FENWICK SOLAR FARM

Fenwick Solar Farm

EN010152

Environmental Statement

Volume III Appendix 8-6: Aquatic Ecology Report

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Prepared for:
Fenwick Solar Project Limited

Prepared by:
AECOM Limited

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Executive Summary

ES1 An aquatic ecological baseline assessment was completed for the proposed Fenwick Solar Farm (hereafter referred to as the 'Scheme'). A desk study was completed in addition to an aquatic walkover and aquatic macroinvertebrate, aquatic macrophyte, and fish surveys to inform the aquatic baseline assessment.

ES2 Thirteen representative sites were selected for survey that may be impacted through the development of the Scheme, based on the construction design including anticipated extent and cable route crossings (**Environmental Statement (ES) Volume I Chapter 2: Scheme Description [EN010152/APP/6.1]**). Two locations were dry at the time of survey, and one had no land access permission, however, the data gathered is considered sufficient to inform the baseline assessment.

ES3 Several notable fish species were identified during the desk study within 2 km of the Order limits, including bullhead (*Cottus gobio*) recorded in the River Went, 2 km upstream of the Order limits but hydrologically connected to drains within the Scheme. European eel (*Anguilla anguilla*) was recorded in the River Don, 2 km downstream of its confluence with Thorpe Marsh Drain. No protected or notable fish species were recorded in the field surveys. The Species Audit of the City of Doncaster Council, produced for the Doncaster Local Biodiversity Action Plan (LBAP) (Ref 19) in 2007 also listed twenty-two records of European eel, six records of Atlantic salmon (*Salmo salar*), and four records of brown trout (*Salmo trutta)* at various unconfirmed locations. Whilst these records do not have specific location information, it does provide evidence that these species were once present in the catchment, albeit potentially historically. Although not found in any field surveys, river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) are also qualifying species for the Humber Estuary Special Area of Conservation (SAC) and Humber Estuary Ramsar Site and have the potential to be present in connected waterbodies.

ES4 The desk study showed no recent records of notable or protected aquatic macroinvertebrates, including white-clawed crayfish, within 2 km of the Order Limits. However, the species audit as part of the Doncaster BAP mentions two aquatic beetles for potential inclusion of the assessment *Hydroporus rufifrons* and *Laccophilus obsoletus*. The species audit also listed two species of mollucs which had historic records (most recent was 1986). These were the mud snail *Lymnaea glabra* (now known as *Omphiscola glabra*), and the shining rams-horn snail *Segmentina nitida*. Field surveys recorded the locally notable snail *Aplexa hypnorum* (conservation score five) and the beetle *Ilybius quadriguttatus* (conservation score five). There are no statutory designations or protections associated with these species.

ES5 The desk study highlighted records of the protected aquatic macrophyte *Callitriche obtusangula* in 2016 (on the River Don, 1 km west of the Order Limits) and 2023 (on Mill Dike, 1.5 km upstream of the Order Limits, although Mill Dike is also within the Grid Connection Corridor). However, this species is now listed as of 'Least Concern' on the Joint Nature Conservation Committee (JNCC) (Ref. 37) conservation designations for UK taxa 2023 which means it is neither threatened or near threatened. A cross-reference

with the JNCC Taxon Designations list confirmed that none of the macrophyte taxa identified during the 2024 field surveys were protected or notable.

ES6 In terms of invasive species, no invasive species of fish were recorded in the desk or field studies. The desk study highlighted that the non-native Nuttall's waterweed (*E. nuttallii*) was recorded in 2016 in the River Don, 1 km west of the Order Limits and in the River Went, 100 m east of the order limits after it's confluence with Fleet Drain (which is within the order limits) which it is no longer listed in Schedule 9 (Ref. 6) but is listed in the Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref. 10). Field surveys recorded Canadian waterweed (*E. canadensis*) on Wrancarr Drain (within the Grid Connection Corridor), a Schedule 9 invasive non-native species (Ref. 6). Non-native but considered naturalised species of macroinvertebrates were recorded in the desk and field surveys on sites within the Order Limits and adjacent waterbodies (*Potamopyrgus antipodarum*, *Crangonyx* species and *Corophium curvispinum*).

ES7 Due to the nature of water bodies within the Order limits, there are opportunities to enhance water bodies and riparian/marginal habitats, and water quality (e.g. to support Biodiversity Net Gain (BNG) objectives). Reducing shading would increase light levels into the water bodies and subsequently improve macrophyte growth, supported by a reduction in nutrient enrichment from agricultural land use. Water quality could be improved through planting selected native macrophyte species, while also developing habitat complexity within the water bodies for aquatic species.

ES8 Good industry practice biosecurity measures should be implemented for works undertaken to or near water bodies, especially those where invasive non-native species are currently present, to prevent the risk of their spread in line with national and European legislation. Mitigation measures are discussed in further detail within **Environmental Statement (ES) Volume I Chapter 8: Ecology [EN010152/APP/6.1]**.

1. Introduction

1.1 Background

1.1.1 This report forms a technical appendix to the **Environmental Statement (ES) Volume I Chapter 8: Ecology [EN010152/APP/6.1]**.

1.1.2 Several aquatic ecological investigations were completed by AECOM (on behalf of Fenwick Solar Project Limited ('the Applicant')) for the proposed Fenwick Solar Farm (hereafter referred to as the 'Scheme') to evaluate the ecological quality of water bodies within the 'Order Limits' to establish potential impacts of the Scheme. This included assessment of Water Framework Directive (WFD) status for each surveyed reach in relation to biological water quality, and biological water quality impact assessment.

1.1.3 Further information on the Scheme and Order limits is provided in **ES Volume II Figure 2-3: Indicative Site Layout [EN010152/APP/6.2]** and **ES Volume I Chapter 2: The Scheme [EN010152/APP/6.1]**.

1.2 The Scheme

1.2.1 The proposed Scheme includes three locations (collectively referred to as the 'Order limits'):

a. The land located east of Fenwick and immediately south of the River Went (hereafter referred to as the 'Solar PV Site');

b. The land between the Solar PV Site and the existing compound for Thorpe Marsh Substation (hereafter referred to as the 'Grid Connection Corridor'); and

c. The land located within the existing compound for Thorpe Marsh Substation (hereafter referred to as the 'Existing National Grid Thorpe Marsh Substation').

1.2.2 The Scheme comprises the installation of Solar PV Panels, Field Stations, BESS Area, On-Site Substation with Grid Connection Cables connecting to the Existing National Grid Thorpe Marsh Substation or a Grid Connection Line Drop, and associated infrastructure including fencing, access tracks, drainage, and biodiversity and landscaping enhancements.

1.2.3 The Order limits is the collective term for the Solar PV Site, Grid Connection Corridor, and Existing National Grid Thorpe Marsh Substation (as defined in **ES Volume I Chapter 2: The Scheme [EN010152/APP/6.1]**). Where ecological features are identified relevant to an individual element of the Scheme (such as the Solar PV Site or Grid Connection Corridor), this is referred to throughout.

1.2.4 The Order limits also includes a section of highway at the junction of the A19 and Station Road in the town of Askern to allow for abnormal indivisible load (AIL) vehicle access and escort. As the works would be limited to temporary traffic signal and banksman control for the period of AIL delivery, no impacts on aquatic ecology is anticipated, and therefore this area is not assessed further.

1.2.5 The Study Area was defined to include ecological features likely to be at risk from direct and indirect impacts that might arise from the Scheme and is

defined in more detail in Section 2 and in **ES Volume I Chapter 8: Ecology [EN010152/APP/6.1].**

1.3 Scope of this Report

1.3.1 The purpose of this appendix is to present the approach and findings of the aquatic ecology desk study and aquatic macroinvertebrate, aquatic macrophyte species and fish surveys of freshwater habitats undertaken in spring and summer 2024 to inform the Environmental Impact Assessment (EIA) for the Scheme.

1.3.2 Aquatic macroinvertebrates are defined by the British Standards Institution (2012) (Ref. 1) as those invertebrate species that are easily visible without magnification i.e. species and life stages greater than 0.5 mm in size.

1.3.3 Macrophytes are defined by the British Standards Institution (2014) (Ref. 2) as larger plants of fresh water which are easily seen with the naked eye, or which usually form colonies, including all aquatic vascular plants, bryophytes, stoneworts (Characeae) and macro-algal growths.

1.3.4 Several aquatic ecological investigations were completed by AECOM (on behalf of the Applicant) for the proposed Scheme to evaluate the ecological quality of water bodies within the 'Site' to establish potential impacts of the Scheme. This included assessment of WFD status for each surveyed reach in relation to biological water quality, and biological water quality impact assessment.

1.3.5 An aquatic walkover survey of water bodies (e.g. watercourses, ditches) within the Order limits was completed to appraise the various habitats, hydromorphological characteristics, and the overall composition of water bodies to inform scoping of further detailed surveys.

1.3.6 Aquatic macroinvertebrate samples were collected to identify the conservation value of aquatic macroinvertebrate communities and record the presence of any protected and notable species, and invasive non-native species (INNS). This supported an assessment of overall water and habitat quality.

1.3.7 Macrophyte surveys were undertaken to characterise water and habitat quality and to record the presence of any protected or notable species, or INNS.

1.3.8 Fish surveys were completed to record the presence of any protected or notable species.

1.3.9 Aquatic macroinvertebrates, macrophytes and fish are biological parameters that are used in assessment as part of the WFD.

1.3.10 Survey locations are illustrated in Figure 1 within Annex A.

1.3.11 Surveys undertaken comprised:

a. Aquatic walkover surveys and habitat appraisals;

b. Benthic macroinvertebrates;

c. Macrophytes; and

d. Fish.

1.4 Legislation, Policy and Guidance

1.4.1 This assessment has been undertaken within the context of the following relevant legislation, planning policy and guidance documents:

a. Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats and Species Directive) (Ref. 3);

b. The Ramsar Convention 1971 (Ref. 4);

c. The Conservation of Habitats Regulations 2017 (as amended) (Habitat Regulations) (Ref. 5);

d. The Wildlife and Countryside Act 1981 (as amended) (WCA) (Ref. 6);

e. The Countryside and Rights of Way Act 2000 (CRoW Act) (Ref. 7);

f. The Environment Act 2021 (Ref. 8);

g. The Natural Environment and Rural Communities Act 2006 (NERC Act) (Ref. 9);

h. The Invasive Alien Species (Enforcement and Permitting) Order 2019 (as amended) (Ref. 10);

i. The Salmon and Freshwater Fisheries Act 1975 (Ref. 11);

j. The Eels (England and Wales) Regulations 2009 (Ref. 12);

k. UK Post-2010 Biodiversity Framework (Ref. 13);

l. Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the ‘Water Framework Directive’ or WFD) (Ref. 14); and

m. Nitrate Vulnerable Zones/Nitrates Directive (The Nitrates Directive 1991) (Ref. 15).

2. Methodology

2.1 Study Area

2.1.1 The Study Area is defined as the Order limits of the Scheme plus an appropriate search area (defined below) for different aquatic ecological receptors. Where water bodies extend beyond the Order limits but notable species records exist, such records may be included where there is connectivity to the Order limits, for example for migratory species.

2.2 Desk Study

2.2.1 A desk-based review of WFD information and aquatic ecology receptors was undertaken for all potentially impacted watercourses and ditches, where information was available. This included a review of:

a. Records on international statutory designated sites up to 30 km from the Scheme where potential hydrological links may exist, national statutory sites within 2 km, ancient woodlands and notable habitats within 2 km, and ponds and standing water within 0.5 km were obtained from the Doncaster Local Records Centre (Ref. 17);

b. Current WFD status of waterbodies within or connected to the Scheme using the Environment Agency's Catchment Data Explorer website (Ref. 18);

c. Ecological survey data from the last ten years using the Environment Agency's Ecology and Fish Data Explorer within 5 km of the Scheme (Ref. 19);

d. Historical commercially available crayfish records within 5 km of the Scheme from the National Biodiversity Network Atlas (NBN) (Ref. 20);

e. Records of non-statutory designated sites (Local Wildlife Sites (LWS) and candidate Local Wildlife Sites (cLWS)) within 2 km of the Scheme (Ref. 21);

f. Records of legally protected and notable species (fauna and flora) within 2 km of the Scheme, including Species of Principal Importance (SPI) for the Conservation of Biodiversity listed under S41 of the NERC Act (Ref. 8) in the England Biodiversity List (Ref. 21) obtained from Doncaster Local Records Centre.

2.2.2 Watercourses and ditches that may be impacted through the development of the Scheme were identified, based on the latest construction design with anticipated extent and cable route crossings.

2.2.3 Detailed lists of all waterbodies in the area and their relationship to the Scheme are presented in Table 9.6 and Table 9.7 in **ES Volume I Chapter 9: Water Environment [EN010152/APP/6.1]**.

2.3 Field Surveys

2.3.1 Field surveys were undertaken on selected water bodies within the Scheme. Further site details are provided in Table 1:. Sites were selected if they were within the Scheme and had the potential for open-cut crossings.

Aquatic Habitat Walkover Surveys

2.3.2 Aquatic habitat walkover surveys were undertaken alongside macroinvertebrate and macrophyte surveys between 11 June and 12 June 2024 (locations illustrated in Figure 1 within Annex A) by two suitably qualified and experienced aquatic ecologists.

2.3.3 The walkover survey encompassed walking in 12 predetermined locations (selected based on being within the Scheme and having the potential for open-cut crossings) to identify their suitability for subsequent detailed surveys. These locations were determined by completing a review of the project proposals and identifying any waterbodies that have the potential to be impacted by the Scheme.

Table 1: Aquatic Habitat Walkover and Macroinvertebrate Survey Locations

Location Within the Scheme	Site ID	National Grid Reference	Survey Date*	Survey Notes
Solar PV Site	Fleet Drain-AAA887	SE 61705 16972	11/06/2024	Light/moderately shaded ditch. Moderate (brown) turbidity, with no perceptible flow (<10 cm/sec (centimetres per second)). 2 m (metre) average width. 60 cm (centimetre) average depth. 100% ditch habitat. 100% silt/clay substrate.
Solar PV Site	Minor Ditch 2 Fenwick Parish Drain (east) AAA 890	SE 61192 16459	11/06/2024	Moderately shaded ditch. Slight (brown) turbidity, with no perceptible flow (<10 cm/sec). 0.5 m average width. 5 cm average depth. 100% ditch/run habitat. 100% silt/clay substrate.
Solar PV Site	Minor Ditch 4-Fenwick Parish Drain (west) AAA890	SE 60013 16398	11/06/2024	Moderately/heavily shaded ditch. Slight (brown) turbidity, with no perceptible flow (<10 cm/sec). 0.8 m average width.

Location Within the Scheme	Site ID	National Grid Reference	Survey Date*	Survey Notes
				15 cm average depth. 100% ditch/run habitat. 100% silt/clay substrate.
Solar PV Site	Minor Ditch 8	SE 60335 17447	11/06/2024	Dry at time of survey.
Solar PV Site	Minor Ditch 9	SE 60087 17404	11/06/2024	Unshaded ditch. Slightly turbid, with no perceptible flow (<10 cm/sec). 2.5 m average width. 70 cm average depth. 100% ditch habitat. 100% silt/clay substrate.
Solar PV Site	Minor Ditch 10	SE 59669 17282	11/06/2024	Dry at time of survey.
Solar PV Site	Fenwick Common Drain (west) AAA887	SE 60236 15747	12/06/2024	Moderately/heavily shaded ditch. Clear water, with no perceptible flow (<10 cm/sec). 0.65 m average width. 5 cm average depth. 100% ditch habitat. 100% silt/clay substrate.
Solar PV Site	Minor Ditch 12 Fenwick Common Drain (east) AAA887	SE 60894 15723	11/06/2024	Heavily shaded ditch. Slight (brown) turbidity, with no perceptible flow (<10 cm/sec). 0.75 m average width. 12 cm average depth. 100% ditch habitat. 100% silt/clay substrate.
Grid Connection Corridor	Ellwood and Fenwick Grange drain AAA945	SE 60119 14930	12/06/2024	Heavily shaded ditch. Clear water, with no perceptible flow (<10 cm/sec).

Location Within the Scheme	Site ID	National Grid Reference	Survey Date*	Survey Notes
				0.65 m average width. 10 cm average depth. 100% ditch habitat. 100% silt/clay substrate.
Grid Connection Corridor	Hawkhouse Green Dike AAA948	SE 59939 13362	12/06/2024	Light to heavily shaded ditch. Clear water, with no perceptible flow (<10 cm/sec). 1.5 m average width. 12 cm average depth. 100% ditch habitat. 100% silt/clay substrate.
Grid Connection Corridor	Mill Dike AAA956	SE 60165 12561	12/06/2024	Moderately/heavily shaded ditch. Clear water, with <10 cm/sec average flow. 0.75 m average width. 35 cm average depth. 100% ditch habitat. 100% silt/clay substrate.
Grid Connection Corridor	Wrancarr Drain AAA955	SE 60067 12348	12/06/2024	Lightly/moderately shaded ditch. Clear water, with 1-25 cm/sec). 1.75 m average width. 45 cm average depth. 100% ditch/run habitat. 20% boulders/cobbles, 20% pebbles/gravel, 10% sand and 50% silt/clay substrate.
Grid Connection Corridor	Minor Ditch 13	SE 60193 11113	n/a	No Access

**Due to delays, macroinvertebrate surveys were completed outside the optimal survey window for spring (March-May); however, this is not considered a constraint to the findings.*

Aquatic Macroinvertebrate Surveys

2.3.4 Spring aquatic macroinvertebrate surveys were undertaken between the 11 and 12 June 2024, in conjunction with habitat appraisals (locations illustrated in Figure 1 within Annex A). Autumn macroinvertebrate samples were collected between the 04-16 September 2024 within the optimal survey season. Macroinvertebrate surveys were undertaken (refer to Table 1:) following habitat appraisals when surveyors deemed a water body suitable for sampling in the context of its location and potential impacts. No surveys were undertaken during or immediately following periods of high flow in accordance with good practice guidance.

Aquatic Macroinvertebrate Survey Methodology

2.3.5 The macroinvertebrate survey method followed the aquatic macroinvertebrate sampling procedures standardised by the Environment Agency (Ref. 22) which conforms to British Standard (BS) EN ISO 10870:2012 Water Quality – Guidelines (Ref. 23) for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters. 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 Freshwater Biological Association (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.

2.3.6 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. 24). 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 (Diptera), 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.

2.3.7 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.

Community Conservation Index

2.3.8 A Community Conservation Index (CCI) (Ref. 25) was calculated for each reach (as detailed in Table B1 and Table B2 in Annex B). 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. 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 CCI author has provided AECOM with updated species scores to take account of this new information (Ref. 26). These updated scores have been used within this assessment.

Lotic-Invertebrate Index for Flow Evaluation

2.3.9 Lotic-invertebrate Index for Flow Evaluation (LIFE) scores were calculated (Ref. 27) which is an index that links benthic macroinvertebrate data to flow regimes prevailing in UK waters. Flow scores have been allocated to various macroinvertebrates based on species/family abundance and ecological association with different flows, as detailed in Annex C. The overall LIFE score for a reach is calculated as the sum of the individual scores divided by the number of scoring species/families. LIFE scores increase with current velocity, scores <6.00 generally indicating sluggish or still water conditions and score >7.5 indicate fast flows. LIFE allows the mean flow preference of invertebrates colonising a reach to be determined so that effect of habitat changes, such as sediment accumulation, can be monitored.

Proportion of Sediment-Sensitive Invertebrates

2.3.10 Calculations were undertaken to determine the proportion of sediment sensitive macroinvertebrates present using the Proportion of Sediment-sensitive Invertebrates (PSI) index (Ref. 28). Using this approach, individual taxa of aquatic macroinvertebrate are assigned a Fine Sediment Sensitivity Rating (FSSR), ranging from A to D, as detailed in Annex D. The PSI score for each aquatic macroinvertebrate sample was derived from individual species scores and abundances. The derived PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample and ranges from 0 to 100, where low scores correspond to watercourses with high fine sediment cover. The PSI score therefore provides an indication of the extent to which watercourses are influenced by fine sediments, and thus by inference the potential sensitivity of the associated aquatic macroinvertebrate community to changes in silt load and deposition.

Whalley, Hawkes, Paisley and Trigg

2.3.11 The aquatic macroinvertebrate data were analysed to generate the Whalley, Hawkes, Paisley and Trigg (WHPT) score, Average Score Per Taxon (ASPT) and Number of scoring taxa (NTAXA) values which provide an indication of the ecological quality in the watercourse (Ref. 29). 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 E). 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 reach-specific context, as described in this appendix.

2.3.12 The WHPT 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' (Ref. 29).

River Invertebrate Classification Tool

2.3.13 Analysis using the River Invertebrate Classification Tool version 2 (RICT) web application is only suitable for freshwater (not estuarine or marine) sites on rivers or streams that are naturally permanently flowing. As such, RICT analysis was not undertaken due the nature (i.e. not naturally permanently flowing condition) of field drain ('ditch') habitats comprising the surveyed reaches.

Limitations

2.3.14 Aquatic macroinvertebrate surveys were completed outside the optimal survey window (March-May and September-November). However, given the relatively poor biological quality of surveyed water bodies, this is not considered a constraint to the assessment.

2.4 Aquatic Macrophyte Surveys

2.4.1 Aquatic macrophyte (plant) surveys were undertaken between the 11 and 12 June 2024 at the same survey locations as macroinvertebrate sampling (locations are illustrated in Figure 1 within Annex A and listed in Table 2 below) within the optimal survey season. The recommended survey period for aquatic macrophyte surveys is between 1 June and 30 September and should not be undertaken during or immediately after periods of high flow.

Table 2: Aquatic Macrophyte Survey Locations

Location Within the Scheme	Site ID	National Grid Reference	Survey Date	Survey Notes
Solar PV Site	Fleet Drain-AAA887	SE 61705 16972	11/06/2024- Aquatic macroinvertebrates and macrophytes 04/09/2024- Aquatic macroinvertebrates 01/08/2024 - Fish	Linear stagnant drainage ditch with 25% macrophyte cover.
Solar PV Site	Minor Ditch 2 – Fenwick Parish Drain (east) AAA890	SE 61192 16459	11/06/2024 - Aquatic macroinvertebrates and macrophytes 04/09/2024- Aquatic macroinvertebrates	Small linear agricultural drainage ditch with no macrophyte cover.
Solar PV Site	Minor Ditch 4 – Fenwick Parish Drain (west) AAA890	SE 60013 16398	11/06/2024 - Aquatic macroinvertebrates and macrophytes 04/09/2024- Aquatic macroinvertebrates	Smal linear and deepened drainage ditch along a hedgerow within arable fields

Location Within the Scheme	Site ID	National Grid Reference	Survey Date	Survey Notes
				with 2% macrophyte cover.
Solar PV Site	Minor Ditch 8	SE 60335 17447	11/06/2024- Aquatic macroinvertebrates and macrophytes 04/09/2024- Aquatic macroinvertebrates	Dry at time of survey.
Solar PV Site	Minor Ditch 9	SE 60087 17404	11/06/2024- Aquatic macroinvertebrates and macrophytes 04/09/2024- Aquatic macroinvertebrates	Drainage ditch in pasture fields, dry apart from a 50 m stretch before it joins the River Went, within which there is 40% macrophyte cover.
Solar PV Site	Minor Ditch 10	SE 59669 17282	11/06/2024- Aquatic macroinvertebrates and macrophytes 04/09/2024- Aquatic macroinvertebrates	Dry at time of survey.
Solar PV Site	Fenwick Common Drain (west) AAA887	SE 60236 15747	12/06/2024- Aquatic macroinvertebrates and macrophytes 04/09/2024- Aquatic macroinvertebrates 01/08/2024 - Fish	Linear drainage ditch along a hedgerow in arable fields with 10% macrophyte cover.
Solar PV Site	Minor Ditch 12 – Fenwick Common Drain (east) AAA887	SE 60894 15723	11/06/2024- Aquatic macroinvertebrates and macrophytes 04/09/2024- Aquatic macroinvertebrates	Smal linear drainage ditch along a hedgerow within arable fields with 5% macrophyte cover.
Grid Connection Corridor	Ellwood and Fenwick Grange Drain AAA945	SE 60119 14930	12/06/2024- Aquatic macroinvertebrates and macrophytes 16/09/2024- Aquatic macroinvertebrates	Smal deepened drainage ditch along a hedgerow within arable fields with 10%

Location Within the Scheme	Site ID	National Grid Reference	Survey Date	Survey Notes
				macrophyte cover.
Grid Connection Corridor	Hawkhouse Green Dike AAA948	SE 59939 13362	12/06/2024- Aquatic macroinvertebrates and macrophytes 16/09/2024- Aquatic macroinvertebrates 01/08/2024 - Fish	Linear drainage ditch in arable fields with 10% macrophyte cover.
Grid Connection Corridor	Mill Dike AAA95+	SE 60165 12561	12/06/2024- Aquatic macroinvertebrates and macrophytes 06/09/2024- Aquatic macroinvertebrates	Small drainage ditch in arable fields with 5% macrophyte cover.
Grid Connection Corridor	Wrancarr Drain AAA955	SE 60067 12348	12/06/2024- Aquatic macroinvertebrates and macrophytes 06/09/2024- Aquatic macroinvertebrates	Small slow flowing watercourse along a hedgerow and road with 20% macrophyte cover.
Grid Connection Corridor	Minor Ditch 13	SE 60193 11113	n/a	No Access

2.5 Aquatic Macrophyte Survey Methodology

2.5.1 Each water body was surveyed to record emergent, aquatic, and marginal flora, however, all taxa present were recorded (including non-aquatic terrestrial species) to help provide further context to the water body. The surveys were completed by an appropriately experienced aquatic ecologist supported by an experienced assistant.

LEAFPACS analysis which provides an assessment of ecological status based on macrophytes was not undertaken due the nature (i.e. not naturally permanently flowing condition) of field drain (‘ditch’) habitats comprising the surveyed reaches.

2.5.2 The survey was completed by walking within the channel of the watercourses and ditches, where safely accessible and not obstructed by dense growth of emergent flora. These latter areas were bypassed as necessary before re-entering the channel at the next available access point.

2.5.3 A list of all emergent and aquatic plant species encountered was made for each drain and their relative abundance recorded using the ‘DAFOR’ scale as follows:

D = Dominant (greater than 75% total cover);

A = Abundant (51 to 75% total cover);

F = Frequent (26 to 50% total cover);

O = Occasional (11 to 25% total cover; and

R = Rare (1 to 10% total cover).

2.6 Fish Survey

2.6.1 Suitably qualified and experienced aquatic ecologists from AECOM completed fully quantitative electric fishing surveys of using stop nets and 3-run depletion methods. All electric fishing surveys followed standard Environment Agency guidelines (Ref. 42). Watercourses were surveyed over a representative ~100 m reach. A Smith-Root LR-24 backpack was used to survey the watercourses. One anode was used to stun the fish while other surveyors captured any stunned fish in hand nets. The fish were then identified and measured to fork length, before being released safely and unharmed to their respective watercourses.

3. Results

3.1 Desk Study

WFD Status

Went from Blowell Drain to the River Don Water Body

3.1.1 Went from Blowell Drain to the River Don Water Body (WFD Water Body ID: GB104027064260) (Ref. 30) is a heavily modified section of the River Went flowing from Stubbs Common to the River Don. After joining the Don, it flows northeast and connects to the Ouse and finally the Humber Estuary. The northern edge of the Scheme reaches the River Went and crosses drains within its catchment.

3.1.2 The Went from Blowell Drain to the River Don Water Body was classified as having ‘Moderate’ ecological potential in 2022. This water body does not achieve ‘Good’ potential due to private sewage treatment, flood protection structures, poor nutrient management, continuous sewage discharge, and hazardous chemical substances.

Went from Hoyle Mill Stream to Blowell Drain Water Body

3.1.3 Went from Hoyle Mill Stream to Blowell Drain Water Body (WFD Water Body ID: GB104027063360) (Ref. 31) is a heavily modified section of the River Went flowing from Low Ackworth to Stubbs Common. It flows east before connecting to the River Don, followed by the Ouse and into the Humber Estuary. The northern edge of the Scheme reaches the River Went downstream of this waterbody on the Went from Blowell Drain to the River Don Water Body.

3.1.4 The Went from Hoyle Mill Stream to Blowell Drain Water Body was classified as having ‘Moderate’ ecological potential in 2022. This water body does not achieve ‘Good’ potential due to poor soil management, continuous and intermittent sewage discharge, poor nutrient management, flood protection structures, and hazardous chemical substances.

Bramwith Drain from Source to River Don Water Body

3.1.5 Bramwith Drain from Source to River Don Water Body (WFD Water Body ID: GB104027063290) (Ref. 32) is an artificial watercourse flowing from Askern to the River Don at Kirk Bramwith. It flows southeast before joining the River Don, after which it flows into the Ouse followed by the Humber Estuary. The Scheme crosses the waterbody.

3.1.6 Bramwith Drain from Source to River Don Water Body was classified as ‘Moderate’ ecological potential in 2022. This water body does not achieve ‘Good’ potential due to poor soil management, private sewage treatment, and hazardous chemical substances.

Don from Mill Dyke to River Ouse Water Body

3.1.7 Don from Mill Dyke to River Ouse Water Body (WFD Water Body ID: GB104027064243) (Ref. 33) is an artificial watercourse flowing from Doncaster to Rawcliffe Bridge. It flows northeast before flowing into the River

Ouse followed by the Humber Estuary. The Scheme crosses drains within this water body catchment.

3.1.8 Don from Mill Dyke to River Ouse Water Body was classified as 'Moderate' ecological potential in 2022. This water body does not achieve 'Good' potential due to poor soil management, continuous sewage discharge, transport drainage, flood protection structures, other physical modification, and hazardous chemical substances.

Ea Beck from the Skell to River Don Water Body

3.1.9 Ea Beck from the Skell to River Don Water Body (WFD Water Body ID: GB104027057591) (Ref. 34) is a heavily modified watercourse flowing from Adwick le Street to the River Don near Thorpe in Balne. It flows northeast, passing through the Grid Connection Corridor before joining the River Don after which it flows into the River Ouse followed by the Humber Estuary.

3.1.10 Ea Beck from the Skell to River Don Water Body was classified as Moderate' ecological potential in 2022. This water body does not achieve 'Good' potential due to flood protection management (operational and water level), land drainage, poor nutrition management, continuous and intermittent sewage discharge, poor soil management, other physical management, and hazardous chemical substances.

Statutory and Non-statutory Designated Sites

3.1.11 Statutory and non-statutory designated sites within 10 km of the Order limits were provided by DLRC and from data searches. A total of three sites were designated as international statutory designated sites with aquatic ecology features within 10 km of the Scheme. These are detailed in Table 3.

Table 3: International Statutory Designated Sites Within 10 km of the Order Limits and National Statutory Designated Sites within 2 km of the Order Limits

Name	Reason for Designation (Aquatic Features)	Distance from the Scheme
Shirely Pool Site of Special Scientific Interest (SSSI)	The site contains excellent examples of wetland habitats including open water, reed swamp, tall fen, wet neutral grassland and carr which grades into Birch-oak woodland on drier ground. It is the most natural wetland of this type in South Yorkshire. The pools and drains support a representative aquatic flora and as a result it is also of high entomological value, the assemblages of insects associated with sedges and carrland being particularly diverse. A number of species recorded within the SSSI are close to the northern edge of their range in Britain.	Approximately 900 m south of the Scheme (a small off-site section of road) and 3.0 km west of the Grid Connection Corridor.
Thorne Moor SAC	The Annex I habitat that is a primary reason for selection of this site is degraded raised bogs still capable of natural regeneration.	Approximately 8.0 km east of the Solar PV Site.

Hatfield Moors SAC	Similar to Thorne Moors, Hatfield Moors is a remnant of the once-extensive bog and fen peatlands within the Humberhead Levels and is still the second-largest area of extant lowland raised bog peat in England. Moraines of sand occur beneath the peat, the largest of which forms Lindholme Island, in the centre of the bog. Little, if any, original bog surface has survived the massive extraction of peat over the last few decades. Peat-cutting has now ceased, and the bog is being restored over its remaining minimum average depth of 0.5 m of peat.	Approximately 8.5 km east of the Grid Connection Corridor.

3.1.12 The River Went (present along the northern boundary of the Scheme) is connected to the Humber Estuary SAC/Ramsar approximately 16 km downstream of the Scheme via the River Don and Dutch River. The Humber Estuary SAC/RAMSAR is partly designated for the migratory fish species River lamprey (*Lampetra fluviatilis*) and Sea lamprey (*Petromyzon marinus*), which have the potential to be present in the River Went and connected watercourses.

3.1.13 A total of 29 non-statutory designated sites with aquatic ecology interest were identified within 2 km of the Order limits and are listed in Table 4.

Table 4: Non-Statutory Designated Sites Within 2 km of the Order Limits

Name	Description	Distance from the Scheme
Wrancarr Drain and Braithwaite Delves LWS	The site comprises two drains. The Ash Carr Drain runs along the western side of a disused railway embankment.	A section of this LWS sits within the Grid Connection Corridor.
Trumfleet Pit LWS	A linear wetland site comprising a water filled drain with an east sloping bank with many mature Alders (*Alnus glutinosa*), occasional Crack Willow (*Salix fragilis*) and Pedunculate Oak (*Quercus robur*).	A section of this LWS sits within the Grid Connection Corridor.
Trumfleet Pond LWS	This is a small wetland, comprising a small linear pond.	Within the Grid Connection Corridor.
Fox Covert LWS	The site comprises deciduous scrub woodland and a drain.	Immediately adjacent to the Grid Connection Corridor.
Thorpe in Balne/Kirk Bramwith Area LWS	A large area situated between the River Don and the canal. There are cattle-grazed flood banks alongside the river, which are species poor apart from a small banking.	Approximately 20 m from the Grid Connection Corridor.

Name	Description	Distance from the Scheme
Fenwick Hall Moat LWS	The deepest area of standing open water is located at the northeastern corner of the moat where the pond has been deepened in recent years. The wet mud of the moat supports a dense stand of Reed Sweet-grass (*Glyceria maxima*) with Great Willowherb (*Epilobium hirsutum*), Plicate Sweet-grass (*Glyceria notata*), Marsh Bedstraw (*Galium palustre*) and Hard Rush (*Juncus inflexus*).	Approximately 25 m from the Solar PV Site, within the central area surrounding Fenwick Hall.
Bentley Tilts and Course of Old Ea Beck LWS	A long linear site, approximately 3.5 km in length. Running along the centre of the site is the straightened and embanked course of the Ea Beck. The site contains two ponds, created by the Environment Agency in the mid-1990s, and south of the Ea Beck flood bank is a series of waterbodies, ditches and wet borrow pits.	Approximately 35 m west of the Grid Connection Corridor, next to the Existing National Grid Thorpe Marsh Substation.
Barnby Dun Old Don Oxbow LWS	Site is split into two, with the northern part being used as a fishery and the southern part being used for agriculture and grazing. The site is part of the course of the Old River Don and consists of standing water with a high flood embankment on the southeast side.	The closest point of the LWS approximately 75 m east of the Grid Connection Corridor.
Broad Ings Oxbow LWS	Broad Ings Oxbow is the original line of the River Don. The area between Broad Ings Oxbow and the straightened River Don is also grazed and has shallow pools after seasonal flooding.	Approximately 90 m east of the Grid Connection Corridor, on the opposite side of the River Don to the Scheme.
Moss Brick Pond LWS	Disused claypit, surrounded by dense scrub. Now used as a fishing lake, the open water area contains locally-abundant Curly Pondweed (*Lagarosiphon major*). Both Southern Marsh (*Dactylorhiza praetermissa*) and Common Spotted Orchid (*Dactylorhiza fuchsia*) are present.	Approximately 110 m southwest of Fenwick Common Lane, which comprises part of the Solar PV Site.
Riddings Farm Pond cLWS	This is a small pond and wetland feature containing small populations of Fine-leaved Water Dropwort (*Oenanthe aquatica*) (which is locally scarce) and good numbers of submerged plant species.	Approximately 130 m from the Solar PV Site, within the central area at Riddings Farm.
Pilkington's Burgy Banks LWS	The Burgy Banks have been created over many years by the nearby Pilkington's Glass factory which was located on the opposite side of the River Don and the Dun Navigation.	Approximately 145 m south of the Grid Connection Corridor.

Name	Description	Distance from the Scheme
Barnby Dun Borrow Pits LWS	This site is a flooded linear 'borrow pit' created during the building of the flood banks of the adjacent River Don Flood Drain.	The closest point of the LWS is approximately 150 m east of the Grid Connection Corridor.
Old Ings and Chequer Lane LWS	This site is large and comprises a series of drains, arable land, improved grassland, woodland, scrub and hedgerows. The adjacent land use is mainly arable.	Approximately 250 m east of the Grid Connection Corridor.
Thorpe Marsh Area LWS	This site comprises Thorpe Marsh Nature Reserve, a reserve of 60 hectares managed by the Yorkshire Wildlife Trust. It consists of ancient ridge-and-furrow pastures, a disused railway line, ponds and a lake excavated in the late 1970s.	Approximately 405 m west of the Grid Connection Corridor.
Northfield Pond LWS	A constant wet pond area with typical wet zone trees and ditch running south from the Northfield Pond.	Approximately 450 m east of the Grid Connection Corridor
Bentley Bank LWS	The site comprises a long linear marsh, grazed grassy floodbank, scrub, ponds and drains.	Approximately 465 m south of the Grid Connection Corridor.
Old River Don Oxbow LWS	The site is located on alluvium in the flood plain of the River Don.	Approximately 495 m south of the Grid Connection Corridor.
Croft Ings LWS	The site comprises a series of three ‘triangular’ borrow pits. A water-filled drain links the ponds.	Approximately 610 m southeast of the Grid Connection Corridor.
Went Valley (near Sykehouse) LWS	This site supports a mosaic of habitats spread over a series of fields. The site is bounded to the north by a small young plantation and the River Went. The southern and eastern boundary is formed by a grassy embankment and established hedge lines.	Within the northern part of the Solar PV Site (adjacent to and south of the River Went).
Shirley Pool and Rushy Moor Area LWS	The site contains excellent examples of wetland habitats including open water, reed swamp, tall fen, wet neutral grassland and carr which grades into Birch-oak woodland on drier ground. Shirley Pool SSSI is also located within this site (a smaller extent than the LWS).	Approximately 700 m southwest of the Solar PV Site.

Name	Description	Distance from the Scheme
Long Sandall Ings LWS	The site is an area of flat, low-lying land situated on alluvium in the flood plain of the River Don, a meander of which formally passed through the area.	Approximately 820 m south of the Grid Connection Corridor.
Ruskholme LWS	This site is located on the east side of the New Junction Canal and on the north bank of the River Don, on the alluvial floodplain.	Approximately 930 m east of the Grid Connection Corridor.
Went Valley (Eskholme) LWS	The riverbank supports an abundance of Reed Sweet-grass, Fool's-watercress (*Apium nodiflorum*), Amphibious Bistort (*Persicaria amphibia*), Reed Canary Grass (*Phalaris arundinacea*), Branched Bur-reed (*Sparganium erectum*), Greater Bulrush (*Typha latifolia*) and locally-frequent Pink Water Speedwell (*Veronica catenate*).	Approximately 1.44 km northeast of the Solar PV Site.
River Went Oxbow cLWS	The old course of the River Went now forms a loop south of the present canalised river. Between one-third to almost a half of this old course is now a dry, or only seasonally wet, depression choked by tall ruderal and scattered wetland vegetation and is shaded throughout much of this western half by dense to scattered scrub and tree cover.	Approximately 1.47 km west of the Solar PV Site.
Joan Croft Pond cLWS	A small wetland site.	Approximately 1.57 km west of the Grid Connection Corridor.
Clay Bridge Field LWS	The site is a small damp meadow enclosed by dense hedgerows on all sides except the south, which has a slightly raised bank along a dry ditch, supporting an old defunct hedgerow comprising a line of mature Pedunculate and Turkey Oaks (Quercus cerris). A deep water-filled drain runs along the northern side of the site.	Approximately 1.79 km east of the Solar PV Site. New Junction Canal separates the Solar PV Site and the LWS. There is no direct habitat connectivity.
Arksey Ings LWS	No site description available.	Approximately 1.80 km southwest of the Grid Connection Corridor.
Westfield Ings LWS	The site is formerly a marsh within which ponds had been dug and trees planted. The southern part has recently been cleared of	Approximately 1.83 km southeast

Name	Description	Distance from the Scheme
	scrub and the ponds filled in, but the area still contains marsh plants and could, with suitable management, redevelop as a marsh habitat.	of the Solar PV Site.

Notable Habitats

3.1.14 The River Went (present along the northern boundary of the Scheme) is connected to the Humber Estuary SAC/RAMSAR approximately 16 km downstream of the Scheme via the River Don and Dutch River. The River Don also runs adjacent to the eastern boundary of the Scheme and the river and its floodplains are included in the Doncaster Biodiversity Action Plan (BAP) (Ref. 21).

3.1.15 There is also various standing water habitat that lies within the Scheme. Some of these habitats are classed as ponds and are covered under the Water and Wetlands Habitat statement, also under the Doncaster BAP (Ref. 21). Ponds have not been included in the aquatic ecology assessment due to the commitment to avoid them with an appropriate buffer zone, and the minimal nature of impacts around them.

Notable Species

Fish

3.1.16 There is one Environment Agency monitoring site within approximately 2 km of the Scheme on the River Went, ID: 4355. Other sites upstream on the River Went were also checked due to the hydrological connections to ditches within the Scheme, these included: 68152, 68153, 68154, 68156, 68158, and downstream on the River Don ID: 36759). Notable species are listed in Table 5 below. Bullhead (*Cottus gobio*) was recorded present in all of the named sites with the most recent record in 2017. There was also an historical record of an individual European eel (*Anguilla anguilla*) present in the River Went (ID 4355) in the 2012 surveys but was not recorded in the more recent surveys.

3.1.17 The Species Audit of the City of Doncaster Council, produced for the Doncaster BAP (Ref. 21) in 2007 also listed twenty-two records of European eel, six records of Atlantic Salmon (*Salmo salar*), and four records of Brown Trout (*Salmo trutta)* located at various unconfirmed locations. Whilst these records do not have specific location information, it does evident that these species were once present in the catchment, albeit potentially historically. River lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) are also qualifying species for the Humber Estuary SAC and Humber Estuary RAMSAR and have potential to be present in connected waterbodies.

Table 5: Notable Fish Species Identified Within 2 km of the Order Limits and Within Relevant Catchment Monitoring Site Records Within the Last 10 Years

Fish species	Habitats Directive (Appendix)	S41 SPI?	Locations (and EA monitoring sites recorded at, if applicable)	Number of records	Most recent year
Bullhead (Cottus gobio)	Annex II	Yes	2 km upstream of the Scheme in the River Went (ID: 4355) Hydrologically connected to drains within the Scheme via River Went (ID: 68152, 68153, 68154, 68156, 68158 all of which are on River Went, c/20 km upstream of the scheme)	5 20	2017 2017
European eel (Anguilla anguilla)	Annex II	Yes	River Don, 2 km downstream of confluence with Thorpe Marsh Drain (ID: 36759) Historical record of a single individual in the River Went (2012) at ID:4355.	40	2017
Atlantic salmon (Salmo salar)	Annex II	Yes	Unconfirmed location. Listed in 'The Species Audit of the City of Doncaster Council', produced for the Doncaster BAP in 2007.	1	2007
Brown trout (Salmo trutta)	No	Yes	Unconfirmed location. Listed in 'The Species Audit of the City of Doncaster Council', produced for the Doncaster BAP in 2007	1	2007
Sea lamprey (Petromyzon marinus)	Annex II	Yes	Unconfirmed location. Listed in 'The Species Audit of the City of Doncaster Council', produced for the Doncaster BAP in 2007 There is also one record of sea lamprey within the New Junction Canal which is connected to the River Went approximately	1	2007

Fish species	Habitats Directive (Appendix)	S41 SPI?	Locations (and EA monitoring sites recorded at, if applicable)	Number of records	Most recent year
			6 km downstream of the Scheme.		

Aquatic Macroinvertebrates

3.1.18 There were no Environment Agency monitoring sites on the drains and rivers within the Study Area, however, there were some hydrologically connected which include Site ID: 327 on the River Went 2 km upstream of the Scheme and Site ID: 1112 on the River Don 1 km east of the Scheme.

3.1.19 There are no recent records of notable or protected aquatic invertebrates, including White-clawed Crayfish, within the Order limits or in connected waterbodies.

3.1.20 Although protected and notable aquatic invertebrate records were absent from the Study Area, it should be noted that for the Went from Blowell Drain to the River Don WFD Water Body (ID: GB104027064260), aquatic macroinvertebrates were classified as High status for the 2022 WFD cycle.

3.1.21 The non-native New Zealand Mud Snail (*P. antipodarum*) was identified in 2016. There are no statutory obligations pertaining to the spread of the species and it is considered naturalised.

3.1.22 The invasive Caspian mud shrimp (*Chelicorophium curvispinum*) and the invasive zebra mussel (*Dreissena polymorpha)* were present on Site ID: 1112 located on the River Don. The most recent record was in 2015. These species are not listed on any UK legislation but bio-security measures (as per the Great Britain non-native species secretariat) to prevent their spread should still be considered on connected waterbodies.

3.1.23 The Doncaster BAP (Ref. 21) has mentions of two aquatic beetles in its species audit list. *Hydroporus rufifrons* (current conservation score of ten), found in temporary marshes, old oxbow systems and has a historical record in Thorne Moor and a more recent record in Epworth (Ref. 21). There was also a mention of *Laccophilus obsoletus*, which has a conservation score of nine. This beetle is typical of marshes near the sea but is not restricted to brackish waters, it was noted in the BAP that ditch management is key for the survival of this species (Ref. 21).

Aquatic macrophytes

3.1.24 There were no Environment Agency monitoring sites on the drains and rivers within the Order limits, however, there were some hydrologically connected which include Site ID: 326 on the River Went-100 m downstream confluence with Fleet Drain (100 m to the east of the Order Limits, Site ID: 1113 on River Don 1 km to the west of Scheme, and Site ID: 205431 on Mill Dike 1.5 km upstream of the Scheme).

3.1.25 There were two records of the protected aquatic macrophyte *Callitriche obtusangula* at Site ID: 1113 in 2016 and Site ID: 205431 in 2023. However, this species is now listed as of ‘least concern’ on the JNCCs conservation designations for UK taxa 2023 which means it is neither threatened or near threatened.

3.1.26 According to Environment Agency catchment database data, macrophytes as a sub-element scored poorly on the Went from Blowell Drain to the River Don Water Body during the 2019 cycle.

3.1.27 The non-native Nuttall's waterweed (*Elodea nuttallii*) was recorded in 2016 at Site ID: 1113 and 326, it no longer listed in Schedule 9 (Ref. 6) but is listed in the Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref. 10).

Invasive Non-Native Species (INNS)

3.1.28 Aquatic INNS were identified in the desk study, as shown in Table 6. Nuttall's waterweed is no longer listed in Schedule 9 (Ref. 6) but is listed in the Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref. 10) There are statutory constraints regarding its potential spread, and therefore mitigation will be required during the construction and decommissioning phases to prevent their spread and, where practicable, locally eradicate these species if present within the scheme or in hydrologically connected waterbodies.

3.1.29 A record of curly waterweed (*Lagarosiphon major*) was found in an offline pond 200 m south of the Order limits. This species is listed under schedule 9 of the Wildlife and Countryside Act (1981) (Ref. 6). It is thought to be unlikely to be present within the Order limits but good practice bio-security measures should be in place.

3.1.30 The non-native but naturalised New Zealand mud snail (*Potamopyrgus antipodarum*) was also recorded along with zebra mussel and Caspian mud shrimp which are also both non-native in the River Don 1 km east of the Scheme by the environment Agency. Whilst neither species is listed in UK legislation, good practice bio-security are recommended to prevent their spread.

Table 6: Aquatic INNS Identified Within 2 km of the Study Area Within the Last Ten Years

Species	Designation/ status	Total number of records	Most recent record	Distance of closest record to the order limits
New Zealand mud snail (*Potamopyrgus antipodarum*)	Non-native but naturalised	15	2016	2.5 km upstream of the Scheme on River Went and on the River Don 2 km upstream of confluence with Thorpe Marsh Drain
Nuttall's Waterweed (*Elodea nuttallii*)	Invasive Alien Species (Enforcement and Permitting) Order 2019	5	2016	70 m downstream of the Scheme on River Went and

Species	Designation/ status	Total number of records	Most recent record	Distance of closest record to the order limits
Zebra mussel (*Dreissena polymorpha*)	Non-native but not on any legislation	1	2015	1 km east of the Scheme on River Don
Caspian mud shrimp (*Corophium curvispinum*)	Non-native but not on any legislation	1	2015	1 km east of the Scheme on River Don

3.2 Aquatic Habitat Walkover Surveys

3.2.1 Aquatic walkover surveys were undertaken alongside macroinvertebrate and macrophyte surveys. Of the 12 locations identified, two were dry, the remaining 10 sites were surveyed, descriptions of these can be found below.

Fleet Drain

3.2.2 Fleet Drain was a moderately sized linear drainage ditch in arable/pasture fields with steep earth banks dominated by uniform and simple vegetation. The water in the ditch was moderately turbid (brown) with an average depth of 60 cm with soft silt/clay substrate. The channel was approximately 2 m wide with no flow, with areas of heavy shading and others with no shading.

3.2.3 The channel was modified through straightening, deepening and culverting, with 10% woody debris. In-channel aquatic macrophytes covered approximately 25% of the channel comprising of four species including reed sweet grass (*Glyceria maxima*) and common duckweed (*Lemna minor*). No fish spawning habitats or crayfish refuges were identified.

3.2.4 The reach was situated within tilled/arable land with some broadleaf woodland, semi-improved grassland and tall herbs/rank present.

Fenwick Parish Drain (East)

3.2.5 Fenwick Parish Drain (east) was a small linear drainage ditch in arable fields with a steep left bank and a fenced stepped right bank comprised of earth, dominated by uniform and simple vegetation. The water in the ditch was slightly turbid (brown) with an average depth of 5 cm with soft silt/clay substrate. The channel was approximately 0.5 m wide with no flow and moderate shading.

3.2.6 The channel was modified through straightening and deepening with 20% woody debris. No in-channel aquatic macrophytes were observed, with no fish spawning habitats or crayfish refuges identified.

3.2.7 The reach was situated within tilled/arable land, however, was primarily surrounded by broadleaf woodland, scrub and tall herbs/rank.

Fenwick Parish Drain (West)

3.2.8 Fenwick Parish Drain (west) was a small linear drainage ditch along a hedgerow in arable fields with a steep left bank and a shelfed right bank

comprised of earth, dominated by uniform and simple vegetation. The water in the ditch was slightly turbid (brown) with an average depth of 15 cm with soft silt/clay substrate. The channel was approximately 0.8 m wide with no flow and was overgrown with heavy shading.

3.2.9 The channel was modified through straightening, deepening and culverting with 10% woody debris. In-channel aquatic macrophytes covered approximately 2% of the channel comprised of various-leaved water starwort (*Callitriche platycarpa*). No fish spawning habitats or crayfish refuges were identified.

3.2.10 The reach was situated within tilled/arable land, however, was primarily surrounded by broadleaf woodland, scrub, and tall herbs/rank.

Minor Ditch 9

3.2.11 Minor Ditch 9 was a moderately sized linear drainage ditch in pasture fields with banks dominated by uniform vegetation. The ditch was dry with the exception of a ~50 m stretch before it connects to the River Went. In this area the water in the ditch was slightly turbid with an average depth of 60 to 80 cm with silt/clay substrate. The channel was approximately 2 to 3 m wide with no flow and no shading.

3.2.12 The channel was modified through straightening and deepening. In-channel aquatic macrophytes covered approximately 40% of the channel comprising of five species including reed sweet grass common duckweed and algae (*Enteromorpha*). No fish spawning habitats or optimal crayfish refuges were identified.

3.2.13 The reach was situated within marsh land with semi-improved grassland and tall herbs/rank present.

Fenwick Common Drain (West)

3.2.14 Fenwick Common Drain (west) was a linear drainage ditch along a hedgerow in arable fields with steep banks, one dominated by uniform vegetation comprising of tall herbs/rank and the other comprising of scrub and trees. The water in the ditch was clear with an average depth of 5 cm with silt/clay substrate. The channel was approximately 0.5 – 0.8 m wide with no flow, with areas of heavy shading and other areas with no shading.

3.2.15 The channel was modified through straightening and deepening with 10% woody debris. In-channel aquatic macrophytes covered approximately 10% of the channel comprising of three species including reed canary grass (*Phalaris arundinacea*) and various-leaved water starwort (*C. platycarpa*). No fish spawning habitats or suitable crayfish refuges were identified.

3.2.16 The reach was situated within tilled/arable land, however, was primarily surrounded by broadleaf woodland, scrub and tall herbs/rank.

Fenwick Common Drain (east)

3.2.17 Fenwick Common Drain (east) was a small linear drainage ditch along a hedgerow in arable fields with banks dominated by uniform and simple vegetation. The water in the ditch was slightly turbid (brown) with an average depth of 5 to 20 cm with silt/clay substrate. The channel was approximately 0.5 to 1 m wide with no flow and was overgrown with heavy shading.

3.2.18 The channel was modified through straightening, deepening and culverting with 15% woody debris. In-channel aquatic macrophytes covered approximately 5% of the channel comprised of water starwort (*Callitriche agg.*) and common water plantain (*Alisma plantago-aquatica*). No fish spawning habitats or suitable crayfish refuges were identified.

3.2.19 The reach was situated within tilled/arable land, however, was primarily surrounded by broadleaf woodland, scrub, and tall herbs/rank.

Ellwood and Fenwick Grange Drain

3.2.20 Ellwood and Fenwick Grange Drain was a small, deepened drainage ditch along a hedgerow in arable fields with a steep left bank and shelfed right bank, dominated by uniform and simple vegetation. The water in the ditch was clear with an average depth of 10 cm with silt/clay substrate. The channel was approximately 0.5 to 0.8 m wide with no flow and was overgrown with heavy shading.

3.2.21 The channel was modified through straightening and deepening with 20% woody debris. In-channel aquatic macrophytes covered approximately 10% of the channel comprised of various-leaved water starwort (*C. platycarpa*) and reed sweet grass. No fish spawning habitats or suitable crayfish refuges were identified.

3.2.22 The reach was situated within tilled/arable land, however, was primarily surrounded by broadleaf woodland, scrub, and tall herbs/rank.

Hawkhouse Green Dike

3.2.23 Hawkhouse Green Dike was a linear drainage ditch in arable fields with banks dominated by simple vegetation, one bank dominated with scrub and hedgerow, with the other dominated by tall herbs and grasses. The water in the ditch was clear with an average depth of 5 to 20 cm with silt/clay substrate. The channel was approximately 1 to 2 m wide with no flow and was overgrown with heavy shading.

3.2.24 The channel was modified through straightening and deepening with 20% woody debris. In-channel aquatic macrophytes covered approximately 10% of the channel comprised of four species including fools watercress (*Apium nodiflorum*) and various-leaved water starwort (*C. platycarpa*). No fish spawning habitats or crayfish refuges were identified.

3.2.25 The reach was situated within tilled/arable land, however, was primarily surrounded by broadleaf woodland, scrub, and tall herbs/rank.

Mill Dike

3.2.26 Mill Dike was a small drainage ditch in arable fields with a steep left bank and shelfed right bank, dominated by uniform and simple vegetation, with its left bank dominated by scrub and trees and right bank dominated by tall herbs and grasses. The water in the ditch was clear with an average depth of 20 to 50 cm with silt/clay substrate. The channel was approximately 0.5 to 1 m wide with no apparent flow (<10 cm/sec).

3.2.27 The channel was modified through straightening, deepening and culverting with 10% woody debris. In-channel aquatic macrophytes covered approximately 5% of the channel comprised of water starwort (*Callitriche*

agg.) and 2% filamentous algae. No fish spawning habitats or crayfish refuges were identified.

3.2.28 The reach was situated within tilled/arable land, however, was primarily surrounded by broadleaf woodland, scrub and tall herbs/rank, with a road close by.

Wrancarr Drain

3.2.29 Wrancarr Drain was a small slow flowing (<10 to 25 cm/sec) watercourse along a hedgerow and road. The watercourse is culverted under a road with the upstream section of the watercourse being slower flowing with silt/clay substrate and the downstream section of the watercourse being faster flowing with coarser substrate. The banks are dominated by uniform and simple vegetation. The water was clear with an average depth of 10 to 80 cm and 1 to 2.5 m wide.

3.2.30 The channel was modified through straightening and culverting with 5% woody debris. In-channel aquatic macrophytes covered approximately 20% of the channel comprised of five species, upstream of the culvert was dominated by branched bur-reed (*Sparganium erectum*), and downstream of the culvert contained various species, including stream water-crowfoot (*Ranunculus penicillatus*) and fools watercress. Notably the schedule 9 (Ref. 6) INNS Canadian waterweed (*Elodea canadensis*) was present in rare quantities at this site.

3.3 Aquatic Macroinvertebrate Survey Results

3.3.1 In spring, a total of ten macroinvertebrate samples were collected as two of the watercourses visited were dry at the time of survey. In autumn, five macroinvertebrate samples were collected, as the remaining watercourses were dry during the surveys. The full aquatic macroinvertebrate taxa list is provided in Annex F. The biological metrics results are presented in Table 7 along with any notable or INNS found in the samples.

Table 7: Macroinvertebrate Index Scores

Index	Survey Season	NTAXA (WHPT)	ASPT (WHPT)	CCI Score	CCI Score - interpretation	LIFE Score (species)	LIFE Score (species) - interpretation	PSI Score (species)	PSI Score (species) - interpretation	Total number of taxa	INNS/Notable Species
Fleet Drain	**Spring**	14	3.9	4.6	Low conservation value	5.4	Low sensitivity to reduced flows	0	Heavily Sediment ed	25	N/A
	Autumn	19	4.3	7.6	Moderate conservation value	5.6	Low sensitivity to reduced flows	0.0	Heavily sediment s	38	A notable beetle species was present in this sample, *Rhantus suturalis* (conservat ion score five)
Fenwick Parish Drain (east)	**Spring**	9	2.9	5.3	Moderate conservation value	4.5	Low sensitivity to reduced flows	5.3	Heavily Sediment ed	13	N/A

Index	Survey Season	NTAXA (WHPT)	ASPT (WHPT)	CCI Score	CCI Score - interpretation	LIFE Score (species)	LIFE Score (species) - interpretation	PSI Score (species)	PSI Score (species) - interpretation	Total number of taxa	INNS/Notable Species
	Autumn	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Fenwick Parish Drain (west)	**Spring**	12	3.3	1.2	Low conservation value	5.2	Low sensitivity to reduced flows	0	Heavily Sediment ed	16	N/A
	Autumn	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Minor Ditch 9	**Spring**	16	4.1	3.5	Low conservation value	5.8	Low sensitivity to reduced flows	5.7	Heavily Sediment ed	27	The non-native but naturalise d New Zealand mud snail (*Potamop yrgus antipodaru m*)

Index	Survey Season	NTAXA (WHPT)	ASPT (WHPT)	CCI Score	CCI Score - interpretation	LIFE Score (species)	LIFE Score (species) - interpretation	PSI Score (species)	PSI Score (species) - interpretation	Total number of taxa	INNS/Notable Species
	Autumn	12	3.6	15.3	High conservation value	5.3	Low sensitivity to reduced flows	0.0	Heavily Sediment ed	22	The non-native but naturalised New Zealand mud snail (*Potamopyrgus antipodarum*). Two notable beetle species were present in this sample, *Rhantus suturalis* (conservation score five) and *Hygrotus parallelogrammus* (conservat

Index	Survey Season	NTAXA (WHPT)	ASPT (WHPT)	CCI Score	CCI Score - interpretation	LIFE Score (species)	LIFE Score (species) - interpretation	PSI Score (species)	PSI Score (species) - interpretation	Total number of taxa	INNS/Notable Species
											ion score seven)
Fenwick Common Drain (west)	**Spring**	15	3.8	4.3	Low conservation value	6	Low sensitivity to reduced flows	2.9	Heavily Sediment ed	25	The non-native but naturalised New Zealand mud snail (*Potamopyrgus antipodarum*) and crustacean ‘shrimp’ (*Crangony x sp**)
	Autumn	11	2.7	5	Moderate conservation value	5.2	Low sensitivity to reduced flows	0	Heavily Sediment ed	20	The non-native but naturalised New Zealand mud snail (Potamop

Index	Survey Season	NTAXA (WHPT)	ASPT (WHPT)	CCI Score	CCI Score - interpretation	LIFE Score (species)	LIFE Score (species) - interpretation	PSI Score (species)	PSI Score (species) - interpretation	Total number of taxa	INNS/Notable Species
											yrgus antipodarum) and crustacean 'shrimp' (Crangonyx sp*)
Fenwick Common Drain (east)	**Spring**	15	3.4	3.9	Low conservation value	6.1	Low sensitivity to reduced flows	10.3	Heavily Sedimented	37	The non-native but naturalised New Zealand mud snail (*Potamopyrgus antipodarum*) and crustacean 'shrimp' (Crangonyx sp.)
	Autumn	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry

Index	Survey Season	NTAXA (WHPT)	ASPT (WHPT)	CCI Score	CCI Score - interpretation	LIFE Score (species)	LIFE Score (species) - interpretation	PSI Score (species)	PSI Score (species) - interpretation	Total number of taxa	INNS/Notable Species
Ellwood and Fenwick Grange Drain	**Spring**	15	3.5	10.4	Fairly High conservation value	5.6	Low sensitivity to reduced flows	0	Heavily Sediment ed	27	The non-native but naturalised crustacean ‘shrimp’ (*Crangonyx sp.*). Locally notable taxa Aplexa hypnorum (conservation score 5) and *Ilybius quadriguttatus* (conservation score 5)

Index	Survey Season	NTAXA (WHPT)	ASPT (WHPT)	CCI Score	CCI Score - interpretation	LIFE Score (species)	LIFE Score (species) - interpretation	PSI Score (species)	PSI Score (species) - interpretation	Total number of taxa	INNS/Notable Species
	Autumn	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Hawk House Green Drain	**Spring**	17	4	3.8	Low conservation value	5.5	Low sensitivity to reduced flows	2.7	Heavily Sediment ed	27	The non-native but naturalise d crustacea n ‘shrimp’ (*Crangony x sp.*)
	Autumn	16	3.3	1.2	Low conservation value	6	Low sensitivity to reduced flows	0	Heavily Sediment ed	23	The non-native but naturalise d New Zealand mud snail (*Potamop yrgus antipodaru m*) and crustacea n ‘shrimp’

Index	Survey Season	NTAXA (WHPT)	ASPT (WHPT)	CCI Score	CCI Score - interpretation	LIFE Score (species)	LIFE Score (species) - interpretation	PSI Score (species)	PSI Score (species) - interpretation	Total number of taxa	INNS/Notable Species
											(*Crangony x sp**)
Mill Dike	**Spring**	15	3.6	4.3	Low conservation value	5.5	Low sensitivity to reduced flows	2.4	Heavily Sediment ed	32	The non-native but naturalise d crustacea n 'shrimp' (*Crangony x sp.*)
	Autumn	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Wrancar r Drain	**Spring**	25	4.4	5.3	Moderate conservation value	7	Moderate sensitivity to reduced flows	32.7	Sediment ed	40	The non-native but naturalise d New Zealand mud snail (*Potamop yrgus antipodaru*

Index	Survey Season	NTAXA (WHPT)	ASPT (WHPT)	CCI Score	CCI Score - interpretation	LIFE Score (species)	LIFE Score (species) - interpretation	PSI Score (species)	PSI Score (species) - interpretation	Total number of taxa	INNS/Notable Species
											m) and crustacean ‘shrimp’ (*Crangonyx sp*.)
	Autumn	15	4.5	5.3	Moderate conservation value	7.5	High sensitivity to reduced flows	43.8	Moderately sedimented	27	The non-native but naturalised New Zealand mud snail (*Potamopyrgus antipodarum*)

** Crangonyx sp. includes both Crangonyx pseudogracilis and Crangonyx floridanus which cannot be successfully speciated from one another.*

Fleet Drain

Spring

3.3.2 Macroinvertebrate diversity at this site was moderate with 25 taxa recorded. The community was dominated by hoglouse (*Asellus aquaticus*), snails from the Planorbidae family including *Anisus sp.* and *Planorbis sp*., and diptera (the non-biting midge larvae Chironomidae). Beetle diversity was high with species of Gyrinidae, Dytiscidae, Hydrophilidae and Hydraenidae, as well as true bugs *Nepa cinerea* and *Velia sp.*

3.3.3 Biological water quality was 'poor, polluted or impacted' (ASPT-WHPT score 3.9 with a 'heavily sedimented' PSI score (0.0). The community at this site had 'low sensitivity' to reduced flows and was of 'low' conservation value (CCI score 4.6).

3.3.4 No notable taxa or INNS were present.

Autumn

3.3.5 Macroinvertebrate diversity at this site was high with 38 taxa recorded. The community was dominated by beetle species, from the families Dytiscidae (*Hygrotus inaequalis*, *Hydroporus palustris*, *Agabus bipustulatus* amongst others), Hydrophilidae (*Anacaena limbata*) and Hydraenidae (*Ochthebius minimus*) amongst other families as well as true bugs (*Sigara lateralis* and *Hesperocorixa sahlbergi* from the family Corixidae and *Notonecta glauca* from the family Notonectidae) along with dipera from the families Chironomidae, Dixidae and Psychodidae.

3.3.6 Biological water quality was 'moderate, moderately impacted' (ASPT-WHPT score 4.3) with a 'heavily sedimented' PSI score (0.0). The community at this site had 'low sensitivity' to reduced flows and was of 'moderate' conservation value (CCI score 7.6).

3.3.7 One notable beetle species from the family Dytiscidae was recorded at this site. This was *Rhantus suturalis* (conservation score five). There are no statutory designations associated with this species.

3.3.8 No INNS were present.

Fenwick Parish Drain (East)

Spring

3.3.9 Macroinvertebrate diversity at this site was low with 13 taxa recorded. The community was dominated hoglouse (*A. aquaticus*), diptera (the non-biting midge larvae Chironomidae) and Oligochaeta. Also present were Lymnaeidae species (*Ampullaceana balthica* and *Stagnicola sp.*), and Planorbidae including *Anisus leucostoma.*

3.3.10 Biological water quality was 'poor, polluted or impacted' (ASPT-WHPT score 2.9) with a 'heavily sedimented' PSI score (5.3). The community at this site had 'low sensitivity' to reduced flows and was of 'moderate' conservation value (CCI score 5.3).

3.3.11 No notable taxa or INNS were present.

Autumn

3.3.12 This site was dry when surveyed in autumn.

Fenwick Parish Drain (West)

Spring

3.3.13 Macroinvertebrate diversity at this site was low with 15 taxa recorded. The community was dominated by hoglouse (*A. aquaticus*), diptera (the non-biting midge larvae Chironomidae) and Oligochaeta. Also, present was alderfly larva (*Sialis lutaria*), and true bug species from the family Corixidae (*Sigara lateralis*) and beetles (*Helophorus aequalis* and *Helophorus brevipalpis)*.

3.3.14 Biological water quality was 'poor, polluted or impacted' (ASPT-WHPT score 3.8) with a 'heavily sedimented' PSI score (2.9). The community at this site had 'low sensitivity' to reduced flows and was of 'low' conservation value (CCI score 4.3).

3.3.15 No notable taxa or INNS were present.

Autumn

3.3.16 This site was dry when surveyed in autumn.

Minor Ditch 9

Spring

3.3.17 Macroinvertebrate diversity at this site was moderate with 27 taxa recorded. The community was dominated by snails from the families Lymnaeidae (*Lymnaea stagnalis, Radix auricularia* and *A. balthica*) and Planorbidae (*Planorbis carinatus* and *Anisus vortex*), as well as hoglouse (*A. aquaticus and Proasellus sp.*). Also present were beetles (*H. brevipalpis*) and Corixidae (*S. lateralis*).

3.3.18 Biological water quality was 'poor, polluted or impacted' (ASPT-WHPT score 4.1) with a 'heavily sedimented' PSI score (5.7). The community at this site had 'low sensitivity' to reduced flows and was of 'low' conservation value (CCI score 3.5).

3.3.19 The non-native New Zealand mud snail (*P. antipodarum*) was present in this sample. This species is now considered naturalised.

3.3.20 No notable or protected taxa were present.

Autumn

3.3.21 Macroinvertebrate diversity at this site was moderate with 22 taxa recorded. The community was dominated by snails from the families Lymnaeidae (*L.stagnalis, Stagnicola sp.* and *A. balthica*) and Planorbidae (*Planorbis corneus, P. planorbis* and *A. vortex*), as well as hoglouse (*A. aquaticus*). Also present were beetles from the families Dytiscidae and Helophoridae, damselfies (Coenagrionidae), dragonflies (*Aeshna sp.*) and true bugs (*Notonecta glauca*).

3.3.22 Biological water quality was 'poor, polluted or impacted' (ASPT-WHPT score 3.6) with a 'heavily sedimented' PSI score (0). The community at this site had 'low sensitivity' to reduced flows and was of 'high' conservation value (CCI score 15.3).

3.3.23 The non-native New Zealand mud snail (*P. antipodarum*) was present in this sample. This species is now considered naturalised.

3.3.24 Two notable beetle species from the family Dytiscidae were recorded at this site. These were *Rhantus suturalis* (conservation score five) and *Hygrotus parallelogrammus* (conservation score seven-notable but not red data book status). There are no statutory designations associated with these species.

Fenwick Common Drain (West)

Spring

3.3.25 Macroinvertebrate diversity at this site was moderate with 25 taxa recorded. The community was dominated by snails from the families Hydrobiidae (*P. antipodarum*) and Planorbidae (*Planorbis sp.* and *Anisus sp.*). Also present were hoglouse (*A. aquaticus and P. meridianus*), crustacean 'shrimp' (*Crangonyx sp*), diptera (the non-biting midge larvae Chironomidae) and beetles (*Hydroporus planus*, *Hydroporus tessellatus,* and *Hydrobius fuscipes*).

3.3.26 Biological water quality was 'poor, polluted or impacted' (ASPT-WHPT score 3.8) with a 'heavily sedimented' PSI score (2.9). The community at this site had 'low sensitivity' to reduced flows and was of 'low' conservation value (CCI score 4.3).

3.3.27 The non-native New Zealand mud snail (*P. antipodarum*) and crustacean 'shrimp' (*Crangonyx sp.*) were present in this sample. These species are now considered naturalised.

3.3.28 No notable or protected taxa were present.

Autumn

3.3.29 Macroinvertebrate diversity at this site was low with 11 taxa recorded. The community was dominated by snails from the families Planorbidae (*Planorbis planorbis* and *Anisus sp.*, Lymnaeidae (*Radix balthica* and *P. antipodarum*) and Sphaeriidae (*Sphaerium sp.* and *Pisidium sp.*).

3.3.30 Biological water quality was 'poor, polluted or impacted' (ASPT-WHPT score 2.7) with a 'heavily sedimented' PSI score (0.0). The community at this site had 'low sensitivity' to reduced flows and was of 'low' conservation value (CCI score 5).

3.3.31 The non-native New Zealand mud snail (*P. antipodarum*) and crustacean 'shrimp' (*Crangonyx sp.*) were present in this sample. These species are now considered naturalised.

3.3.32 No notable taxa or protected species were present.

Fenwick Common Drain (East)

Spring

3.3.33 Macroinvertebrate diversity at this site was high with 37 taxa recorded. The community was dominated by snails from the families Lymnaeidae (*A. balthica*), crustacean 'shrimps' (*Crangonyx sp. Gammarus sp. and Gammarus pulex),* hoglouse (*A. aquaticus* and *P. meridianus*) and diptera (the non-biting midge larvae Chironomidae). Also present were numerous species of beetles from the family Dytiscidae (*H. planus*, *Hydroporus palustris* and *Agabus bipustulatus*).

3.3.34 Biological water quality was ‘poor, polluted or impacted’ (ASPT-WHPT score 3.4) with a ‘heavily sedimented’ PSI score (10.3). The community at this site had ‘low sensitivity’ to reduced flows and was of ‘low’ conservation value (CCI score 3.9).

3.3.35 The non-native New Zealand mud snail (*P. antipodarum*) and crustacean ‘shrimp’ (*Crangonyx sp.*) were present in this sample. These species are now considered naturalised.

3.3.36 No notable or protected taxa were present.

Autumn

3.3.37 This site was dry when surveyed in autumn.

Ellwood and Fenwick Grange Drain

Spring

3.3.38 Macroinvertebrate diversity at this site was moderate with 27 taxa recorded. The community was dominated by snails from the families Lymnaeidae (*A. balthica*) and Planorbidae (including *Anisus sp.* and *A. vortex*). It was also dominated by crustacean ‘shrimp’ *Crangonyx sp.* and hoglouse (*A.aquaticus and P. meridianus*). Other macroinvertebrates at this site included Dytiscidae species (*H. tesselatus*, *A. bipustulatus* and *Ilybius quadriguttatus*) and Hydrophilidae species (*H. brevipalpis*, *Anacaena globulus* and *Anacena latescent*).

3.3.39 Biological water quality was ‘poor, polluted or impacted’ (ASPT-WHPT score 3.5) with a ‘heavily sedimented’ PSI score (0.0). The community at this site had ‘low sensitivity’ to reduced flows and was of ‘fairly high’ conservation value (CCI score 10.4).

3.3.40 The non-native crustacean ‘shrimp’ (*Crangonyx sp.)* was present in this sample. This species is now considered naturalised.

3.3.41 Locally notable moss bladder-snail (*Aplexa hypnorum* conservation score five) and the beetle *Ilybius quadriguttatus* (conservation score five) were present within this sample. There are no designations associated with these species.

Autumn

3.3.42 This site was dry when surveyed in autumn.

Hawkhouse Green Drain

Spring

3.3.43 Macroinvertebrate diversity at this site was moderate with 27 taxa recorded. The community was dominated by diptera (the non-biting midge larvae Chironomidae), worms, caddisfly (*Limnephilus lunatus*) and hoglouse (*A. aquaticus)*. Also present was mayfly (*Cloeon dipterum*), and snails from the families such as Lymnaeidae (*A. Balthica*) and Sphaeriidae (*Pisidium sp.*). Numerous beetles were also present including those from families Dytiscidae and Hydrophilidae.

3.3.44 Biological water quality was ‘poor, polluted or impacted’ (ASPT-WHPT score 4.0) with a ‘heavily sedimented’ PSI score (2.7). The community at this site

had ‘low sensitivity’ to reduced flows and was of ‘low’ conservation value (CCI score 3.8).

3.3.45 The non-native crustacean ‘shrimp’ *Crangonyx sp.* was present in this sample. This species is now considered naturalised.

3.3.46 No notable or protected taxa were present.

Autumn

3.3.47 Macroinvertebrate diversity at this site was moderate with 23 taxa recorded. The community was dominated by snails from the families Lymnaeidae (*R. balthica*, *Physella sp.*), Sphaeriidae (*Sphaerium sp*. and *Pisidium sp*.) and Physidae (*Physella sp.*) as well as diptera from the families Chironomidae, Psychodidae and Limoniidae.

3.3.48 Biological water quality was ‘poor, polluted or impacted’ (ASPT-WHPT score 3.3) with a ‘heavily sedimented’ PSI score (0). The community at this site had ‘low sensitivity’ to reduced flows and was of ‘low’ conservation value (CCI score 1.2).

3.3.49 The non-native New Zealand mud snail (*P. antipodarum*) and crustacean ‘shrimp’ (*Crangonyx sp.*) were present in this sample. These species are now considered naturalised.

3.3.50 No notable or protected taxa were present.

Mill Dike

Spring

3.3.51 Macroinvertebrate diversity at this site was moderately high with 32 taxa recorded. The community was dominated by crustacean ‘shrimp’ (*Crangonyx sp.*), snails, including those from the families Lymnaeidae and Planorbidae, Cladocera, and diptera (the non-biting midge larvae Chironomidae). Also present were hoglouse (*A. Aquatics* and *P. meridianus*) and numerous beetles such as species of Dytiscidae (*H. planus* and *A. bipustulatus*) and Hydrophilidae (*H. brevipalpis* and *H. aequalis*). Other taxa such as Corixidae and Notonectidae were also present.

3.3.52 Biological water quality was ‘poor, polluted or impacted’ (ASPT-WHPT score 3.6) with a ‘heavily sedimented’ PSI score (2.4). The community at this site had ‘low sensitivity’ to reduced flows and was of ‘low’ conservation value (CCI score 4.3).

3.3.53 The non-native crustacean ‘shrimp’ *Crangonyx sp.* was present in this sample. This species is now considered naturalised.

3.3.54 No notable or protected taxa were present.

Autumn

3.3.55 This site was dry when surveyed in autumn.

Wrancarr Drain

Spring

3.3.56 Macroinvertebrate diversity at this site was high with 40 taxa recorded. The community was dominated by snails from the family Hydrobiidae (*P. antipodarum*), crustacean ‘shrimp’ (*G.pulex* and *Crangonyx sp.)*, the mayfly

family Baetidae (*Baetis vernus* and *Centroptilum luteolum*), diptera (Simuliidae), and hoglouse (*A. aquaticus*). Also present were caddisflies from the families Limnephilidae (*L. lunatus*), Hydropsychidae and Leptoceridae (*Athripsodes cinereus*) as well as other taxa such as Vellidae, Corixidae, Calopterygidae and Sialidae.

3.3.57 Biological water quality was ‘moderate, moderately impacted’ (ASPT-WHPT score 4.4) with a ‘sedimented’ PSI score (32.7). The community at this site had ‘moderate sensitivity’ to reduced flows and was of ‘moderate’ conservation value (CCI score 5.3).

3.3.58 The non-native New Zealand mud snail (*P. antipodarum*) and crustacean ‘shrimp’ *Crangonyx sp.* were present in this sample. These species are now considered naturalised.

3.3.59 No notable or protected taxa were present.

Autumn

3.3.60 Macroinvertebrate diversity at this site was moderate with 27 taxa recorded. The community was dominated by snails from the family Sphaeriidae, crustacean ‘shrimp’ (*G.pulex* and *Crangonyx sp.)*, the mayfly family Baetidae (*Baetis vernus*), diptera (Simuliidae), and hoglouse (*A. aquaticus*). Also present were other taxa such as Calopterygidae and Sialidae.

3.3.61 Biological water quality was ‘moderate, moderately impacted’ (ASPT-WHPT score 4.5) with a ‘sedimented’ PSI score (32.7). The community at this site had ‘moderate sensitivity’ to reduced flows and was of ‘moderate’ conservation value (CCI score 5.3).

3.3.62 The non-native New Zealand mud snail (*P. antipodarum*) was present in this sample. This species is now considered naturalised.

3.3.63 No notable or protected taxa were present.

3.4 Aquatic Macrophyte Survey Results

3.4.1 The full aquatic macrophyte taxa list is provided in Annex G. A cross-reference with the Joint Nature Conservation Committee (JNCC) (ref) Taxon Designations list confirmed that none of the macrophyte taxa identified during the surveys were protected or notable. However, the INNS Canadian waterweed was identified in Wrancarr Drain, which is listed under the Schedule 9 WAC Act 1981 (Ref. 6).

Fleet Drain

3.4.2 Fleet Drain was a moderately sized stagnant drainage channel that was heavily shaded in areas, but open in others. The channel was approximately 2 m wide and 60 cm deep with soft silt/clay substrate. The channel had 25% macrophyte cover comprising of four species. Abundant reed sweet grass (*G. maxima*-occasional), reed canary grass (*P. arundinacea* occasional) and amphibious bistort (*Persicaria amphibia*- rare) and common duckweed (*L. minor*-rare).

Fenwick Parish Drain (East)

3.4.3 Fenwick Parish Drain (east) was a small linear drain running through arable fields that was moderately shaded with slow flow. The channel was

approximately 0.5 m wide and 5 cm deep with silt/clay substrate and 20% woody debris. No macrophytes were found.

Fenwick Parish Drain (West)

3.4.4 Fenwick Parish Drain (west) was a small linear drain running along a hedgerow in arable fields and was heavily shaded with no flow. The channel was approximately 0.8 m wide and 15 cm deep with silt/clay substrate and 10% woody debris. The channel had 2% macrophyte cover comprising of occasional various-leaved water starwort (*C. platycarpa*-rare).

Minor Ditch 9

3.4.5 Minor Ditch 9 was a moderately sized stagnant drainage ditch within pasture fields and was not shaded. This ditch was dry except for a 50 m stretch before it connects to the River Went, which was surveyed. The channel was 2 to 3 m wide and 60 to 80 cm deep with silt/clay substrate. The channel had 40% macrophyte coverage. Three macrophyte species were recorded: reed sweet grass (*G. maxima* -frequent), reed canary grass (*P. arundinacea*-occasional) and common duckweed (*Lemna minor*-occasional). Algae (*Enteromorpha*) was also recorded (<10% cover).

Fenwick Common Drain (West)

3.4.6 Fenwick Common Drain (west) was a linear drainage ditch along a hedgerow in arable fields and was heavily shaded with no flow. The channel was 0.5 to 0.8 m wide and 5 cm deep with silt/clay substrate and 10% woody debris. The channel had 10% macrophyte coverage comprising of frequent reed canary grass (*P. arundinacea*) and various-leaved water starwort (*C. platycarpa*) with rare common water plantain (*A. plantago-aquatica*).

Fenwick Common Drain (East)

3.4.7 Fenwick Common Drain (east) was a small linear drainage ditch along a hedgerow in arable fields and was heavily shaded with no flow. The channel was 0.5 to 1 m wide and 5 to 20 cm deep with silt/clay substrate and 15% woody debris. The channel had 5% macrophyte cover comprising of abundant reed canary grass (*P. arundinacea*), frequent water starwort (*Callitriche agg*.) and rare common water plantain (*A. plantago-aquatica*).

Ellwood and Fenwick Grange Drain

3.4.8 Ellwood and Fenwick Grange Drain is a small, deepened drainage ditch along a hedgerow in arable fields and was heavily shaded with no apparent flow. The channel was 0.5 to 0.8 m wide and 10 cm deep with silt/clay substrate and 20% woody debris. The channel had 10% macrophyte cover comprising of occasional reed sweet grass (*G. maxima*) and various-leaved water starwort (*C. platycarpa*).

Hawkhouse Green Dike

3.4.9 Hawkhouse Green Dike is a linear drainage ditch in arable fields with no flow and was mostly heavily shaded with some open areas. The channel was 1 - 2 m wide and 5 to 20 cm deep with silt/clay substrate and 20% woody debris. The channel had approximately 10% macrophyte cover and four species were recorded: common water plantain (*A. plantago-aquatica*-rare),

fools watercress (*A. nodiflorum*-rare), various-leaved water starwort (*C. platycarpa* -rare), and reed canary grass (*P. arundinacea*-rare).

Mill Dike

3.4.10 Mill Dike is a small drainage ditch in arable fields with no apparent flow and moderately heavy shading. The channel was 0.5 to 1 m wide and 20 to 50 cm deep with silt/clay substrate with 20% woody debris. The channel had 5% macrophyte cover comprised of water starwort (*Callitriche agg*.-rare) and filamentous algae (2%) with reed canary grass (*P. arundinacea*) also present on the banks.

Wrancarr Drain

3.4.11 Wrancarr Drain is a small slow flowing watercourse running along a hedgerow and a road. The watercourse is culverted under a road, upstream of the road the watercourse is slow flowing with high branched bur-reed coverage (*S. erectum*) and a silt/clay substrate. Downstream of the road the watercourse has more flow and increased percentages of coarser substrate. The watercourse is 1 to 2.5 m wide and 10 to 80 cm deep with 5% woody debris. The channel had 30-40% macrophyte cover and six species were recorded: branched bur-reed (*S. erectum*-frequent), fools watercress (*A. nodiflorum*-occasional), stream water-crowfoot (*R. penicillatus* -rare), common water plantain (*A. plantago-aquatica* -rare) and spiked water-milfoil (*Myriophyllum spicatum* -rare). The Schedule 9 (Ref. 6) INNS Canadian waterweed (*E. canadensis* -rare) was also present at this site.

3.5 Fish Survey Results

3.5.1 Species presence, abundance, and fork length (nearest mm) were recorded for all fish species captured.

Fleet Drain-AAA887

3.5.2 Three common and widespread fish species were recorded at Fleet Drain. These were nine spined stickleback (*Pungitius pungitius)*, three-spined stickleback (*Gasterosteus aculeatus*) and stone loach (*Barbatula barbatula*). All were present in low numbers (<40 and only one individual stone loach).

Fenwick Common Drain (West) AAA887

3.5.3 Two common and widespread fish species were recorded in Fenwick Common Drain. These were three-spined stickleback (four individuals) and nine-spined stickleback (five individuals).

Hawkhouse Green Dike AAA948

3.5.4 Only one common and widespread fish species was recorded in Hawkhouse Green Dike at the time of survey, and this was one individual pike (*Esox lucius*).

4. Discussion and Evaluation

4.1.1 The desk study highlighted the current issues facing the associated catchments which are: private sewage treatment, sewage discharge, poor nutrient and soil management, land drainage, flood protection structures and management, and other priority hazardous chemical substances (established from WFD classifications). All waterbodies associated with this area had a Moderate ecological quality, this suggests the Scheme is unlikely to cause lasting impacts to the wider WFD catchments compared to current impacts. However, as a result there are opportunities to seek appropriate mitigation and enhancement through the **Biodiversity Net Gain (BNG) Assessment** [**EN010152/APP/7.11]** which could improve habitat and water quality to meet BNG objectives for the Scheme.

Protected and Notable Species

Fish

4.1.2 The desk study highlighted records of bullhead in the River Went, 2.5 km upstream of the scheme as well as European eel in the River Don, 2 km downstream of its confluence with Thorpe Marsh Drain. There were also historical fish species records at unconfirmed locations mentioned in the species audit for the Doncaster BAP (Ref. 21) including Atlantic salmon, brown trout and sea lamprey.

4.1.3 Bullhead, Atlantic salmon and sea lamprey are listed under Annex II of the European Commission Habitats and Species Directive (Ref. 3) whilst brown trout are listed under Section 41 of the Natural Environment and Rural Communities Act 2006. European eel in is afforded protection under the Eels (England and Wales) Regulations 2009 (Ref. 12), which places a requirement upon developers and abstracters to ensure continued eel passage and to prevent eel entrainment.

4.1.4 Surveys for fish did not record any protected or notable fish species.

Aquatic Macroinvertebrates

4.1.5 The desk study showed no recent records of notable or protected aquatic invertebrates, including White-clawed Crayfish within the Study Area.

4.1.6 The species audit as part of the Doncaster BAP (Ref. 21) has mentions of two aquatic beetles for potential inclusion. One of which was *Hydroporus rufifrons* (conservation score of 10) which can be found in temporary marshes and old ox bow systems. There were records for Thorne Moor and Epworth areas. The second beetle species was *Laccophilus obsoletus*, (conservation score of nine) which is a beetle typical of marshes near the sea, though not restricted to brackish waters. It was noted in the audit that this species could benefit from ditch management. The species audit also listed two species of mollucs which had historic records (most recent was 1986). These were the mud snail *Lymnaea glabra* (now known as *Omphiscola glabra*, conservation score of nine) and the shining rams-horn snail *Segmentina nitida* (conservation score of ten).

4.1.7 The field surveys in spring recorded locally notable snail *Aplexa hypnorum* (conservation score five) and the beetle *Ilybius quadriguttatus* (conservation score five). The autumn field surveys recorded *Rhantus suturalis*

(conservation score five) and *Hygrotus parallelogrammus* (conservation score seven). There are no statutory designations associated with any of these species.

Aquatic Macrophytes

4.1.8 The desk study highlighted records of the protected aquatic macrophyte *Callitriche obtusangula* in 2016 and 2023. However, this species is now listed as of 'least concern' on the JNCCs conservation designations for UK taxa 2023 (Ref. 37) which means it is neither threatened or near threatened.

4.1.9 A cross-reference with the JNCC Taxon Designations list (Ref. 35 and Ref. 36) confirmed that none of the macrophyte taxa identified during the 2024 field surveys were protected or notable. However, the INNS Canadian waterweed was identified in Wrancarr Drain which is listed under the Schedule 9 WAC Act 1981 (Ref. 6).

Invasive Non-Native Species

Aquatic Macroinvertebrates

4.1.10 The desk study highlighted three invasive aquatic macroinvertebrate species these were the New Zealand Mud Snail (*P. antipodarum*) in the River Went and River Don as well as the Caspian mud shrimp (*C. curvispinum)* and zebra mussel (*D. polymorpha*) in the River Don, 1 km to the east of the Scheme.

4.1.11 The field surveys recorded two non-native but now considered naturalised species. New Zealand mud snail (*P. antipodarum*) was present in Minor Ditch 9, Fenwick Common Drain (east), Fenwick Common Drain (west) and Wrancarr Drain. Crustacean 'shrimp' (*Crangonyx sp.*) which was present in Fenwick Common Drain (east), Fenwick Common Drain (west), Ellwood and Fenwick Grange Drain, Hawkhouse Green Drain, Mill Dike, and Wrancarr drain.

4.1.12 Whilst neither of these species is listed in UK legislation, good practice bio-security measures are recommended to prevent their spread.

Aquatic macrophytes

4.1.13 The desk study highlighted that the non-native Nuttall's waterweed (E. nuttallii) was recorded in 2016 in the River Don, 1 km west of the Order Limits and in the River Went, 100 m east of the order limits after it's confluence with Fleet Drain (which is within the order limits) , it is no longer listed in Schedule 9 but is listed in the Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref. 10).

4.1.14 There is also a record of Curly waterweed (*Lagarosiphon major*) in a pond 200 m outside the order limits of the scheme which is a Schedule 9 (Ref. 6) INNS.

4.1.15 The field surveys recorded Canadian waterweed (*E. canadensis*) on Wrancarr Drain, another Schedule 9 (Ref. 6) INNS.

4.1.16 Both legislations referenced makes it an offence to plant, or otherwise cause to grow (including allowing to spread), listed plant species in the wild. If transported off-site, there is a duty of care with regards to the disposal of any part of the plant that may facilitate establishment in the wild and cause

environmental harm (as per the Environmental Protection Act 1990 (Ref. 8). The legislation also makes it an offense to release, or allow to escape, listed species (or species not ordinarily resident in and is not a regular visitor to Great Britain in a wild state) into the wild.

Fish

4.1.17 No invasive species of fish were found in the desk study or field survey.

5. Conclusions and Recommendations

5.1.1 The water bodies within the Order limits are subject to high levels of habitat and water quality pressures from existing industries, especially agriculture. This is exhibited within the results of the macroinvertebrate and macrophyte surveys. Current impacts on biological communities appear to be the result of watercourse habitat and channel modification indicated by aquatic habitat walkover surveys, including adjacent land use and rural management practices, also as indicated in the WFD desk study.

5.1.2 It is recommended that Solar PV Panels and any temporary or permanent infrastructure are installed a minimum of 8 m away from the banktop of any water bodies (watercourses, or ditches) on-site. This prevents any impacts of shading on these water bodies and is in accordance with Environment Agency flood risk guidance (see **ES Volume I Chapter 9: Water Environment [EN010152/APP/6.1]**).

5.1.3 The use of good practice construction and decommissioning methods should be implemented during construction to avoid sediment runoff into surface waters and avoid impacts to water quality.

5.1.4 A minimum of 8 m between watercourses to any spoil heaps created during construction and decommissioning should be employed and these should be either seeded or dampened to prevent runoff. The use of silt fencing is also recommended if construction and/or decommissioning is likely to result in runoff entering water bodies.

5.1.5 Redistribution of rainfall precipitation from Solar PV Panels could reduce the impacts of topsoil erosion and improve plant growth below. This is expected to reduce input of topsoil and nutrients into local watercourses, especially when land is no longer managed for arable agriculture. Increased surface runoff on larger solar sites could lead to higher rates of soil erosion, especially if interspace and site ground is bare, which warrants additional consideration as impacts to flow and sedimentation were present at all surveyed water bodies.

5.1.6 Due to the heavily modified nature of water bodies in the Order limits, including their management for agricultural drainage, there are opportunities to enhance water bodies and riparian/marginal habitats, and water quality (e.g. to support BNG objectives). Reducing shading would increase light levels into the water bodies and subsequently improve macrophyte growth, supported by a reduction in nutrient enrichment from agricultural land use. Water quality could also be improved through planting selected macrophyte species, while also developing habitat complexity within the water bodies for aquatic species.

5.1.7 Due to the presence of protected fish species recorded locally in connected water bodies (including Annex II species European bullhead and European eel, as well as the following species which are listed in the Doncaster BAP species audit (Ref. 21): Atlantic salmon, river lamprey and brown trout), there is the potential for these species to be present within the Order limits in the network of watercourses and ditches. Therefore, any direct impacts to water bodies should consider these, and other fish species. Such impacts are likely to include open trenching for watercourse crossings (such as the cable connections), culverting of water bodies for access or construction roads, and the extension of existing culverts to upgrade access roads. Such

impacts should ensure connectivity is maintained along all water bodies to allow fish passage for all migratory species and longitudinal connectivity for other aquatic species. Fish rescues during construction and decommissioning where draw-down or over-pumping is required should be completed. Culverting should be avoided, however, where this is not possible, culverts should be designed to allow fish to pass as per Environment Agency guidance (Ref. 43). They should have a flush bottom to the channel bed and be as short as possible. Water velocities should not be too fast to prevent the movement of resident or migratory fish populations. The height of the invert for all culverts should not pose an obstruction to fish movement. Baffles or other features providing shelter for fish as they pass upstream through the culvert may be incorporated into the design of a culvert base. Standard measures for avoiding any potential impacts on watercourses during construction should be included in the **Framework Construction Environmental Management Plan [EN010152/APP/7.7]**, including suitable buffers, avoiding fish spawning and migration periods during construction and keeping any chemicals/fuels outside of the floodplain.

5.1.8 Good industry practice biosecurity measures should be implemented for works undertaken to or near water bodies, especially those where INNS are currently present, to prevent the risk of their spread in line with national and European legislation.

5.1.9 Mitigation measures are discussed in further detail within **ES Volume I Chapter 8: Ecology [EN010152/APP/6.1]**.

5.1.10 No further aquatic ecological investigations are required to inform the assessment of impacts to water bodies present within the Order limits. A **BNG Assessment [EN010152/APP/7.11]** has been undertaken to inform mitigation requirements to support BNG objectives, including assessment of watercourses and ditches. The BNG assessment provides specific recommendations for the enhancement of these watercourses, where mitigation is required for direct impacts to them.

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Annex A Figures

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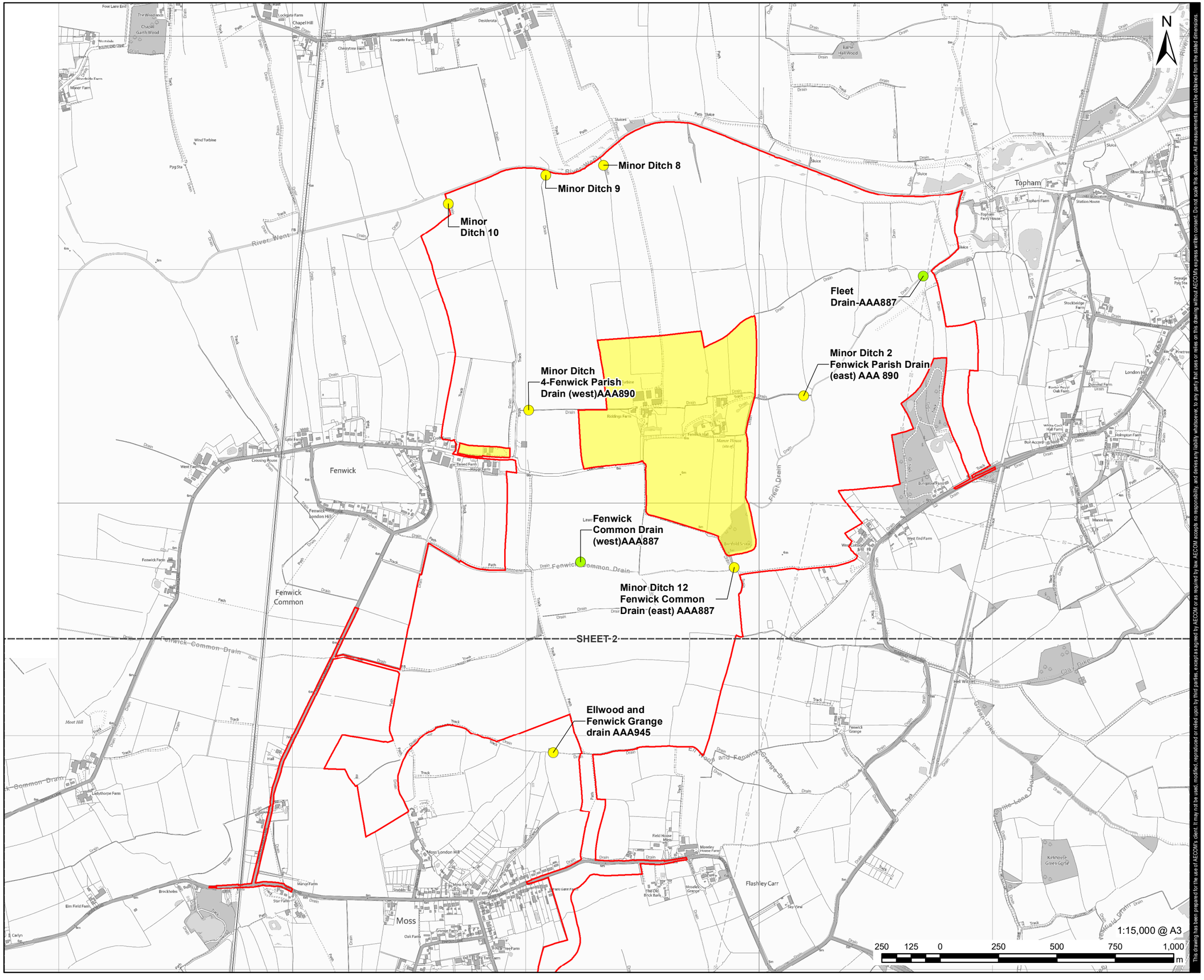

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AECOM

PROJECT

Fenwick Solar Farm

CLIENT

Fenwick Solar Project Limited

CONSULTANT

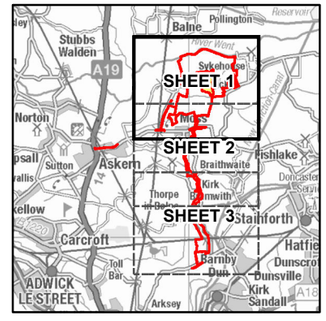
AECOM Limited
Midpoint,
Alencon Link
Basingstoke, RG21 7PP
www.aecom.com

LEGEND

- Order limits
- Land not included in the Order limits

Aquatic Survey Type

- Aquatic Macroinvertebrates and Macrophytes Survey
- Fish Survey



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ISSUE PURPOSE

Environmental Statement

PROJECT NUMBER

60698207

FIGURE TITLE

Aquatic Survey Locations
Sheet 1 of 3

FIGURE NUMBER

Figure 8-6-1

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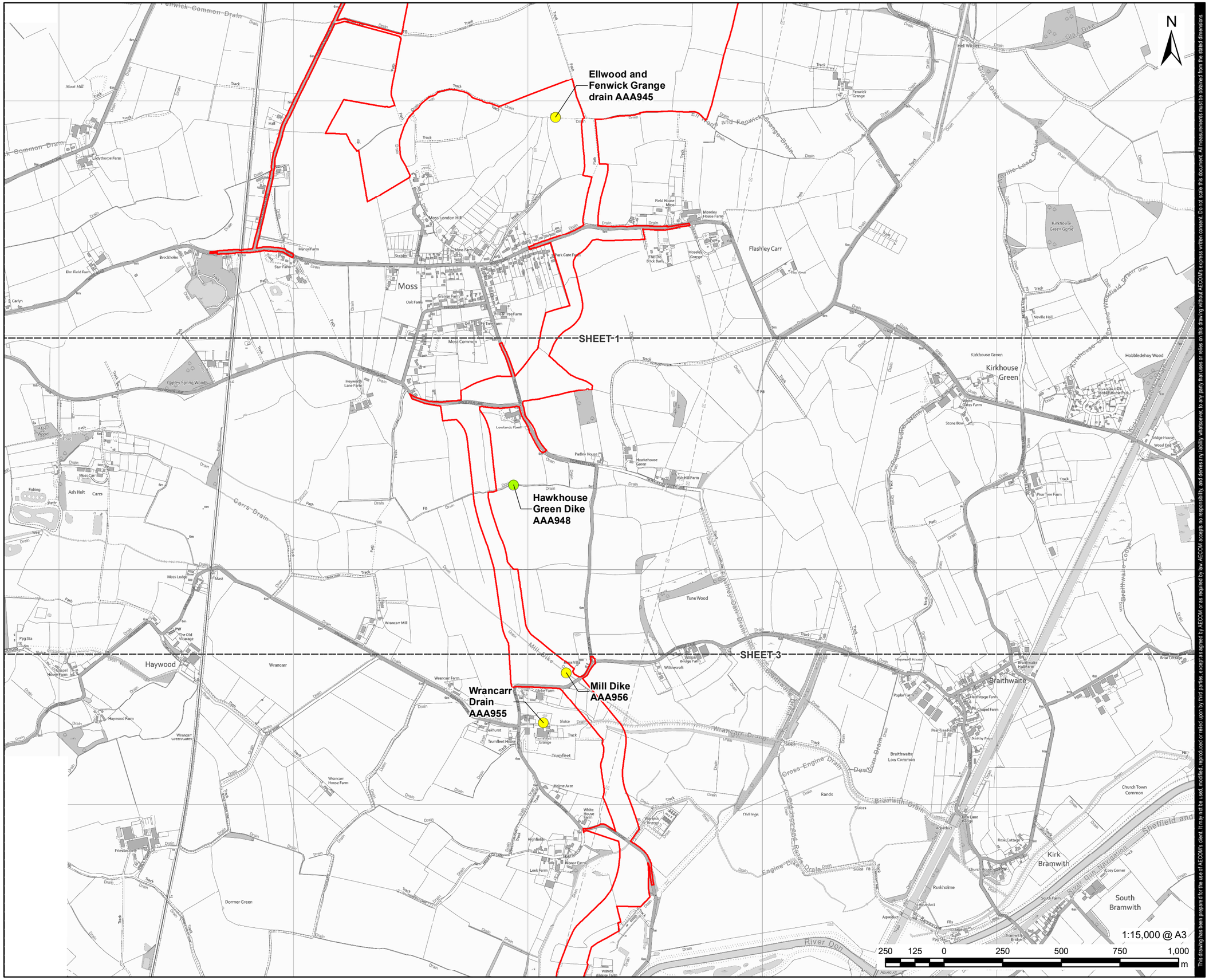

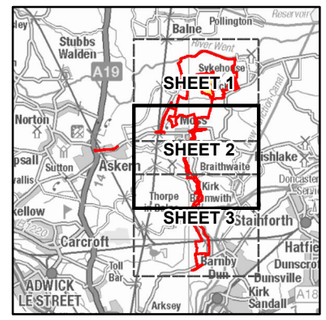

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PROJECT

Fenwick Solar Farm

CLIENT

Fenwick Solar Project Limited

CONSULTANT

AECOM Limited
Midpoint,
Alencon Link
Basingstoke, RG21 7PP
www.aecom.com

LEGEND

Order limits

Aquatic Survey Type

- Aquatic Macroinvertebrates and Macrophytes Survey
- Fish Survey

NOTES

ISSUE PURPOSE

Environmental Statement

PROJECT NUMBER

60698207

FIGURE TITLE

Aquatic Survey Locations
Sheet 2 of 3

FIGURE NUMBER

Figure 8-6-1

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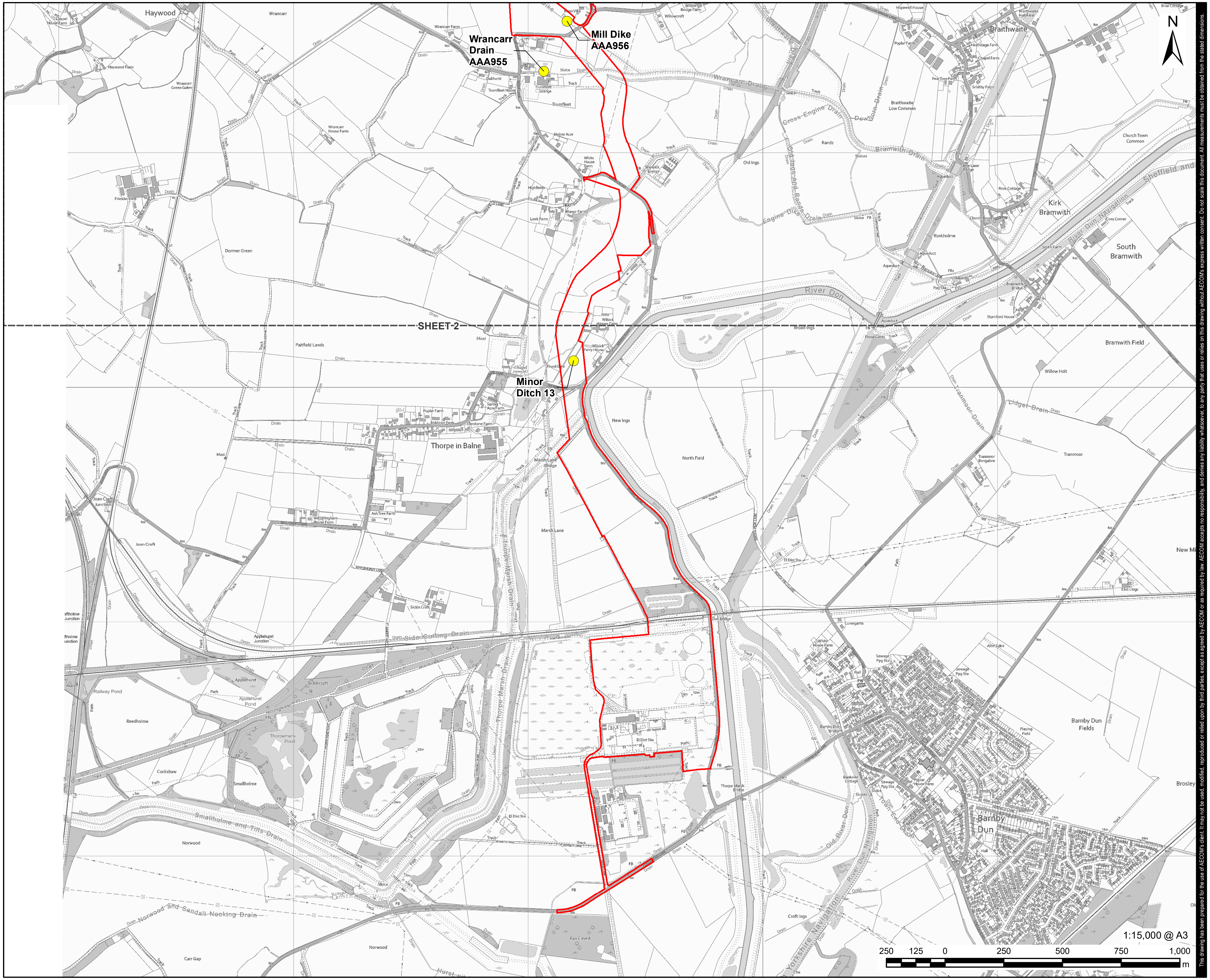

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Fenwick Solar Project Limited

CONSULTANT

AECOM Limited
Midpoint,
Alencon Link
Basingstoke, RG21 7PP
www.aecom.com

LEGEND

Order limits

Aquatic Survey Type

Aquatic Macroinvertebrates and Macrophytes Survey

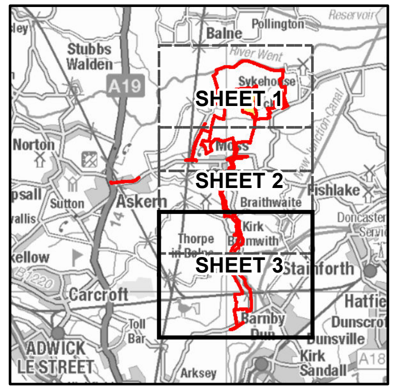

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FIGURE TITLE

Aquatic Survey Locations
Sheet 3 of 3

FIGURE NUMBER

Figure 8-6-1

Annex B Community Conservation Index

B.1.1 The Community Conservation Index (CCI) (Ref. 25) 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 (Ref. 38, Ref. 39, Ref. 40). Conservation Scores assigned to individual species vary from 1 to 10, as detailed in Table B1. The derived CCI scores generally vary from 0 to >20 and are detailed in Table B2 which provides a guide to interpreting CCI scores.

Table B1: Conservation Scores from the Community Conservation Index (Ref. 25)

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 B2: General Guide to CCI Scores (Ref. 25)

CCI Score	Description	Interpretation
0 to 5.0	Reaches supporting only common species and/or community of low taxon richness.	Low conservation value
>5.0 to 10.0	Reaches supporting at least one species of restricted distribution and/or a community of moderate taxon richness.	Moderate conservation value
>10.0 to 15.0	Reaches supporting at least one uncommon species, or several species of	Fairly high conservation value

CCI Score	Description	Interpretation
	restricted distribution and/or a community of high taxon richness.	
>15.0 to 20.0	Reaches 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	Reaches supporting several rarities, including species of national importance and/or a community of very high taxon richness	Very high conservation value

Annex C Lotic-Invertebrate Index of Flow Evaluation

C.1.1 The Lotic-Invertebrate Index for Flow Evaluation (LIFE) provides an assessment of the impact of variable flows on benthic macroinvertebrate communities. Under the assessment, individual species of aquatic macroinvertebrates are assigned to a flow group varying from I to VI, as detailed in Table C1. The LIFE score for a macroinvertebrate sample is then derived (mean of individual scores) from individual species scores and abundances, as detailed in Tables C2 and C3. LIFE scores for a macroinvertebrate sample ranges from 1 to 12, where highest scores describe communities adapted to rapid flows.

Table C1: Flow Groups Used to Derive LIFE Scores (Ref. 27)

LIFE Score Group	Description	Mean Current Velocity
I	Taxa primarily associated with rapid flows.	Typically >100cm.s^{-1}
II	Taxa primarily associated with moderate to fast flows.	Typically 20 to 100cm.s^{-1}
III	Taxa primarily associated with slow or sluggish flows.	Typically <20cm.s^{-1}
IV	Taxa primarily associated with (usually slow) and standing waters.	
V	Taxa primarily associated with standing waters.	
VI	Taxa frequently associated with drying or drought impacted sites.	

Table C2: Abundance Categories Used to Derive LIFE Scores (Ref. 27)

Abundance Category	Description
A	1 to 9
B	10 to 99
C	100 to 999
D	1000 to 9999
E	> 10000

Table C3: A Guide to Interpreting LIFE Scores (Ref. 27)

Flow groups	Abundance categories			
	A	**B**	**C**	**D/E**
I	9	10	11	12
II	8	9	10	11
III	7	7	7	7
IV	6	5	4	3
V	5	4	3	2
VI	4	3	2	

Annex D Proportion of Sediment-Sensitive Invertebrates

D.1.1 The Proportion of Sediment-sensitive Invertebrates (PSI) index allows an assessment of the extent to which a water body is composed of, or covered by, fine sediments. This follows the method stated in Ref. 28 Under this system, individual species of aquatic macroinvertebrates are assigned a Fine Sediment Sensitivity Rating (FSSR) as detailed in Table D1, and abundance rating based on LIFE scores as detailed in Table D2. The PSI score for the aquatic macroinvertebrate sample is then derived from the individual species scores and abundances, as detailed in Table D3. The PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample and ranges from 0 to 100, with low scores corresponding to water bodies with high fine sediment cover.

Table D1: Fine Sediment Sensitivity Rating (FSSR) Groups Used to Derive PSI Scores (Ref. 28)

FSSR group	Description
A	Highly sensitive
B	Moderately insensitive
C	Moderately insensitive
D	Highly insensitive

Table D2: Abundance Categories Used to Derive PSI Scores (Ref. 28)

FSSR group	Abundance			
	1-9	10-99	100-999	>999
A	2	3	4	5
B	2	3	4	5
C	1	2	3	4
D	1	2	3	4

Table D3: Interpretation of PSI Scores (Ref. 28)

PSI	Description
81-100	Minimally sedimented
61-80	Slightly sedimented
41-60	Moderately sedimented
21-40	Sedimented
0-20	Heavily sedimented

Annex E Whalley, Hawkes, Paisely and Trigg (WHPT) Metric

E.1.1 There are approximately 4,000 species of aquatic macroinvertebrates in the British Isles. To simplify the analysis of the samples and the data, only the major types (taxa), mostly at the family taxonomic level, have been identified. A key piece of information is the number of different taxa at a reach. 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).

E.1.2 The WHPT scoring system (Ref. 29) is based upon the sensitivity of macroinvertebrate families to organic pollution. It replaces the Biological Monitoring Working Party (BMWP) system (Ref. 41) previously used in the UK.

E.1.3 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 Reach, as in the BMWP scoring system, the WHPT system also uses another type of information, this being the abundances of different scoring taxa.

E.1.4 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 [PS] is then assigned to each taxa, depending on the taxa sensitivity and abundances recorded.

E.1.5 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; and

c. ASPT.

E.1.6 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.

E.1.7 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 of watercourse are dependent on the quality and diversity of habitat, natural water chemistry

(associated with, e.g. geology, distance from source), altitude, gradient, time of year the sample was taken and other factors.

Annex F Macroinvertebrate Taxa List

Table F1: Spring field survey aquatic macroinvertebrates taxa list

	Species	WHPT score (presence only)	Conservation Score	Fleet Drain AAA887	Fenwick Parish Drain (east) AAA890	Fenwick Parish Drain (west) AAA890	Minor Ditch 9	Fenwick Common Drain (west) AAA897	Minor Ditch 12	Ellwood and Fenwick Grange Farm AAA945	Hawk House Green Dike AAA948	Mill Dike AAA956	Wrancarr Drain AAA955
Flatworms													
Dendrocoelidae	*Dendrocoelum lacteum*	3.0	2	2									1
Planariidae	*Polycelis nigra/tenuis*	4.9	1	7									
Dugesiidae	*Schmidtea lugubris/polychroa*	2.9	2				1						
Snails													
Lymnaeidae	Lymnaeidae (juvenile/damaged)	3.3		1					145	15	8	649	
Lymnaeidae	*Stagnicola sp.*	3.3			18								
Lymnaeidae	*Lymnaea stagnalis*	3.3	1				15						
Lymnaeidae	*Radix auricularia*	3.3	2				10						
Lymnaeidae	*Ampullaceana balthica*	3.3	1	1	16	1	30	12	10	20	9	13	
Hydrobiidae	*Potamopyrgus antipodarum*	4.2	1				1	120	7				300
Bithyniidae	*Bithynia tentaculata*	3.7	1				3						
Physidae	Physidae (juvenile/damaged)	2.4					1						8

	Species	WHPT score (presence only)	Conservation Score	Fleet Drain AAA887	Fenwick Parish Drain (east) AAA890	Fenwick Parish Drain (west) AAA890	Minor Ditch 9	Fenwick Common Drain (west) AAA897	Minor Ditch 12	Ellwood and Fenwick Grange Farm AAA945	Hawk House Green Dike AAA948	Mill Dike AAA956	Wrancarr Drain AAA955
Physidae	*Aplexa hypnorum*	2.4	5							1			
Physidae	*Physa fontinalis*	2.4	1										4
Physidae	*Physella sp.*	2.4									2		
Succineidae	*Succinea sp.*	-		1			1						
Planorbidae	Planorbidae (juvenile/damaged)	3.1			12		10		2				
Planorbidae	*Planorbis sp.*	3.1		15				90					
Planorbidae	*Planorbis carinatus*	3.1	1				20						
Planorbidae	*Planorbis planorbis*	3.1	1	25					1				
Planorbidae	*Anisus sp.*	3.1		50				20	35	90	5	553	
Planorbidae	*Anisus vortex*	3.1	1	2			30			5		11	
Planorbidae	*Anisus leucostoma*	3.1	4	25	6								
Limpets and mussels													
Sphaeriidae	Sphaeriidae (juvenile/damaged)	3.9					3						
Sphaeriidae	*Sphaerium sp.*	3.9											20
Sphaeriidae	*Sphaerium corneum*	3.9	1										3
Sphaeriidae	*Pisidium/Euglesa/Odhneripisidium*	3.9				3		35	8	3	25		15

	Species	WHPT score (presence only)	Conservation Score	Fleet Drain AAA887	Fenwick Parish Drain (east) AAA890	Fenwick Parish Drain (west) AAA890	Minor Ditch 9	Fenwick Common Drain (west) AAA897	Minor Ditch 12	Ellwood and Fenwick Grange Farm AAA945	Hawk House Green Dike AAA948	Mill Dike AAA956	Wrancarr Drain AAA955
Worms													
Oligochaeta	Oligochaeta	2.7		20	125	108	15	8	10	5	41	5	4
Glossiphoniidae	*Glossiphonia heteroclita*	3.2	4										10
Erpobdellidae	Erpobdellidae (juvenile/damaged)	3.1			1								
Mites													
Oribatei	*Oribatei*	-							1				
Crustaceans													
Ostracoda		-											2
Copepoda		-										4	
Cladocera		-										2360	
Gammaridae	*Gammarus sp.*	4.4							40				210
Gammaridae	*Gammarus pulex*	4.4	1				16	1	30				180
Crangonyctidae	*Crangonyx sp. (floridanus/pseudogracilis)*	3.9						40	180	40	11	1402	15
Asellidae	Asellidae	2.8							90			6	
Asellidae	*Asellus sp./Proasellus sp.*	2.8					3		17			31	

	Species	WHPT score (presence only)	Conservation Score	Fleet Drain AAA887	Fenwick Parish Drain (east) AAA890	Fenwick Parish Drain (west) AAA890	Minor Ditch 9	Fenwick Common Drain (west) AAA897	Minor Ditch 12	Ellwood and Fenwick Grange Farm AAA945	Hawk House Green Dike AAA948	Mill Dike AAA956	Wrancarr Drain AAA955
Asellidae	*Asellus aquaticus*	2.8	1	390	125	689	60	30	102	40	30	55	80
Asellidae	*Proasellus meridianus*	2.8	3					1	4	6		10	
Mayflies													
Baetidae	*Baetis sp.*	5.5											25
Baetidae	*Baetis vernus*	5.5	3										40
Baetidae	*Centroptilum luteolum*	5.5	4										2
Baetidae	*Cloeon dipterum*	5.5	1							1	24		
Damselflies													
Calopterygidae	*Calopteryx splendens*	6.0	1										2
True bugs													
Veliidae	*Velia sp.*			2							2		10
Veliidae	*Velia caprai*		2					4					
Nepidae	*Nepa cinerea*	2.9	3	1						1			
Corixidae	Corixidae (nymph/damaged)	3.8				3	15					3	1
Corixidae	*Corixa punctata*	3.8	1								1		
Corixidae	*Sigara dorsalis*	3.8	1				1						

	Species	WHPT score (presence only)	Conservation Score	Fleet Drain AAA887	Fenwick Parish Drain (east) AAA890	Fenwick Parish Drain (west) AAA890	Minor Ditch 9	Fenwick Common Drain (west) AAA897	Minor Ditch 12	Ellwood and Fenwick Grange Farm AAA945	Hawk House Green Dike AAA948	Mill Dike AAA956	Wrancarr Drain AAA955
Corixidae	*Sigara fossarum*	3.8	4										1
Corixidae	*Sigara lateralis*	3.8	2			1							
Notonectidae	Notonectidae (nymph/damaged)	3.4										2	
Notonectidae	*Notonecta sp.*	3.4											1
Beetles													
Haliplidae	Haliplidae (larvae/damaged)	3.6							5				
Haliplidae	*Haliplus lineaticollis*	3.6	1						1	1		8	
Gyrinidae	Gyrinidae (larvae/damaged)	8.2		1			2						
Gyrinidae	*Gyrinus substriatus*	8.2	1				1						
Dytiscidae	Dytiscidae (larvae/damaged)	4.5				1	1	2	1		1	9	
Dytiscidae	*Hydroporus sp.*	4.5							1				
Dytiscidae	*Hydroporus palustris*	4.5	1						2		3	2	
Dytiscidae	*Hydroporus planus*	4.5	2					2	4		6	16	
Dytiscidae	*Hydroporus tessellatus*	4.5	2	1				1	1	1	2	3	

	Species	WHPT score (presence only)	Conservation Score	Fleet Drain AAA887	Fenwick Parish Drain (east) AAA890	Fenwick Parish Drain (west) AAA890	Minor Ditch 9	Fenwick Common Drain (west) AAA897	Minor Ditch 12	Ellwood and Fenwick Grange Farm AAA945	Hawk House Green Dike AAA948	Mill Dike AAA956	Wrancarr Drain AAA955
Dytiscidae	*Agabus bipustulatus*	4.5	1	1					1	4		6	
Dytiscidae	*Ilybius sp.*	4.5									1		
Dytiscidae	*Ilybius fuliginosus*	4.5	1	1									
Dytiscidae	*Ilybius quadriguttatus*	4.5	5							1			
Hydrophilidae	Hydrophilidae (larvae/damaged)	6.2					1		3	5			
Hydrophilidae	*Helophorus sp.*	6.2									1	7	1
Hydrophilidae	*Helophorus aequalis*	6.2	1		1	1					2	9	
Hydrophilidae	*Helophorus brevipalpis*	6.2	1	5		1	40	1	1	4	7	39	1
Hydrophilidae	*Helophorus minutus*	6.2	2								1		
Hydrophilidae	*Hydrobius fuscipes*	6.2	1					5					
Hydrophilidae	*Anacaena globulus*	6.2	1							3		4	
Hydrophilidae	*Anacaena limbata*	6.2	1					1					
Hydrophilidae	*Anacaena lutescens*	6.2	3							3		1	

	Species	WHPT score (presence only)	Conservation Score	Fleet Drain AAA887	Fenwick Parish Drain (east) AAA890	Fenwick Parish Drain (west) AAA890	Minor Ditch 9	Fenwick Common Drain (west) AAA897	Minor Ditch 12	Ellwood and Fenwick Grange Farm AAA945	Hawk House Green Dike AAA948	Mill Dike AAA956	Wrancarr Drain AAA955
Hydraenidae	*Ochthebius minimus*	8.9	1	1									
Hydraenidae	*Hydraena sp.*	8.9										1	
Elmidae	*Elmis aenea*	6.6	1										1
Curculionidae	Curculionidae	-		1				1					1
Alderflies													
Sialidae	Sialidae (juvenile/damaged)	4.3											
Sialidae	*Sialis sp.*	4.3											2
Sialidae	*Sialis lutaria*	4.3	1			32							3
Caddisflies													
Hydropsychidae	Hydropsychidae (juvenile/damaged)	6.6											1
Limnephilidae	Limnephilidae (juvenile/damaged)	6.2						1					4
Limnephilidae	*Limnephilus lunatus*	6.9	1				1	4			35	1	5
Leptoceridae	*Athripsodes cinereus*	6.7	1										4
Trueflies													
Chironomidae	Chironomidae (damaged/pupea)	1.1				3							

	Species	WHPT score (presence only)	Conservation Score	Fleet Drain AAA887	Fenwick Parish Drain (east) AAA890	Fenwick Parish Drain (west) AAA890	Minor Ditch 9	Fenwick Common Drain (west) AAA897	Minor Ditch 12	Ellwood and Fenwick Grange Farm AAA945	Hawk House Green Dike AAA948	Mill Dike AAA956	Wrancarr Drain AAA955
Chironomidae	Tanypodinae	1.1		25	125	120		16	86	2	72	39	3
Chironomidae	Orthocladiinae	1.1		1			7						55
Chironomidae	Chironomini	1.1		25	125	75	12	3	57	22	4	99	
Chironomidae	Tanytarsini	1.1					12	4	91	2	64		3
Chironomidae	Prodiamesinae	1.1						1	14				
Tipulidae	*Tipula sp.*	5.9			1						2		
Pediciidae	Dicranota sp.	5.9											3
Simuliidae	Simuliidae (damaged/juvenile)	5.8											230
Simuliidae	Simulium sp.												30
Dixidae	Dixella sp.	7.0					1						
Psychodidae		4.4			1	1		1	4		2		1
Ceratopogonidae		5.5											2
Culicidae	Culicidae	2.0		1		5				1		24	
Dolichopodidae		4.9				1							
Sciomyzidae		3.4						2	2	6	7	1	
Other Taxa													
Collembola		-			4				2	1		1	

	WHPT score (presence only) Species	Conservation Score	Fleet Drain AAA887	Fenwick Parish Drain (east) AAA890	Fenwick Parish Drain (west) AAA890	Minor Ditch 9	Fenwick Common Drain (west) AAA897	Minor Ditch 12	Ellwood and Fenwick Grange Farm AAA945	Hawk House Green Dike AAA948	Mill Dike AAA956	Wrancarr Drain AAA955
Diptera	-					2	2	1				

Table F2: Autumn Field Survey Aquatic Macroinvertebrates Taxa List

Family	Species	Fleet Drain	Minor Ditch 9	Fenwick Common Drain (West)	Hawkhouse Green Dike	Wrancarr Drain
Flatworms						
Dendrocoelidae	*Dendrocoelum lacteum*					1
Dugesiidae	Dugesiidae (juvenile/damaged)		1			
Snails						
Lymnaeidae	Lymnaeidae (juvenile/damaged)	1		5	33	
Lymnaeidae	*Stagnicola sp.*		1			
Lymnaeidae	*Lymnaea stagnalis*		13			
Lymnaeidae	*Radix balthica*	1	5	26	100	
Hydrobiidae	*Potamopyrgus antipodarum*	35		1	187	
Bithyniidae	*Bithynia tentaculata*	1	11			
Physidae	Physidae (juvenile/damaged)				6	
Physidae	*Physella sp.*				13	
Succineidae	*Succinea sp.*		1			
Planorbidae	Planorbidae (juvenile/damaged)	2				
Planorbidae	*Planorbarius corneus*		10			
Planorbidae	*Planorbis sp.*	14	34	3		
Planorbidae	*Planorbis planorbis*	1	2	10		
Planorbidae	*Anisus sp.*	5		10	2	
Planorbidae	*Anisus vortex*	7	30			
Limpets and mussels						
Sphaeriidae	Sphaeriidae (juvenile/damaged)				4	

Family	Species	Fleet Drain	Minor Ditch 9	Fenwick Common Drain (West)	Hawkhouse Green Dike	Wrancarr Drain
Sphaeriidae	*Sphaerium sp.*					2
Sphaeriidae	*Pisidium sp.*			126	12	25
Sphaeriidae	*Musculium lacustre*			84		
Worms						
Oligochaeta	Oligochaeta	3		15	30	40
Leeches						
Erpobdellidae	Erpobdellidae (juvenile/damaged)		1	2		
Mites						
Hydracarina	Hydracarina	1				
Oribatei	*Oribatei*					8
Crustaceans						
Gammaridae	*Gammarus sp.*					248
Gammaridae	*Gammarus pulex/fossarum agg.*					186
Gammaridae	*Gammarus pulex*					186
Crangonyctidae	*Crangonyx sp. (floridanus/pseudogracilis)*			14	1	
Asellidae	Asellidae	12		32	18	7
Asellidae	*Asellus aquaticus*	19	6	15	20	5
Mayflies						
Baetidae	Baetidae (juvenile/damaged)	1				6
Baetidae	*Baetis sp.*					85
Baetidae	*Baetis vernus*					73
Damselflies						
Coenagrionidae	Coenagrionidae (juvenile/damaged)	3	4			
Calopterygidae	*Calopteryx sp.*					1

Family	Species	Fleet Drain	Minor Ditch 9	Fenwick Common Drain (West)	Hawkhouse Green Dike	Wrancarr Drain
Calopterygidae	*Calopteryx splendens*					2
Dragonflies						
Aeshnidae	*Aeshna sp.*		1			
True bugs						
Gerridae	Gerridae (nymph/damaged)	1				
Gerridae	*Gerris lacustris*	9				
Veliidae	*Velia caprai*				1	
Nepidae	*Nepa cinerea*			1		
Corixidae	*Callicorixa praeusta*	5				
Corixidae	*Hesperocorixa sahlbergi*	12				
Corixidae	*Sigara lateralis*	1				
Notonectidae	*Notonecta glauca*	1	1			
Beetles						
Haliplidae	*Haliplus lineaticollis*				1	
Gyrinidae	*Gyrinus substriatus*	7				
Dytiscidae	Dytiscidae (larvae/damaged)				7	
Dytiscidae	*Hygrotus inaequalis*	1				
Dytiscidae	*Hygrotus parallelogrammus*		1			
Dytiscidae	*Hydroporus palustris*	2			1	
Dytiscidae	*Hydroporus planus*	4				
Dytiscidae	*Hydroporus tesselatus*	1				

Family	Species	Fleet Drain	Minor Ditch 9	Fenwick Common Drain (West)	Hawkhouse Green Dike	Wrancarr Drain
Dytiscidae	*Agabus bipustulatus*	4	1			
Dytiscidae	*Agabus nebulosus*	2				
Dytiscidae	*Ilybius fuliginosus*	1				
Dytiscidae	*Rhantus suturalis*	5	2			
Hydrophilidae	*Helophorus sp.*	8	1			
Hydrophilidae	*Anacaena limbata*	1				
Hydraenidae	*Ochthebius minimus*	5				
Elmidae	*Elmis aena*					5
Elmidae	*Oulimnius sp.*					1
Curculionidae	Curculionidae			1		
Alderflies						
Sialidae	Sialidae (juvenile/damaged)					
Sialidae	*Sialis lutaria*					9
Caddisflies						
Hydropsychidae	*Hydropsyche angustipennis*					1
Trueflies						
Chironomidae	Chironomidae (damaged/pupea)			3		1
Chironomidae	Tanypodinae	18	1	76	56	4
Chironomidae	Orthocladiinae			21		3
Chironomidae	Chironomini	21	1		24	
Chironomidae	Tanytarsini				7	
Pediciidae	*Dicranota* sp.					6
Limoniidae	Limoniidae				6	

Family	Species	Fleet Drain	Minor Ditch 9	Fenwick Common Drain (West)	Hawkhouse Green Dike	Wrancarr Drain
Simuliidae	Simuliidae (damaged/juvenile)					4
Simuliidae	*Simulium lundstromi*					1
Dixidae	*Dixa nebulosa*					1
Dixidae	*Dixella* sp.	4				
Psychodidae		1			12	
Culicidae	Culicidae	2		15		
Dolichopodidae					1	
Sciomyzidae		2			1	
Other Taxa						
Lepidoptera			1	3		

Annex G Macrophyte Taxa List

Table G1: Field Survey Macrophyte List

				Fleet Drain AAA887		Minor Ditch 2 Fenwick Parish Drain (west) AAA890		Minor Ditch 4 Fenwick Parish Drain (west) AAA890		Minor Ditch 9		Fenwick Common Drain (west) AAA897		Minor Ditch 12 Fenwick Common Drain (east) AAA897		Ellwood and Fenwick Grange drain AAA945		Hawkhouse Green Dike AAA948		Mill Dike AAA956		Wrancarr Drain AAA955	
				Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks
Common name	**Latin name**		**Status**																				
Common water plantain	Alisma plantago aquatica	Common water plantain (Alisma plantago aquatica)	Least concern									R		R				R				R	
Cow's parsley	Anthriscus sylvestris	Cow's parsley (Anthriscus sylvestris)	Least concern						Y										Y				
Fools watercress	Apium nodiflorum	Fools watercress (Apium nodiflorum)	Least concern															R				R	
Water starwort	Callitriche agg.	Water starwort (Callitriche agg.)	n/a											F						R			
Various-leaved water starwort	Callitriche platycarpa	Various-leaved water starwort (Callitriche platycarpa)	Least concern					R				O				R		R					

				Fleet Drain AAA887		Minor Ditch 2 Fenwick Parish Drain (west) AAA890		Minor Ditch 4 Fenwick Parish Drain (west) AAA890		Minor Ditch 9		Fenwick Common Drain (west) AAA897		Minor Ditch 12 Fenwick Common Drain (east) AAA897		Ellwood and Fenwick Grange drain AAA945		Hawkhouse Green Dike AAA948		Mill Dike AAA956		Wrancarr Drain AAA955	
				Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks
Common name	**Latin name**		**Status**																				
Wavy bittercress	Cardamine flexuosa	Wavy bittercress (Cardamine flexuosa)	Least concern								Y												
False fox-sedge	Carex otrubae	False fox-sedge (Carex otrubae)	Least concern						Y				Y								Y				
Thistle	Cirsium sp.	Thistle (Cirsium sp.)	n/a						Y														
Hawthorn	Crataegus sp.	Hawthorn (Crataegus sp.)	n/a				Y		Y				Y		Y		Y		Y		Y		Y
Canadian waterweed	Elodea canadensis	Candian waterweed (Elodea canadensis)	Schedule 9 WAC Act 1981																			R	
Algae	Enteromorpha	Algae (Enteromorpha)	Least concern							O													
Willowherb	Epilobium hirsutum	Willowherb (Epilobium hirsutum)	Least concern								Y		Y								Y		
Field horsetail	Equisetum arvense	Field horsetail (Equisetum arvense)	Least concern						Y								Y						

				Fleet Drain AAA887		Minor Ditch 2 Fenwick Parish Drain (west) AAA890		Minor Ditch 4 Fenwick Parish Drain (west) AAA890		Minor Ditch 9		Fenwick Common Drain (west) AAA897		Minor Ditch 12 Fenwick Common Drain (east) AAA897		Ellwood and Fenwick Grange drain AAA945		Hawkhouse Green Dike AAA948		Mill Dike AAA956		Wrancarr Drain AAA955	
				Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks
Common name	**Latin name**		**Status**																				
Meadowsweet	Filipendula ulmaria	Meadowsweet (Filipendula ulmaria)	Least concern								Y		Y										
	Galium sp.		n/a												Y						Y		
Reed Sweet Grass	Glyceria maxima	Reed Sweet Grass (Glyceria maxima)	Least concern	O	F					F	D					R	F						
Common hogweed	Heracleum sphondylium	Common hogweed (Heracleum sphondyliu m)	Least concern				Y		Y				Y		Y		Y		Y		Y		Y
Common duckweed	Lemna minor	Common duckweed (Lemna minor)	Least concern	R						O													
Creeping jenny	Lysimachia nummularia	Creeping jenny (Lysimachia nummularia)	Least concern		Y																		
Spiked water-milfoil	Myriophyllum spicatum	Spiked water-milfoil (Myriophyll	Least concern																			R	

				Fleet Drain AAA887		Minor Ditch 2 Fenwick Parish Drain (west) AAA890		Minor Ditch 4 Fenwick Parish Drain (west) AAA890		Minor Ditch 9		Fenwick Common Drain (west) AAA897		Minor Ditch 12 Fenwick Common Drain (east) AAA897		Ellwood and Fenwick Grange drain AAA945		Hawkhouse Green Dike AAA948		Mill Dike AAA956		Wrancarr Drain AAA955	
				Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks
Common name	**Latin name**		**Status**																				
		um spicatum)																					
Amphibious bistort	Persicaria amphibia	Amphibious bistort (Persicaria amphibia)	Least concern	R							F												
Reed canary grass	Phalaris arundinacea	Reed canary grass (Phalaris arundinacea)	Least concern	O								O		O				R	Y				
Rough meadow-grass	Poa trivialis	Rough meadow-grass (Poa trivialis)	Least concern																		Y		
Oak	Quercus sp.	Oak (Quercus sp.)	n/a				Y						Y		Y		Y				Y		Y
Meadow buttercup	Ranunculus acris	Meadow buttercup (Ranunculus acris)	Least concern																		Y		
Stream water-crowfoot	Ranunculus penicillatus	Stream water-crowfoot (Ranunculu	Least concern																			R	

				Fleet Drain AAA887		Minor Ditch 2 Fenwick Parish Drain (west) AAA890		Minor Ditch 4 Fenwick Parish Drain (west) AAA890		Minor Ditch 9		Fenwick Common Drain (west) AAA897		Minor Ditch 12 Fenwick Common Drain (east) AAA897		Ellwood and Fenwick Grange drain AAA945		Hawkhouse Green Dike AAA948		Mill Dike AAA956		Wrancarr Drain AAA955	
				Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks	Channel	Banks
Common name	**Latin name**		**Status**																				
		s penicillatus)																					
Creeping buttercut	Ranunculus repens	Creeping buttercut (Ranunculus repens)	Least concern																Y				
Dock	Rumex sp.	Dock (Rumex sp.)	n/a		Y		Y						Y		Y		Y		Y		Y		Y
Wood dock	Rumex sanguineus	Wood dock (Rumex sanguineus)	Least concern						Y														
Willow	Salix sp.	Willow (Salix sp.)	n/a		Y														Y				
Bittersweet	Solanum dulcamara	Bittersweet (Solanum dulcamara)	Least concern		Y														Y				
Branched bur-reed	Sparganium erectum	Branched bur-reed (Sparganium erectum)	Least concern																			F	
Nettle	Urtica dioica	Nettle (Urtica dioica)	Least concern		Y		Y		Y		Y		Y		Y		Y				Y		Y

Annex H Site Photographs

Plate H1 – Fleet Drain AAA887

Plate H2 – Minor Ditch 2 Fenwick Parish Drain (east) AAA890

Plate H3 – Minor Ditch 4 Fenwick Parish Drain (west) AAA890

Plate H4 – Minor Ditch 8 (Dry)

Plate H5 – Minor Ditch 9

Plate H6 – Minor Ditch 10 (Dry)

Plate H7 – Fenwick Common Drain (west) AAA887

Plate H8 – Minor Ditch 12 Fenwick Common Drain (east) AAA887

Plate H9 – Ellwood and Fenwick Grange Drain AAA945

Plate H10 – Hawkhouse Green Drain AAA948

Plate H11 – Mill Dike AAA956

Plate H12 – Wrancarr Drain AAA955

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