Longfield Solar Farm

Environmental Statement PINS Ref: EN010118

Volume 2

Appendix 8D: Aquatic Ecology Survey Report

Document Reference EN010118/APP/6.2

Revision Number: 1.0

February 2022

Longfield Solar Farm Ltd

APFP Regulation 5(2)(a)

Planning Act 2008

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

Quality information

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1. Introduction

1.1 Background

1.1.1 In 2020 and 2021, AECOM undertook a Preliminary Ecological Appraisal (PEA) (***Appendix 8B: Preliminary Ecological Appraisal*** of the Environmental Statement (ES) **[EN010118/APP/6.2]**) of the Longfield Solar Farm Site on behalf of Longfield Solar Farm Ltd (hereafter referred to as 'the Applicant'). This PEA identified the need for follow-up ecological surveys and assessments to determine a baseline and potential impacts of the proposed Longfield Solar Energy Farm (hereafter referred to as 'the Scheme') on protected and, or notable species. As part of this work, AECOM undertook aquatic surveys within and up to 500m from the Scheme boundary (hereafter referred to as the 'Order limits').

1.2 Order limits Description

1.2.1 The Order limits is approximately centred on National Grid Reference (NGR) TL 74179 14620 and located approximately 1.1km to the West of the village of Terling.

1.2.2 The Order limits comprises a single parcel of land separated by several areas of woodland which are in total approximately 453 hectares (ha) in area.

1.2.3 The landscape features within the Order limits consist of agricultural fields mainly under arable production, with some small parcels of pasture, interspersed with individual trees, hedgerows, linear tree belts, small woodland blocks and farm access tracks. The hedgerows within the Order limits range between lengths of dense tall vegetation (shrub and tree species), the dominant hedgerow type in the landscape, and thin lines of vegetation with sporadic trees. The arable fields are of small to moderate size, some of which are of irregular shape.

1.2.4 The landscape features immediately surrounding the Order limits comprise a number of villages, including Fuller Street approximately 300 metres (m) to the north, Gamble's Green and Terling 500m and 1.1km to the east, Boreham 500m to the south-west, Hatfield Peverel 1.5km to the south-east and the city of Chelmsford 5.7 kilometres (km) to the south-west. Boreham Road runs north to south along the western edge of the Order limits, with the A12 carriageway abutting and bounding the southern edge of the Order limits.

1.2.5 The northern part of the Order limits and surrounding area consists of undulating and relatively elevated landform, as part of the River Ter valley. The landform rises steeply northwards from the river and Terling Spring, between 35 (m) Above Ordnance Datum (AOD) to 50m AOD along parts of Braintree Road. It culminates at a ridgeline at 70m AOD at Rank's Green, in the northern part of the study area. To the south of the River Ter, the landform also rises steeply, across Sandy Wood, to a ridgeline at 55m AOD.

1.2.6 To the west of the Order limits, the landscape consists of a varied pattern of landform, reflecting past sand and gravel extraction and engineered flat terrain across Boreham airfield, which is situated at 55m AOD approximately 800m to the west of the Order limits. From the airfield, the landform falls very

gradually eastwards to the River Ter, which flows southwards between Terling and the northern part of Hatfield Peverel, at approximately 20m AOD.

1.2.7 The River Chelmer is present 2.5km to the south of the Order limits. There are several large-scale reservoirs and lakes adjacent to the river. From the river, the landform rises consistently northwards, to form a ridgeline around 40m AOD at Boreham, and southwards, across Little Baddow, to an elevated ridgeline at 100m AOD, approximately 3km from the Order limits.

1.2.8 Most of the southern and central part of the Order limits is located across flat and low-lying landform at approximately 45m AOD, between Waltham Road / Boreham Road and Terling Road. The northern part of the Order limits is located within part of the River Ter valley, where there is rising land to the north and south of Terling Spring and adjacent to Braintree Road.

1.3 Description of the Scheme

1.3.1 Longfield Solar Farm is a new solar farm scheme that would connect to the national electricity transmission network. Longfield will use ground mounted solar photovoltaic (PV) panel arrays to generate electricity energy from the sun and combine these with a Battery Energy Storage System (BESS). The Scheme will be connected to the national electricity transmission network by an underground cable. The Scheme will be located within the Order limits as shown on.

1.3.2 The principal infrastructure will be located within the Order limits and will include:

a. Solar PV modules;
b. PV module mounting structures;
c. Inverters;
d. Transformers;
e. Switchgears (housed inside a building);
f. On-site cabling;
g. One or more BESS (expected to be formed of lithium ion batteries storing electrical energy);
h. An electrical compound comprising a substation and control building;
i. Fencing and security measures; and
j. Access tracks.

1.3.3 During the construction phase, one or more temporary construction compound(s) will be required as well as temporary roadways to facilitate access to all land within the Order limits.

1.3.4 Further information on the Scheme is provided in ***Chapter 2: The Scheme*** of the ES **[EN010118/APP/6.1]**.

1.4 Scope of this Report

1.4.1 This report aims to determine the potential impacts that the construction of the Longfield Solar Farm may have on the aquatic ecology of the River Ter and multiple ponds contained within the Order limits.

1.4.2 The purpose of the assessment was to:

a. Identify and categorise all aquatic habitats present within the Scheme red line boundary where there may be potential for direct or indirect effects (the "zone of influence");

b. Carry out an appraisal of the potential of the aquatic habitats recorded to support protected or notable species of fauna and flora;

c. Identify if there are any aquatic invasive non-native plant or animal species;

d. Provide advice on any potential ecological constraints and opportunities in the zone of influence, including the identification (where relevant) of any requirements for follow-up habitat and species surveys and/or requirements for ecological mitigation;

e. Inform the design of the Scheme and identify the scope of further work (where necessary); and

f. Make high level recommendations on potential options for the avoidance, mitigation or compensation of the potential impacts of the Scheme (where known) on the identified ecological receptors, and of potential enhancements to the biodiversity and ecosystem services.

1.5 Water Framework Directive

1.5.1 The Water Framework Directive (WFD) (EC Directive 2000/60/EC) aims to protect and enhance the quality of the water environment across all European Union (EU) member states. It takes a holistic approach to the sustainable management of water by considering the interactions between surface water (including transitional and coastal waters, rivers, streams and lakes), groundwater and water-dependent ecosystems. This includes interactions between sediment and water.

1.5.2 The WFD requires all EU member states to classify the current condition (*i.e.* the 'Status' or 'Potential') of surface and groundwater bodies, and to set a series of objectives for maintaining or improving conditions, so that waterbodies maintain or reach 'Good' Status or Potential. The Environment Agency is the competent authority for implementing the WFD in England. As part of its role, the Environment Agency (EA) must consider whether proposals for new developments have the potential to:

a. Cause deterioration of a waterbody from its current status or potential; and/ or

b. Prevent future attainment of good status or potential where not already achieved.

1.5.3 New developments that have the potential to impact on current or predicted WFD status are therefore required to assess their compliance with the WFD objectives of the potentially affected waterbodies.

1.5.4 The Scheme has the potential to impact the River Ter, a WFD water body, through the construction of the scheme and the associated infrastructure, such as access routes (***Appendix 9B: WFD Assessment*** and ***Chapter 9: Flood Risk, Drainage and Surface Water*** **[EN010118/APP/6.2]**).

2. Desk study

2.1.1 The River Ter waterbody ID (GB105037033940) is a river in Essex that rises near the village of Stebbing Green before flowing 31.4 km in a south easterly direction and joining the River Chelmer[1]. The River Ter was classified as Moderate for ecological elements and Moderate overall in the 2019 classification cycle, it has not been designated artificial or heavily modified[1]. The reasons for not achieving good was due to elevated phosphate from livestock farming and wastewater discharge from a sewage treatment works[1].

2.1.2 Historic records of fish and macroinvertebrate species within the past fifteen years are available from the EA through their routine ecological monitoring programme[2]. The EA has three monitoring sites on the River Ter within close proximity of the Order limits, Ridley Hall Lyons Hall and Great Leighs Sewage Treatment Works (**Table 1**).

Table 1: Location of Environment Agency, fish, macrophyte and macroinvertebrate monitoring stations within 3km of the Scheme

Site name	Site NGR	Proximity to Scheme	Year last surveyed
Ridley Hall	TL7560015300	Within Order limits boundary	2005
Lyons Hall (River Ter)	TL7389715667	1km upstream	2005
Great Leighs STW	TL7260016300	3km upstream	2012

2.1.3 The fish assemblage recorded within the River Ter adjacent to the Scheme area by the EA in 2005 and 2012 identified four protected/notable fish species: Brown Trout *Salmo trutta*, Bullhead *Cottus gobio*, European Eel *Anguilla anguilla* and Brook Lamprey ammocoetes *Lampetra planeri* (**Table 2**).

Table 2: Fish species identified in the 2005 and 2012 EA fish surveys on the River Ter.

Fish species	Protected/Notable
Brown Trout *Salmo trutta*	Y
Bullhead *Cottus gobio*	Y
Chub *Leuciscus cephalus*	N
Roach *Rutilus rutilus*	N
European Eel *Anguilla anguilla*	Y
Brook Lamprey *Lampetra planeri*	Y
Three-spined Stickleback *Gasterosteus aculeatus*	N
Stone Loach *Barbatula barbatula*	N
Minnow *Phoxinus phoxinus*	N

[1] environment.data.gov.uk/catchment-planning/WaterBody/GB105037033940
[2] environment.data.gov.uk/ecology-fish/

2.1.4 Protected fish species identified in the desk study as present in the area of the Scheme are shown in **Table 3**, with the relevant legislation under which they are notable or afforded protection. All spawning fish, their eggs and spawning habitats are protected under the Salmon and Freshwater Fisheries Act 1975.

Table 3: Protected fish species identified within River Ter desk study and relevant designations

Common name	Bern Convention (Appendix)	Habitats Directive (Appendix)	UKBAP priority species	The Habitats Regulations 2010 (schedule)
European Eel			Y	
Bullhead		II	Y	
Lamprey (unspecified)	III	II, V	Y	4
Brown/sea Trout			Y	

2.1.5 Four species of macrophytes were recorded at the Great Leighs STW macroinvertebrate sampling station in 2007; Fool's Watercress *Helosciadium nodiflorum*, Filamentous Algae Cladophora, Common Duckweed *Lemna minor* and Reed Canary Grass *Phalaris arundinacea*. None of these species are protected or notable.

2.1.6 Fifty-nine macroinvertebrate taxa were recorded in the 2007 EA surveys; however, no taxa were classed as notable or protected. Two non-native species were recorded, the Freshwater Shrimp *Crangonyx pseudogracilis* and the New Zealand Mud Snail *Potamopyrgus antipodarum*. Neither of these species are considered as invasive.

2.1.7 Environmental data from the Local Environmental Records Centre (LERC) the Essex Field Club was received on the 12th January 2021. The data was analysed and all records of protected, notable or non-native aquatic species within 2 km of the Scheme are displayed in **Table 4**. Kingfisher *Alcedo atthis* have been recorded within 1.4 km of the Order limits as recently as 2017. Two notable species of dragonfly (listed under the Essex red data list), the Small Red-eyed Damselfly *Erythromma viridulum*[3] and the Ruddy Darter Dragonfly *Sympetrum sanguineum*[4] have been recorded within 1.2 km of the Scheme, however this record dates back from 2000.

2.1.8 Two invasive non-native plant species, Nuttalls Waterweed *Elodea nuttallii*[5] and New Zealand Pigmyweed *Crassula helmsii*[6] have been reported within 1.4 km and 1 km respectively from the Order limits as recently as 2015.

[3]Essex Field Club
[4] Essex Field Club
[5] Listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and the Invasive Non-native Species (Amendment etc.) (EU Exit) Regulations 2019
[6] Listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)

Table 4: Protected and notable aquatic species recorded within 2km of the Scheme from the LERC

Common name	Taxon	Protected	Non-native	Distance from Scheme (km)	Date of last record
Nuttall's Waterweed	*Elodea nuttallii*	N	Y	1.4	2015
Kingfisher	*Alcedo atthis*	Y*	N	1.4	2017
Small Red-eyed Damselfly	*Erythromma viridulum*	Y- (Essex red data list)	N	1.2	2000
Ruddy Darter	*Sympetrum sanguineum*	Y- (Essex red data list)	N	1.2	2000
New Zealand Pigmyweed	*Crassula helmsii*	N	Y	1	2015

2.1.9 No historical data on any of the ponds located within agricultural land within the red line boundary was available for review.

3. Methods

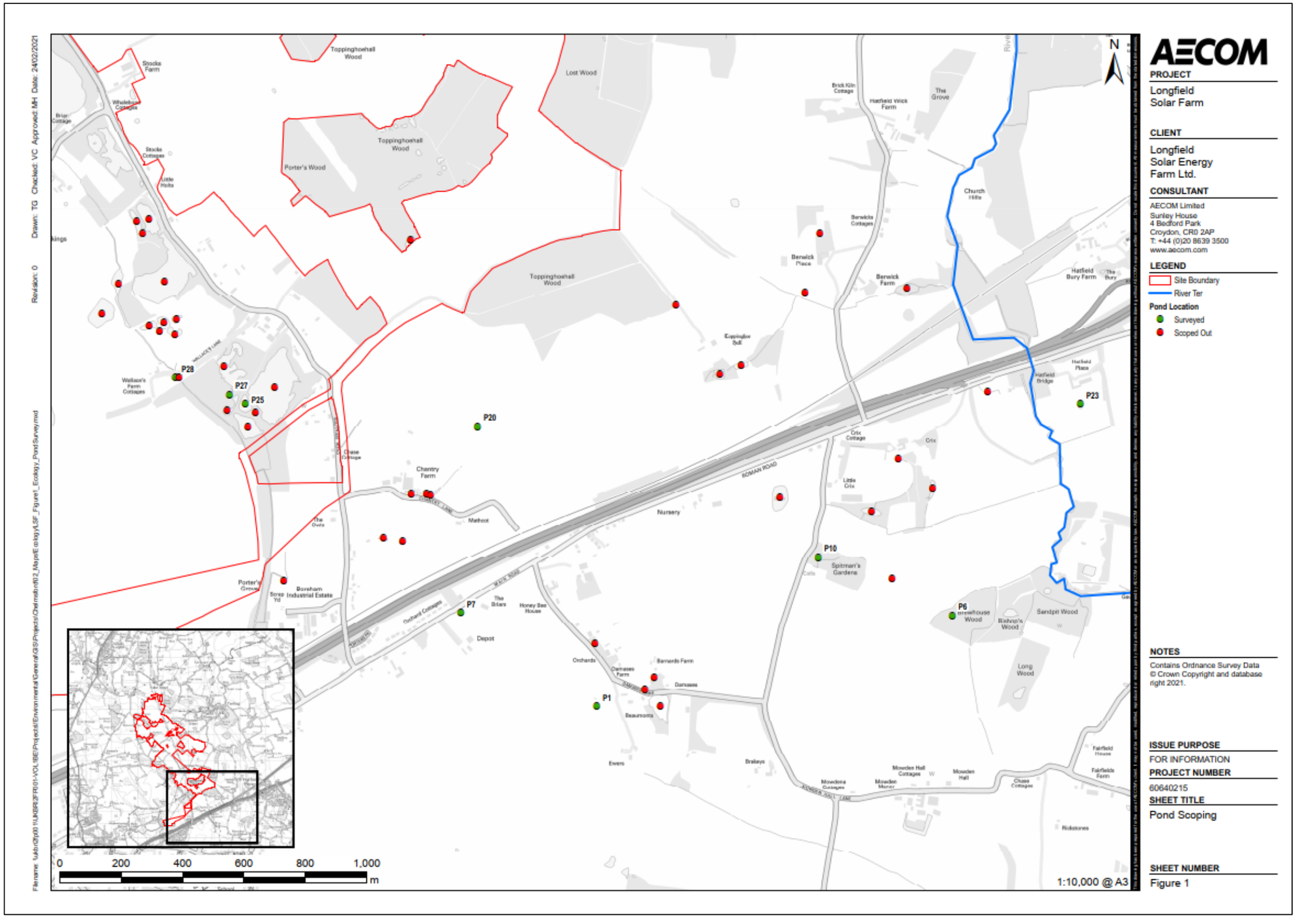
3.1 Initial Pond Scoping Survey

3.1.1 Initial scoping surveys were carried out by two suitably qualified ecologists on three occasions: 17th March, 19th May and 1st June 2020 to determine which ponds required further surveys. The criteria used to determine the need for further surveys was based on an initial assessment of pond quality, and likelihood of supporting protected, notable or invasive species.

3.1.2 Based on the criteria set out above, ten ponds out of a total of fourty-nine surveyed were recommended for further analysis using the Predictive SYstem for Multimetrics (PSYM) method. The ponds were located either adjacent to or within agricultural fields (**Figure 1**).

Figure 1: Location of the ponds scoped in (green) and out (red) for PSYM analysis during the scoping surveys.

(*Note: Figure is based on a previous iteration of the site boundary (Order limits) which was valid at the time of writing)*



3.2 PSYM Pond Surveys

3.2.1 In order to assess the biological quality of ponds within the Order limits, the PSYM method was used, with surveys completed on the 16th and 22nd June 2020 for ponds listed in Table 5. This is a standard method that provides an assessment of the biological quality of a pond and includes collection of physical data, invertebrate sampling and macrophyte recording. Surveys were carried out within the optimal PSYM survey season (summer).

3.2.2 Macroinvertebrate samples were taken using 'kick/sweep sampling' for three minutes followed by a one-minute hand search of larger substrates using a standard Freshwater Biological Association (FBA) pattern pond net (mesh size: 1 mm) in line with the PSYM methodology. The samples were analysed, and individuals were identified to mixed taxon level (as described in Section 3.1.8) where appropriate.

3.2.3 Pond macrophytes were surveyed by walking or wading the entire perimeter of the dry and shallow water areas of the waterbody. Deeper water areas were sampled by grapnel thrown from shallow water or the bank. The aim of plant recording was to make a complete list of wetland plants present within and on the banks of each pond.

3.2.4 In order to determine conservation importance of the ponds, the data collected during the surveys was submitted to the Freshwater Habitats Trust (FHT) to be compared against a national pond database. This analysis provides a rating from Very Poor to Good and determines whether the pond was a priority for conservation purposes.

Table 5: Location of ponds surveyed using the PSYM methodology

Pond ID	National Grid Reference
Pond 1	TL 75219 14367
Pond 6	TL 74837 13809
Pond 7	TL 74403 14090
Pond 10	TL 74904 14653
Pond 20	TL 75131 13137
Pond 22	TL 77194 11891
Pond 23	TL 75785 13825
Pond 25	TL 75785 13825
Pond 27	TL 75733 15335
Pond 28	TL 74568 15432

3.3 River Ter Macroinvertebrate Surveys

3.3.1 Macroinvertebrate samples were collected from the River Ter on the 14th May 2020 and the 23rd September 2020 by two suitably qualified ecologists. The macroinvertebrate survey method followed the aquatic macroinvertebrate sampling procedures standardised by the Environment Agency (Environment Agency, 2017). These methods allow characterisation of aquatic macroinvertebrate communities and can be used to determine whether rare or notable species or communities are present. The samples were taken using a standard FBA pattern pond net (mesh size: 1 mm). The habitats present were sampled through a combination of kick sampling and sweep sampling for three minutes followed by a one-minute hand search of larger substrates in accordance with the standard methods. The samples collected were subsequently preserved in Industrial Methylated Spirit (IMS) for laboratory processing.

3.3.2 Each of the samples collected was sorted and analysed in a laboratory setting by suitably trained and experienced aquatic ecologists. Lists of the aquatic macroinvertebrate taxa present were produced in line with Environment Agency guidance (Ref. 15Ref. 2). The aquatic macroinvertebrate samples were identified to 'mixed taxon level' using a stereomicroscope. Most groups were identified to species level (where practicable), with the exception of the following:

a. Worms (Oligochaeta) which were identified to sub-class;

b. Marsh beetles (Scirtidae) which were identified to family;

c. True-fly larvae, which were identified to the maximum resolution possible; and

d. Immature or damaged specimens, which were identified to the maximum resolution possible on a case-by-case basis.

3.3.3 The survey data was then used to calculate metrics that can be used to inform an assessment of relative nature conservation value and general degradation.

3.3.4 A Community Conservation Index (CCI) (Chadd & Extence, 2004) was calculated for each site as detailed in Annex B – Community Conservation Index (CCI). The CCI classifies many groups of aquatic macroinvertebrates according to their scarcity and nature conservation value in England as understood at the time that the classification was developed. Species scores range from 1 to 10, with 1 being very common and 10 being Endangered (see Annex C - Whalley, Hawkes, Paisley & Trigg (WHPT) Metric). Since its initial publication, in some cases the references used in the CCI classification to define scarcity and value have been superseded by more recent assessments. Due to this, the author has provided AECOM with updated species scores to take account of this new information (Chadd, pers. comm., 2018). These updated scores have been used within this assessment.

3.3.5 The aquatic macroinvertebrate data were analysed to generate the Whalley, Hawkes, Paisley & Trigg (WHPT) score Average Score Per Taxon (ASPT), and Number of scoring taxa (NTAXA) values, which provides an indication of the ecological quality in the watercourse (WFD-UKTAG, 2014a). This assigns numerical value to taxa according to their sensitivity to organic pollution. The average of the values for each taxon in a sample, known as ASPT is a stable

and reliable index of organic pollution. Therefore, these assessments can indicate to what extent an aquatic macroinvertebrate community is exposed to organic pollution (further information is provided in Annex C - Whalley, Hawkes, Paisley & Trigg (WHPT) Metric). It is important to note that these indices can vary between geological regions and habitat types. Ditches for example are unable to support many of the high-scoring taxa associated with fast flowing habitats. Therefore, the resultant metrics should be reviewed with an awareness of their potential limitations, and the site-specific context, as described in this report.

3.3.6 The resultant WHPT-ASPT and NTAXA values and environmental data collected at the time of the surveys were processed through River Invertebrate Classification Tool Version 2 (RICT2) web application, available on the Freshwater Biological Association website[7].

3.3.7 RICT2 predicts the WHPT-ASPT and NTAXA scores for the surveyed locations based on the site location, altitude, alkalinity, slope, discharge category, distance from source, channel dimensions and substrate composition. The predicted scores are then compared to actual scores and the output is an Ecological Quality Ratio (EQR). The EQR can be translated into a Water Framework Directive (WFD) classification (High, Good, Moderate, Poor or Bad). Alkalinity data for the River Ter was not available, so average conductivity at 25°C for the River Ter at Great Leighs between July 2012 and January 2014 (798.5263 μScm^{-1}) from the EA WIMS database was utilised as a substitute[8].

3.3.8 The RICT2 method has been primarily designed to respond to organic pollution, however it is suitable for monitoring other types of impact and is used for assessing the WFD classification parameter “General degradation” (WFD-UKTAG, 2014a)

3.4 White-clawed Crayfish Surveys

3.4.1 Surveys were undertaken within the River Ter in order to determine the presence/absence of the protected, White-Clawed Crayfish (WCC) *Austropotamobius pallipes*. The surveys were undertaken on two occasions (9th and 10th September 2020, and the 23rd and 24th September 2020) using the standard methodology for surveying WCC, which consisted of manual searches of suitable habitat and the deployment of baited traps[9]. The national grid references for the baited trap surveys are detailed in **Table 6** and **Table 7**. The surveys were also used to determine the presence of the invasive signal crayfish *Pacifastacus leniusculus*.

Table 6: Location of crayfish traps deployed in the River Ter on White Clawed Crayfish survey 1 (9th and 10th September 2020)

Trap ID	Number of traps deployed	National Grid Reference
1-4	4	TL 75671 15232

[7] https://fba.org.uk/FBA/Public/Discover-and-Learn/Projects/RIVPACS_Landing.aspx
[8] https://environment.data.gov.uk/water-quality/view/sampling-point/AN-TE0155
[9] Peay S (2003). Monitoring the White-clawed Crayfish Austropotamobius pallipes. Conserving Natura 2000 Rivers Monitoring Series No. 1, English Nature, Peterborough

Trap ID	Number of traps deployed	National Grid Reference
5-6	2	TL 75623 15259
7-8	2	TL 75599 15265
9-10	2	TL 75547 15304
11-12	2	TL 75541 15317
13-14	2	TL 75536 15351
15-16	2	TL 75538 15351
17-20	4	TL 75516 15378

Table 7: Location of crayfish traps deployed in the River Ter during White Clawed Crayfish survey 2 (23rd and 24th September 2020)

Trap ID	Number of traps deployed	National Grid Reference
1-4	4	TL 74685 15463
5-6	2	TL 74692 15451
7	1	TL 74681 15448
8-9	2	TL 74778 15478
10-12	3	TL 74785 15496
13	1	TL 74786 15488

3.5 Survey Limitations

3.5.1 All surveys were undertaken during the optimum season and followed standard ecological practices; however, they captured a snapshot of the conditions and species present at the time of the survey. The macrophyte and macroinvertebrate assemblages will change over the seasons and the surveys may have under-reported the number of species present.

3.5.2 Alkalinity data was not collected during the River Ter macroinvertebrate surveys so conductivity data from the EA WIMS monitoring website was used as a proxy when undertaking RICT analysis. The use of conductivity as a substitute for alkalinity is a viable option reported in the RICT user guide, available on the FBA website[10].

3.5.3 The macroinvertebrate data was analysed to produce WHPT and ASPT scores, the indices generated by this scoring system can differ between habitat types and geographical locations. This should be taken into account when drawing conclusions based on the data collected.

[10] FBA Public Discover and Learn Projects [Online].

4. Results

4.1 Pond PSYM

Pond 1

4.1.1 The macrophyte community at Pond 1 was dominated by one species of floating-leaved plant; Common Duckweed.

4.1.2 The macroinvertebrate community at Pond 1 was dominated by seed shrimp Ostracoda which accounted for 55% of individuals recorded. A further 14% of individuals was accounted for by water slaters Asellidae. Other taxa included freshwater worms Oligochaeta, leaches (*Glossiphonia* sp., *Helobdella stagnalis*), mayflies such as *Cloeon dipterum*, the Damselfly *Chalcolestes viridis*, true bugs (Coroxide, Notonectidae), the water beetles *Hyphydrus ovatus*, *Hygrotus inaequalis*, *Hydroporus nigrita, Hydroporus palustris*, *Helophorus brevipalpis, Hydrobius fuscipes, Anacaena bipustulata,* and *Helochares lividus*, and the true flies Chironomidae (Tanypodinae, Orthocladiinae, Chironomini), Syrphidae, and Culicidae.

4.1.3 The Willow Emerald Damselfly *Chalcolestes viridis* is a recent colonist in south east Suffolk first recorded in 2009[11]. It is slowly expanding its range but currently has no current statutory designations.

4.1.4 This pond was assessed as poor quality by Freshwater Habitats Trust (FHT) (Table 8).

Pond 6

4.1.5 No macrophyte species were recorded at Pond 6.

4.1.6 The macroinvertebrate community at Pond 6 was dominated by seed shrimp Ostracoda, water flea Cladocera and the microscopic crustacean Copepoda which in combination accounted for 93% of individuals recorded. A further 2% of individuals was accounted for by freshwater worms Oligochaeta. Other taxa included the freshwater snails *Valvata cristata*, *Valvata piscinalis*, and *Armiger crista*, Erpobdellidae leaches, beetles (*Hydroporus* sp.) and Chironomidae Tanypodinae, Orthocladiinae, Chironomini, Tanytarsini.

4.1.7 One species of aquatic beetle, *Graptodytes bilineatus*, is notable within pond 6. This is a Nationally Scarce aquatic beetle species according to Foster (2010).

4.1.8 This was assessed as a very poor quality pond by FHT (Table 8).

Pond 7

4.1.9 The macrophyte community at Pond 7 comprised of seven species, five common; common water-plantain *Alisma plantago-aquatica*, pond water-starwort *Callitriche stagnalis*, great willowherb *Epilobium hirsutum*, hard rush *Juncus inflexus* and common duckweed. Two uncommon plant species were also recorded; Fine-leaved Water Dropwort *Oenanthe aquatica* and Common Water-crowfoot *Ranunculus aquatilis*.

[11] https://british-dragonflies.org.uk/the-willow-emerald-damselfly-is-spreading-in-england/

4.1.10 The macroinvertebrate community at Pond 7 was dominated by the water slater *Asellus aquaticus* which accounted for 48% of individuals recorded. A further 20% was accounted for by freshwater shrimp *Crangonyx floridanus/pseudogracilis* and 9% by water flea Cladocera. Other taxa included flatworms (*Polycelis* sp., *Polycelis felina*), the freshwater snail *Valvata cristata*, Sphaeriidae pea mussels, freshwater worms Oligochaeta, seed shrimp Ostracoda, Aeshnidae dragonfly larvae, true bugs (Gerridae, *Velia* sp., Coroxidae, Notonectidae), the water beetles *Haliplus lineaticollis*, *Haliplus ruficollis*, Gyrinidae, *Hydroporus palustris, Hydroporus tesselatus, Agabus bipustulatus, Helophorus aequalis, Helophorus brevipalpis, Hydrobius fuscipes, Anacaena globulus, Anacaena limbata, Helochares lividus, Cymbiodita marginella, Hydraena* sp., and *Ochthebius* sp., and the true flies Tanypodinae, Orthocladiinae, Chironomini, Culicidae, Chaoboridae.

4.1.11 Larvae of the Willow Emerald Damselfly, notable as a recent coloniser (see **Section 4.1.3**) was also recorded in Pond 7.

4.1.12 This pond was assessed as good quality by FHT (Table 8).

Pond 10

4.1.13 The macrophyte community at Pond 10 was dominated by three common species of emergent aquatic plants; Great willowherb, Gypsywort *Lycopus europaeus* and Bittersweet *Solanum dulcamara.*

4.1.14 The macroinvertebrate community at Pond 10 was dominated by seed shrimp Ostracoda, water flea Cladocera and the microscopic crustacean Copepoda which accounts for 71% of individuals recorded. A further 11% was accounted for by larvae of the non-biting midge family Chrionomidae. Other taxa included the freshwater snail *Armiger crista*, freshwater worms Oligochaeta, *Glossiphonia* leaches, freshwater shrimp *Crangonyx floridanus/pseudogracilis*, water slater *Asellus aquaticus*, Baetidae mayflies, true bugs (*Gerris* sp., Coroxidae, Notonectidae), the water beetles Gyrinidae, *Hydroporus* sp., *Helophorus* sp., *Helophorus aequalis, Helophorus brevipalpis* and trueflies Culicidae and Chaoboridae.

4.1.15 No Notable or INNS species have been recorded at Pond 10.

4.1.16 This was assessed as a poor-quality pond by FHT (Table 8).

Pond 20

4.1.17 No macrophyte species were recorded at Pond 20.

4.1.18 The macroinvertebrate community at Pond 20 was dominated by water flea Cladocera accounting for 27% of individuals recorded and lesser water boatmen *Sigara lateralis* accounting for a further 33% of individuals. A further 24% was accounted for by larvae of the non-biting midge family *Chrionomidae* (*Tanypodinae, Orthocladiinae, Chironomini*). Other taxa recorded included the mayfly *Cloeon dipterum*, Greater Water Boatmen *Notonectidae*, and the water beetle families *Hydrophilidae* and *Curculionidae*.

4.1.19 No Notable or INNS species have been recorded at Pond 20.

4.1.20 This pond was assessed as very poor quality by FHT (Table 8).

Pond 22

4.1.21 The macrophyte community at Pond 22 comprised of four common species; Fool's-water-cress *Helosciadium nodiflorum*, Common Duckweed, Great Willowherb and Unbranched Bur-reed *Sparganium emersum*.

4.1.22 The macroinvertebrate community at Pond 22 was dominated by Gammaridae freshwater shrimp, accounting for 78% of individuals recorded. A further 12% was accounted for by freshwater worms Oligochaeta and the non-biting midge family *Chironomidae* (*Tanypodinae*, *Orthocladiinae*, *Tanytarsini*). Other taxa recorded included *Coenargionidae* damselfly larvae, *Libellulidae* dragonfly larvae, larvae of the water beetle family *Scirtidae*, and trueflies *Limoniidae*, *Dixidae*, *Psychodidae*, *Ceratopogonidae*, and *Syrphidae*.

4.1.23 No Notable or INNS species have been recorded at Pond 22.

4.1.24 This was assessed as a poor quality pond by FHT (Table 8).

Pond 23

4.1.25 No macrophyte species were recorded at Pond 23.

4.1.26 The macroinvertebrate community at Pond 23 was dominated by seed shrimp Ostracoda, water flea Cladocera and Copepoda which, in combination, accounted for 94% of individuals recorded. Other taxa included the beetle *Helophorus brevipalpis* and the water beetle family Dytiscidae, and true fly larvae (Tanypodinae, Orthocladiinae, Chironomini, Syrphidae, Culicidae).

4.1.27 No Notable or INNS species have been recorded at Pond 23.

4.1.28 This pond was assessed as very poor quality by FHT (Table 8).

Pond 25

4.1.29 The macrophyte community in Pond 25 was dominated by one species, common reed *Phragmites australis*.

4.1.30 The macroinvertebrate community at Pond 25 was dominated by seed shrimp (Ostracoda), and water fleas Cladocera, which accounted for 55% of individuals recorded. A further 40% of individuals recorded was accounted for by mosquito larvae Culicidae. Other taxa included Oligochaeta freshwater worms, and true fly larvae of the families Chironomidae and Syrphidae.

4.1.31 No Notable or INNS species have been recorded at Pond 25.

4.1.32 This was assessed as a very poor-quality pond by FHT (Table 8).

Pond 27

4.1.33 The macrophyte community at Pond 27 was dominated by eight taxa, six common taxa; Great Willowherb, Gypsywort, Hard Rush, Pondweed *Potamogeton* sp., Soft Rush *Juncus effusus* and Water Pepper *Persicaria hydropiper*. Two uncommon species were also recorded; Slender Tufted-sedge *Carex acuta*, and Rigid Hornwort *Ceratophyllum demersum*.

4.1.34 The macroinvertebrate community at Pond 27 was dominated by freshwater worms Oligochaeta, water slater *Asellus aquaticus*, and mayflies *Cloeon dipterum,* and *Caenis robusta*, which together accounted for 54% of

individuals recorded. Other taxa recorded included freshwater snails including *Radix auricularia*, *Potamopyrgus antipodarum*, and *Physa fontinalis*, the freshwater mussel *Anodonta anatina*, the leach species *Theromyzon tessulatum, Glossiphonia complanata,* and *Helobdella stagnalis*, the freshwater shrimp *Crangonyx floridanus/pseudogracilis*, the true bugs *Plea minutissima*, *Micronecta scholzi*, *Sigara lateralis*, and *Sigara concinna*, the water beetles *Haliplus ruficollis*, *Hygrotus nigrolineatus*, *Berosus affinis*, *Dytiscidae*, and *Hydrophilidae*, alderfly larvae *Sialis* sp., caddisfly larvae *Hydroptilidae*, and true flies *Orthocladiinae*, *Chironomini*, *Tanytarsini*, and *Ceratopogonidae*.

4.1.35 One species of aquatic beetle is notable within pond 27 which is *Hygrotus nigrolineatus*. This is a nationally scarce species of aquatic beetle (Foster, 2010). The aquatic beetle, *Berosus affinis* is listed as a locally protected species under Essex Red Data List[12].

4.1.36 This pond was assessed as moderate quality by FHT (Table 8).

Pond 28

4.1.37 The macrophyte community at Pond 28 was comprised of nine common species; Common Water-plantain, Pendulous Sedge *Carex pendula*, Great Willowherb, Yellow Iris *Iris pseudacorus*, Gypsywort, Water Mint *Mentha aquatica*, Water Forget-me-not *Myosotis scorpioides*, Reed Canary Grass *Phalaris arundinacea* and Bittersweet.

4.1.38 The macroinvertebrate community at Pond 28 was dominated by Truefly Chironomidae larvae Orthocladiinae and Chironomini, which accounted for 38% of individuals recorded. A further 24% individuals were accounted for by water slater *Asellus aquaticus*. Other taxa recorded included the freshwater snails *Anisus vortex,* and *Bathyomphalus contortus*, Oligochaeta freshwater worms, the leach *Glossiphonia* sp., Coenagrionidae damselfly larvae, the true bugs *Gerris* sp., *Hesperocorixa sahlbergi* and *Notonecta* sp., the water beetles Haliplidae, *Colymbetes fuscus, Helophorus* sp. and *Helochares lividus*, and caddisfly larave *Limnephilus lunatus*.

4.1.39 In addition to being recorded in Ponds 1 and 7, larvae of the recent coloniser Willow Emerald damselfly (see Section 4.1.3) were also found in Pond 28.

4.1.40 This was assessed as a moderate quality pond by FHT (Table 8).

4.1.41 The full aquatic macroinvertebrate taxa list can be found in Annex A - Macroinvertebate species.

Table 8: Macrophyte and macroinvertebrate pond index scores calculated for the ten ponds surveyed

Index	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
No. of uncommon Plant Species	0	0	2	0	0	0	0	0	2	0

[12] Essex Field Club – Red Data List

Trophic Ranking Score (TRS)	9.0	0	8.83	10.0	0	10.00	0	7.3	10.00	8.76
ASPT	4.1	2.83	4.63	4.0	4.2	4.6	4.0	1.5	4.22	4.4
Odonata & Megaloptera (OM) Families	1	0	2	0	0	2	0	0	1	2
Coleoptera Families	2	1	4	3	1	0	2	0	3	3
Index of Biotic Integrity (%)	44	11	89	33	17	39	22	17	56	72
Priority Ponds (IBI.>75 %)	Poor	Very Poor	Good	Poor	Very Poor	Poor	Very Poor	Very Poor	Moderate	Moderate
Priority Pond	No	No	Yes	No	No	No	No	No	No	No

4.2 River Ter Macroinvertebrate Surveys

4.2.1 The community at River Ter West in spring was dominated by Chrionomidae larvae Tanytarsini and Orthocladiinae, which accounted for 52% of individuals recorded. A further 13% of individuals recorded were accounted for by the freshwater shrimp *Gammarus* sp. Other taxa recorded include; the flatworms *Polycelis* sp. and *Dendrocoelum lacteum*, the non-native snail *P. antipodarum,* the snails *Valvata cristata* and *Physa fontinalis*, the freshwater worm Oligochaeta, the leaches *Glossiphonia complanata* and *Helobdella stagnalis*, water slater *Asellus aquaticus*, mayfly larvae *Baetis* sp*., Ephemera danica,* and *Caenis* sp*.*, damselfly larvae *Calopteryx* sp., riffle beetles *Limnius volckmari, Elmis aenea and Oulimnius* sp., and caddisfly larvae *Limnephilus lunatus, Chaetopteryx villosa, Athripsodes* sp*.,* and *Mystacides azurea*.

4.2.2 The community at River Ter East in spring was dominated by *Gammarus* sp. which accounted for 49% of individuals recorded. A further 22% of individuals recorded were accounted for by riffle beetles Elmidae and freshwater worms Oligochaeta. Other taxa recorded include; the snails *P. antipodarum* and *Valvata cristata*, the leech *Erpobdella testacea*, water slater *A. aquaticus*, mayfly larvae *Baetis* sp*., E. danica,* and *Caenis* sp., damselfly larvae *Calopteryx* sp., alderfly larvae *Sialis lutaria*, caddisfly larvae *L. lunatus, C. villosa, Athripsodes* sp*.,* and *Mystacides azurea*, and Chrionomidae larvae Tanytarsini and Orthocladiinae.

4.2.3 The community at River Ter in autumn was dominated by Chrionomidae larvae Tanytarsini, Chironomini, Orthocladiinae and Tanypodinae which accounted for 54% of individuals recorded, whilst *Gammarus pulex* comprised a further 16%. Other taxa include the snails *P. antipodarum, Bithynia tentaculata,* and *P. fontinalis*, pea mussels *Pisidium* sp. and *Sphaerium corneum*, the leaches *Helobdella stagnalis* and *Piscicola siddali*, mayfly larvae Baetidae and *E. danica*, damselfly larvae *Calopteryx* sp., the beetles *Platambus maculatus, L.*

volckmari, E. aenea and *Oulimnius* sp., alderfly larvae *S. lutaria* and caddisfly larvae *Polycentropus flavomaculatus, Athripsodes* sp*., Mystacides* sp*.,* and *Sericostoma personatum*.

4.2.4 The community at River Ter West in autumn was dominated by *Gammarus* sp. which accounted for 38% of individuals recorded. A further 20% of individuals were accounted for by Chrionomidae larvae Tanytarsini, Chironomini, Orthocladiinae and Tanypodinae. Other taxa include; the flatworm *D. lacteum*, the snails *P. antipodarum, Valvata piscinalis*, and Succineidae, the pea mussels *Pisidium* sp*.* and *S. corneum*, the leach *Helobdella stagnalis*, mayfly larvae Baetidae and *E. danica*, damselfly larvae *Calopteryx splendens*, the water beetles *L. volckmari, E. aenea and Oulimnius* sp., alderfly larvae *S. lutaria* and the caddisfly larvae *P. flavomaculatus, Lype* sp*., Athripsodes* sp*.,* and *Hydropsyche pellucidula*.

4.2.5 Based on the criteria outlined in Section 3.4, Community Conservation Index (CCI), Whalley, Hawkes, Paisley & Trigg (WHPT) score Average Score Per Taxon (ASPT), and Number of scoring taxa (NTAXA) values for each survey site are detailed in **Table 9**.

Table 9: Macroinvertebrate index scores for the River Ter and River Ter west for both Spring and Autumn.

Index	River Ter East, spring	River Ter West, spring	River Ter East, autumn	River Ter West, autumn
NTAXA (WHPT)	30	28	23	22
WHPT score	155.2	147.8	118.2	107.4
ASPT (WHPT)	5.2	5.3	5.1	4.9
CCI Score	6.5	6.4	9.8	8.6
CCI Score - interpretation	Moderate conservation value	Moderate conservation value	Moderate conservation value	Moderate conservation value

4.2.6 The Community Conservation Index (CCI) scores ranged from 6.5 to 9.8 (indicating a moderate conservation value for all samples). None of the species recorded from the River Ter were protected or notable. However, two non-native taxa were present; *Potamopyrgus antipodarum* and *Cranognyx pseudogracilis/floridanus*. An incidental record of Bullhead *Cottus gobio*, a UK BAP Species, was recorded within the kick-sample within the Order limits. All taxa had a conservation value that was Occasional (species which occur in up to 10 % of all samples from similar habitats) or lower.

4.2.7 The aquatic macroinvertebrate community indicates biological water quality was clean but slightly impacted at both River Ter and River Ter West. The WHPT index scores at these sites are likely supressed due to aquatic habitat restrictions.

4.2.8 **Table 10** displays the Ecological Quality Ratio (EQR) and WFD macroinvertebrate status for the WHPT ASPT and NTAXA indices for the River Ter east and River Ter west for spring and autumn, as well as the most probable WFD status based on the combination of the modelled distributions for each of ASPT and NTAXA across all classes, termed MINTA (Minimum of NTAXA and ASPT EQRs).

Table 10: Macroinvertebrate WFD classification for the River Ter east and River Ter west.

Index	River Ter East	River Ter West
ASPT Ecological Quality Ratio spring (EQR)	1.03	0.99
ASPT Ecological Quality Ratio autumn (EQR)	1.07	0.98
ASPT invertebrate classification	High	High
NTAXA Ecological Quality Ratio spring (EQR)	1.21	1.10
NTAXA Ecological Quality Ratio autumn (EQR)	0.91	0.88
NTAXA invertebrate classification (spring & autumn)	High	High
MINTA most probable WFD invertebrate classification (spring & autumn)	High	High

4.2.9 Both the River Ter East and River Ter West were classified as High overall and achieved High for ASPT and High for NTAXA, indicating minimal water quality and habitat pressures.

4.3 White-clawed Crayfish Surveys

4.3.1 No WCC were found during the manual searches or captured in the baited traps deployed during the field surveys. Suitable habitat for WCC, including cobbles, boulders and submerged tree roots was found during the surveys (**Figure 2**). No invasive American Signal Crayfish *Pacifastacus leniusculus* were captured during the surveys. Several brown trout were captured during the surveys highlighting the importance of the River Ter to this species.

Figure 2: White-clawed Crayfish Surveys

Optimal habitat for WCC was recorded during the surveys on the River Ter including large cobbles and boulders in stream (top left), Submerged tree roots (Top right) and overhanging vegetation (bottom left). Several Brown trout were captured in the crayfish traps during the surveys (bottom right).

5. Discussion / Evaluation

5.1 Desk Study

5.1.1 The River Ter was classified as Moderate in the 2019 WFD classification cycle, with the reasons for not achieving good due to high levels of phosphate from poor livestock management and sewage discharge[1]. The change in land use from agriculture to solar generation may result in an improvement in water quality in the River Ter through a reduced input of fertilizer. This change in land use may also improve the water quality in the ponds located in the arable fields due to reduced nutrification.

5.1.2 Four notable/protected fish species were identified in the EA data as being present in the River Ter; Brown Trout (UK BAP), Brook Lamprey (UK BAP, Bern Convention (Appendix 3) Habitats Directive Annex II), Bullhead (UK BAP) and European Eel (UK BAP). It should be noted that the EA fish data was last collected in 2012, so this has the potential to be out of date. However brown trout were recorded during the WCC surveys. It is likely that these species will be utilising the section of the River Ter that runs parallel to the Scheme, for habitat, migration (Brown Trout and European Eel) and potentially for spawning (Brown Trout and Brook Lamprey). The Scheme has the potential to negatively impact these species through habitat modification and disturbance in the form of drilling and associated noise during the construction phase. There is also the potential for sediment to enter the watercourse during the construction phase and smother potential fish spawning habitat.

5.1.3 Two dragonfly species of local importance (Essex red data list), the Small Red-eyed Damselfly and Ruddy Darter, were recorded within 1.2km of the Scheme. Both of these species are associated with well vegetated ponds. Currently six of the ten ponds surveyed within the Scheme are of poor quality, therefore the Scheme offers the opportunity to improve habitat through pond restoration.

5.1.4 Two species of invasive macrophytes, New Zealand Pigmyweed and Nuttall's Waterweed have been recorded within 1.4km of the Scheme boundary, however it should be noted that these records were not from the River Ter, but from isolated waterbodies outside of the Scheme boundary. Nuttall's Water weed is unlikely to cause any issues to the Scheme, however the highly invasive nature of New Zealand Pigmyweed would necessitate the implementation of standard INNS protocols to minimise the further spread of this species, if it was found to be present within the Order limits at a later date and there was a risk of its spread. Both species are listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), which makes it an offence to spread or otherwise cause the species to grow in the wild.

5.2 Pond PSYM

5.2.1 The PSYM analysis indicates that only one out of the ten ponds surveyed (Pond 7) was assessed as Good and consequently classed as a Priority Pond by the FHT. This was due to the diversity of uncommon aquatic plants within the pond. The results also suggest that Pond 7 provides ideal habitat for damselfly, dragonfly and beetle taxa resulting in it achieving a very high conservation value classification.

5.2.2 The remaining nine ponds were classified as very poor (4 ponds), poor (3 ponds) or moderate (2 ponds). The reasons for these ponds not achieving good status could be due to several factors including eutrophication from algricultural runoff, other sources of pollution or shading by riparian vegetation. The Scheme can potentially improve the quality of the ponds through reduced eutrophication from change in land use and result in a reduction in shading through tree removal.

5.2.3 Four species of macrophytes recorded during the surveys were classed as uncommon by the FHT; Fine-leaved Water Dropwort, Common Water-crowfoot, Slender Tufted-sedge, and Rigid Hornwort. However, all of these macrophyte taxa are classed as Least Concern based on JNCC taxa designations.

5.3 Aquatic Macroinvertebrates

5.3.1 The aquatic macroinvertebrate survey results indicate the River Ter is a Good, Clean and Slightly Impacted watercourse from the WHPT-ASPT interpretation, indicating there is likely a small impact from sedimentation, water quality or other environmental influences. The results differ between spring and autumn due to variations in caddisfly and mayfly populations because of their lifecycle emerging in late summer resulting in a dip in the WHPT score in autumn. Furthermore, the results indicate that the River Ter has a Moderate Conservation Value due to the lack of impacts and containing 52 macroinvertebrate taxa.

5.3.2 Two non-native species were identified in the macroinvertebrate samples, the New Zealand Mud Snail and the Freshwater Shrimp *Cranognyx pseudogracilis/floridanus*. These species are now classed as naturalised in the UK and are not thought to impact native flora and fauna. The New Zealand Mud Snail and the Freshwater Shrimp *Cranognyx pseudogracilis/floridanus* are not listed in statutory legislation as invasive species, and therefore these species are not considered to represent a constraint to the development of the scheme; however, best practice biosecurity measures would reduce the likelihood of them being spread.

5.3.3 The RICT analysis of the spring and autumn macroinvertebrate samples collected from the River Ter during the surveys resulted in a classification score of High. This score is the same as the EA WFD classification score from the 2019 surveys[1]. This suggests that the water quality, although impacted slightly by eutrophication, is not negatively impacting the resident macroinvertebrate community. The Scheme has the potential to affect the River Ter macroinvertebrate community, both positively and negatively. The Scheme has the potential to positively affect the macroinvertebrate community through a reduction in eutrophication through change in land use from farming to solar energy production. The Scheme also has the potential to negatively impact the community through increased sedimentation from construction work and increased surface runoff from spoil heaps created during construction.

5.4 White-clawed Crayfish

5.4.1 Although suitable habitat for WCC was recorded in the River Ter, no specimens were found during the surveys. Although this doesn't mean that

WCC are not present in the River Ter, it means that their presense is considered unlikely. No individuals of the invasive American signal crayfish were captured during the WCC surveys, nor are there are any current records of this species in the River Ter. This may suggest that WCC are not present in the River Ter for a different reason other than displacement by Signal Crayfish, potentially due to water quality issues.

6. Conclusions

6.1.1 A number of rare/notable macroinvertebrate species including the beetles *Hygrotus nigrolineatus* and *Berosus affinis* were identified from the pond surveys. These species are often reliant on certain conditions, for example the Willow Emerald Damselfly has particular requirements in order to reproduce. Females lay eggs on branches (typically *Salix* sp) that overhang the water, and when they hatch the larvae drop into the ponds[12]. Water quality issues are often cited as an impediment to species distribution; this highlights the importance of maintaining good water quality and riparian vegetation around the ponds.

6.1.2 The Order limits encompasses several water bodies in addition to those surveyed. A tributary of the River Ter flows from north to south through the hamlet of Fuller Street before discharging into the River Ter in the northern end of the Order limits. Furthermore, a tributary of the River Chelmer crosses through the Order limits in the south western extent of the Order limits to the north of the village of Boreham.

7. References

Ref. 1 Chadd, R. & Extence, C. (2004) The conservation of freshwater macroinvertebrate populations: a community-based classification scheme. *Aquatic Conservation: Marine and Freshwater Ecosystems* 14: 597-624.

Ref. 2 Environment Agency (2014). *Freshwater macro-invertebrate analysis of riverine samples Operational Instruction 024_08*. Environment Agency, Bristol, UK.

Ref. 3 Environment Agency (2017). *Freshwater macro-invertebrate sampling in rivers Operational Instruction 018_08*. Environment Agency, Bristol, UK.

Ref. 4 Foster, G.N. 2010. A review of the scarce and threatened Coleoptera of Great Britain. Part 3: Water beetles of Great Britain. Species Status No. 1, JNCC, Peterborough, ISSN 1473-0154

Ref. 5 Maitland, P.S., (2003) Ecology of the river, brook, and sea lamprey. Conserving Natura 2000 Rivers Monitoring Series No. 5. *English Nature, Peterborough*, *52*.

Ref. 6 WFD-UKTAG (2014a). *UKTAG River Assessment Method Benthic Invertebrate Fauna: Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT)*. Water Framework Directive - United Kingdom Advisory Group, Stirling, UK.

Ref. 7 WFD-UKTAG (2014b). *UKTAG River Assessment Method Macrophytes and Phytobenthos: Macrophytes (River LEAFPACS2)*. Water Framework Directive - United Kingdom Advisory Group, Stirling, UK.

8. Annexes

8.1 Annex A - Macroinvertebate species

Table A1: Macroinvertebrate Taxa and their Conservation score from the River Ter and impacted Ponds within the Scheme boundary.

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Flatworms																
Dendrocoelidae	*Dendrocoelum lacteum*	2			2		2									
Planariidae	*Polycelis* sp.						6			35						
Planariidae	*Polycelis felina*	3								24						
Snails																
Lymnaeidae	Lymnaeidae (juvenile / damaged)														1	2
Lymnaeidae	*Radix auricularia*	2													1	
Valvatidae	*Valvata cristata*	2				20	2		8	1						
Valvatidae	*Valvata piscinalis*	1			1				1							
Hydrobiidae	*Potamopyrgus antipodarum*	1		2	5	37	55								19	
Bithyniidae	*Bithynia* sp.					2										
Bithyniidae	*Bithynia tentaculata*	1		5		1										
Physidae	Physidae (juvenile / damaged)														18	
Physidae	*Physa fontinalis*	1		3		6									3	

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Succineidae	Succineidae			1												
Planorbidae	*Anisus vortex*	1			2											18
Planorbidae	*Armiger crista*	2							8		3					
Planorbidae	*Bathyomphalus contortus*	2														38
Planorbidae	*Hippeutis complanatus*	3			1											
Limpets and mussels																
Anyclidae	*Ancylius fluviatilis*	1			2											
Sphaeriidae	Sphaeriidae (juvenile / damaged)									1						
Sphaeriidae	*Sphaerium corneum*	1		3		2										
Sphaeriidae	*Pisidium* sp.		38	2	49	3										
Unionidae	*Anodonta anatina*	2													1	
Worms																
Oligochaeta			8	17	17	100	3	38	3	8	80			1	71	10
Leeches																
Glossiphoniidae	Glossiphoniidae (juvenile / damaged)										3					
Glossiphoniidae	*Theromyzon tessulatum*	2													3	
Glossiphoniidae	*Glossiphonia* sp.						1				1				2	8
Glossiphoniidae	*Glossiphonia complanata*	1		3	2	15									1	

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Glossiphoniidae	*Helobdella stagnalis*	1	2	12	1		1								13	
Erpobdellidae	Erpobdellidae (juvenile / damaged)							1								
Erpobdellidae	*Erpobdella testacea*	4		2												
Erpobdellidae	*Erbodella octoculata*	1		1	1											
Piscicolidae	*Piscicola geometra*	2			1											
Piscicolidae	*Piscicola siddali*	6	1													
Mites																
Hydracarina					2			4	1	6					9	
Oribatei	*Oribatei*				1											
Crustaceans																
Ostracoda					1		150	160	13	280			103	25	53	
Copepoda								600		30			1		2	
Cladocera								700	103	620	20		1000	1000	2	
Gammaridae	Gammaridae											700				
Gammaridae	*Gammarus* sp.		36	79	20	250										
Gammaridae	*Gammarus pulex*	1	142	64	136	200						300				
Crangonyctidae	*Crangonyx floridanus/pseudogracilis*								235	2					16	
Asellidae	*Asellus aquaticus*	1	8	35	42	30			585						116	103

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Asellidae	*Asellus meridianus*	3						38			1					
Mayflies																
Baetidae	Baetidae (juvenile / damaged)			2			10				1					
Baetidae	*Baetis* sp.					2										
Baetidae	*Baetis rhodani*	1				4										
Baetidae	*Baetis rhodani / atlanticus*				1	24										
Baetidae	*Centroptilum luteolum*	4		1												
Baetidae	*Cloeon* sp.														12	
Baetidae	*Cloeon dipterum*	1						1			1	7			88	
Ephemerellidae	*Serratella ignita*	1				1										
Ephemeridae	*Ephemera* sp.					7	6									
Ephemeridae	*Ephemera danica*	1		18	11	4	6									
Caenidae	*Caenis luctuosa / macrura*					10										
Caenidae	*Caenis robusta*	5													1	
Damselflies																
Coenagrionidae	Coenagrionidae (juvenile / damaged)					1							15			3
Coenagrionidae	*Pyrrhosoma nymphula*	3											10			
Lestidae	*Chalcolestes viridis*	6						4		4						2
Calopterygidae	*Calopteryx* sp.					2										

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Calopterygidae	*Calopteryx splendens*	1		6	4	1										
Dragonflies																
Aeshnidae	Aeshnidae (juvenile / damaged)									5						
Libellulidae	Libellulidae (juvenile / damaged)												2			
True bugs																
Gerridae	Gerridae (nymph / damaged)									3	2					4
Gerridae	*Gerris* sp.															2
Veliidae	*Velia* sp.									1						
Pleidae	*Plea minutissima*	4													2	
Corixidae	Corixidae (nymph / damaged)						2		11	83	20				6	17
Corixidae	*Micronecta scholzi*	5													25	
Corixidae	*Hesperocorixa sahlbergi*	2														10
Corixidae	*Sigara lateralis*	2									5				3	
Corixidae	*Sigara concinna*	5													1	
Notonectidae	Notonectidae (nymph / damaged)						6		17	12	2					
Notonectidae	*Notonecta* sp.															20
Notonectidae	*Notonecta glauca*	1														1

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Beetles								8		6				3		3
Haliplidae	Haliplidae (larvae / damaged)														1	7
Haliplidae	*Haliplus lineaticollis*	1								1						
Haliplidae	*Haliplus ruficollis* group									1					1	
Gyrinidae	Gyrinidae (larvae / damaged)									1	1					
Dytiscidae	Dytiscidae (larvae / damaged)							8	5	3	23			2		
Dytiscidae	*Hyphydrus ovatus*	2						1								
Dytiscidae	*Hygrotus inaequalis*	2						3								
Dytiscidae	*Hygrotus nigrolineatus*	8													5	
Dytiscidae	*Hydroporus* sp.								1		1					
Dytiscidae	*Hydroporus nigrita*	3						7								
Dytiscidae	*Hydroporus palustris*	1						1		2						
Dytiscidae	*Hydroporus tesselatus*	2								1						
Dytiscidae	*Graptodytes bilineatus*	7							1							
Dytiscidae	*Platambus maculatus*	1		6												
Dytiscidae	*Agabus bipustulatus*	1								1						

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Dytiscidae	*Colymbetes fuscus*	1														1
Hydrophilidae	Hydrophilidae (larvae / damaged)										1	2			1	
Hydrophilidae	*Helophorus* sp.										1					2
Hydrophilidae	*Helophorus aequalis*	1								2	1					
Hydrophilidae	*Helophorus brevipalpis*	1						5		11	4			2		3
Hydrophilidae	*Hydrobius fuscipes*	1						1		1						
Hydrophilidae	*Anacaena bipustulata*	5						1								
Hydrophilidae	*Anacaena globulus*	1								1						
Hydrophilidae	*Anacaena limbata*	1								4						
Hydrophilidae	*Helochares lividus*	5						1		1						1
Hydrophilidae	*Cymbiodita marginella*	5								1						
Hydrophilidae	*Berosus affinis*	7													2	
Hydraenidae	*Ochthebius* sp.									1						
Hydraenidae	*Hydraena* sp.									1						
Scirtidae	Scirtidae (larvae / damaged)												10			
Elmidae	*Elmis aena*	1		6	4	27	40									
Elmidae	*Limnius volckmari*	1		2	19	7	40									
Elmidae	*Oulimnius* sp.			8	8	3	15									

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Elmidae	*Oulimnius tuberculatus*	1				25	5									
Curculionidae	Curculionidae											1				
Alderflies																
Sialidae	*Sialis* sp.															1
Sialidae	*Sialis lutaria*	1		23	1		1									4
Caddisflies							1									
Glossosomatidae	Glossosomatidae (juvenile / damaged)						1									
Glossosomatidae	*Agapetus* sp.						5									
Glossosomatidae	*Agapetus fuscipes*	1					6									
Polycentropodidae	Polycentropodidae (juvenile / damaged)					2	1									
Polycentropodidae	*Polycentropus flavomaculatus*	2		29	7	7										
Psychomyiidae	*Lype* sp.				1											
Psychomyiidae	*Lype reducta*	2					1									
Hydropsychidae	*Hydropsyche pellucidula*	1			1											
Hydropsychidae	*Hydropsyche siltatai*	1					1									
Hydroptilidae	Hydroptilidae (juvenile / damaged)															2
Hydroptilidae	*Hydroptila* sp.					9	1									

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Limnephilidae	Limnephilidae (juvenile / damaged)		7		11	15										
Limnephilidae	*Limnephilus lunatus*	1			16	3										1
Limnephilidae	*Chaetopteryx villosa*	3			21	2										
Leptoceridae	*Athripsodes* sp.				1	7										
Leptoceridae	*Athripsodes aterrimus*	1			1											
Leptoceridae	*Athripsodes cinereus*	1			2											
Leptoceridae	*Atripsodes bilineatus*	5	2	1												
Leptoceridae	*Mystacides azurea*	2			3											
Leptoceridae	*Mystacides longicornis*	1	1													
Lepidostomatidae	Lepidostomatidae (juvenile / damaged)					8										
Lepidostomatidae	*Lepidostoma hirtum*	1			3	3										
Sericostomatidae	*Sericostoma personatum*	1	1													
Trueflies					2						1		2			
Chironomidae	Chironomidae (damaged / pupea)		1	1		5	6				1	1		1	3	1	8
Chironomidae	Tanypodinae		42	9		5	2	2	4	5	1	7	1			
Chironomidae	Orthocladiinae		94	26	126	20	10	2	20	102	12	70	15	1	33	41

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Chironomidae	Chironomini		103	31			8	6	7	40	4		10	55	15	108
Chironomidae	Tanytarsini		227	9	476	40		1		1		7			1	
Pediciidae	*Dicranota* sp.					4										
Limoniidae	Limoniidae											1				
Simuliidae	Simuliidae (damaged / juvenile)					3										
Simuliidae	*Simulium* sp.		10	1	7											
Simuliidae	*Simulium lundstromi*	4	17	1												
Simuliidae	*Simulium ornatum* group	1		2												
Dixidae	*Dixa* sp.											5				
Dixidae	*Dixa nebulosa*	4	4	3								1				
Psychodidae						1						20				
Empididae					3											
Ceratopogonidae					4	3						2			5	
Syrphidae							3						19	20		
Stratiomyidae	Stratiomyidae					1										
Tabanidae	(Is Chrysops sp at R. Ter West sample)		4	5	9	2										
Culicidae	Culicidae						2		12	1			16	750		
Culicidae	*Culiseta*													1		
Syrphidae												35				
Chaoboridae									81	83						

Family	Species	Conservation score	River Ter East autumn	River Ter West autumn	River Ter East spring	River Ter West spring	Pond 1	Pond 6	Pond 7	Pond 10	Pond 20	Pond 22	Pond 23	Pond 25	Pond 27	Pond 28
Other Taxa																
Lepidoptera														1		
Collembola								1	1	2	1		10	1		
Microturbellaria									18							
Cottus gobio					1											
Gasterosteus aculeatus				3												
Hydrophilidae	Cryptopleurum							1								

8.2 Annex B – Community Conservation Index (CCI)

The Community Conservation Index (Chadd & Extence, 2004) allows a classification of the nature conservation value associated with a macroinvertebrate community. The CCI score for one sample is derived from individual Conservation Scores (CS), assigned to some species of aquatic macroinvertebrates and relating closely to the available published Red Data Books (Bratton, 1991a, 1991b; Shirt, 1987). Conservation Scores assigned to individual species vary from 1 to 10, as detailed on the Table B1 below. The derived CCI scores generally vary from 0 to > 20, as detailed in the Table B2 below. The Table B2 below provides a guide to interpreting CCI scores.

Table B2: Conservation Scores from the Community Conservation Index (from Chadd & Extence, 2004)

Conservation Score	Relation to Red Data Books
10	RDB1 (Endangered)
9	RDB2 (Vulnerable)
8	RDB3 (Rare)
7	Notable (but not RDB status)
6	Regionally notable
5	Local
4	Occasional (species not in categories 10-5, which occur in up to 10% of all samples from similar habitats)
3	Frequent (species not in categories 10-5, which occur in up to >10-25% of all samples from similar habitats)
2	Common (species not in categories 10-5, which occur in up to >25-50% of all samples from similar habitats)
1	Very common (species not in categories 10-5, which occur in up to >50-100 % of all samples from similar habitats)

Table B3: General guide to CCI scores (from Chadd & Extence, 2004)

CCI Score	Description	Interpretation
0 to 5.0	Sites supporting only common species and/or community of low taxon richness	Low conservation value
> 5.0 to 10.0	Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness	Moderate conservation value
> 10.0 to 15.0	Sites supporting at least one uncommon species, or several species of restricted distribution and/or a community of high taxon richness	Fairly high conservation value
> 15.0 to 20.0	Sites supporting several uncommon species, at least one of which may be nationally rare and/or a community of high taxon richness	High conservation value
> 20.0	Sites supporting several rarities, including species of national	Very high conservation value

	importance and/or a community of very high taxon richness

8.3 Annex C - Whalley, Hawkes, Paisley & Trigg (WHPT) Metric

There are approximately 4,000 species of aquatic macroinvertebrates in the British Isles. To simplify the analysis of the samples and the data we do not identify individual species but only the major types (taxa), mostly at the family taxonomic level. A key piece of information is the number of different taxa at a site. A fall in the number of taxa indicates ecological damage, including pollution (organic, toxic and physical pollution such as siltation, and damage to habitats or the river channel).

The WHPT scoring system (WFD-UKTAG, 2014) is based upon the sensitivity of macroinvertebrate families to organic pollution. It replaces the Biological Monitoring Working Party (BMWP) system (Hawkes, 1997) previously used in the UK.

The WHPT system assigns a numerical value to about 100 different taxa (known as the WHPT-scoring taxa) according to their sensitivity to organic pollution. In addition to the presence of macroinvertebrate taxa at a sampling site, as in the BMWP scoring system, the WHPT system also uses another type of information, this being the abundances of different scoring taxa.

Taxa abundances are classified in four categories (Class 1: 1 to 10 individuals, Class 2: 11 to 100 individuals, Class 3: 101 to 1,000 individuals, and Class 4: > 1,000 individuals). A score (Pressure Sensitivity Scores (PSs) is then assigned to each taxa, depending of the taxa sensitivity and abundances recorded.

The total WHPT score for a sample corresponds to the sum of PSs of scoring taxa recorded. The Average Score Per Taxon (ASPT) values are calculated as the Sum PSs divided by the number of scoring taxa (NTAXA). As such, three metrics are calculated:

a. WHPT score
b. NTAXA
c. ASPT

Some animals are more susceptible to organic pollution than others, and the presence of sensitive species indicates good water quality. This fact is taken into account by the WHPT metrics. The most useful way of summarising the biological data was found to be one that combined the number of taxa and the ASPT. The best quality is indicated by a diverse variety of taxa, especially those that are sensitive to pollution. Poorer quality is indicated by a smaller than expected number of taxa, particularly those that are sensitive to pollution. Organic pollution sometimes encourages an increased abundance of the few taxa that can tolerate it. However, maximum achievable values will vary between geological regions. For example, pristine lowland streams in East Anglia will always score lower than pristine Welsh mountain streams because they are unable to support many of the high-scoring taxa associated with fast flowing habitat. WHPT scores and ASPT for different types watercourse are dependent on the quality and diversity of habitat, natural water chemistry (associated with geology, distance from source etc.), altitude, gradient, time of year the sample was taken and other factors.