



## UNIVERSAL DESTINATIONS & EXPERIENCES UK PROJECT

Former Kempston Hardwick Brickworks  
and adjoining land, Bedford

### Environmental Statement Volume 3

### Appendix 6.17 - Aquatic Ecology Survey Report

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# 1 INTRODUCTION

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## 1.1 PROJECT BACKGROUND

- 1.1.1 This aquatic ecology survey report has been prepared in support of a planning proposal for the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)** of the Environmental Statement. (ES)
- 1.1.2 The Site boundary is shown in **Figure 1: Aquatic Ecology Survey Area** of **Annex 1: Figures**. The Site equates to 268ha and is divided into four zones referred to as the Core Zone, Lake Zone, West Gateway Zone, and East Gateway Zone. These Zones are hereafter collectively referred to as 'the Site'. This report focusses on the watercourses located in the Core Zone and the West Gateway Zone, and the lakes located within the Lake Zone.

## 1.2 ECOLOGICAL BACKGROUND

- 1.2.1 The Aquatic Habitat Scoping Assessment (**Appendix 6.2: Aquatic Habitat Scoping Assessment Report (Volume 3)**) identified the potential for the watercourses within the Site to support aquatic species.

## 1.3 SCOPE OF THE REPORT

- 1.3.1 WSP was commissioned to carry out fish and aquatic macroinvertebrate surveys of Elstow Brook and the Core Zone watercourse, and Predictive System for Multimetrics (PSYM) surveys of the lakes within the Site. The objectives of this report are to:
- Identify the potential of Elstow Brook and the Core Zone watercourse to support legally protected or otherwise notable fish and aquatic macroinvertebrate species; and
  - Characterise the ecological quality of the lakes within the Lake Zone and determine the presence of lakes with Good ecological quality and therefore deemed to be Habitats of Principal Importance.

## 2 METHODS

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### 2.1 DESK STUDY

- 2.1.1 An online desk study was undertaken in April 2024 to review existing ecological baseline information available in the public domain and to obtain any information held by relevant third parties. The full desk study methodology is reported in **Appendix 6.2: Aquatic Habitat Scoping Assessment Report (Volume 3)**.

### 2.2 FISH SURVEY

- 2.2.1 Following the initial aquatic habitat scoping assessment, fish surveys were recommended to be carried out on both Elstow Brook and the Core Zone watercourse. However, channel profiles, steep banks, and bankside vegetation cover constrained access to the watercourse such that an electric fishing survey to inform the baseline was not possible. To gain a better understanding of the fish populations of these watercourses, water samples were taken at strategic locations within the watercourses and analysed for fish environmental DNA (e-DNA) against an extensive reference library.
- 2.2.2 e-DNA sampling was also conducted on the four lakes located within the Lake Zone to better understand the fish populations present within them.

### 2.3 e-DNA SURVEY

- 2.3.1 In aquatic environments, animals shed cellular material into the water via reproduction, saliva, urine, faeces, and skin cells. This DNA will persist for several weeks and can be collected through a water sample, which is then analysed to determine if the target species of interest are present.
- 2.3.2 Studies have shown this approach to be effective for inventorying fish and invertebrates in lakes and rivers<sup>1,2,3,4,5</sup>.

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<sup>1</sup> Civade, R., Dejean, T., Valentini, A., Roset, N., Raymond, J.-C., Bonin, A., Taberlet, P. and Pont, D. (2016) 'Spatial Representativeness of Environmental DNA Metabarcoding Signal for Fish Biodiversity Assessment in a Natural Freshwater System', *PLoS One*, 11(6). Available at: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0157366> [Accessed: 07 May 2025].

<sup>2</sup> Hänfling, B., Lawson Handley, L., Read, D.S., Hahn, C., Li, J., Nichols, P., Blackman, R.C., Oliver, A. and Winfield, I.J. (2016) 'Environmental DNA metabarcoding of lake fish communities reflects long-term data from established survey methods', *Molecular Ecology*, 25(13), pp. 3101-3119. Available at: <https://onlinelibrary.wiley.com/doi/10.1111/mec.13660> [Accessed: 07 May 2025].

<sup>3</sup> Olds, B.P., Jerde, C.L., Renshaw, M.A., Li, Y., Evans, N.T., Turner, C.R., Deiner, K., Mahon, A.R., Brueske, M.A., Shirley, P.D., Pfrender, M.E., Lodge, D.M. and Lamberti, G.A. (2016) 'Estimating species richness using environmental DNA', *Ecology and Evolution*, 6(12), pp. 4214–4226. Available at: <https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.2186> [Accessed: 07 May 2025].

<sup>4</sup> Valentini, A., Taberlet, P., Miaud, C., Civade, R., Herder, J., Thomsen, P.F., Bellemain, E., Besnard, A., Coissac, E., Boyer, F., Gaboriaud, C., Jean, P., Poulet, N., Roset, N., Copp G.H., Geniez, P., Pont, D., Argillier, C., Baudoin, J., Peroux, T., Crivelli, A.J., Olivier, A., Acqueberge, M., Brun, M.L., Møller, P.R., Willerslev, E. and Dejean T. (2015) 'Next-

## Sample Collection

- 2.3.3 e-DNA samples were collected from locations within Elstow Brook, the Core Zone watercourse, and the four lakes, by suitably qualified and experienced aquatic ecologists on 26 November 2024.
- 2.3.4 Each sample taken from Elstow Brook and the Core Zone watercourse consisted of two litres of water collected from sub-sampling different habitat and flow types present within each watercourse sampled. The water was collected by a surveyor entering the watercourse and collecting water upstream of their position.
- 2.3.5 Each sample taken from the four lakes consisted of two litres of water collected from sub-sampling at several locations of different habitat around the perimeter of each lake. Potential thermal stratification of the lakes, and therefore the mixing of the lakes, was considered alongside health and safety concerns to ensure that the samples collected were as representative as possible.
- 2.3.6 The samples were collected using nitrile gloves, collecting as little sediment as possible, to avoid contamination.
- 2.3.7 The sample was filtered until two litres of water was sampled or to the point where no more liquid could be pushed through the filter. The amount of liquid filtered was recorded. The filter was then removed, a preservative added and capped before being returned to the laboratory for analysis.
- 2.3.8 This methodology is consistent with the *BS EN 17805:2023. Water quality. Sampling, capture and preservation of environmental DNA from water*<sup>6</sup>.

## e-DNA Sample Analysis

- 2.3.9 The analysis is conducted in two phases. The sample first goes through an extraction process where the filter is incubated in order to obtain any DNA within the sample.
- 2.3.10 The extracted sample is then tested via real time polymerase chain reaction (PCR) (also called q-PCR) for each of the species selected in the analysis. This process amplifies a select part of DNA, allowing it to be detected and measured in 'real time' as the analytical process develops. qPCR combines amplification and detection of target DNA into a single step. With qPCR, fluorescent dyes specific to the target sequence are used to label targeted PCR products during thermal cycling. The accumulation of fluorescent signals during this reaction is measured for fast and objective data analysis.
- 2.3.11 Consensus taxonomic assignments were made for each taxon using sequence similarity searches against the National Center for Biotechnology Information (NCBI) (nt GenBank) reference database. Assignments were made to the lowest possible taxonomic level where there was consistency in the

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generation monitoring of aquatic biodiversity using environmental DNA metabarcoding', *Molecular Ecology*, 25(4), pp. 929-942. Available at: <https://onlinelibrary.wiley.com/doi/10.1111/mec.13428> [Accessed: 07 May 2025].

<sup>5</sup> Nakagawa, H., Yamamoto, S. Sato, Y., Sado, T., Minamoto, T. and Miya, M. (2018) 'Comparing local- and regional-scale estimations of the diversity of stream fish using e-DNA metabarcoding and conventional observation methods', *Freshwater Biology*, 63(6), pp. 569–580. Available at: <https://onlinelibrary.wiley.com/doi/10.1111/fwb.13094> [Accessed: 07 May 2025].

<sup>6</sup> British Standards Institution (2023) *BS EN 17805:2023: Water quality. Sampling, capture and preservation of environmental DNA from water*. Available at: <https://knowledge.bsigroup.com/products/water-quality-sampling-capture-and-preservation-of-environmental-dna-from-water> [Accessed: 07 May 2025].

matches. Conflicts were flagged and resolved manually. Minimum similarity thresholds of 99%, 97%, and 95% were used for species-, genus- and higher-level assignments respectively. In cases where there were equally good matches to multiple species, public records from the Global Biodiversity Information Facility (GBIF) were used to assess which were most likely to be present in the United Kingdom. Higher-level taxonomic identifications or multiple potential identifications were reported in cases that could not be resolved in this way.

- 2.3.12 Taxa with low abundance (<0.02% or <10 reads) were removed, as was any unidentified, non-target, and common contaminant sequences.
- 2.3.13 The proportion of sequence reads per detected taxon is calculated. This metric is not an indicator of relative taxon abundance, as whilst it is a consequence of abundance, it is also impacted by factors such as biomass, activity, surface area, condition, distance from the physical sample, primer bias, and species-specific variation in the genome. High proportion of sequence reads can however be interpreted as lending greater confidence in detection.
- 2.3.14 There is lower support for the taxonomic identification when there are fewer than three matches to sequences in the reference database (NCBI nt GenBank), and/or limited geographic occurrence records for the taxon. Where this has occurred, confidence in the taxonomic assignment, and consequently absence/presence of the taxa, has been determined by habitat suitability/viability of the proposed taxa, supplemented by professional experience.
- 2.3.15 True positive controls, negatives and blanks are included in every analysis, and these have to be correct before any result is declared, therefore acting as additional quality control measures.

## 2.4 AQUATIC MACROINVERTEBRATE SURVEYS

### FIELD SURVEY

- 2.4.1 Aquatic macroinvertebrate surveys were undertaken on 30 May 2024 (spring) and 26 November 2024 (autumn) on Elstow Brook and the Core Zone watercourse. Two samples were taken from each watercourse (one sample in spring and one sample in autumn), with the Elstow Brook samples taken from the proposed road bridge crossing point within the West Gateway Zone and the Core Zone watercourse samples taken from an area of representative habitat.
- 2.4.2 Aquatic macroinvertebrate samples were collected using the standard three-minute kick sampling of all in channel habitats in proportion to their occurrence at the Core Zone watercourse. However, due to steep banks, access to Elstow Brook was constrained. Therefore, the aquatic macroinvertebrate samples were collected using the Environment Agency's standard three-minute sweep sampling methodology. These surveys were carried out using a standard sample net (1mm mesh) with a one-minute timed manual search following the Environment Agency (2017) procedure<sup>7</sup>. Both sampling

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<sup>7</sup> Environment Agency (2017) *Freshwater macro-invertebrate sampling in rivers: Operational Instruction 018\_08*. Available at: <https://static1.squarespace.com/static/621616256950454546689e6d/t/623c57e2af4d0d4ec278528e/1648121828368/LIT+11610+-+Freshwater+macro-invertebrate+sampling+in+rivers+09-12-2017.pdf> [Accessed: 07 May 2025].



methodologies conform to *BS EN ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters*<sup>8</sup>.

- 2.4.3 A standardised field sheet was completed to record details of channel and bank physical habitat (bank material, substrate, flow types, channel features, bank structure), riparian land use and potential sources of anthropogenic stress.
- 2.4.4 Samples were placed in one-litre sample pots, preserved in Industrial Denatured Alcohol on-Site and transported to the laboratory for sorting and identification to Taxonomic Level 5, in adherence with Environment Agency (2014) procedures<sup>9</sup>.

## BIOLOGICAL METRICS

- 2.4.5 The use of biological metrics allowed the assignment of ecological values to the aquatic macroinvertebrate communities observed, and an assessment of pressures on those communities to be made.

### River Invertebrate Classification Tool

- 2.4.6 The River Invertebrate Classification Tool (RICT) determines the ecological condition of a given watercourse based on a comparison of aquatic macroinvertebrate communities observed at each sampling location, with the aquatic macroinvertebrate communities observed at reference sites<sup>10</sup>. RICT reference sites are deemed to be as close as possible to pristine conditions and not impacted by environmental stressors such as pollution, habitat modification or flow stress. Reference sites provide an expected aquatic macroinvertebrate community score for that river type. The observed aquatic macroinvertebrate community score at a given watercourse is divided by the expected community score, with reference and bias adjustments applied to obtain the Ecological Quality Ratio (EQR). The RICT can derive EQR scores for a number of biological metrics. These metrics are discussed further below.

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<sup>8</sup> British Standards Institution (2012) *BS EN ISO 10870:2012. Water quality. Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters*. London: British Standards Institution. Available at: <https://www.normsplash.com/FreeDownload/132828213/BS-EN-ISO-10870-2012-en.pdf> [Accessed: 22 May 2025]

<sup>9</sup> Environment Agency (2014) *Freshwater macro-invertebrate analysis of riverine samples: Operational Instruction 024\_08*. Available at: <https://static1.squarespace.com/static/621616256950454546689e6d/t/623c5810cf53f72674a3c2f6/1648121873457/lit+11614+-+freshwater+macro-invertebrate+analysis+of+riverine+samples+28+jan+2014.pdf> [Accessed: 07 May 2025].

<sup>10</sup> SNIFFER (2008) *River Invertebrate Classification tool, Project WFD72C*. Available at: [https://eprints.bournemouth.ac.uk/16550/2/SNIFFER\\_WFD72C\\_RICT\\_Final\\_Report\\_-\\_Davy-Bowker%2C\\_Clarke\\_et\\_al\\_2008.pdf](https://eprints.bournemouth.ac.uk/16550/2/SNIFFER_WFD72C_RICT_Final_Report_-_Davy-Bowker%2C_Clarke_et_al_2008.pdf) [Accessed: 07 May 2025].

## Whalley, Hawkes, Paisley and Trigg

- 2.4.7 The Whalley, Hawkes, Paisley and Trigg (WHPT) metric<sup>11</sup> is based on the tolerance of different aquatic macroinvertebrates to organic pollution. Each aquatic macroinvertebrate family is assigned a score from -1.6 to 13, depending on their tolerance to pollution and abundance category (on a continuous scale, -1.6 is for highly abundant pollution-tolerant taxa, 13 is for highly abundant pollution-intolerant taxa) and an overall score is produced from the total. The WHPT index is widely used to determine the ecological water quality of running waters and specifically the detection of organic pollution. As such, any extrapolation of other water quality pressures should be undertaken with caution.
- 2.4.8 The Average Score Per Taxon (ASPT) is derived from the WHPT index. By dividing the total WHPT score by the number of scoring taxa present (NTAXA), the ASPT can be calculated. This metric is more easily comparable with other sites and enables an assessment of biological water quality that is less influenced by the presence of a greater proportion of low scoring taxa or sampling effort than the overall WHPT score. In both the case of WHPT score and ASPT, higher scores indicate better ecological quality.

## Lotic-invertebrate Index for Flow Evaluation

- 2.4.9 Aquatic macroinvertebrates have specific requirements for flow conditions and can be used to determine not only predominant flow types<sup>12</sup>, but also changes in flow character. The Lotic-invertebrate Index for Flow Evaluation (LIFE) metric uses abundance data and flow group associations detailed by Extence *et al.* (1999), to assign a flow preference score to aquatic macroinvertebrate families present in a sample. An overall LIFE score for the sampling site can be interpreted as an abundance-weighted ASPT metric. Taxa including Oligochaeta and Chironomidae are not used in the calculation of LIFE scores as there is no clear relationship between flow and their abundance at this level of taxonomic resolution.
- 2.4.10 The LIFE scores generated can be interpreted against the scale described **Table 2-1** in respect of sensitivity to changes in water flow.

<sup>11</sup> Water Framework Directive UK Technical Advisory Group (2014) *Invertebrates (General Degradation): Whalley, Hawkes, Paisley, and Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT)*. Available at: [https://wiki.therrc.co.uk/images/e/e3/Invertebrates\\_%28General\\_Degradation%29.pdf](https://wiki.therrc.co.uk/images/e/e3/Invertebrates_%28General_Degradation%29.pdf) [Accessed: 07 May 2025].

<sup>12</sup> Extence, C.A., Balbi, D.M. and Chadd, R.P. (1999) 'River flow indexing using British benthic macroinvertebrates: a framework for setting hydroecological objectives', *Regulated Rivers: Research and Management*, 15(6), pp. 543-574. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1002/%28sici%291099-1646%28199911%12%2915%3A6%3C545%3A%3Aaid-rrr561%3E3.0.co%3B2-w> [Accessed: 05 March 2025].

**Table 2-1 - Interpretation of LIFE scores**

Life Score	Aquatic Macroinvertebrate Community Flow Sensitivity
7.26 and above	High sensitivity to reduced flows
6.51 – 7.25	Moderately sensitivity to reduced flows
6.5 and below	Low sensitivity to reduced flows

- 2.4.11 There are currently no Water Framework Directive (WFD) related class boundaries for LIFE EQRs, but a threshold of 0.94 is used to indicate the presence of flow stressed aquatic macroinvertebrate communities<sup>13</sup>.

#### Proportion of Sediment-sensitive Invertebrates

- 2.4.12 The Proportion of Sediment-sensitive Invertebrates (PSI) metric acts as a proxy for the quantity of fine sediment at a site<sup>14</sup>. Aquatic macroinvertebrate species are assigned a fine sediment sensitivity rating that ranges from highly insensitive to highly sensitive to fine sediment. The PSI score is calculated as the percentage of sensitive taxa in the sample and used to indicate how sedimented a watercourse is, from minimally sedimented/un-sedimented to heavily sedimented (**Table 2-2**).
- 2.4.13 There are currently no WFD-related class boundaries for PSI EQRs but a threshold of 0.70 is used to indicate the presence of aquatic macroinvertebrate communities tolerant to sedimentation<sup>15</sup>.

**Table 2-2- PSI scores and interpretation**

PSI Score	River bed condition
81-100	Minimally sedimented/un-sedimented
61-80	Slightly sedimented
41-60	Moderately sedimented
21-40	Sedimented

<sup>13</sup> Environment Agency (2012) *Hydroecological validation using macroinvertebrate data: Operational Instruction 318\_10*.

<sup>14</sup> Extence, C.A., Chadd, R., England, J., Wood, P.J. and Taylor., E. (2011) 'The assessment of fine sediment accumulation in rivers using macro-invertebrate community response', *River Research and Applications*, 29(1), pp. 17-55. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1002/rra.1569> [Accessed: 05 March 2025].

<sup>15</sup> Turley, M.D., Bilotta, G.S., Cadd, R.P., Extence C.A., Brazier, R.E., Burnside, N.G. and Pickwell, A.G.G. (2016) 'A sediment-specific family-level biomonitoring tool to identify the impacts of fine sediment in temperate rivers and streams', *Ecological Indicators*, 70, pp. 151-165. Available at: <https://www.sciencedirect.com/science/article/pii/S1470160X16302837> [Accessed: 07 May 2025].

PSI Score	River bed condition
0-20	Heavily sedimented

### Community Conservation Index

- 2.4.14 The diversity and conservation interest of an aquatic macroinvertebrate community at each sampling site can be represented by analysing species level data through the Community Conservation Index (CCI). The CCI incorporates elements of taxon rarity and richness to summarise the conservation value of aquatic macroinvertebrate communities<sup>16</sup>. Scores defined by Chadd and Extence (2004) are assigned to species within the sample to derive a total sample conservation score which infers a conservation value from the criteria listed in **Table 2-3**.

**Table 2-3 - CCI scores and classification descriptions**

Conservation Score	Conservation Classification	Description
0 ≤ 5	Low	Sites supporting only common species and/or a community of low taxon richness.
5 ≤ 10	Moderate	Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness.
10 ≤ 15	Fairly high	Sites supporting at least one uncommon species, or several species of restricted distribution and/or a community of high taxon richness.
15 ≤ 20	High	Sites supporting several uncommon species, at least one of which may be nationally rare and/or a community of high taxon richness.
>20	Very High	Sites supporting several rarities, including species of national importance, or at least one extreme rarity (such as taxa included in the British Red Data Book (RDB)) and/or a community of very high taxon richness (potentially of national significance and may merit statutory protection).

### Water Framework Directive Aquatic Macroinvertebrate Classification

- 2.4.15 The WFD uses the pollution sensitivity (WHPT ASPT) and aquatic macroinvertebrate richness (WHPT NTAXA) EQR scores to determine whether a watercourse meets Good Ecological Status, as required under the WFD<sup>17</sup>.
- 2.4.16 There are five ecological status classes: Bad, Poor, Moderate, Good and High.

<sup>16</sup> Chadd, R. and Extence, C. (2004) 'The Conservation of freshwater macroinvertebrate populations: a community-based classification scheme', *Aquatic Conservation: Marine and Freshwater Ecosystems*, 14(6), pp. 597-624. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1002/aqc.630> [Accessed: 05 March 2025].

<sup>17</sup> *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017*. (as amended from time to time)

- 2.4.17 Where an aquatic macroinvertebrate community is recorded at, or above Good Ecological Status, then biological or physical pressures including flow and anthropogenic pollution are not assumed to be affecting aquatic ecology.
- 2.4.18 Watercourses failing to meet Good Ecological Status for aquatic macroinvertebrates may be influenced by a variety of stressors, and EQRs can be interrogated to determine the likely cause of failure to meet Good Ecological Status.
- 2.4.19 A relative WFD class was calculated from the aquatic macroinvertebrate community identified at each sampling location for comparison with the WFD status of the wider catchment.

## 2.5 LAKE SURVEYS

- 2.5.1 Surveys of the aquatic macroinvertebrate and macrophyte communities of the four lakes located in the Lake Zone, were conducted on 28 August 2024 by suitably qualified and experienced aquatic ecologists.
- 2.5.2 The lakes were assessed following the standard guidance for PSYM surveys<sup>18</sup>, which assesses both the plant and aquatic macroinvertebrate communities present in a water body. This is because, together, both groups span a complementary range of sensitivities to potential degradation factors.
- 2.5.3 Aquatic macroinvertebrate sampling consisted of three-minute hand-net sampling methods. Sampling time was allocated according to the mesohabitat types (e.g. flooded marginal grasses or gravel bottomed shallows) present (i.e. sampling time is divided equally between the different mesohabitats).
- 2.5.4 The sample was sorted on the bankside with aquatic macroinvertebrates present identified to Taxonomic Level 2.
- 2.5.5 All wetland plants present within the outer edge of each pond were recorded. A hand net or grapnel was used to sample deeper areas. Plants were identified to species in the field; where this was not possible, plants were photographed or bagged and identified ex situ.
- 2.5.6 Plant species and aquatic macroinvertebrate family data were processed using the following PSYM indices:

### Aquatic macroinvertebrates

- ASPT: indicates average pollution tolerance of macroinvertebrates within a community;
- Number of dragonfly (*Odonata*) and alderfly (*Megaloptera*) families (F\_OM): indicates long term quality of a pond as larvae have a long aquatic life stage; and
- Number of beetle (*Coleoptera*) families (F\_COL): indicates the habitat quality and diversity of a pond.

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<sup>18</sup> Howard, S. (2002) *A guide to monitoring the ecological quality of ponds and canals using PSYM: PSYM Manual*. Available at: [https://content.freshwaterhabitats.org.uk/2013/09/NPMN\\_PSYM\\_MANUAL\\_July09.pdf](https://content.freshwaterhabitats.org.uk/2013/09/NPMN_PSYM_MANUAL_July09.pdf) [Accessed: 07 May 2025].

## Macrophytes

- Number of submerged and emergent plant species (SM\_NTX): indicates species richness of a site;
- Trophic ranking score for aquatic and emergent plants (TRS\_ALL): indicates nutrient tolerance on a scale of 1 to 10 (10 = very tolerant); and
- Number of uncommon plant species (PL\_NUS): measures conservation value of a community.

## ASSESSMENT CRITERIA

- 2.5.7 Observed data was compared with predicted values generated by the Freshwater Habitats Trust to calculate Ecological Quality Indices (EQI). EQI are expressed as a ratio which is calculated based on the observed value against a national value for ponds of this type under national reference conditions. EQI equal to/or greater than one denotes a pond is achieving or exceeding the expected value.
- 2.5.8 EQI are used to inform the Index of Biological Integrity (IBI), which is interpreted as an overall percentage and quality class. The quality classes are outlined in **Table 2-4**. Ponds achieving a quality class of Good qualify as Habitats of Principal Importance (HPI) in accordance with the requirements of the *NERC Act 2006*<sup>19</sup>.

**Table 2-4 - PSYM percentage class boundaries**

Status Class Boundary	Percentage (%)
Good	>75
Moderate	51 – 75
Poor	25 – 50
Very Poor	<25

## 2.6 NOTES AND LIMITATIONS

- 2.6.1 Every effort has been made to provide a comprehensive description of the aquatic species located within the Site; however, the following specific limitations apply to this assessment:
- e-DNA data cannot provide information on the age structure or provide information on the size of fish populations within a water body; however, they can provide information on the species composition of a fish community. These data provide valuable information on the presence of protected and notable fish species. As such, the use of e-DNA data to determine the fish baseline condition and inform the impact assessment and necessary mitigation measures were considered a reasonable alternative to electric fishing surveys;
  - No amplifiable DNA may be a result observed from the e-DNA surveys conducted. This indicates that DNA sequence amplification was not successful, which may be due to a low concentration of

<sup>19</sup> *Natural Environment and Rural Communities Act 2006*. (as amended from time to time)

DNA or PCR inhibition. Target groups that are rare, or at very low abundance, may not be detected;

- The aquatic macroinvertebrate sampling methods used were selected to provide the data necessary for the calculation of a range of biological quality indices. It is not intended that the sampling methods will capture a full list of all species present within the watercourses, which will vary according to season and abundance of individual species. Identification to species level is not always possible where juvenile or damaged specimens are present in the sample, or where identification to species level is not standard practice. Nevertheless, through the calculation of appropriate indices, it is possible to evaluate the biological quality of the water body in relation to others; and
- Ecological survey data is typically valid for 12 to 18 months unless otherwise specified. The likelihood of surveys needing to be updated increases with time and is greater for mobile species or in circumstances where the habitat or its management has changed significantly since the surveys were undertaken. Factors to be considered include (but are not limited to): whether a site supports, or may support, a mobile species which could have moved on to site, or changed its distribution within a site<sup>20</sup>. Therefore, habitat validation surveys may be required pre-construction should construction commence later than 18 months after the issuing of this report, to ensure that the survey data presented here remain valid.

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<sup>20</sup> Chartered Institute of Ecology and Environmental Management (2019) *On the lifespan of ecological reports and surveys*. Available at: <https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf> [Accessed: 05 March 2025].

## 3 RESULTS

### 3.1 DESK STUDY

- 3.1.1 Results from the desk study undertaken in April 2024 are reported within **Appendix 6.2: Aquatic Habitat Scoping Assessment Report (Volume 3)**.

### 3.2 FISH E-DNA SURVEY

#### Elstow Brook

- 3.2.1 The e-DNA of 10 species of fish were detected in the sample taken from Elstow Brook. The species detected and the relative proportion of the sequences found in the sample are detailed in **Table 3-1**.
- 3.2.2 The e-DNA of one species of conservation interest, European eel (*Anguilla anguilla*), was recorded in the sample. European eel is a species of conservation interest and is listed under Section 41 of the *NERC Act 2006*<sup>19</sup> as a species of principal importance (SPI). The species is also listed on the IUCN Red List of Threatened Species as being critically endangered<sup>21</sup>. Additionally, the movement and safe passage of European eel is protected under *The Eels (England and Wales) Regulations 2009*<sup>22</sup>.

**Table 3-1 – Fish species identified in the e-DNA sample from Elstow Brook**

Common Name	Latin Name	Percentage Composition (%)
Perch	<i>Perca fluviatilis</i>	85.66
-	<i>Cottus</i> sp.	4.47
Roach	<i>Rutilus rutilus</i>	3.96
Chub	<i>Squalius cephalus</i>	1.64
Common dace	<i>Leuciscus leuciscus</i>	1.55
Stone loach	<i>Barbatula barbatula</i>	1.37
Northern pike	<i>Esox lucius</i>	0.59
European eel*	<i>Anguilla anguilla</i>	0.32

<sup>21</sup> Jacoby, D. and Gollock, M. (2014) *Anguilla anguilla*. *The IUCN Red List of Threatened Species 2014*. Available at: <https://www.iucnredlist.org/species/60344/45833138> [Accessed: 08 May 2025].

<sup>22</sup> *The Eels (England and Wales) Regulations 2009*. (as amended from time to time).



Common Name	Latin Name	Percentage Composition (%)
Minnow	<i>Phoxinus phoxinus</i>	0.25
Common bream	<i>Abramis brama</i>	0.19

Note: Species marked with an \* are species of conservation interest.

### Core Zone Watercourse

- 3.2.3 A water sample was collected from the Core Zone watercourse for e-DNA analysis, however, no amplifiable DNA was detected in the sample, and as such no results were obtained. This could be the result of a low concentration of DNA present, or PCR inhibition during the analysis process.
- 3.2.4 Although the e-DNA surveys did not highlight the presence of the DNA of fish species within the Core Zone watercourse at the time of sampling, it does not necessarily preclude their presence. During the spring aquatic macroinvertebrate surveys, it was noted that European bullhead (*Cottus gobio*) and nine-spined stickleback (*Pungitius pungitius*) were present in this watercourse.

### Lake 1

- 3.2.5 The e-DNA of seven species of fish were detected in the sample taken from Lake 1. The species detected and the relative proportion of the sequences found in the sample are detailed in **Table 3-2**.
- 3.2.6 The e-DNA of one species of conservation interest, European eel, was recorded in the sample.

**Table 3-2 – Fish species identified in the e-DNA sample from Lake 1**

Common Name	Latin Name	Percentage Composition (%)
Perch	<i>Perca fluviatilis</i>	46.64
-	<i>Pungitius</i> sp.	24.57
Common rudd	<i>Scardinius erythrophthalmus</i>	12.39
European eel*	<i>Anguilla anguilla</i>	4.52
Northern pike	<i>Esox lucius</i>	3.84
Roach	<i>Rutilus rutilus</i>	1.84
Minnow	<i>Phoxinus phoxinus</i>	1.24

Note: Species marked with an \* are species of conservation interest.

## Lake 2

- 3.2.7 The e-DNA of three species of fish were detected in the sample taken from Lake 2. The species detected and the relative proportion of the sequences found in the sample are detailed in **Table 3-3**. No species of conservation interest were detected in the sample.

**Table 3-3 – Fish species identified in the e-DNA sample from Lake 2**

Common Name	Latin Name	Percentage Composition (%)
Common rudd	<i>Scardinius erythrophthalmus</i>	72.17
Roach	<i>Rutilus rutilus</i>	21.67
Northern pike	<i>Esox lucius</i>	6.16

## Lake 3a

- 3.2.8 The e-DNA of four species of fish were detected in the sample taken from Lake 3a. The species detected and the relative proportion of the sequences found in the sample are detailed in **Table 3-4**. No species of conservation interest were detected in the sample.

**Table 3-4 – Fish species identified in the e-DNA sample from Lake 3a**

Common Name	Latin Name	Percentage Composition (%)
Common rudd	<i>Scardinius erythrophthalmus</i>	62.48
Northern pike	<i>Esox lucius</i>	19.52
Perch	<i>Perca fluviatilis</i>	9.61
Roach	<i>Rutilus rutilus</i>	7.68

## Lake 3b

- 3.2.9 The e-DNA of five species of fish were detected in the sample taken from Lake 3b. The species detected and the relative proportion of the sequences found in the sample are detailed in **Table 3-5**. No species of conservation interest were detected in the sample.

**Table 3-5 – Fish species identified in the e-DNA sample from Lake 3b**

Common Name	Latin Name	Percentage Composition (%)
Northern pike	<i>Esox lucius</i>	40.50
Perch	<i>Perca fluviatilis</i>	27.46

Common Name	Latin Name	Percentage Composition (%)
Common rudd	<i>Scardinius erythrophthalmus</i>	25.55
Roach	<i>Rutilus rutilus</i>	4.12
-	<i>Cottus</i> sp.	2.36

### 3.3 AQUATIC MACROINVERTEBRATE SURVEY

#### BIOLOGICAL METRICS

- 3.3.1 Images of sampling locations are displayed in **Annex 2**. The full aquatic macroinvertebrate taxon list is presented in **Annex 3**.
- 3.3.2 The biological metrics calculated for each site based on the aquatic macroinvertebrate communities present in spring and autumn 2024 are displayed in **Table 3-6**.

**Table 3-6 – Biological metrics for the two aquatic macroinvertebrate sampling sites in spring and autumn 2024**

Site	Season	WHPT-ASPT	WHPT-NTAXA	LIFE (O)	LIFE (E)	LIFE EQR	PSI (O)	PSI (E)	PSI EQR	CCI (TL5)
Elstow Brook	Spring	4.47	11	6.72	6.79	0.99	31.25	41.23	0.76	1.25
	Autumn	4.90	7	7.00	6.65	1.05	54.54	37.94	1.44	16.33
Core Zone Watercourse	Spring	3.68	13	5.00	7.18	0.69	9.09	52.88	0.17	13.33
	Autumn	4.43	11	5.33	7.07	0.75	5.00	49.36	0.10	11.11

- 3.3.3 At Elstow Brook, 11 and seven different scoring taxa were identified in spring and autumn 2024, respectively. The observed LIFE EQR values in spring and autumn are above the guideline threshold of 0.94, indicating that the aquatic macroinvertebrate communities in Elstow Brook are not flow stressed. The observed PSI scores indicate Sedimented to Moderately sedimented conditions in spring and autumn 2024, respectively. The PSI EQR values are above the threshold of 0.70, which is indicative of an aquatic macroinvertebrate community that is not subject to sedimentation stress. The CCI scores indicate an aquatic macroinvertebrate community of Low to High conservation value in spring and autumn 2024, respectively.
- 3.3.4 At the Core Zone watercourse, 13 and 11 different taxa were identified in spring and autumn 2024, respectively. The observed LIFE EQR values are below the guideline threshold of 0.94, indicating that the aquatic macroinvertebrate community of the Core Zone watercourse are flow stressed. The observed PSI scores indicate Heavily sedimented conditions in both spring and autumn 2024. The PSI EQR values are below the threshold of 0.70, which is indicative of an aquatic macroinvertebrate community that is subject to sedimentation stress. The CCI scores indicate an aquatic macroinvertebrate community of Fairly High conservation value in both spring and autumn 2024.

## RIVER INVERTEBRATE CLASSIFICATION TOOL

- 3.3.5 RICT analysis was performed to produce indicative WFD classification scores for aquatic macroinvertebrates; outputs are summarised in **Table 3-7**.

**Table 3-7 – RICT output for the two aquatic macroinvertebrate sampling sites in spring and autumn 2024**

Site	Index	Spring EQR	Autumn EQR	Combined EQR	Overall classification	Confidence of class (%)
Elstow Brook	WHPT-ASPT	0.82	0.95	0.88	Bad	88.65
	WHPT-NTAXA	0.47	0.32	0.39		
Core Zone Watercourse	WHPT-ASPT	0.60	0.84	0.72	Poor	61.41
	WHPT-NTAXA	0.58	0.52	0.55		

- 3.3.6 The aquatic macroinvertebrate community at the Elstow Brook sampling location was indicative of Bad WFD status, whilst the community within the Core Zone watercourse was indicative of Poor WFD status.

## AQUATIC MACROINVERTEBRATE ASSEMBLAGE AND CONSERVATION STATUS

- 3.3.7 The Elstow Brook spring sample was dominated by the riffle beetle (*Elmis aenea*). The autumn sample was sparse, with the most dominant species being the freshwater shrimp (*Gammarus pulex/fossarum* agg.), albeit with only four individuals recorded.
- 3.3.8 The Core Zone watercourse spring sample was dominated by the white-lipped ramshorn (*Anisus leucostoma*) and the moss bladder snail (*Aplexa hypnorum*). The autumn sample was dominated by water hoglouse (*Asellus aquaticus*).
- 3.3.9 The invasive non-native species (INNS), the amphipod (*Crangonyx pseudogracilis/floridanus* agg), was recorded in both the autumn and spring samples in the Core Zone watercourse.
- 3.3.10 Only one species of note under CCI scoring was recorded. One individual of the beetle (*Anacaena bipustulata*) was identified in the autumn sample in the Elstow Brook (**Table 3-8**). This beetle has a conservation score of 7 and as such is Notable (scarce in Great Britain but not of RDB Status).

**Table 3-8 – Aquatic macroinvertebrates identified with a Conservation score of six or greater**

Latin Name	Common Name	Conservation score	Status
<i>Anacaena bipustulata</i>	Water scavenger beetle	7	Notable (scarce in Great Britain but not RDB Status)

## PSYM SURVEY

- 3.3.11 The data obtained from the aquatic macroinvertebrate samples and macrophyte surveys from the PSYM field surveys are summarised in **Table 3-9**. The PSYM results and overall classification of each water body is presented in **Table 3-10** and **Table 3-11**.

- 3.3.12 Lake 3a supported the highest number of PSYM scoring aquatic macroinvertebrate taxa. The macrophyte communities differed between ponds, with Lake 2 supporting the greatest number of macrophyte species. A full list of aquatic macroinvertebrate and macrophyte taxa for both ponds is presented in **Annex 4**.
- 3.3.13 Two invasive non-native macrophyte species were recorded, with Canadian waterweed (*Elodea canadensis*) recorded in Lake 1, and New Zealand pygmyweed (*Crassula helmsii*) recorded in Lakes 2, 3a, and 3b.
- 3.3.14 Lake 3a was identified as a HPI achieving a PSYM Quality Category of Good. All other lakes achieved a PSYM Quality Category of Moderate.

**Table 3-9 - PSYM field data and parameter summary**

Sampling Site Details	Lake 1	Lake 2	Lake 3a	Lake 3b
Area (m <sup>2</sup> )	35233	12226	17510	64785
Emergent plant cover (%)	10	60	40	20
No. of submerged and marginal plant species	12	7	11	7
No. of uncommon plant species	2	3	3	2
Trophic Ranking Score (TRS)	8.29	8.40	8.23	8.23
Invertebrate ASPT	4.35	4.80	5.19	4.45
Odonata and Megaloptera (OM) families	2	4	4	1
Coleoptera families (COL)	3	0	3	2
pH	8.13	8.00	8.38	8.31

**Table 3-10 - PSYM Results; Predicted (P), Actual (A), EQI, and IBI**

Lake Code	Submerged and marginal plant species (SM)				Uncommon plant species (NUS)				Trophic Ranking Score (TRS)				Invertebrate ASPT				OM families				COL families			
	P	A	EQI	IBI	P	A	EQI	IBI	P	A	EQI	IBI	P	A	EQI	IBI	P	A	EQI	IBI	P	A	EQI	IBI
Lake 1	40.50	12.00	0.30	1	6.80	2.00	0.30	1	8.74	8.29	0.95	3	5.19	4.35	0.84	2	3.32	2.00	0.60	2	3.85	3.00	0.78	3
Lake 2	32.50	7.00	0.20	0	5.30	3.00	0.60	2	8.74	8.40	0.96	3	5.12	4.80	0.94	3	3.11	4.00	1.29	3	3.77	0.00	0.00	0
Lake 3a	34.50	11.00	0.30	1	5.60	3.00	0.50	2	8.76	8.23	0.94	3	5.19	5.19	1.00	3	3.31	4.00	1.21	3	3.84	3.00	0.78	3
Lake 3b	43.80	7.00	0.20	0	7.10	2.00	0.30	1	8.76	8.23	0.94	3	5.15	4.45	0.87	3	3.20	1.00	0.31	1	3.80	2.00	0.53	2

**Table 3-11 - PSYM Metric Quality Categories**

Lake Code	Sum of individual metric IBI scores	Index of Biotic Integrity (%)*	PSYM Quality Category
Lake 1	12	67	Moderate
Lake 2	11	61	Moderate
Lake 3a	15	83	Good
Lake 3b	10	56	Moderate

\*calculated based on the observed EQI value against a national value for ponds of this type under national reference conditions

## 4 DISCUSSION

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### 4.1 ELSTOW BROOK

- 4.1.1 The results from the e-DNA surveys show that Elstow Brook supports a coarse fish community, characteristic of habitat observed. The DNA of one species of conservation interest, European eel, was detected within the Elstow Brook sample.
- 4.1.2 Elstow Brook supports an aquatic macroinvertebrate assemblage of limited diversity. One species of note under CCI scoring, the beetle (*Anacaena bipustulata*) was recorded in the autumn sample from Elstow Brook. The species is classified as Notable (scarce in Great Britain but not of RDB Status). No INNS were recorded in the spring nor autumn 2024 samples.
- 4.1.3 The aquatic macroinvertebrate community within Elstow Brook does not appear to be subject to flow or sedimentation pressures. The indicative WFD status of Elstow Brook calculated in the RICT analysis was Bad. This classification differs from the 2022 WFD invertebrate status for the Elstow Brook (US Shortstown) WFD water body (**Appendix 6.2: Aquatic Habitat Scoping Assessment Report (Volume 3)**).

### 4.2 CORE ZONE WATERCOURSE

- 4.2.1 No amplifiable DNA was detected in the e-DNA sample taken from the Core Zone watercourse. However, during the spring aquatic macroinvertebrate surveys, it was noted that European bullhead and nine-spined stickleback were present in the watercourse.
- 4.2.2 The Core Zone watercourse is ephemeral in nature, and therefore seasonally wet. As a result, it is unlikely that the watercourse supports a self-sustaining fish population. However, there remains the possibility that the watercourse supports fish during wet periods, acting as a corridor enabling the movement of fish species between hydrologically connected water bodies.
- 4.2.3 The Core Zone watercourse supports an aquatic macroinvertebrate assemblage of limited diversity, with no Notable species under CCI scoring identified. However, the observed CCI score for the aquatic macroinvertebrate communities in both spring and autumn 2024, classified the watercourse as being of Fairly High conservation value. This can be attributed to the presence of three species of Local importance (Conservation Score of 5). One INNS, the amphipod (*Crangonyx pseudogracilis/floridanus agg*), was recorded in both the autumn and spring samples from the Core Zone watercourse.
- 4.2.4 The aquatic macroinvertebrate community within the Core Zone watercourse does appear to be subject to flow and sedimentation pressures. The indicative WFD status of the Core Zone watercourse calculated in the RICT analysis, was Poor. Despite the indicative classification of Poor WFD status, the presence of species of Local importance in both spring and autumn highlight the ecological importance of the Core Zone watercourse and its provision of habitat to aquatic macroinvertebrate species.



## 4.3 LAKES

- 4.3.1 The results from the e-DNA surveys show that all four lakes support coarse fish communities, characteristic of habitat observed. The DNA of one species of conservation interest, European eel, was detected within the Lake 1 sample. There is a hydrological connection between Lake 1 and Elstow Brook, so it is possible that European eel actively move between the lake and Elstow Brook.
- 4.3.2 There is also a hydrological connection between Lake 3a and Lake 3b, likely explaining the similar fish community composition in both lakes. There is the potential for fish to freely move between both lakes.
- 4.3.3 Lakes 2, 3a and 3b currently support a community of omnivorous and piscivorous fish species. The lack of benthivorous (bottom feeding) fish species from the fish community benefits the lakes within the Lake Zone, as sediment resuspension is reduced thus enabling light to penetrate to depth and promoting submerged macrophyte growth.
- 4.3.4 Lake 3a supported the highest number of PSYM scoring aquatic macroinvertebrate taxa, with Lake 2 supporting the greatest number of macrophyte species. Two invasive non-native macrophyte species were recorded, with Canadian waterweed (*Elodea canadensis*) recorded in Lake 1, and New Zealand pygmyweed (*Crassula helmsii*) recorded in Lakes 2, 3a, and 3b.
- 4.3.5 Lake 3a identified as HPI, achieving a PSYM Quality Category of Good. The remaining three lakes achieved a PSYM Quality Category of Moderate.

# Annex 1

## FIGURES







- Key
- Site boundary
  - e-DNA Survey Locations
  - Aquatic Macroinvertebrate Survey Locations
  - PSYM Survey Locations
  - Watercourses
  - Lakes

0 250 500 m



Client:  
Universal Destinations & Experiences

Project:  
Universal Destinations & Experiences  
UK Project

Title:  
Figure 1 - Aquatic Ecology Survey  
Area

Drawing No:	70116516-Appendix 6-17-Figure 1	Drawn:	LB
Date:	16/05/2025	Checked:	LM
Scale:	1:15,308	Approved:	VD



# Annex 2

## **SITE PHOTOGRAPHS**





**Figure C-1 – Elstow Brook spring 2024 – view downstream**



**Figure C-2 – Elstow Brook spring 2024 – view upstream**



**Figure C-3 – Elstow Brook autumn 2024 – view downstream**



**Figure C-4 – Elstow Brook autumn 2024 – view upstream**





**Figure C-5 – Core Zone Watercourse spring 2024**



**Figure C-6 – Core Zone Watercourse autumn 2024**



**Figure C-7 – Lake 1 summer 2024**



**Figure C-8 – Lake 2 summer 2024**





**Figure C-9 – Lake 3a summer 2024**



**Figure C-10 – Lake 3b summer 2024**

# Annex 3

## **AQUATIC MACROINVERTEBRATE TAXA LIST**





**Table C1 - Aquatic macroinvertebrate taxa list from surveys conducted on Elstow Brook and the Core Zone watercourse in spring and autumn 2024**

Family	Species	Conservation Score	Elstow Brook		Core Zone Watercourse	
			Spring	Autumn	Spring	Autumn
Planariidae	<i>Polycelis nigra</i>	1				1
Sphaeriidae	<i>Pisidium</i> sp.	-	1			4
Lymnaeidae	<i>Ampullaceana balthica</i>	1	3			
Planorbidae	<i>Anisus leucostoma</i>	5		208		6
Physidae	<i>Aplexa hypnorum</i>	5		89		8
Erpobdellidae	<i>Erpobdella octoculata</i>	1				2
Isopoda	<i>Asellus aquaticus</i>	1	1	22	2	47
Crangonyctidae	<i>Crangonyx pseudogracilis/floridanus</i> agg.	1		33		17
Gammaridae	<i>Gammarus pulex/fossarum</i> agg.	1	2		4	
Caenidae	<i>Caenis horaria</i>	1	1			
Baetidae	<i>Baetis</i> sp.	-		1		
Baetidae	<i>Baetis rhodani</i>	1			1	
Calopterigidae	<i>Calopteryx splendens</i>	2	1			
Libellulidae	<i>Sympetrum sanguineum</i>	5		30		
Gerridae	<i>Gerris lacustris</i>	1		1		
Gyrinidae	<i>Orectochilus villosus</i>	3			2	
Elmidae	<i>Limnius volckmari</i>	2	1			

Family	Species	Conservation Score	Elstow Brook		Core Zone Watercourse	
			Spring	Autumn	Spring	Autumn
Elmidae	<i>Elmis aenea</i>	1	42			
Halipidae	<i>Halipus lineatocollis</i>	1	4			
Hydrophilidae	<i>Anacaena bipustulata</i>	7			1	
Hydrophilidae	<i>Helophorus nubilus</i>	4		5		
Sialidae	<i>Sialis lutaria</i>	1		1		
Limnephilidae	<i>Glyptotaelius pellucidus</i>	3				1
Limnephilidae	<i>Limnephilus flavicornis</i>	2				1
Limnephilidae	<i>Limnephilus lunatus</i>	1	4	4	1	9
Hydroptilidae	<i>Hydroptila</i> sp.	-	3			
Simuliidae	<i>Simulium</i> sp.	-			1	
Tipulidae/Limoniidae/Cylindrotomidae	<i>Erioptera</i> sp.	-				1
Chironomidae	Chironomini	-	1	55		
Chironomidae	Chironomidae	-	1	1	1	
Chironomidae	Tanypodinae	-		29		
Chironomidae	Tanytarsini	-		35		
Chaoboridae	Chaoboridae	-				1
Collembola	Collembola	-		1		

# Annex 4

## **PSYM SURVEYS AQUATIC MACROINVERTEBRATE AND MACROPHYTE TAXA LISTS**



**Table D1 – Lake 1 aquatic macroinvertebrate results**

Common Name	Family	Odonata and Megaloptera Taxa	Coleoptera Taxa
Tube-maker caddisflies	Polycentropodidae	-	-
Amphipods	Gammaridae (inc. Crangonyctidae)	-	-
Narrow-winged damselflies	Coenagriidae	X	-
Freshwater planarians	Planariidae (inc. Dugesiiidae)	-	-
Water striders	Gerridae	-	-
Creeping bugs	Naucoridae	-	-
Backswimmers	Notonectidae	-	-
Water boatmen	Corixidae	-	-
Crawling water beetles	Halplidae	-	X
Diving beetles	Dytiscidae (inc. Noteridae)	-	X
Whirligig beetles	Gyrinidae	-	X
Small minnow mayflies	Baetidae	-	-
Alderfly	Sialidae	X	-
Valve snails	Valvatidae	-	-
Mud snails	Hydrobiidae (Bithyniidae)	-	-
Pond snails	Lymnaeidae	-	-
Ramshorn snails	Planorbidae	-	-
Freshwater jawless leeches	Glossiphoniidae	-	-
Waterlice	Asellidae	-	-
Non-biting midges	Chironomidae	-	-

**Table D2 – Lake 1 macrophyte results**

Common Name	Latin Name	Rarity Score	Trophic Ranking Score
<b>Emergent Plants</b>			
Water plantain	<i>Alisma plantago-aquatica</i>	1	9.0
Bushgrass	<i>Calamagrostis epigejos</i>	2	-
False fox-sedge	<i>Carex otrubae</i>	1	-
Hairy willowherb	<i>Epilobium hirsutum</i>	1	
Yellow flag iris	<i>Iris pseudacorus</i>	1	
Water mint	<i>Mentha aquatica</i>	1	7.3
Common reed	<i>Phragmites australis</i>	1	7.3
Common club-rush	<i>Schoenoplectus lacustris</i>	2	7.7
Bittersweet	<i>Solanum dulcamara</i>	1	10.0
Branched bur-reed	<i>Sparganium erectum</i>	1	8.5
Reedmace	<i>Typha latifolia</i>	1	8.5
<b>Floating Leaved Plants</b>			
Amphibious bistort	<i>Persicaria amphibia</i>	1	9.0
<b>Submerged Plants</b>			
Canadian waterweed	<i>Elodea canadensis</i>	1	7.3

**Table D3 – Lake 2 aquatic macroinvertebrate results**

Common Name	Family	Odonata and Megaloptera Taxa	Coleoptera Taxa
Darners	Aeshnidae	X	-
Emerald dragonflies	Corduliidae	X	-
Northern caddisflies	Limnephilidae	-	-
Amphipods	Gammaridae (inc. Crangonyctidae)	-	-
Narrow-winged damselflies	Coenagriidae	X	-

Common Name	Family	Odonata and Megaloptera Taxa	Coleoptera Taxa
Creeping bugs	Naucoridae	-	-
Backswimmers	Notonectidae	-	-
Water boatmen	Corixidae	-	-
Small minnow mayflies	Baetidae	-	-
Alderfly	Sialidae	X	-
Mud snails	Hydrobiidae (Bithyniidae)	-	-
Pond snails	Lymnaeidae	-	-
Bladder snails	Physidae	-	-
Waterlice	Asellidae	-	-
Non-biting midges	Chironomidae	-	-

**Table D4 – Lake 2 macrophyte results**

Common Name	Latin Name	Rarity Score	Trophic Ranking Score
<b>Emergent Plants</b>			
Bushgrass	<i>Calamagrostis epigejos</i>	2	-
New Zealand pygmyweed	<i>Crassula helmsii</i>	1	-
Hairy willowherb	<i>Epilobium hirsutum</i>	1	
Common reed	<i>Phragmites australis</i>	1	7.3
<b>Submerged Plants</b>			
Stonewort species	<i>Chara</i> sp.	2	7.3
Spiked water milfoil	<i>Myriophyllum spicatum</i>	2	9.0
Fennel pondweed	<i>Potamogeton pectinatus</i>	1	10.0

**Table D5 – Lake 3a aquatic macroinvertebrate results**

Common Name	Family	Odonata and Megaloptera Taxa	Coleoptera Taxa
Giant caddisflies	Phryganeidae	-	-
Spiketails	Cordulegastridae	X	-
Darners	Aeshnidae	X	-
Small square-gilled mayflies	Caenidae	-	-
Northern caddisflies	Limnephilidae	-	-
Amphipods	Gammaridae (inc. Crangonyctidae)	-	-
Narrow-winged damselflies	Coenagriidae	X	-
Creeping bugs	Naucoridae	-	-
Backswimmers	Notonectidae	-	-
Pygmy backswimmers	Pleidae	-	-
Water boatmen	Corixidae	-	-
Crawling water beetles	Halplidae	-	X
Diving beetles	Dytiscidae (inc. Noteridae)	-	X
Water scavenger beetles	Hydrophilidae (inc. Hydraenidae)	-	X
Small minnow mayflies	Baetidae	-	-
Alderfly	Sialidae	X	-
Mud snails	Hydrobiidae (Bithyniidae)	-	-
Pond snails	Lymnaeidae	-	-
Bladder snails	Physidae	-	-
Waterlice	Asellidae	-	-
Non-biting midges	Chironomidae	-	-

**Table D6 – Lake 3a macrophyte results**

Common Name	Latin Name	Rarity Score	Trophic Ranking Score
<b>Emergent Plants</b>			
False fox-sedge	<i>Carex obtruae</i>	1	-
New Zealand pygmyweed	<i>Crassula helmsii</i>	1	-
Hairy willowherb	<i>Epilobium hirsutum</i>	1	
Hard rush	<i>Juncus inflexus</i>	1	-
Gypsywort	<i>Lycopus europaeus</i>	1	-
Water mint	<i>Mentha aquatica</i>	1	7.3
Common reed	<i>Phragmites australis</i>	1	7.3
<b>Submerged Plants</b>			
Stonewort species	<i>Chara</i> sp.	2	7.3
Spiked water milfoil	<i>Myriophyllum spicatum</i>	2	9.0
Fennel pondweed	<i>Potamogeton pectinatus</i>	1	10.0
Thread-leaved water-crowfoot	<i>Ranunculus trichophyllus</i>	2	8.5

**Table D7 – Lake 3b aquatic macroinvertebrate results**

Common Name	Family	Odonata and Megaloptera Taxa	Coleoptera Taxa
Northern caddisflies	Limnephilidae	-	-
Amphipods	Gammaridae (inc. Crangonyctidae)	-	-
Narrow-winged damselflies	Coenagriidae	X	-
Creeping bugs	Naucoridae	-	-
Crawling water beetles	Haliplidae	-	X
Whirligig beetles	Gyrinidae	-	X
Small minnow mayflies	Baetidae	-	-



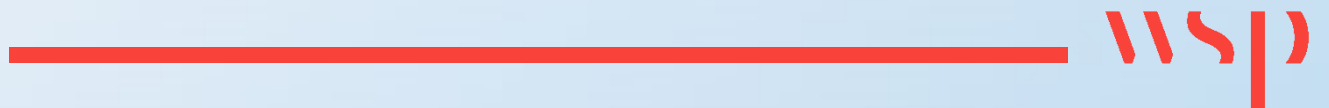
Common Name	Family	Odonata and Megaloptera Taxa	Coleoptera Taxa
Mud snails	Hydrobiidae (Bithyniidae)	-	-
Pond snails	Lymnaeidae	-	-
Waterlice	Asellidae	-	-
Non-biting midges	Chironomidae	-	-

**Table D8 – Lake 3b macrophyte results**

Common Name	Latin Name	Rarity Score	Trophic Ranking Score
<b>Emergent Plants</b>			
New Zealand pygmyweed	<i>Crassula helmsii</i>	1	-
Water mint	<i>Mentha aquatica</i>	1	7.3
Common reed	<i>Phragmites australis</i>	1	7.3
Reedmace	<i>Typha latifolia</i>	1	8.5
<b>Submerged Plants</b>			
Stonewort species	<i>Chara</i> sp.	2	7.3
Spiked water milfoil	<i>Myriophyllum spicatum</i>	2	9.0
Fennel pondweed	<i>Potamogeton pectinatus</i>	1	10.0

# Annex 5

## **RELEVANT LEGISLATION AND POLICY**



This report has been compiled with reference to relevant wildlife legislation and planning policy. Full details of all relevant legislation and policy are provided in **Appendix 3.1: Legislation, Policy and Guidance for all ES Technical Topics (Volume 3)**.

## ***Natural Environment and Rural Communities (NERC) Act 2006***

Species and Habitats of Principal Importance in England and Wales are listed under *Section 41* and *Section 42* respectively of the *NERC Act*<sup>19</sup>. The *Section 41* and *42* lists detail species that are of principal importance for the conservation of biodiversity in England and Wales and should be used to guide decision-makers such as local and regional authorities when implementing their duty to have regard for the conservation of biodiversity in the exercise of their normal functions – as required under *Section 40* of the *NERC Act 2006*.

## ***The Eels (England and Wales) Regulations 2009***

*The Eels (England and Wales) Regulations 2009*<sup>22</sup> implement *Council Regulation (EC) No 1100/2007* of the Council of the European Union, which required Member States to establish measures for the recovery of the stock of European eel. The regulations apply to England and Wales.

They give powers to the regulators (the Environment Agency or Natural Resources Wales) to implement recovery measures in all freshwater and estuarine waters in England and Wales. The aim of the regulations is to achieve 40% escapement of adult eels relative to escapement levels under pristine conditions. The measures, as set out in the legislation, by which this is to be achieved is to reduce fishing pressures, improve access and habitat quality and reduce the impact of impingement and entrainment.

Under *The Eels (England and Wales) Regulations 2009*<sup>22</sup>, the regulators can serve notice to companies detailing their legal obligation to screen intakes and outfalls for eel and/or to remove or modify obstructions to eel migration. However, it is possible for companies to be granted with exemptions if the costs of works greatly exceeds the benefits. In such a situation it is likely the regulator will seek a package of more cost-effective, “*alternative measures*”.

## ***The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017***

The purpose of the *WFD*<sup>17</sup> is to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater and for water all waterbodies (unless artificial or heavily modified) to achieve “*good*” ecological status.

Ecological Status is expressed in terms of five classes (high, good, moderate, poor, or bad). These classes are established on the basis of specific criteria and boundaries defined against biological, physico-chemical and hydromorphological elements. Biological assessment uses numeric measures of communities of plants and animals (for example, fish and rooted plants). Physico-chemical assessment looks at elements such as temperature and the level of nutrients, which support the biology. Hydromorphological quality looks at water flow, sediment composition and movement, continuity (in rivers) and the structure of physical habitat.

The overall Ecological Status of a water body is determined by whichever of these assessments is the poorer. For example, a water body might pass ‘Good Status’ for chemical and physico-chemical assessments but be classed as ‘Moderate Status’ for the biological assessment: In this case it would

be classed overall as 'Moderate Ecological Status'. To achieve the overall aim of good surface water status, the Directive requires that surface waters be of at least Good Ecological Status and Good Chemical Status. To achieve High Status, the Directive requires that the hydromorphological Quality Elements are also in place.

When considering the effect of a development or activity on a waterbody it is a regulatory requirement under the *WFD*<sup>17</sup> to assess if it will cause or contribute to a deterioration in status or jeopardise the waterbody achieving good status in the future.



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