

Steeple Renewables Project

Appendix 7.11: Aquatic invertebrates report

Issuing office

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1 Introduction

1.1 This report is a technical appendix to accompany the Preliminary Environmental Information Report (PEIR) Chapter 7: Ecology and Biodiversity and includes the following information:

- Methods.
- Results including relevant Figures, and summary interpretation.

1.2 For ease of reference the following will be terms referred to within this report to define areas within the Site:

- Proposed Solar Areas: areas within the Site which have been provisionally identified for locating the solar panels, battery storage and other associated infrastructure.
- Biodiversity Mitigation Areas (Eastern and Western): areas of the Site that would not be used for development, and provisionally identified for use as biodiversity mitigation and enhancement.
- The Site: collectively including the Proposed Solar Areas and Biodiversity Mitigation Areas.

2 Methods

Desk study

- 2.1 Several designated sites with features of interest / qualifying features that include aquatic invertebrates are located within the search area for designated sites. Further detail can be found within the baseline report for designated sites (Appendix 7.2 of the Ecology PEIR Chapter).
- 2.2 A review of publicly available on-line aerial photographs (Google Earth Pro) and Ordnance Survey maps (Bing Maps 1:25,000) was undertaken in March 2024 to gather information on potential hydrological connectivity of watercourses within the Site.
- 2.3 A data search for records of protected and notable species, including aquatic invertebrates, within 2 km of the Site was requested from Nottinghamshire Biological and Geological Records Centre (NBGRC) and Lincolnshire Environmental Records Centre (LERC) in March 2024.
- 2.4 Other sources such as the Nottinghamshire Local Biodiversity Action Plan (LBAP) have also been reviewed to identify invertebrate species of local importance (Nottinghamshire Biodiversity Action Group, 2020). The Nottinghamshire Local Wildlife Site criteria (Nottinghamshire Local Sites Plan, 2018) allow for the following assemblages of water beetles and water bugs to qualify a site for selection as a Local Wildlife Site (LWS):
- Criterion 1: Any site at which a Near Threatened or Nationally Scarce species of water beetle, or a Rare¹ or Scarce species of waterbug, has been recorded;
 - Criterion 2: Any site at which at least 3 'Local A' and 5 'Local B' species of water beetle or 2 'Local A' and 4 'Local B' species of water bug have been recorded;
 - Criterion 3: Any site at which a 'Local A' or 'Local B' species which has been found at 4 or fewer sites in Nottinghamshire has been recorded';
 - Criterion 4: Any site at which at least 32 species of water beetle or 15 species of water bug have been recorded.

Field survey

Targeted survey for aquatic invertebrates

- 2.5 Selected wet drains (ED5, ED11, FD5, FD1, FD8, GD2, and HD5a - as shown on Figure 7.11.1) were surveyed on 03 and 04 June 2024 by Dr Jim Fairclough (Principal Ecologist, BSG Ecology) and Emma Bruce (Ecologist, EJB Ecology). Ditches FD8, GD2 and HD5a are designated as LWSs due to the presence of notable aquatic invertebrates and were selected for sampling to collate further data on their LWS citations. Ditches FD8 and GD2 form the 'Thornhill Lane Drain, Littleborough' LWS and ditch HD5a forms part of the 'Mother Drain, Upper Ings' LWS (refer to Appendix 7.2: Designated Sites for further details). Other wet ditches across the Site were selected for sampling based on the water levels within the drain, and those that supported aquatic plant communities that were considered potentially suitable for notable aquatic invertebrates.
- 2.6 A survey comprising 3-minutes of netting using a 1 mm mesh hand net was carried out in each stretch of ditch in order to standardise the survey approach. The survey included a separate search (timed at 1 minute) to look for taxa (e.g. caddis-flies and leeches) fixed to woody debris / rocks and to sample surface water taxa such as whirligig beetles, pond skaters and water crickets.
- 2.7 Invertebrates were separated from detritus and bed material in the field and preserved immediately in 70% Industrial Methylated Spirit (IMS) for subsequent laboratory analysis.

¹ Rare = a species recorded in 30 hectads or fewer (water bugs only). Scarce = a species recorded in 31-100 hectads (water bugs only). Local A = a species recorded in 101-200 hectads. Local B = a species recorded in 201-400 hectads. Common = a species recorded in 401+ hectads. Where a hectad is a 10 km x 10 km grid square. According to Nottinghamshire Local Sites Plan (2018)

- 2.8 Habitat characteristics of each drain surveyed were recorded at the time of the survey, which included for example observations of: water and silt depths; evidence of pollution; presence of waterfowl, fish and amphibians; and likely source water and inflow/outflow points. A photographic record of each of the drains was also made.
- 2.9 As part of the survey, an appraisal of the composition of the plant community of each drain was made. All aquatic and marginal plants were identified to species-level in the field using the most up-to-date identification keys available.
- 2.10 Table 7.11.1 shows the weather conditions on the days of survey and gives details of the weather in the week preceding surveys (as this could influence conditions within the drains).

Table 7.11.1: Weather conditions during invertebrate surveys

| Survey date | Survey type | Survey Effort | Weather conditions |
|--------------|---|---------------|--|
| 03 June 2024 | Targeted survey for aquatic invertebrates | 8 hours | Preceding week: occasional showers, then clearing to dry, calm and warm weather. Max temp. varying between 14 °C and 22°C. Date of Survey: Dry. Gentle breeze, 7/8 cloud cover, max temp. 18°C. |
| 04 June 2024 | Targeted survey for aquatic invertebrates | 8 hours | Preceding week: as above. Date of Survey: Dry. Still to gentle breeze, 7/8 cloud cover, max temp. 15°C. |

Sample Sorting and Identification

- 2.11 Whilst some aquatic invertebrate species could be identified in the field, the majority of specimens were stored in 70% IMS for later identification, using a stereoscopic microscope with the aid of identification literature. For all target groups identification was taken down to species level.

Data Analysis

Pantheon Assemblage Analysis

- 2.12 Identification of the collected invertebrates is ongoing. Upon completion of the identification, the following analysis will be undertaken.
- 2.13 The list of species derived from the aquatic invertebrate surveys will be analysed using the 'Pantheon' database tool developed by Natural England and the Centre for Ecology and Hydrology (Webb *et al.*, 2018). For each species recognised by Pantheon, various attributes relating to associated habitats and resources, assemblage types and habitat fidelity scores are placed against them. Reports can then be generated including those that provide:
- information on each individual species entered into the database;
 - a list of species belonging to different feeding guilds (e.g. xylophagous, saprophagous, nectivorous);
 - a list of species with different associations (e.g. to certain groups of plant, fungi or animal);
 - a summary of the number of species within the sample that have a particular score or fidelity and, if relevant an overall score that provides insight into the quality of the site that the sample has come from; and
 - summary tables that assess where species live and what assemblages they are associated with.
- 2.14 The key function of Pantheon, relevant to this baseline assessment, is the output that that models which assemblage species may be associated with, which can be used to evaluate the relative

importance of a site for its invertebrates. The model considers the habitats and resources used by an invertebrate species at various hierarchical levels, from broad biotopes (e.g. tree associated, wetland, coastal) at the highest level, down to specific habitats (e.g. tall sward and scrub, decaying wood, arboreal, marshland) at a mid-level, and resources (e.g. sapwood & bark decay, heart-rot and fungal fruiting bodies all associated with the decaying wood habitat) at the finest level. The assessment also considers the Invertebrate Species-habitat Information System (ISIS) assemblage types that had previously been developed by Natural England (Drake *et al.*, 2007). The original Specific Assemblage Types (SATs) are therefore carried forward in their original form, although 'Habitats' have replaced the ISIS Broad Assemblage Types (BATs).

- 2.15 SATs include only habitat specific species, which are normally faithful to a single habitat or resource, which are often closely associated with sites of higher conservation value. Analysis of SATs is helpful to inform the determination of the nature conservation value of a site for invertebrates; sites with high-scoring SATs are considered to have good quality invertebrate assemblages.
- 2.16 The original role of ISIS was to guide Natural England on assessing the conservation value of Sites of Special Scientific Interest (SSSI) for their invertebrate assemblages (especially for the purposes of Common Standards Monitoring). This was done by identifying whether an assemblage associated with a site was in a 'favourable condition' (i.e. where it was considered to be of sufficient condition to meet the threshold criteria for an assemblage of SSSI-level value). However, whilst the condition assessment function is still retained within Pantheon, it is not the sole use. Accordingly, the analysis may be used in other situations (e.g. by nature reserve managers or those assessing the effects of a development) to help understand which assemblages (SATs) within a site are likely to be important.
- 2.17 A useful measure of the quality of a site for its invertebrate assemblage is to count and assign scores that are more heavily weighted towards the rarer species. The Species Quality Index (SQI) is a numerical scoring system contained within Pantheon that does exactly this. Each species recorded from a sample is given a Species Quality Score (SQS) based on their conservation status. The SQI is the sum of all SQSs divided by the number of species in that sample. This score is multiplied by 100 to give a three figure value without decimal places (e.g. 100 rather than a 1.00). This SQI score is preferred to the SQS since it eliminates, to a greater extent the effect of recorder effort. Notwithstanding this, sites where little effort has been made to record the common species could result in overly amplified SQI scores. There is presently no published guidance on what SQI score might be classed as 'good' or 'average' as this might vary between habitats and regions (e.g. northern vs. southern England). However, as a general rule of thumb, based on the experience of the assessor, a habitat with an SQI score exceeding 125 is likely to be of some value and merit further consideration.

Personnel

- 2.18 The team for this survey and reporting involved the following personnel:
- Dr Jim Fairclough BSc, PhD, MCIEEM (Principal Ecologist, BSG Ecology): Jim led the field surveys, identified the aquatic invertebrates, and reviewed the technical reporting. He studied invertebrates for his PhD and has worked full-time as a professional ecologist since 2003, during which time he has completed invertebrate surveys and assessment at over 100 development sites. Jim also completed the identification of aquatic invertebrates for the project, which will be reported within Environmental Statement.
 - Emma Bruce MSc, ACIEEM (Senior Ecologist, EJB Ecology): Emma assisted during the field work and botanical recording of each drain during the aquatic invertebrate surveys.
 - Emily McVean BSc, MCIEEM (Senior Ecologist, BSG Ecology): Emily prepared this report with direction from Dr Jim Fairclough. This report was reviewed by Jim Gillespie BSc, PGDiP, MCIEEM (Director, BSG Ecology), who has authored and reviewed ecological assessments for over 25 years for a wide range of large and small EIA projects in the UK and Ireland.

Consideration of Limitations

- 2.19 The surveys were undertaken at the Site during the optimal season and therefore provide a good representation of the invertebrate assemblages likely to be present.

- 2.20 If appropriate, further consideration of limitations with regards to the species identification and analysis of the assemblage will be reported at a later date, once analysis is complete.

3 Results and summary interpretation

Desk study

Designated sites

- 3.1 Further information on designated sites with entomological interest is provided in Appendix 7.2: Designated Sites.
- 3.2 In summary, Mother Drain, Upper Ings LWS is within the Site (Eastern Biodiversity Mitigation Area) and was cited as supporting an assemblage of local species such as water beetle *Limnebius nitidus*, and water bugs *Notonecta maculate* and *Notonecta viridis*.
- 3.3 Thornhill Lane Drain, Littleborough LWS is also within the Site (Eastern Biodiversity Mitigation Area) and cited as supporting 25 water beetle species and 5 water bug species have been recorded from the drain; including water beetles *Agabus uliginosus*, *Agabus didymus*, *Cercyon convexiusculus*, *Graptodytes pictus* and *Laccophilus hyalinus*. Water bugs recorded include Water scorpion *Nepa cinerea* and Water cricket *Velia caprai*.
- 3.4 No designated sites with invertebrate interest exist within the Proposed Solar Areas or the Western Biodiversity Mitigation Area,

Local Biodiversity Action Plan

- 3.5 The following aquatic invertebrate species have been identified as Species of Conservation Concern in the Nottinghamshire LBAP, for which Species Action Plans have been developed (last updated March 2024), which state:
- White-clawed crayfish *Austropotamobius pallipes* - Within Nottinghamshire, White-clawed Crayfish are found in a number of river catchments to the west of the county, primarily those of the River Erewash, the River Leen and the River Maun.
- 3.6 Of these, only white-clawed crayfish is associated with aquatic environments.

Notable records

- 3.7 The NBGRC data indicate that no species considered to be rare, scarce, or local within Nottinghamshire² have been recorded within the Site in the last 20 years – with no records any rare species within the Site from any date. Records made for the Sorby Atlas 2006 (Sorby Natural History Society, 2006), held by NBGRC, indicate that the following scarce species were recorded in the east of Site more than 20 years ago (dating from 1999 to 2002): water beetles *Agabus uliginosus*, *Hygrotus quinquelineatus*, *Hygrotus nigrolineatus*, and *Hydrochus elongatus*. A further 19 species of water beetle and seven species of water bug that are classes as 'Local A' or Local B' have been recorded within the Eastern Mitigation Area and ditch ED11 in the Proposed Solar Area more than 20 years ago (records dating from 1999 to 2002).

Invasive species records

- 3.8 A record of Chinese mitten crab *Eriocheir sinensis* exists on the boundary of the Site, in the Catchwater Drain (offsite section of the drain west of ditch FD6), dating from 2008. Chinese mitten crab records also exist for the surrounding area dating from 2008 to 2023 for the River Trent and nearby drains to the north of the Site.
- 3.9 Zebra mussel *Dreissena polymorpha* has been recorded more than 2 km from the Site in a tributary of the River Idle, near Retford, dating from 2005.

² Rare = a species recorded in 30 hectads or fewer (water bugs only). Scarce = a species recorded in 31-100 hectads (water bugs only). Local A = a species recorded in 101-200 hectads. Local B = a species recorded in 201-400 hectads. Common = a species recorded in 401+ hectads. Where a hectad is a 10 km x 10 km grid square. According to Nottinghamshire Local Sites Plan (2018)

Field survey

- 3.10 Most of the ditches on Site were found to have some suitability to support aquatic invertebrates when wet. Ditches that are potentially of increased suitability, such as those with greater abundance and diversity of aquatic plants, have been surveyed to confirm the aquatic invertebrate baseline and inform appropriate site design and mitigation as necessary.
- 3.11 The results of the targeted aquatic invertebrate survey will be provided at a later stage to give an indication of the relative species diversity within the targeted groups of invertebrates. This report will be updated to present the results and summary interpretation.

Summary of key points

- 3.12 The desk study does not provide any records of rare aquatic invertebrate species at the Site, but that species considered to be scarce in Nottinghamshire may be present within the east of the Site (within the Biodiversity Mitigation Area, ditch GD2, HD5a and in Littleborough Lagoon). Two LWSs that are cited for their aquatic invertebrate interest area within the Eastern Biodiversity Mitigation Area at the Site, and these were sampled during the targeted aquatic invertebrate survey.
- 3.13 The methods employed included kick sampling and searches of ditches, undertaken in favourable weather during the 03 and 04 June 2024, with samples collected for analysis. Analysis of the collected samples is current ongoing, and the results of the targeted aquatic invertebrate surveys are not presented within this report. This report will be updated at a later stage presenting the results and summary interpretation of the aquatic invertebrate surveys.

4 References

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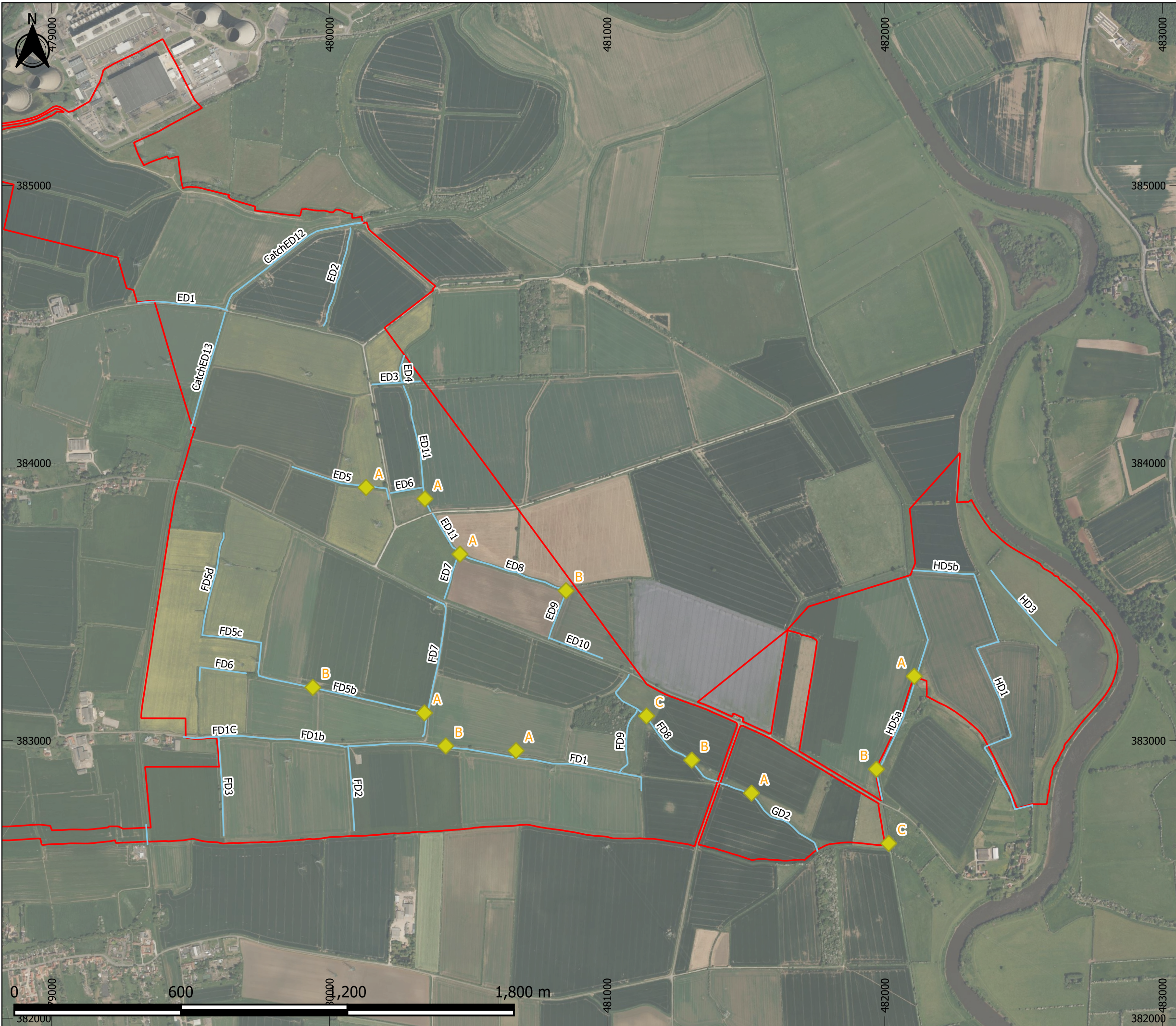
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5 Figures



- Legend
- ▭ Site boundary
 - ◆ Sample locations
 - Ditches



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PROJECT TITLE
STEEPLE RENEWABLES PROJECT

DRAWING TITLE
Figure 7.11.1: Aquatic Invertebrate Sampling Locations

DATE: 13/09/2024 CHECKED: EM SCALE: 1:13,090
 DRAWN: SP APPROVED: DF VERSION: 1.2

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