stakeholders via regular onshore ecology Expert Working Group meetings between March 2023 and June 2024. Further detail regarding consultation undertaken with respect to onshore ecology, including terrestrial invertebrate surveys can be found in Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES.

1.1.6.3 One comment was received from Natural England regarding aquatic invertebrate surveys. It was noted in the response that *'the current assessment does not include a range of surveys including reptile and invertebrates. … as this assessment is based on incomplete/ missing*

surveys, the submitted ES needs to present the assessment with full survey data.'

1.1.6.4 The locations and results of the aquatic invertebrate surveys undertaken are shown in **section 1.3.2**, including those undertaken since the publication of the Preliminary Environmental Information Report (PEIR). The survey results presented in this annex inform the assessment in Volume 3, Chapter 3: Ecology and nature conservation of the ES.

1.2 Methodology

1.2.1 Overview

1.2.1.1 A combination of desk studies and field surveys were undertaken to ascertain the presence or likely absence of aquatic invertebrate species and the diversity of these species within the study and survey area.

1.2.1.2 The results of the desk study are presented in Volume 3, Annex 3.1: Onshore ecology desk study technical report of the ES and summarised below.

1.2.2 Desk study

1.2.2.1 Aquatic invertebrate species data was collected from existing desk studies and datasets. These are summarised in **Table 1.1** below.

Table 1.1: Summary of key desktop sources

Title	Source	Year	Author
Lancashire Environmental Records Network (LERN)	LERN data share site.	2024	LERN
Multi Agency Geographic Information for the Countryside (MAGIC).	Department for Environment, Food and Rural Affairs (Defra).	2024	Defra
UK Protected Area Joint Nature Conservation Committee (JNCC).	JNCC website.	2024	JNCC
Red List	International Union for the Conservation of Nature (IUCN).	2023	IUCN

1.2.3 Site-specific survey

1.2.3.1 The main objectives of the aquatic invertebrate surveys were to:

- sample and identify invertebrate species in the waterbodies on site; and

- classify the sites' importance in relation to the invertebrate community present.

Survey methodology

1.2.3.2 The proposed approach broadly followed the guidelines set out in '*Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation*' (English Nature, 2007).

Qualifications and experience

1.2.3.3 All surveyors involved were suitably qualified and experienced in:

- field identification of widespread invertebrate species and life stages (e.g., adults, larvae, eggs and exuviae);
- assessing the potential suitability of on-site habitats for widespread aquatic invertebrate species;
- determining appropriate spatial scope for survey; and
- identifying appropriate survey techniques to achieve a robust survey in a variety of habitat types.

Scoping surveys

1.2.3.4 In order to inform the baseline and the existing environmental conditions to be reported within the ES, as well as to inform any necessary mitigation, an Extended Phase 1 survey has been carried out for the Transmission Assets. Extended Phase 1 habitat surveys undertaken between September 2022 and identified 31 waterbodies and eleven watercourses within the Phase 1 habitat survey area potentially required for further assessment (see Volume 3, Annex 3.2: Phase 1 habitat, NVC and hedgerow survey technical report of the ES).

1.2.3.5 Six waterbodies were scoped out on initial desk based assessment and two were dry at the time of survey.

1.2.3.6 25 waterbodies and nine watercourses were subsequently visited and assessed in the field by an experienced aquatic invertebrate survey specialist. The field visit by the aquatic invertebrate specialist scoped each waterbody and watercourse either in or out for further detailed aquatic invertebrate assessment. The scoping determination was informed by the waterbody or watercourse's extent, structure, ability to hold water and macrophyte cover.

1.2.3.7 All surveyed waterbodies and watercourses were assigned a unique identification number. Watercourses were labelled A-Q. Due to the length of some of the watercourses and variation in structure, water quality and water depth, any watercourses scoped in for further, detailed surveys were sub-divided into two or three survey locations. Each survey location was assigned a number.

1.2.3.8 Waterbodies were scoped in for further survey using professional judgement and/or if they received a BMWP score of over 30 during the rapid assessment.

1.2.3.9 Each waterbody or watercourse scoped in for further survey was subsequently assessed to determine its suitability to support protected and notable aquatic invertebrates at specific survey locations. All waterbodies and watercourses that were dry or ephemeral were assessed as unsuitable for protected or notable aquatic invertebrates and were not subject to a rapid assessment as detailed in **paragraph 1.2.3.10**.

Rapid assessments

1.2.3.10 Site-specific surveys comprised a series of rapid assessments that involved sampling watercourses and waterbodies for aquatic invertebrates to identify the presence or likely absence of protected and notable species.

1.2.3.11 Aquatic invertebrate surveys were undertaken between July 2023 and July 2024.

1.2.3.12 The rapid assessment method was used for both waterbodies and watercourses. The method is designed to identify aquatic invertebrate species present and to assess the aquatic invertebrate diversity. Aquatic invertebrate diversity was used as an indicator to assess biological water quality and naturalness of watercourses and waterbodies and was based on the Biological Monitoring Working Party (BMWP) system (BMWP, 1997).

1.2.3.13 Watercourses were subject to one survey. Waterbodies scoped in for detailed assessment were recommended to have two surveys across different seasons by a suitably qualified and experienced surveyor undertaking the surveys. Visit one was completed in July 2024.

Waterbodies

1.2.3.14 The rapid assessment methodology for waterbodies comprised sweep-netting and visual searches of the waterbody perimeter, to sample aquatic invertebrate diversity. A rectangular net, with a net depth of 30 cm and a 1 mm mesh was used. Standing at the waters' edge the surveyor netted the vegetation by making short jabbing thrusts into dense emergent and raft forming plants (where present), making occasional longer strokes into submerged plants and over bare substrate in deeper water. The number of netting jabs varied between waterbodies and was assessed on site, but each netting jab was no longer than three minutes in duration.

1.2.3.15 The diversity of the aquatic invertebrate assemblage was then analysed at the bankside. If large numbers of different invertebrate families were present, samples were sent for laboratory analysis.

Watercourses

1.2.3.16 The rapid assessment methodology for watercourses comprised the sampling of aquatic invertebrates using a three-minute kick sampling technique. Kick sampling was undertaken on all habitat features within each suitable and accessible watercourse. The surveyor stood in the

water facing downstream with a 1 mm mesh net in front of them. The surveyor then disturbed sediment immediately upstream of the net, upturning stones, and displacing gravel with their feet to dislodge invertebrates so disturbed organisms were collected in the net.

1.2.3.17 The surveyor then moved backwards, upstream, from one side of the watercourse to the other so that the banks were sampled as well as midstream. Pools and shallower riffles were included where possible.

1.2.3.18 This kick sampling method was undertaken in accordance with ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in freshwater (British Standards Institution, 2012) and Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation (Natural England, 2007).

Identification

1.2.3.19 Where possible and practical, invertebrates were identified in the field, but wherever doubt existed, one or more specimens were collected for more detailed inspection. Where the surveyor was unable to identify any specimens, they were submitted to relevant experts.

1.2.3.20 It is desirable that as wide a taxonomic range as possible is identified, in order to sample numerous ecological types, i.e. invertebrates with widely differing natural histories. Where possible, the following orders and families of invertebrates were named to species level.

- *Araneae* – Spiders.
- *Clitellata* – Leeches.
- *Coleoptera* – Beetles (all except small *Aleocharine* rove beetles and other very small obscure families).
- *Crustacea* – Shrimps, water fleas, water louse.
- *Diptera* - True flies (except, *Cecidomyiidae*, *Chironomidae*, *Ceratopogonidae*, *Simulidae*, *Phoridae*, *Sphaeroceridae*, and females of some groups which are not identifiable).
- *Ephemeroptera* – Mayflies.
- *Hemiptera, Heteroptera* - True bugs (excluding smaller *Miridae*).
- *Hemiptera*, *Aphididae* - Aphids (few conspicuous species only).
- *Odonata* – Dragonflies and damselflies.
- *Plecoptera* – Stoneflies.
- *Trichoptera* – Caddisflies.
- *Mollusca* – Slugs and snails.

Aquatic invertebrate sample analysis

1.2.3.21 Aquatic invertebrate samples obtained from sweep-netting and kick sampling were analysed at the bankside to determine the presence or

likely absence of protected or notable species. The samples were also analysed to identify the aquatic invertebrate families present within the sample. The samples were identified to family level (and to species level, where possible). The sample data was used to determine the importance of each survey location and to generate BMWP scores and Average Score Per Taxon (ASPT) values.

1.2.3.22 The BMWP system assigns numerical values (between 1 and 10) to more than 50 different aquatic invertebrate taxa according to their sensitivity to pollution. The larger the numerical value of the family, the more sensitive the family is to pollution. The sum of the values in each population provides an indication of the ecological status of a waterbody or watercourse and how polluted they are likely to be. A higher score indicates a waterbody supports animals typical of high quality waterbodies, and lower scores indicate a waterbody is in poorer condition.

1.2.3.23 To supplement the biological quality of a watercourse or waterbody the BMWP scores are averaged to generate the ASPT. Lower ASPT numbers indicate a waterbody or watercourse is likely to be in poorer condition. The BMWP and the ASPT results are useful when assessed together as they provide an index of how polluted a waterbody or watercourse may be.

1.2.3.24 Walley, Hakes, Paisley and Trigg (WHPT) metric calculations (British Standard, 1994; UKTAG 2021) is the standard method for collecting and sampling invertebrates in rivers. This method was used and assessed the condition of the quality element using parameters number of taxa and ASPT. The parameters are indicative or the impact of organic enrichment on the quality element. This is calculated on family level data and no species level data. Watercourse results include WHPT scores.

1.2.3.25 A watercourse or waterbody with good water quality is indicated by a diverse variety of taxa, especially those that are sensitive to pollution (such as mayflies, stoneflies and dragonflies). Poorer quality is indicated by a smaller than expected number of taxa, particularly those that are less sensitive to pollution (worms and midges). BMWP scores and ASPT values are listed in **Table 1.2** below (as per Armitage *et al.,* 1983; Chapman, 1996; and Mason, 2002). The individual BMWP numerical values for aquatic invertebrate families are listed in **Appendix B.1.3**.

Table 1.2: BMWP and ASPT scores

BMWP Score	ASPT Value	Interpretation of Biological Water Quality
Over 100	Over 5.4	Very good biological quality
71-100	4.8 – 5.4	Good biological quality
41 – 70	4.3 – 4.8	Fair biological quality
11 – 40	3 – 4.3	Poor biological quality
0 – 10	3.0 or less	Very poor biological quality

Data analysis

1.2.3.26 The quality of the site for invertebrates was assessed with reference to the species found which are considered to be nationally scarce or rare by the various Natural England Commissioned Reports published by JNCC (e.g., Falk 1991a; Falk 1991b; Hyman, 1992) and subsequently Natural England. These reviews place all nationally scarce species into categories according to their degree of rarity and their vulnerability to extinction and are accepted as the "official" JNCC/Natural England designations, as detailed in **Appendix B**. The more recent ones also assess taxa with reference to IUCN threat categories.

1.2.3.27 As a simple and readily comparable indication of quality, the proportion of Nationally Scarce and Red Data Book (RDB) species of the total diversity has been calculated. The same calculation will be done for the rarest taxa with RDB status. Depending on the habitat type, a proportion of 3-5% Nationally Scarce/RDB species needs to be exceeded before it can be safely concluded that the site has some conservation significance. Very high quality sites of national importance will have a proportion close to or exceeding 10% Nationally Scarce/RDB species.

1.2.3.28 The surveyor compared the habitats present at each waterbody or watercourse survey location with other sites of similar habitat and nature, and classified each waterbody or watercourse as:

- little/no importance;
- local/county importance;
- regional importance;
- national importance; or
- European importance.

1.2.3.29 As well as describing the communities present, any species of high interest are reported. These could include:

- species of principal importance for nature conservation;
- Schedule 5 species under the Wildlife and Countryside Act 1981; or
- threatened species.

1.2.3.30 Where these species occurred, their locations and the locations of suitable habitat were recorded.

1.2.4 Limitations

1.2.4.1 Access was not granted to all sections of identified watercourses within the aquatic invertebrate survey area and as a result some could not be fully surveyed. Where access was granted to upstream or downstream sections of these watercourses they were surveyed accordingly. The extent of surveyed watercourses is shown in **Figure 1.6** to **Figure 1.8**.

1.2.4.2 Waterbodies or sections of watercourses that were difficult to survey due to access constraints or safety concerns, were assessed by the

aquatic invertebrate survey specialist and a suitable survey approach was decided on a case-by-case basis. Considerations included:

- the sampling of areas of similar adjacent habitat;
- conducting a visual search only; and
- risk assessment based on habitat suitability.

1.2.4.3 Not all aquatic invertebrate species that colonise watercourses and waterbodies are present throughout the year. Therefore, some species may be overlooked if surveying in a single season. Further, other species that may be present at other times of year, sporadically or in low numbers may not be recorded. For this reason, the survey methodology included spring, summer and autumn visits for any watercourses or waterbodies suitable for supporting protected or notable aquatic invertebrates.

1.2.4.4 However, autumn visits to waterbodies scoped in for rapid assessment surveys have not yet been completed.

1.2.4.5 For the surveys that have been completed, standard methods were applied, and the data collected are considered representative of the conditions present and appropriate for assessment of the value of each waterbody and watercourse.

1.2.4.6 If aquatic invertebrates were identified in the accessible sections of a watercourse the precautionary approach was applied and presence was assumed within the entire stretch of the watercourse.

1.2.4.7 It should be noted that the River Ribble was not surveyed as part of the aquatic invertebrate surveys. This is because the watercourse is not suitable for the standard invertebrate surveys described in the methodology above, and also because the design of the Transmission Assets, through the use of trenchless technologies, will avoid direct impacts to the River Ribble (see Volume 1, Chapter 3; Project description of the ES and Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES).

1.3 Results

1.3.1 Desk study

1.3.1.1 No records of protected or notable aquatic macro-invertebrates were identified a part of the desk study.

1.3.2 Site-specific surveys

Waterbodies

1.3.2.1 A total 31 waterbodies were located within the survey area, as identified during Phase 1 habitat surveys (see Volume 3, Annex 3.2: Phase 1 habitat, National Vegetation Classification and hedgerow survey technical report of the ES). Based on scoping surveys, five of the waterbodies were scoped in for further rapid assessment survey and 26 were scoped out (see **Table 1.3**). Of the waterbodies scoped in, all

were located within the Transmission Assets Order Limits. The results and rationale of the scoping assessments are presented in **Appendix A**. The waterbody locations are presented in **Figure 1.2** to **Figure 1.4**. The results and rationale of the waterbodies scoped in are presented in **Table 1.3**.

1.3.2.2 In total 11 different invertebrate groups were recorded during the aquatic invertebrate waterbody scoping surveys. The groups comprised alderfly larvae *Megaloptera*, dragonfly larvae and damselfly larvae *Odanata*, water beetles and water bugs *Coleoptera,* mayfly larvae *Ephemeroptera*, freshwater shrimps, water skaters and pond skaters *Hempitera*, water snails *Mollusca* and species such as leeches *Hirudinea* and worms *Lumbricidae*.

1.3.2.3 A diverse assemblage of aquatic invertebrates were recorded within three of the waterbodies during scoping surveys: 133, 249 and 240 (as shown in **Table 1.3**) These waterbodies received a BMWP score of 30 or more during scoping surveys. Ponds 238 and 483 did not receive a score high enough to be surveyed further but have been scoped in for further survey due to their classification previously within Biological Heritage Sites (BHS).

1.3.2.4 The diversity of the aquatic invertebrate assemblage during the scoping surveys was highest in pond 579. The diversity of aquatic invertebrates within waterbody 579 was the highest and 238 and 235 were the lowest.

1.3.2.5 All waterbodies surveyed were within the survey area.

Table 1.3: Scoped in waterbody description and survey results

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond BMWP score	Further survey required	Justification for scoping
133	The pond has been fenced off to prevent incursion and poaching from cattle and as a result the improvement in condition is noticeable, water quality is good with some nice emergent macrophtes (water crowfoot *Ranunculus aquatilus*) and a diverse invertebrate assemblage.	10	53	Yes – further survey recommended	Scoring above 30
249	The pond is located in located in pasture fields and suffers from poaching to a degree, but is afforded some protection by steep banks and hawthorn cover. Some pondweed and water plantain in the margins where not poached.	7	38	Yes – further survey recommended	Scoring above 30
240	The pond is fringed with a matt of soft rush and horsetail with a fairly deep (1.5 to 2 m) area of open water in the middle. Difficult to sample due to filimentous algae, but large number of Odonata in the open water.	7	33	Yes – further survey recommended	Scoring above 30
238	North Freshfields BHS no longer represents the citation. The pond is in very poor condition, completely lacking macrophytes with a substrate of woody debris, leaf litter and anaerobic silt.	1	1	Yes – further survey recommended	BHS pond so requires further survey

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond BMWP score	Further survey required	Justification for scoping
241	The pond still resembles the citation with the notable species still present. The site comprises a field pond, formerly a marlpit, supporting a bog community. The pond is shallow and has a fringe of open water surrounding a peat mat with actively building mounds of bog mosses *Sphagnum recurvum*, and *S. squarrosum*. Plants present include yellow iris, lesser reedmace, marsh cinquefoil, yellow loosestrife, marsh bedstraw, branched burreed, brooklime, soft-rush, water starwort and common duckweed. The pond is notable for the occurrence of the mud pond snail *Lymnaea glabra*, a British Red Data Book species, which requires shallow acid pools. Another important invertebrate found here is a nationally scarce water beetle *Ilybius guttiger*. The pond also supports a number of other invertebrates such as diving and scavenger beetles, and the moss bladder snail *Aplexa hypnorum*, a species of restricted occurrence. Frogs breed in the pond.	5	18	Yes – further survey recommended	BHS pond so requires further survey

1.3.2.6 The waterbodies scoped in for detailed assessments are recommended to have two surveys following the scoping survey. One survey is recommended in summer and one survey in autumn, in order to establish a baseline of the species composition in the waterbodies. The summer survey results for the scoped in ponds are in **Table 1.4**.

1.3.2.7 The summer survey visit recorded 117 different aquatic invertebrate species. The full species list is presented in **Appendix A.2**. Species recorded included:

- single celled eukaryotes *Protozoa*;
- earthworms *Lumbricidae*;
- leeches *Hirundinea*;
- flatworms *Tricladida*;
- snails, mussels and slugs *Mollusca*;
- spiders *Arachnida*;
- microcrustaceans *Microcrustacea*;
- crustaceans *Malocrustacea*;
- lacewings and scorpion flies *Megaloptera*;
- mayflies *Ephemeroptera*,
- caddisflies *Trichoptera*;
- dragonflies and damselflies *Odonata*;
- water bugs *Hemiptera*;
- butterflies and moths *Lepidoptera*;
- true flies *Diptera*; and
- springtails *Colembola.*

1.3.2.8 Waterbody 133 recorded the highest number of invertebrate taxa. Waterbody 238 recorded the alder leaf beetle *Agelastica alni* – the only RDB species recorded during the aquatic invertebrate waterbody surveys. Waterbody 240 supports the burreed pollen beetle *Telmatophilus caricis*, appearing to be the only record in Lancashire County, although its habitat plant is plentiful in the area. Waterbody 241 is notable for the occurrence of the mud pond snail in its BHS citation *Lymnaea glabra*, a RDB species, although there was no evidence of this species during this survey. Full survey results are presented in **Appendix A.2** of this report.

Table 1.4: Scoped in waterbody survey results

Waterbody ID	Scoping survey date	Summer survey date	Total invertebrate taxa recorded
133	01/05/2024	01/08/2024	44
249	24/05/2024	26/07/2024	42
240	07/05/2024	05/07/2024	32
238	07/05/2024	05/07/2024	9
241	07/05/2024	05/07/2024	39

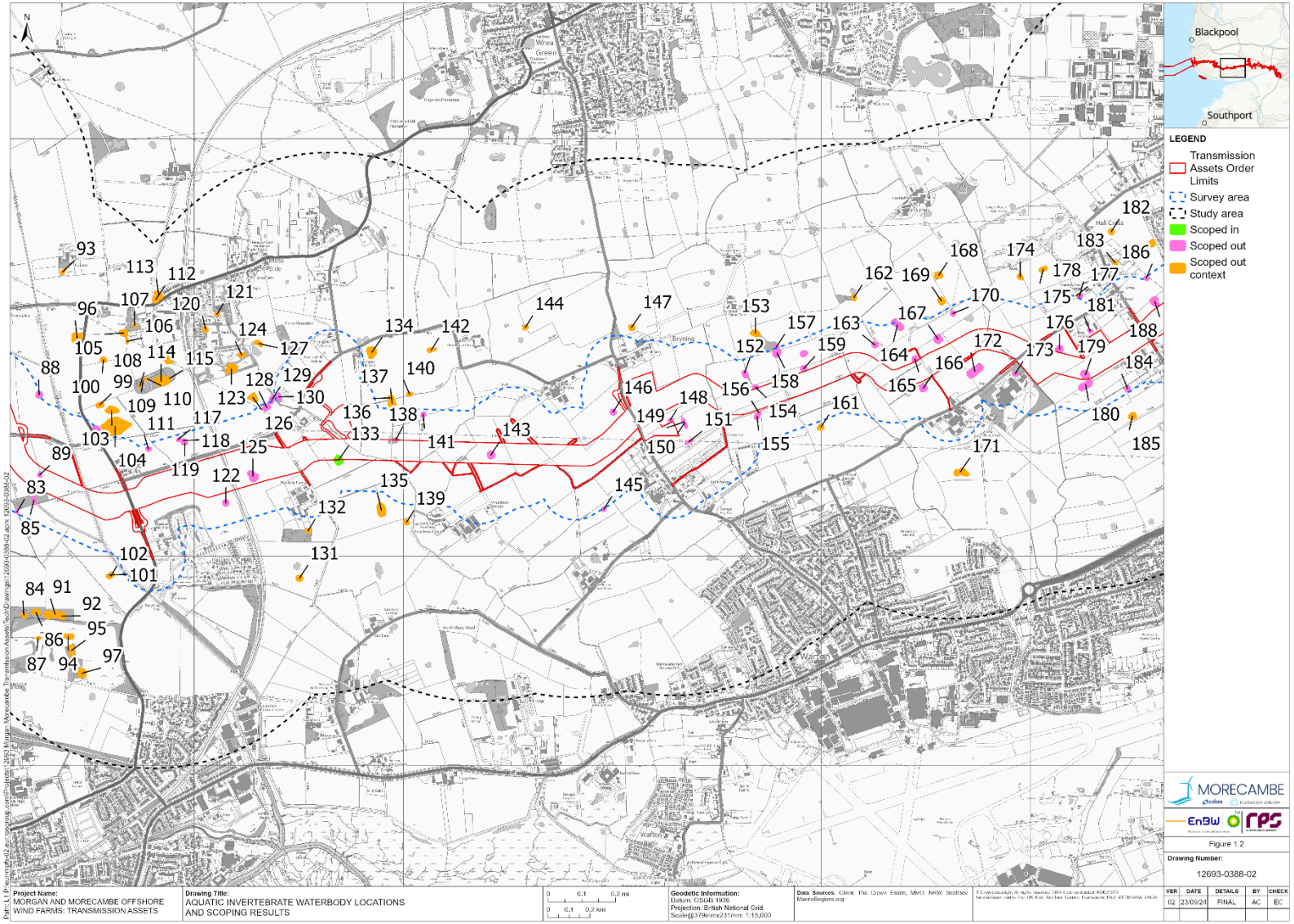

Figure 1.2: Aquatic invertebrate waterbody locations and scoping results – Sheet 1

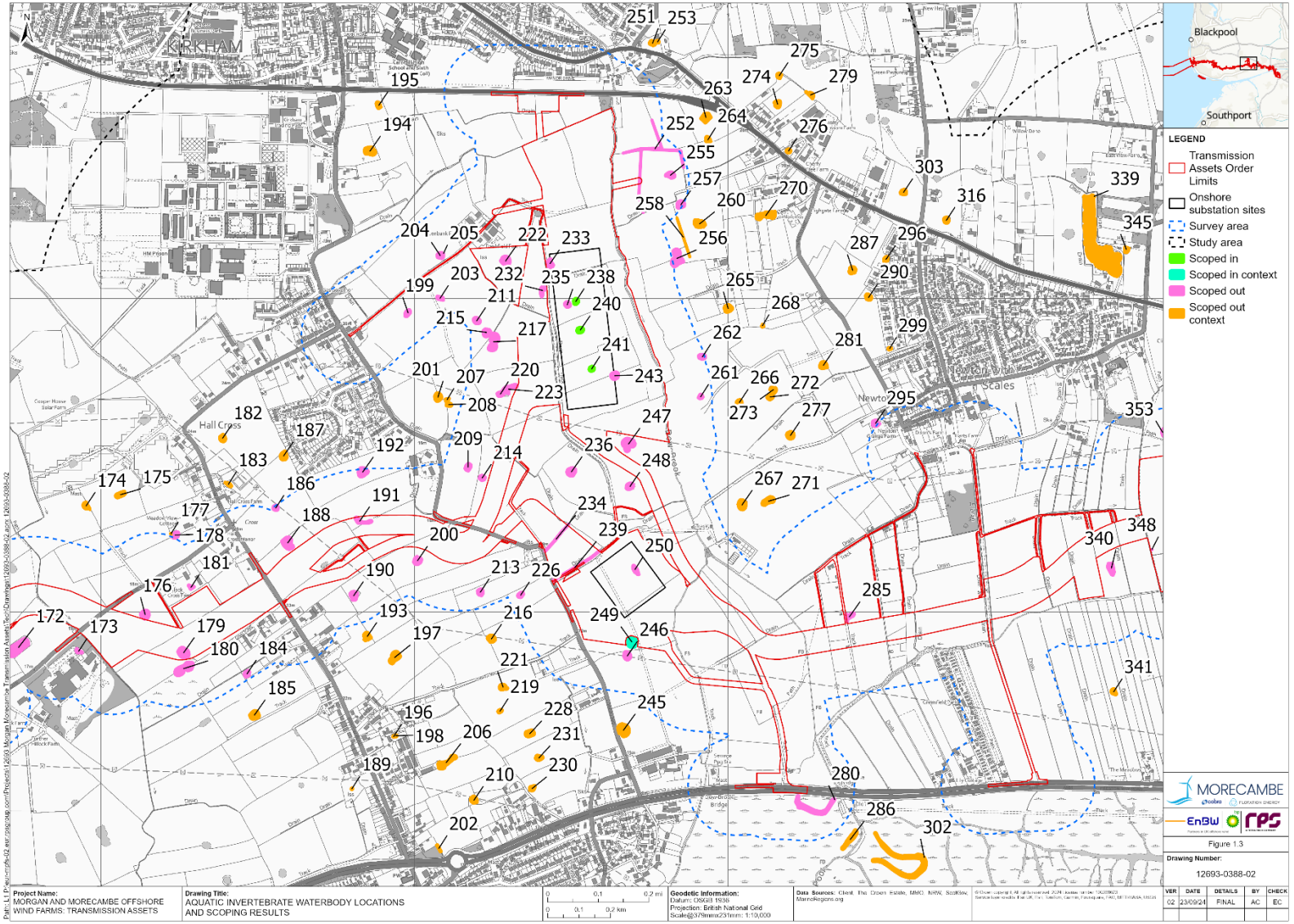

Figure 1.3: Aquatic invertebrate waterbody locations and scoping results – Sheet 2

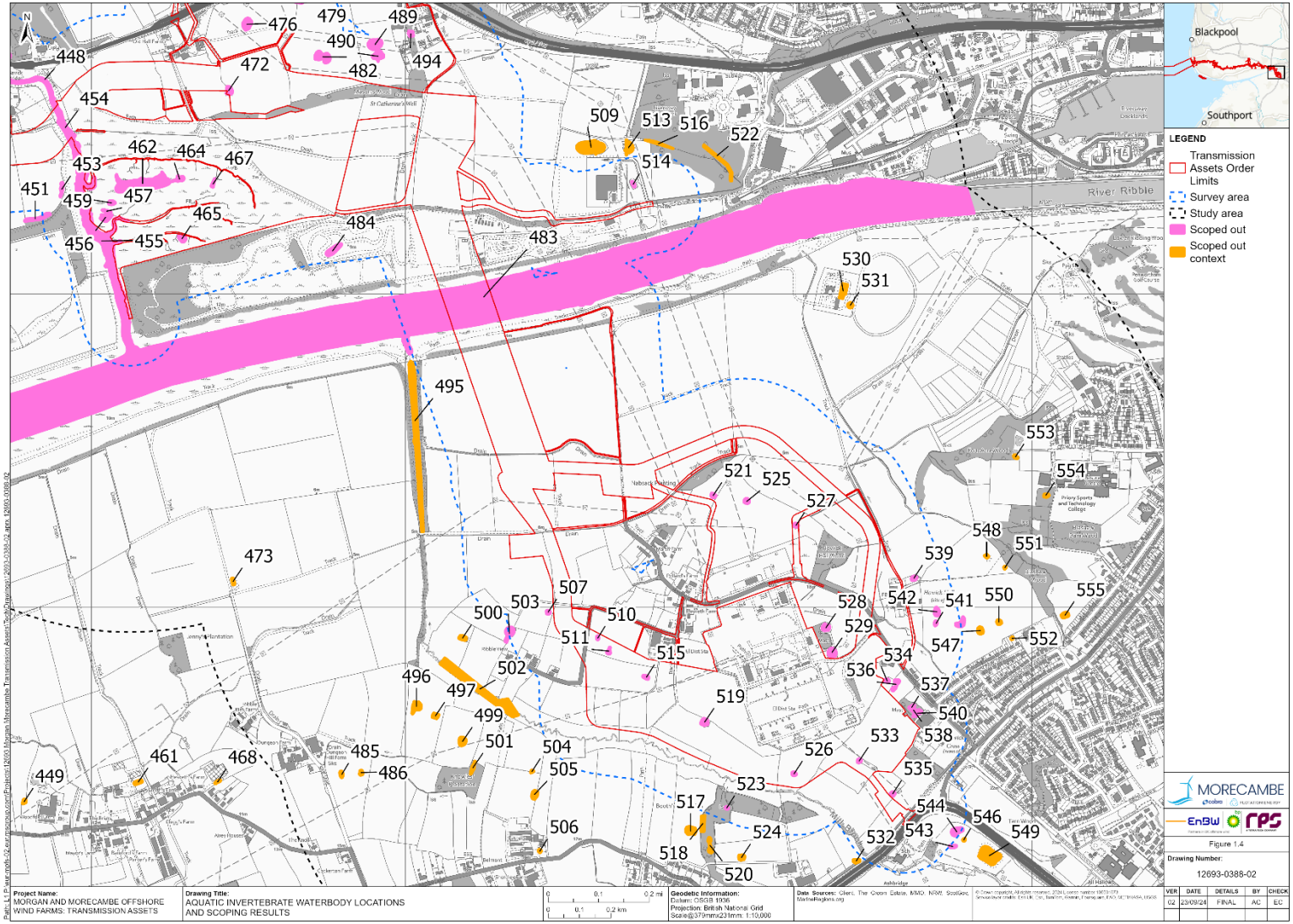

Figure 1.4: Aquatic invertebrate waterbody locations and scoping results – Sheet 3

Watercourses

1.3.2.9 A total of 11 watercourses were identified within the aquatic invertebrate survey area, as identified during Phase 1 habitat surveys (see Volume 3, Annex 3.2: Phase 1 habitat, National Vegetation Classification and hedgerow survey technical report of the ES). Eight of the 11 watercourses were confirmed to be suitable for protected or notable aquatic invertebrates and were scoped in for more detailed rapid assessment surveys. A summary of survey results from within the survey area, is presented in **Table 1.5** below with contextual results presented in **Table 1.6**. One watercourse survey location intersects with the Transmission Assets Order Limits (D), two lie within the survey area (C & P), four outside the survey area (B, F, H, N) and one lies outside the study area (Q) as shown on **Figure 1.5** to **Figure 1.8**.

1.3.2.10 The eight watercourses were sub-divided into separate survey locations and each survey location was assessed to determine its suitability to support protected and notable invertebrates. Of the eight watercourses, one survey location on each watercourse was assessed as being suitable to support aquatic invertebrates, as shown on **Figure 1.6** to **Figure 1.8** of this technical report. Other possible survey locations on the eight watercourses were scoped out based on the watercourses being too dry or shallow to support aquatic invertebrates. Of the eight watercourse survey locations assessed as suitable for aquatic invertebrates, one survey location was in the Transmission Assets Order Limits (Watercourse D, survey location 3).

1.3.2.11 All watercourses scoped out for further survey are listed in **Appendix A.1**. They were either dry or unsuitable for kick-sampling (e.g. Savick Brook).

1.3.2.12 In total 17 different aquatic invertebrate families were recorded during the aquatic invertebrate watercourse surveys. Surveys recorded leeches *Clitellata*, shrimps, water fleas, water louse C*rustacea*, limpets *Patellidae*, true bugs *Hemiptera, Heteroptera*, stoneflies *Plecoptera* and true flies *Diptera*. No species of conservation concern were recorded so species were only recorded to family level. A summary of survey results, including list of aquatic invertebrate families and associated WHPT and ASPT score is presented in **Table 1.5** below. Full survey results are presented in **Appendix** Error! Reference source not found. of this report.

1.3.2.13 A diverse assemblage of aquatic invertebrates was recorded within Watercourse B with eight different invertebrate families. Watercourse Q had an assemblage of seven different families. Watercourses B and Q had the most diverse assemblage of aquatic invertebrates. Watercourse B comprised ramshorn snails *Planorbidae*, valve snails *Valvatidae*, bladder snails *Physidae*, mud snails *Hydrobiidae*, true bugs *Nepidae* and *Veliidae*, leeches *Hirudinidae* and crustaceans *Asellidae*. Watercourse Q comprised caddisflies *Phryganeidae*, worms *Oligochaeta*, leeches *Hirudinidae,* midges *Chironomidae*, isopods *Asellidae*, amphipods *Gammaridae* and mayflies *Baetidae*.

1.3.2.14 The diversity of aquatic invertebrates within watercourse B was the highest and watercourse H was the lowest. Watercourse H only recorded one invertebrate family water boatmen *Corixidae*.

1.3.2.15 All eight watercourses supported aquatic invertebrate families with higher sensitivity to pollution (a BMWP score of five and above). These families were shrimp *Gammeridae*, water boatmen *Corixidae* and diving beetles *Dytiscidae*. Watercourse B (survey location 1) was the only watercourse to not support these species. The diversity of the aquatic invertebrate assemblage was lower in watercourse H with only one family recorded, indicating poorer water quality. This watercourse survey location is outside the survey area and is included for context.

1.3.2.16 **Table 1.6** summarises contextual information from aquatic invertebrate surveys undertaken outside of the survey area. A total of eight watercourses were surveyed. Five of these watercourse survey locations were contextual data.

1.3.2.17 Only one watercourse survey was undertaken for each suitable watercourse. The aquatic invertebrate surveyor noted no further surveys were required as the aquatic invertebrate communities were not of sufficient conservation interest to require further survey. Further surveys were descoped based on the surveyor professional judgement.

Table 1.5: Watercourse description and results within survey area

Watercourse reference	Watercourse survey location	Watercourse name	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
C	SD 38525 29701	Wrea Brook	Re-aligned stream with low flow running through arable fields. Aquatic invertebrate assemblage included: *Asellidae, Gammaridae, Chironomidae, Dytiscidae*	4	14.3	3.58	Poor biological quality	Little/no importance
D	SD 43629 31346	Dow Brook	The section sampled is in a suburban location with a modified channel with riffle and pool sections. Aquatic invertebrate assemblage included: *Oligochaeta, Asellidae, Gammaridae, Baetidae*	4	16.4	4.1	Poor biological quality	Little/no importance
P	SD 49905 27499	Mill Brook 2	Narrow, steep sided channel meandering through pasture. Himalayan balsam throughout reach. Aquatic invertebrate assemblage included: *Physidae, Corixidae, Gammaridae*	3	11.0	3.66	Poor biological quality	Little/ no importance

Table 1.6: Contextual watercourse description and results

Watercourse reference	Watercourse survey location	Watercourse name	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
B	SD 37311 29841	Main Drain	Deep, fairly swift flowing drain with an abundance of in-channel macrophytes. Aquatic invertebrate assemblage included: *Planorbidae, Valvatidae, Physidae, Hydrobiidae, Hirudinidae, Asellidae, Nepidae, Veliidae*	8	22.7	2.84	Poor biological quality	Little/ no importance
F	SD 44506 29241	Newton Marsh	Shallow relict channel in marsh land, heavily poached by cattle. Poor water quality. Likely to fully dry out in prolonged dry weather. Lacking in channel macrophytes. Sweep-netting only possible due to deep layer of mud. Aquatic invertebrate assemblage included: *Corixidae, Chironomidae*	2	3	2.5	Poor biological quality	Little/ no importance

Watercourse reference	Watercourse survey location	Watercourse name	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
H	SD 46417 28557	Unnamed watercourse 3	Straightened modified drain. Pipe inlet at upstream extent, outfall to Ribble estuary has a tidal flap valve. Sampling is very difficult due to filamentous algae and as soon as substrate is disturbed thick anaerobic silt deposits fill the water column. On the site of an active tip. Aquatic invertebrate assemblage included: *Corixidae*	1	3.7	3.7	Poor biological quality	Little/ no importance
N	SD 490041 28516	Mill Brook	Modified straight channel set within a wooded levee. Tidal flap valve at confluence with the river Ribble. Standard kick sampling is difficult due to predominantly sandy substrate. Aquatic invertebrate assemblage included: *Chironomidae, Asellidae, Gammaridae*	3	9.4	3.13	Poor biological quality	Little/ no importance

Watercourse reference	Watercourse survey location	Watercourse name	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
Q	SD 47791 26469 (survey location outside study area)	Longton Brook	Shallow, slow flowing re-aligned stream running through rough pasture (PRoW and informal dog walking area) and arable fields. Aquatic invertebrate assemblage included: *Phryganeidae, Oligochaeta, Chironomidae, Hirudinidae, Asellidae, Gammaridae, Baetidae*	7	22.3	3.19	Poor biological quality	Little/ no importance

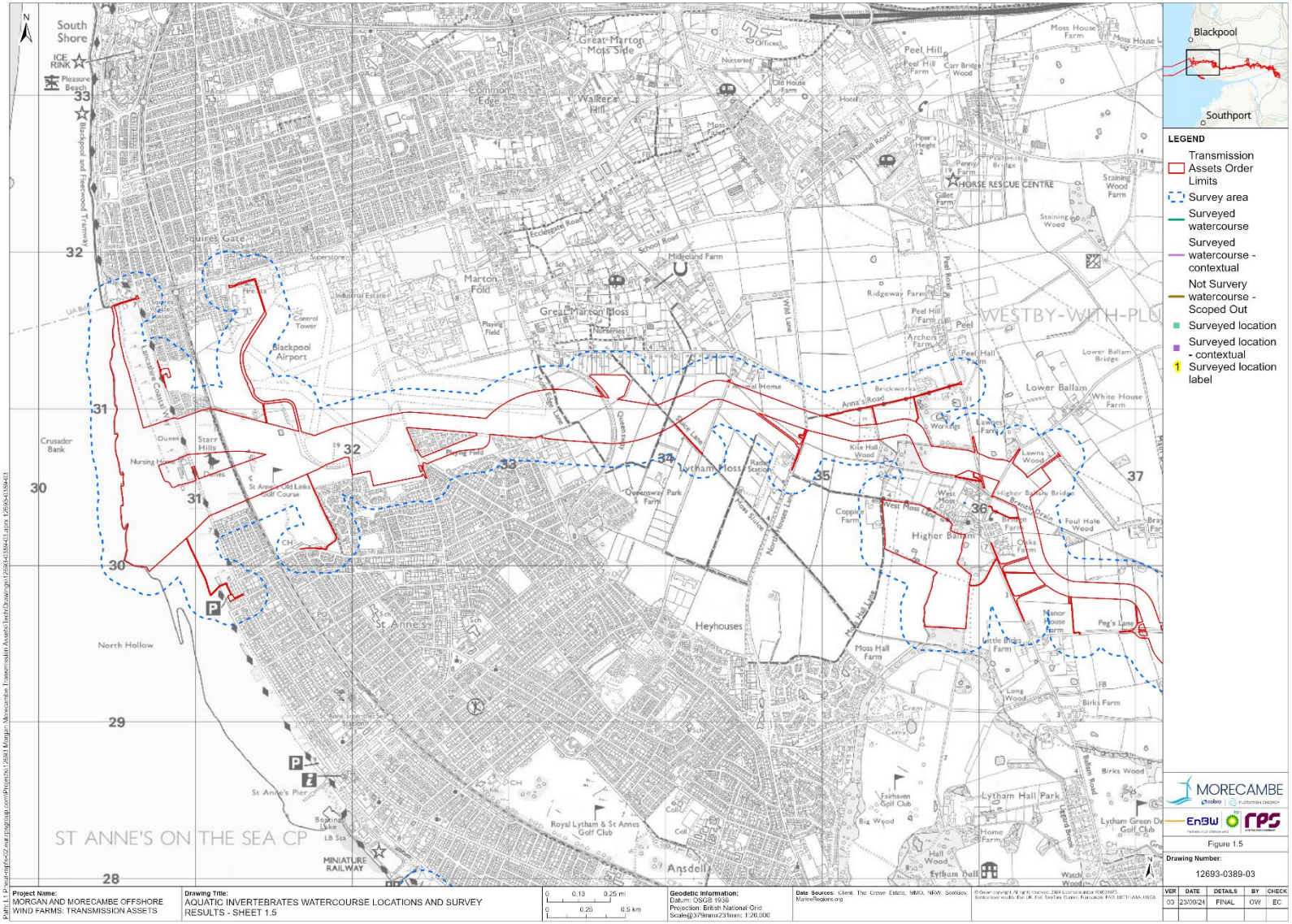

Figure 1.5: Aquatic invertebrates watercourse survey locations and scoping results – Sheet 1

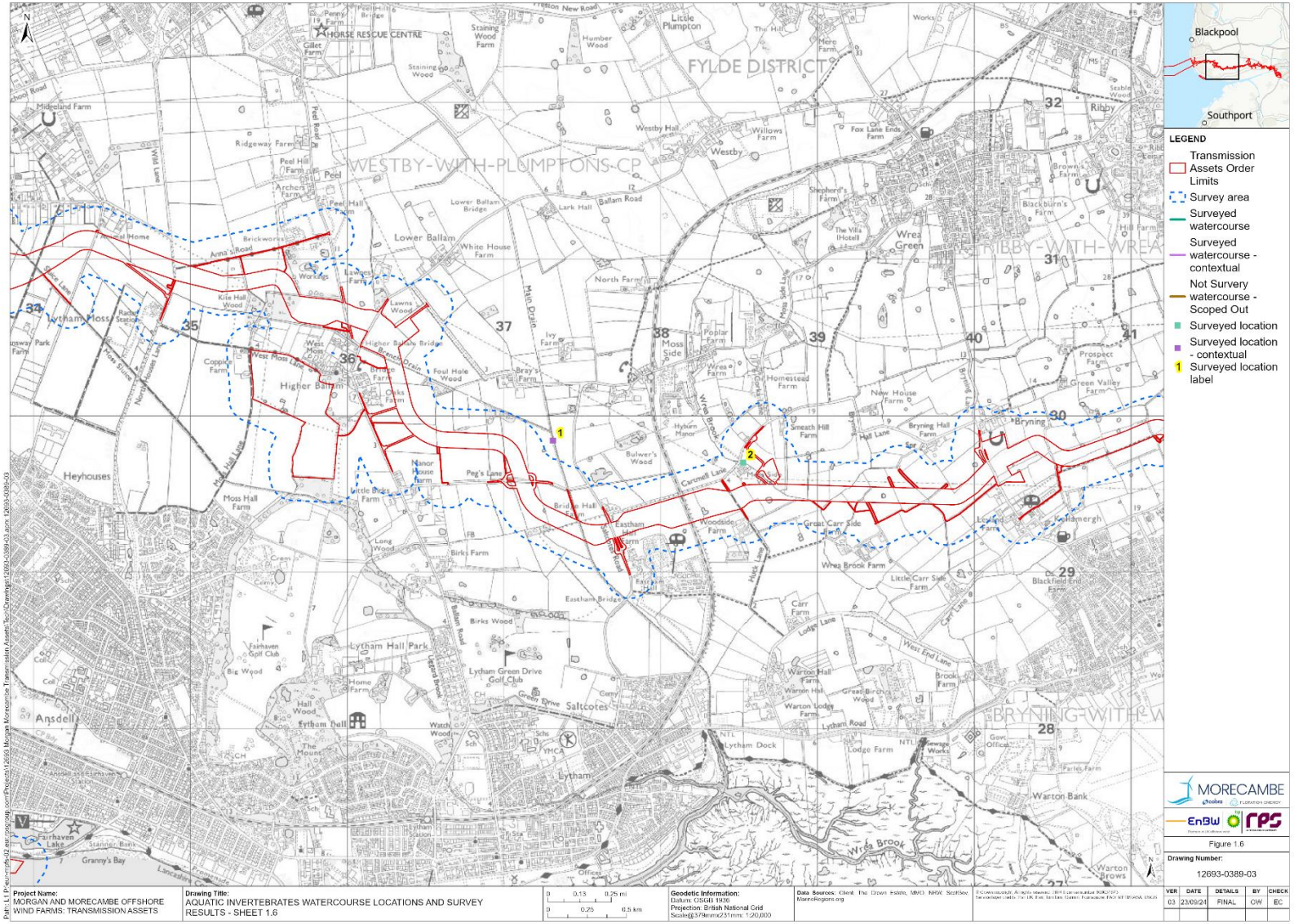

Figure 1.6: Aquatic invertebrates watercourse survey locations and scoping results – Sheet 2

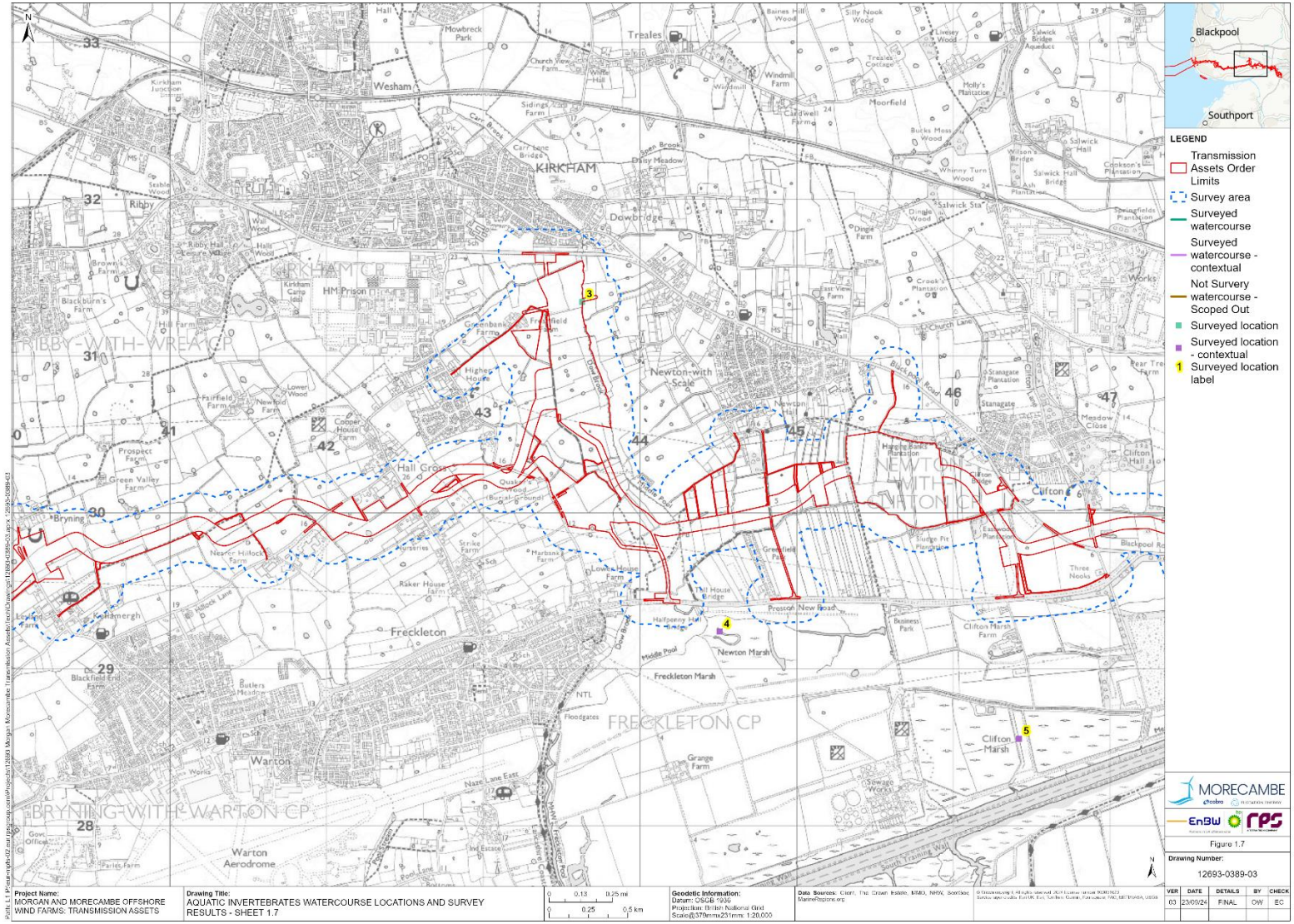

Figure 1.7: Aquatic invertebrates watercourse survey locations and scoping results – Sheet 3

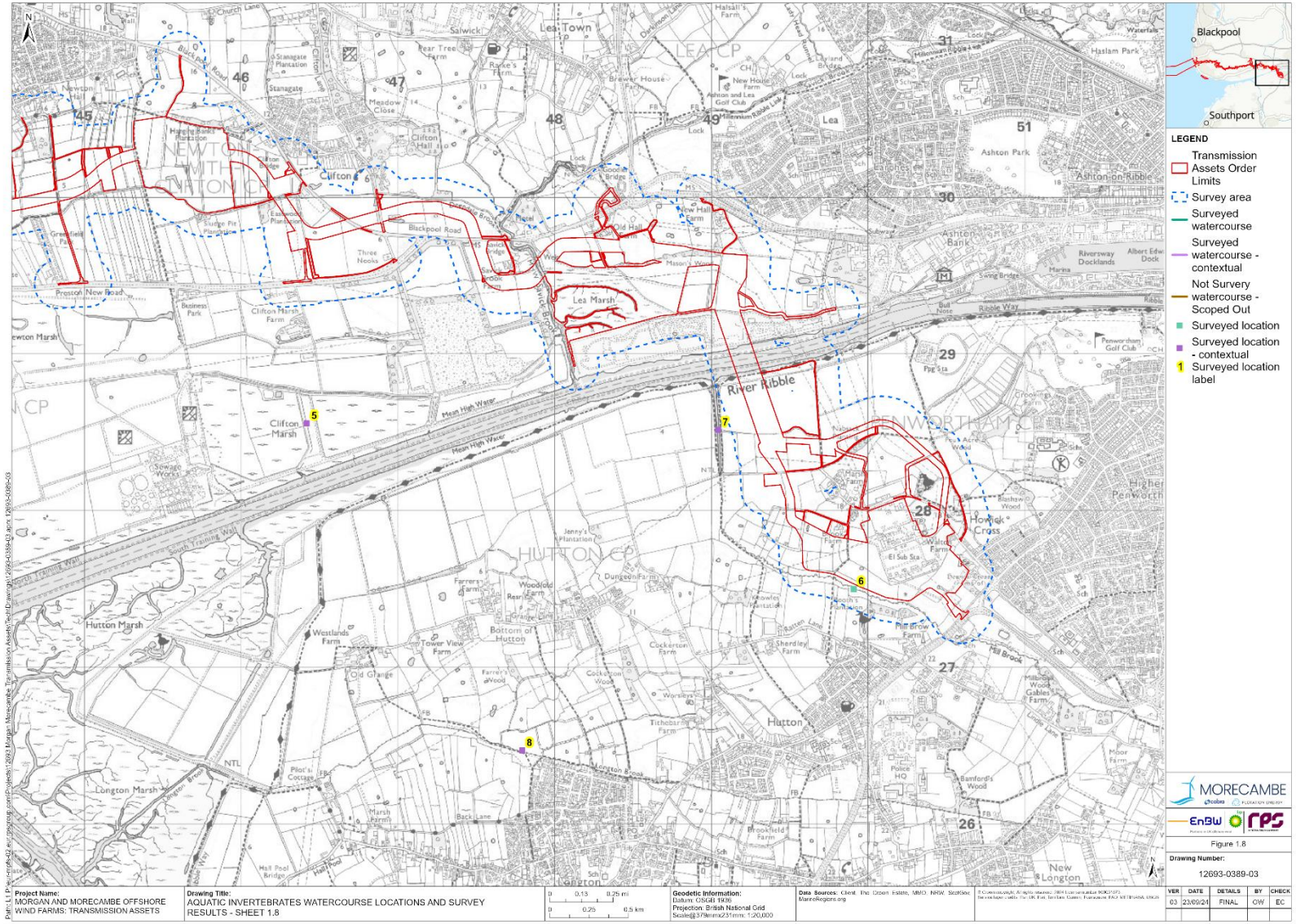

Figure 1.8: Aquatic invertebrates watercourse survey locations and scoping results – Sheet 4

1.4 Summary

1.4.1.1 This technical report presents the results of the aquatic invertebrate desk study and field surveys undertaken in July 2023 and July 2024 to inform Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES.

1.4.1.2 No protected or notable aquatic invertebrate species were identified during the desk study.

1.4.1.3 Thirty-one waterbodies were present within the survey area, of which five were identified as being suitable to support aquatic invertebrate and were subsequently surveyed. All of the waterbodies scoped in were in the Transmission Assets Order Limits. Eleven different invertebrate groups were recorded during the scoping surveys. The groups comprised alderfly larvae, dragonfly larvae, damselfly larvae, water beetles, water bugs, pond skaters, may fly larvae, freshwater shrimps, water skaters, water snails and other species such as leeches and worms.

1.4.1.4 The subsequent detailed surveys recorded 117 different aquatic invertebrate species. Waterbody 133 recorded the highest number of invertebrate taxa. Waterbody 238 recorded the alder leaf beetle *Agelastica alni* – the only RDB species recorded during the aquatic invertebrate waterbody surveys. Waterbody 240 supports the burreed pollen beetle *Telmatophilus caricis*, appearing to be the only record in Lancashire County, although its habitat plant is plentiful in the area. Waterbody 241 is notable for the occurrence of the mud pond snail in its BHS citation *Lymnaea glabra*, a RDB species, although there was no evidence of this species during this survey.

1.4.1.5 Eleven watercourses were present in the aquatic invertebrates survey area. Eight watercourses were subject to detailed survey following assessment by a competent aquatic invertebrate survey specialist. One was within the Onshore Order Limits, two were within the wider survey area, four were outside the survey area and one was outside the study area. The eight watercourses were each assessed at one watercourse survey location. Watercourse D survey location 3 is within the Onshore Order Limits.

1.4.1.6 Watercourses B and Q had the most diverse assemblage of aquatic invertebrates. All eight watercourse survey locations supported aquatic invertebrate families with higher sensitivity to pollution (a BMWP score of five and above). The diversity of the aquatic invertebrate assemblage was lower in watercourse H with only one family recorded, indicating poorer water quality.

1.5 References

Armitage, P. D., Moss, D., Wright, J. F and Furse, M. T. (1983) The performance of a new biological water quality score system based on macroinvertebrates over a wide range of unpolluted running-water sites, Water Research, Volume 17, Issue 3,1983, Pages 333-347, ISSN 0043-1354,

Chapman, D. V. (1996). World Health Organization, UNESCO & United Nations Environment Programme. Water quality assessments : a guide to the use of biota, sediments and water in environmental monitoring / edited by Deborah Chapman, 2nd ed. E & FN Spon.

Defra (2023) Magic Map Application. Available: https://magic.defra.gov.uk/MagicMap.aspx. Accessed: January 2023.

Drake, C. M., Lott, D. A., Alexander, K. N. A., & Webb, J. (2007). Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation . In Surveying terrestrial and freshwater invertebrates for conservation evaluation (NERR005). Natural England. https://publications.naturalengland.org.uk/publication/36002

British Standards Institution (2012) ISO 10870:2012 Water quality − Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters.

Environment Agency (2014) Freshwater macro-invertebrate analysis of riverine samples, Version 28/01/2014. Operational instruction 024_08

Hawkes H.A. (1997) Origin and Development of the Biological Monitoring Working Party Score System. Water Research 32 (3): 964-968

JNCC (2023) Conservation designations for UK taxa 2023. Available: https://hub.jncc.gov.uk/assets/478f7160-967b-4366-acdf-8941fd33850b Accessed: September 2024.

JNCC (2024) UK Protected Areas Available: https://jncc.gov.uk/our-work/uk-protected-areas/ Accessed: February 2024.

Labat, F. (2017). A new method to estimate aquatic invertebrate diversity in French shallow lakes and ponds. Ecological Indicators, 81, 401–408. https://doi.org/10.1016/j.ecolind.2017.05.073

Lancashire County Council and Lancashire Wildlife Trust Lancashire County Heritage (1998 updated 2005, 2023) Sites Scheme Biological Heritage Sites Guidelines for Site Selection https://www.lancashire.gov.uk/lern/site-designations/local-sites/biological-heritage-sites/bhs-guidelines-for-site-selection/. Accessed: July 2024.

Lee, P. (2012). Water Quality: Guidelines for the Selection of Sampling Methods and Devices for Benthic Macroinvertebrates in Fresh Waters. In ISO 10870:2012 Water quality Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters. CIEEM. https://www.iso.org/standard/46251.html. BS EN ISO 10870:2012.

Mason, C.F. (2002). Biology of freshwater pollution,4th ed. Pearson Education limited.

Water Framework Directive – United Kingdom Advisory Group. UKTAG River Assessment. Method. Benthic Invertebrate Fauna. Invertebrates (General

Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT). July 2014. ISBN: 978-1-906934-49-1.

UK TAG (2021) UKTAG River Assessment Method Benthic Invertebrate Fauna: Invertebrates (General Degradation): Walley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT). WFD UK Technical Advisory Group.

Appendix A

A.1 Waterbody scoping results

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond score	Further survey required	Justification for scoping
338	Pond suffers from poaching and diffuse agricultural pollution. Completely lacking in macrophytes with a substrate of anaerobic sludge.	Waterbugs, other (worms, leeches)	6	No further survey required	N/A
89	The pond looks to have been recently dug out/modified to aid field drainage and looks in very poor condition, but surprisingly has good numbers of baetis nymphs.	Dragonfly larvae, waterbugs, marfly larvae, other (worms, leeches)	21	No further survey required	N/A
125	Shallow pond with clay substrate, lacking in macrophytes, likely fully dries out in summer.	Waterbugs, other (worms, leeches)	6	No further survey required	N/A

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond score	Further survey required	Justification for scoping
133	The pond has been fenced off to prevent incursion and poaching from cattle and as a result the improvement in condition is noticeable, water quality is good with some nice emergent macrophtes (water crowfoot, *Ranunculus aquatilus*) and a diverse invertebrate assemblage.	Alderfly larvae, dragonfly larvae, damselfly larvae, water beetles, water bugs, pond skaters, mayfly larvae, water skaters, water snails, other (worms, leeches)	53	Yes – further survey recommended	Scoring above 30.
143	The pond is located in an arable field, generally lacking in macrophytes bar juncus around the fringes. Turbid, shallow, suspect suffers from diffuse agricultural pollution.	Damselfly larvae, waterbugs, mayfly larvae, water skaters, other (worms, leeches)	22	No further survey required	N/A
154	The pond is located in a pasture field, presently grazed by sheep. The majority of the pond is fenced off with access to livestock available to a limited extent and thus the waterbody is in a fair condition with a fairly diverse assemblage of emergent macrophtyes.	Damselfly larvae, waterbugs, mayfly larvae, waters skaters, other (worms, leeches)	22	No further survey required	N/A

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond score	Further survey required	Justification for scoping
179	Overgrown fishing club pond, completely enclosed by woodland screening and fringed with flag iris, marsh marigold and *Salix* sp. pond drops of to 1.5m depth from bankside and waterbody is almost completely occluded with lily pads.	Water beetles, water bugs, mayfly larvae, freshwater shrimps, water skaters, other (worms, leeches)	18	No further survey required	N/A
243	The pond is located on the boundary of a field that is grazed by cattle and as such the waterbody suffers from poaching. The pond is shallow and dries to a fraction of its size in summer, if not fully in dry summer conditions. Silty substrate with poor water quality.	Waterbugs, water skaters, other (worms, leeches)	12	No further survey required	N/A
246	The pond in fringed with hawthorn but, suffers from poaching where cattle can access. Generally lacking in macrophytes, some pondweed but dominated by duckweed	Damselfly larvae, water beetles, mayfly larvae, water skaters, water snails, other (worms, leeches)	23	No further survey required	N/A

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond score	Further survey required	Justification for scoping
249	The pond is located in located in pasture fields and suffers from poaching to a degree, but is afforded some protection by steep banks and hawthorn cover. Some pondweed and water plantain in the margins where not poached.	Caddis fly larvae, damselfly larvae, waterbugs, mayfly larvae, water skaters, water snails, other (worms, leeches)	38	Yes – further survey recommended	Scoring above 30
286	Pond 286 no longer exists	None	0	No further survey required	N/A
285	Waterbody is an extension of the fieldside drainage ditch and completely occluded with Common reed Phragmites australis. Despite the recent sustained wet weather the waterbody is almost dry and will completely dry out in summer.	Freshwater shrimps, water skaters	6	No further survey required	N/A
472	Marl pit in conner of field, willow encroaching from east and west banks, generally lackinging in macrophytes and very turbid.	Damselfly larvae, water beetles, water bugs, mayfly larvae, water skaters, other (worms, leeches)	27	No further survey required	N/A

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond score	Further survey required	Justification for scoping
	Dry/ not a pond when visited	None	N/A	No further survey required	N/A
511	Pond suffers from poaching and likely dries out in prolonged dry summer conditions.	Damselfly, water beetles, water bugs, other (worms, leeches)	21	No further survey required	N/A
510	Ephemeral waterbody. Pond completely dry despite despite sustained recent heavy rainfall.	None	0	No further survey required	N/A
519	The pond has fairly recently been fenced off to protect it from poaching, but its legacy is still evident on the banks. The majority of the waterbody is chocked out with horsetail with willow encroaching from one side, leaving a smaller patch of standing water in the middle.	Freshwater shrimps, water skaters	22	No further survey required	N/A

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond score	Further survey required	Justification for scoping
527	The pond is perched is an odd position in a depression on the shoulder of a slope (possible bomb crater). The pond is virtually dry despite the recent sustained wet weather and likely fully dries out. Vegetation is dominated by horsetail and hard rush with duckweed occluding the sparse patches of standing water.	Mayfly larvae, freshwater shrimps, water skaters, water snails	12	No further survey required	N/A
535	The pond is devoid of open standing water and completely covered with horsetail and as such very difficult to sample. The perimeter of the pond completely fringed	Freshwater shrimps, water skaters	6	No further survey required	N/A
533	Like other ponds in the area it has fairly recently been fenced off to protect it from poaching. The pond is probably better described as a bog dominated by juncus with very little standing water despite the recent sustained heavy rainfall. The scattered patches of	Water bugs, mayfly larvae, other (worms, leeches)	11	No further survey required	N/A

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond score	Further survey required	Justification for scoping
	standing water are shallow and occluded with duckweed.				
240	The pond is fringed with a matt of soft rush and horsetail with a fairly deep (1.5-2m) area of open water in the middle. Difficult to sample due to filamentous algae, but large number of Odonata in the open water.	Dragonfly larvae, damselfly larvae, waterbugs, mayfly larvae, water skaters, water snails, other (worms, leeches)	33	Yes – further survey recommended	Scoring above 30
238	North Freshfields BHS no longer represents the citation. The pond is in very poor condition, completely lacking macrophytes with a substrate of woody debris, leaf litter and anaerobic silt.	Water skaters	1	Yes – further survey recommended	BHS pond so will require further survey
241	The pond still resembles the citation with the notable species still present; The site	Dragonfly larvae, water beetles, water skaters, water snails, other (worms, leeches)	18	Yes – further survey recommended	BHS pond so will require further survey

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond score	Further survey required	Justification for scoping
	comprises a field pond, formerly a marlpit, supporting a bog community. The pond is shallow and has a fringe of open water surrounding a peat mat with actively building mounds of bog mosses *Sphagnum recurvum*, and *S. squarrosum*. Plants present include yellow iris, lesser reedmace, marsh cinquefoil, yellow loosestrife, marsh bedstraw, branched burreed, brooklime, soft-rush, water starwort and common duckweed. The pond is notable for the occurrence of the mud pond snail, Lymnaea glabra, a British Red Data Book species, which requires shallow acid pools. Another important invertebrate found here is a nationally scarce water beetle, *Ilybius guttiger*. The pond also supports a number of other invertebrates such as diving and scavenger beetles, and the moss				

Waterbody ID	Waterbody description	Number of invertebrate groups present	Pond score	Further survey required	Justification for scoping
	bladder snail, *Aplexa hypnorum*, a species of restricted occurrence. Frogs breed in the pond.				
235	The pond is in very poor condition, completely lacking macrophytes with a substrate composed of wood bedris, leaf litter and anaerobic silt. Likely emphemeral.	Water skaters	1	No further survey required	N/A
233	Dry and damaged from livestock	None	N/A	No further survey required	N/A

A.2 Waterbody summer survey results (a blank cell means species were not found at that waterbody)

Species present		Waterbody ID				
		133	241	238	240	249
PROTOZOA:	PROTOZOANS:					
Vorticella	Colonial Bell Animacule			Present		
BRYOZOA:	MOSS ANIMALS:					
Plumatella	Bryzoan Dark-branched Moss Animal	Present				
Lophopus crystallinus	Bryzoan Glutinous White Moss Animal		Present			
LUMBRICIDAE:	EARTHWORMS:					

Species present		Waterbody ID				
		133	241	238	240	249
Lumbriculus variegatus	Oligochate Worm	Present				
HIRUDINEA:	LEECHES:					
Erpobdella octoculata	Swimming Leech					Present
Glossiphonia complanata	Green Mollusc Leech					Present
Haemopis sanguisuga	Horse Leech				Present	
Helobdella stagnalis	Two-eyed White Leech	Present				
Theromyzon tessultatum	Duck Leech	Present				Present
TRICLADIDA:	FLATWORMS:					
Dugesia polychroa	a Two-eyed Flatworm			Present		
Polycelis nigra	Black Flatworm				Present	
MOLLUSCA:	SNAILS, MUSSELS & SLUGS:					
Aplexa hypnorum	Moss Bladder Snail				Present	
Anisus vortex	Whirlpool Ramshorn			Present		
Gyraulus albus	White Ramshorn					Present
Physella acuta	American Bladder Snail	Present				
Radix auricularia	Ear-pond Snail					Present
Lymnaea stagnalis	Great Pond Snail			Present		
Ampullaceana balthica (Lym per)	Wandering Snail					Present
Stagnicola palustris	Marsh Snail				Present	
Sphaerium corneum	Horny Orb Mussel			Present		
ARACHNIDA:	SPIDERS:					

Species present		Waterbody ID				
		133	241	238	240	249
Antistea elegans	Marsh Combtail				Present	
Pirata piraticus	Cabin Hooks Otter Spider			Present	Present	Present
Clubiona phragmitis	Reedbed Sac Spider				Present	
Erigone atra	Aeronaut Money Spider				Present	
MICROCRUSTACEA:	MICROCRUSTACEANS:					
Daphnia pulex	Few-spined Water Flea	Present	Present			
Simocephalus vetulus	Elongate-eyed Water Flea	Present				
Cyclops spp	Cyclopic Copepods	Present	Present			
MALACOSTRACA :	CRUSTACEANS:					
Asellus aquaticus	Common Hoglouse	Present	Present	Present	Present	Present
MEGALOPTERA:	LACEWINGS & SCORPION FLIES:					
Sialis lutaria	Common Alderfly	Present				Present
EPHEMEROPTERA:	MAYFLIES:					
Cloeon dipterum	Pond Olive Mayfly	Present		Present		Present
TRICHOPTERA:	CADDISFLIES:					
Limnephilus flavicornis group Sc7	Caddis case (unidentifiable)			Present		
Mystacides longicornis	Spotted Caddis	Present				Present
Phryganea bipunctata	Four-spotted Lake Caddis					Present
ODONATA:	DRAGONFLIES & DAMSELFLIES:					
Aeshna grandis	Brown Hawker Dragonfly	Present				Present
Anax imperator	Emperor Dragonfly	Present		Present		Present

Species present		Waterbody ID				
		133	241	238	240	249
Calopteryx splendens	Banded Demoiselle					Present
Libellula quadrimaculata	Four-spot Chaser Dragonfly (out)	Present				Present
Coenagrion puella	Azure Damselfly	Present				Present
Ischneura elegans	Blue-tailed Damselfly			Present		
HEMIPTERA:	WATER BUGS:					
Gerris thoracicus	Yellow Pond Skater	Present				
Corixa punctata	Common Water Boatman	Present		Present		Present
Paracorixa concinna	Dark-ankled Lesser Water Boatman	Present				
Sigara distincta	Two-rowed Lesser Water Boatman	Present				Present
Sigara fossarum	Two-spotted Water Boatman					Present
Sigara limitata	Four-striped Lesser Water Boatman	Present				
Sigara nigrolineata	Zebra Water Boatman					Present
Corixini sp				Present		
Notonecta glauca	Common Backswimmer	Present		Present		Present
Notonecta viridis	Ivory X-marked Backswimmer	Present		Present		Present
Plea minutissima	Least Backswimmer	Present				Present
Hydrometra stagnorum	Common Water Measurer	Present				Present
Ilyocoris cimicoides	Saucer Bug	Present		Present		Present
Ranatra linearis	Water Stick Insect	Present				Present
Saldula saltatoria	Common Shorebug				Present	
Damselbug species:						

Species present		Waterbody ID				
		133	241	238	240	249
Nabis limbatus	Marsh Damselbug (small-winged broad-edged)				Present	
Larger Leafhopper species:						
Cicadella viridis	Large Green Leafhopper				Present	
Planthopper species:						
Conomelus anceps	Marsh Short-winged Planthopper				Present	
LEPIDOPTERA:	BUTTERFLIES & MOTHS:					
Butterfly species:						
Maniola jurtina	Meadow Brown Butterfly	Present				
Moth species:						
Cataclysta lemnata	Duckweed Moth					Present
Coleophora sp	cased micromoth caterpillar				Present	
COLEOPTERA:	BEETLES:					
Water Beetle species:						
Haliplus ruficollis	Common Halipus Beetle	Present		Present		Present
Hygrobia hermanni	Squeak Beetle	Present		Present		Present
Dytiscus circumflexus	Banded Great Diving Beetle	Present				
Acilius sulcatus	Grooved Diving Beetle	Present		Present		
Colymbetes fuscus	Larger Diving Beetle					Present
Agabus affinis	Kilij-ended Diving Beetle				Present	
Agabus bipustulatus	Common Black Diving Beetle	Present		Present	Present	Present

Species present		Waterbody ID				
		133	241	238	240	249
Agabus nebulosus	Mottled Diving Beetle					Present
Ilybius fuliginosus	Side-banded Diving Beetle					Present
Ilybius guttiger	Black Fen Diving Beetle				Present	
Rhantus suturalis	3-spot Gold-speckled Diving Beetle	Present				
Noterus clavicornis	Boat-shaped Small Diving Beetle	Present		Present		
Hydroporus gyllenhalii	Shiny-brown Small Diving Beetle				Present	
Hydroporus pubescens	Smaller Brown Diving Beetle				Present	
Hydroporus umbrosus	Black & Brown Tiny Diving Beetle				Present	
Hygrotus confluens	Black-bellied Oval Diving Beetle	Present				
Hygrotus inaequalis	Striped Oval Diving Beetle	Present				
Hyphydrus ovatus	Orange Egg-shaped Diving Beetle	Present				Present
Laccophilus minutus	Quiet Khaki Diving Beetle	Present		Present		Present
Cercyon convexiusculus	Black Domed Scavenger Beetle				Present	
Cercyon tristis	Black Domed Scavenger Beetle			Present		
Enochrus testaceus	Dark-tipped Scavenger Beetle			Present		
Helochares lividus	Shiny Pale Helochares Beetle	Present				
Helophorus brevipalpis	Golden Scavenger Beetle		Present		Present	Present
Helophorus grandis	Large-toothed Greater Scavenger Beetle			Present	Present	
Helophorus minutus	Common Golden Scavenger Beetle	Present				
Hydrobius fuscipes agg	Common Black-domed Scavenger Beetle					Present

Species present		Waterbody ID				
		133	241	238	240	249
Laccobius bipuncatatus	Common Grey-domed Scavenger Beetle					Present
Contacyphon hilaris	Mid-streaked Marsh Beetle				Present	
Microcara testacea	Dark-spot Marsh Beetle				Present	
Scirtes hemisphaericus	Oval Marsh Flea Beetle			Present		
Leaf & Flea Beetle species:						
Agelastica alni	Alder Leaf Beetle (Nationally Scarce)		Present			
Galerucella sagittariae	Marginal Galerucella Beetle					Present
Gastrophysa viridula	Green Dock Beetle		Present		Present	
Ladybird species:						
Coccinella 7-punctata	Common 7 Spot Red Ladybird	Present				
Ground Beetle species:						
Agonum piceum	Narrow-fronted dark & pale Agonum			Present		
Bembidion lunulatum	Brown Ground Beetle				Present	
Pterostichus minor	Lesser Blackclock GB				Present	
Pterostichus rhaeticus	Pincer Blackcock GB				Present	
Stenolophus mixtus	Yellow-edged Brown GB				Present	
Rove Beetle species:						
Stenus binotatus	Camphor Beetle			Present		
Stenus impressus	Spurred Camphor Beetle				Present	
Stenus nitidiusculus	Uneven-elytrad Camphor Beetle				Present	

Species present		Waterbody ID				
		133	241	238	240	249
Aleochara sp	Brown Aleochara Beetle				Present	
Other Beetle species:						
Telmatophilus caricis	Burreed Pollen Beetle (Only record in Lancashire county)			Present		
DIPTERA:	TRUE FLIES:					
Craneflies:						
Erioptera flavata	Small Yellow Cranefly			Present		
Prionocera turcica	Yellow-nosed Cranefly adult+ larva				Present	
Tipula vittata	Streak-winged Spring Cranefly				Present	
Tipulidae	Larva/Pupa (undeterminable)			Present		
other Nematocera species:						
Chaoborus sp & c (larvae)	Phantom Midge					Present
Anopheles atroparvus/messeae (larvae)	Mosquito					Present
Culiseta aaa (larvae)	Mosquito		Present			
Culiseta sp (larvae)	Mosquito				Present	
Chironomidae (red larvae)	Non-biting Midges (bloodworm)	Present	Present		Present	
Tanypodinae (larvae)	Non-biting Midge (Narrow Head)			Present		
Tanypodinae (larvae)	Non-biting Midge (Wide Head)	Present				
COLLEMBOLA:	SPRINGTAILS:					
Pogonognathellus longicornis	Coil-antennaed Yellow Springtail				Present	
Tomocerus minor	Trident Brown Springtail				Present	

Species present		Waterbody ID				
		133	241	238	240	249
TOTAL INVERTEBRATE TAXA:		**44**	**9**	**32**	**39**	**42**

A.3 Watercourse scoping results

Watercourse number	Watercourse survey location	Watercourse ID	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
A	N/A	Branch Drain	Scoped out from further survey					
B	SD 37311 29841	Main Drain	Deep, fairly swift flowing drain with an abundance of in-channel macrophytes. Aquatic invertebrate assemblage included: *Planorbidae, Valvatidae, Physidae, Hydrobiidae, Hirudinidae, Asellidae, Nepidae, Veliidae*	8	22.7	2.84	Poor biological quality	Little/ no importance
C	SD 38525 29701	Wrea Brook	Re-aligned stream with low flow running	4	14.3	3.58	Poor biological quality	Little/ no importance

Watercourse number	Watercourse survey location	Watercourse ID	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
			through arable fields. Aquatic invertebrate assemblage included: *Asellidae, Gammaridae, Chironomidae, Dytiscidae*					
D	SD 43629 31346	Dow Brook	The section sampled is in a suburban location with a modified channel with riffle and pool sections. Aquatic invertebrate assemblage included: *Oligochaeta, Asellidae, Gammaridae, Baetidae*	4	16.4	4.1	Poor biological quality	Little/ no importance
E	N/A	Branch of Dow Brook	Scoped out from further survey - dry					

Watercourse number	Watercourse survey location	Watercourse ID	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
F	SD 44506 29241	Newton Marsh	Shallow relict channel in marsh land, heavily poached by cattle. Poor water quality. Likely to fully dry out in prolonged dry weather. Lacking in channel macrophytes. Sweep-netting only possible due to deep layer of mud. Aquatic invertebrate assemblage included: *Corixidae, Chironomidae*	2	5.0	2.5	Poor biological quality	Little/ no importance
G	N/A	Unnamed watercourse 4	Scoped out from further survey (contextual)					

Watercourse number	Watercourse survey location	Watercourse ID	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
H	SD 46417 28557	Unnamed watercourse 3	Straightened modified drain. Pipe inlet at upstream extent, outfall to Ribble estuary has a tidal flap valve. Sampling is very difficult due to filamentous algae and as soon as substrate is disturbed thick anaerobic silt deposits fill the water column. On the site of an active tip. Aquatic invertebrate assemblage included: *Corixidae*	1	3.7	3.7	Poor biological quality	Little/ no importance
I	N/A	Savick Brook	Scoped out from further survey – unsuitable for kick sampling					
J	N/A	Deepdale Brook	Scoped out from further survey - dry					
K	N/A	Unnamed watercourse 2	Scoped out from further survey - dry					
M	N/A	Unnamed watercourse	Scoped out from further survey (contextual)					

Watercourse number	Watercourse survey location	Watercourse ID	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
N	SD 490041 28516	Mill Brook	Modified straight channel set within a wooded levee. Tidal flap valve at confluence with the river Ribble. Standard kick sampling is difficult due to predominantly sandy substrate. Aquatic invertebrate assemblage included : Chironomidae, Asellidae, Gammaridae	3	9.4	3.13	Poor biological quality	Little/ no importance
O	N/A	Unnamed tributary of Mill Brook	Scoped out from further survey (contextual)					
P	SD 46417 28557	Mill Brook 2	Narrow, steep sided channel meandering through pasture. Himalayan balsam throughout reach. Aquatic invertebrate assemblage	3	11.0	3.66	Poor biological quality	Little/ no importance

Watercourse number	Watercourse survey location	Watercourse ID	Description	Number of taxa	WHPT	ASPT	Biological water quality index	Importance
			included: *Physidae, Corixidae, Gammaridae*					
Q	SD 47791 26469	Longton Brook	Shallow, slow flowing re-aligned stream running through rough pasture (PRoW and informal dog walking area) and arable fields. Aquatic invertebrate assemblage included: *Phryganeidae, Oligochaeta, Chironomidae, Hirudinidae, Asellidae, Gammaridae, Baetidae*	7	22.3	3.19	Poor biological quality	Little/ no importance

Appendix B: Protected/notable aquatic invertebrates

B.1.1 Protected aquatic invertebrate species

Aquatic invertebrate species	Scientific Name	Wildlife and Countryside Act 1981
Lesser silver water beetle	*Hydrochara caraboides*	Schedule 5
Water beetle	*Paracymus aeneus*	Schedule 5
Norfolk aeshna	*Aeshna isosceles*	Schedule 5
Southern damselfly	*Coenagrion mercuriale*	Schedule 5
Fen raft spider	*Dolomedes plantarius*	Schedule 5
White-clawed crayfish	*Austropotamobius pallipes*	Schedule 5
Fairy shrimp	*Chirocephalus diaphanus*	Schedule 5
Tadpole shrimp	*Triops cancriformis*	Schedule 5
Lagoon sand shrimp	*Gammarus insensibilis*	Schedule 5
Pearl mussel	*Margaritifera margaritifera*	Schedule 5
De Folin's lagoon snail	*Caecum armoricum*	Schedule 5
Sandbowl snail	*Catinella arenaria*	Schedule 5
Carthusian snail	*Monacha cartusiana*	Schedule 5
Northern hatchet-shell	*Thyasira gouldi*	Schedule 5
Medicinal leech	*Hirudo medicinalis*	Schedule 5

B.1.2 British Conservation Status Categories - definitions

The following definitions are those used by the Joint Nature Conservation Committee review of the statuses of scarce invertebrates of Great Britain (JNCC, 2023).

Red Data Book Category 1. RDB1-ENDANGERED

Taxa in danger of extinction if causal factors continue unabated. Includes species occurring as a single colony or only in habitats which are much reduced and highly threatened, or which have shown a rapid and continuous decline.

Red Data Book Category 2. RDB2-VULNERABLE

Taxa believed likely to move into the endangered category in the near future if the causal factors continue operating. Includes species of which most or all populations are decreasing and those which are confined to vulnerable habitats.

Red Data Book Category 3. RDB3-RARE

Taxa with small populations that are not at present endangered or vulnerable but are at risk; usually localised within restricted geographical areas or habitats or are thinly scattered over a wider range. Includes species estimated to exist in only fifteen or less post 1970 10km squares or, if more, then in vulnerable habitat.

Red Data Book Category 4. RDBK – Data deficient

Taxa that are suspected, but not definitely known, to belong to any of the above categories, because of lack of information. Includes taxa recently discovered or recognised in Great Britain which may prove to be more widespread in the future; taxa with very few or perhaps only a single known locality but which belong to poorly recorded or taxonomically difficult groups; species known from very few localities but which occur in inaccessible habitats or habitats which are seldom sampled; species with very few or perhaps only a single known locality and of questionable native status, but not clearly falling into the category of recent colonist, vagrant or introduction.

Nationally Scarce Category a. Na

Taxa which do not fall within the RDB categories, but which are uncommon in Great Britain and are known to occur in 30 or fewer 10km squares or, in less well recorded groups, within seven or fewer vice-counties.

B.1.3 BMWP families and scores

Group	BMWP Family	BMWP Score
Dragonflies	*Libelludae*	8
Shrimps	*Gammeridae*	6
Backswimmers	*Notonoctidae*	5
Waterboatmen	*Corixidae*	5
Pond skaters	*Gerridae*	5
Diving beetles	*Dytiscidae*	5
Mud snails	*Hydrobidae*	3
Pond snails	*Lymnaeidae*	3
Ramshorn snails	*Planorbidae*	3
Leeches	*Hirudidae*	3
Isopods	*Asellidae*	3
Midges	*Chironomidae*	2