



BEACON FEN ENERGY PARK

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Appendix 7.4 Great Crested Newt Habitat Suitability and eDNA Report

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Bicker Fen Solar Farm

Great Crested Newt Habitat Suitability Index and eDNA Report

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1. Introduction

1.1 Introduction

- 1.1.1 AECOM was instructed by Low Carbon to undertake ecological surveys to determine the presence or absence of Great Crested Newt *Triturus cristatus* at the proposed Bicker Fen Solar Farm (the Site).
- 1.1.2 The surveys undertaken included:
- a desk study to identify all water bodies within 500m of the Site (the survey area) and a review of Ordnance Survey (OS) mapping to determine whether water bodies outside of the Site (but within the survey area) could be scoped in or scoped out of further assessment;
 - a Habitat Suitability Index (HSI) survey; and
 - an eDNA survey on accessible water bodies on the Site, to determine whether Great Crested Newt were present, or absent.
- 1.1.3 The scope of surveys was restricted to water bodies within the Site boundary and any off-site water bodies under ownership of on-Site landowners. No access to any off-site water bodies within third-party land was undertaken.

1.2 The Scheme

- 1.2.1 The Bicker Fen Solar Farm (see **Figure 1**, Annex A) is a proposed new solar energy farm, co-located with battery storage. The proposals include grid infrastructure to connect the solar farm to the National Grid. The Proposed Scheme would export or import up to 500MW of electricity to and from the National Grid. The proposed generation capacity of the Proposed Scheme means it is a Nationally Significant Infrastructure Project (NSIP) and as such would require a Development Consent Order (DCO).

1.3 Site description

- 1.3.1 The Scheme is located on two sites (termed the 'northern site' and 'southern site' hereafter, where referring to specific locations). The northern site is located to the east of the villages of Howell and Ewerby Thorpe (Ordnance Survey (OS) grid reference TF145474) and the southern site is located in the vicinity of Thorpe Latimer (OS grid reference at TF122404). The location of the Proposed Scheme is presented in **Figure 1** (Annex A). Both sites are within the district of North Kesteven.
- 1.3.2 Both sites are dominated by arable fields with game crop strips, hedgerows, woodland blocks, numerous mature trees and plantation woodland. The Site is surrounded by mainly arable and improved grassland livestock fields.
- 1.3.3 Details of any grid connections between sites and to substations were unknown at the time of writing this report and an assessment of such areas for the location of water bodies within 500m of these areas and presence or absence of Great Crested Newt does not form part of the commissioned scope reported in this document.

1.4 Scope of the report

- 1.4.1 The objective of the surveys, reported in this document, is:
- to identify the presence or absence of Great Crested Newt within the Site;
 - to identify water bodies outside of the Site that will, or may, require further survey;

- to determine whether there are any likely impacts from the Scheme on Great Crested Newt; and
- to determine where further surveys are required.

1.4.2 This report includes the following information:

- relevant legislation and policy;
- methodologies for desk and field-based assessments undertaken in June 2022;
- limitations to the surveys undertaken and any assumptions made as a result of incomplete data;
- survey results; and
- conclusions and recommendations.

1.4.3 This report is intended for Low Carbon, for future inclusion in detailed ecological assessments that follow.

2. Great Crested Newt Ecology

- 2.1.1 Great Crested Newt is one of seven species of amphibian native to Britain and in common with other UK amphibians, they spend the majority of their lives on land, returning to standing water (water bodies and ditches) in the spring in order to breed.

2.2 Effect of temperature on activity

- 2.2.1 Great Crested Newts are ectothermic, meaning that they regulate their temperature through exchange of heat with the external environment. Gaseous exchange (oxygen/carbon dioxide) is achieved largely by absorption through their permeable skins, which must be moist for this purpose. Behaviour and activity are therefore strongly linked to external environmental conditions, especially daily and seasonal cycles. Great Crested Newts are mainly active at night (usually when temperatures exceed 5°C and following recent rainfall). With the onset of winter frosts, Great Crested Newts hibernate. Activity recommences when the frosts subside (which may be as early as January / February), with adults migrating to breeding water bodies. Peak breeding activity is usually between mid-March and mid-May.

2.3 Reproduction

- 2.3.1 Breeding takes place within water bodies with males performing a courtship 'dance' in order to attract and encourage females to take up a spermatophore (a packet containing sperm). Females deposit eggs (up to 200 per season) on the submerged leaves of aquatic broadleaved plants. Each egg is individually sealed for protection from predators within a folded leaf. Adults begin to leave the water bodies around May but may return in order to feed.
- 2.3.2 Larvae hatch after three weeks and feed on small aquatic invertebrates and the larvae/eggs of other amphibians for approximately three months. They metamorphose into land-adapted juveniles called efts and begin to emerge from their water bodies around August.

2.4 Habitat requirements

- 2.4.1 During their terrestrial phase, Great Crested Newts require a complex habitat structure in order to provide both food and shelter. These are most commonly provided by broadleaved woodland, rough or tussocky grassland and scrub habitats. They also require a secure area in which to hibernate. Hibernacula generally need to provide a stable temperature, be free from frost and provide protection from flooding and predation (a hibernaculum is a shelter occupied during the winter by a dormant animal). These requirements are commonly met by log/rubble piles, underground crevices or mammal burrows.
- 2.4.2 For breeding, Great Crested Newts require water bodies that provide suitable protection and food for their developing larvae. Generally, such water bodies should be of relatively good water quality so as to provide a diverse range of invertebrate prey. Unshaded water bodies tend to provide more of the required broadleaf aquatic vegetation, upon which great crested newt eggs can be laid. Water bodies with large fish populations (which can prey on newts) or heavy grazing pressure from waterfowl (which can prey on newts and reduce water quality and egg laying habitat) tend not to support Great Crested Newt. Connectivity between water bodies and good quality terrestrial habitat tend to favour large, viable, populations of Great Crested Newt. In rural landscapes in Britain, such connectivity is often provided by the hedgerow network.

2.5 Great Crested Newt dispersal

- 2.5.1 Great Crested Newts are thought to commonly move between water bodies up to a distance of 250m from each other (Ref 7-1), although there are studies showing Great Crested Newt travelling much further than this (Ref 7-2). The range of Great Crested Newt may be impacted by a range of factors, including the type and quality of habitat surrounding a breeding water

body, the availability of hibernation sites and the presence or absence of barriers to dispersal (e.g. large and busy roads with no features that Great Crested Newt could move through).

3. Legislative and Policy Framework

3.1 Relevant legislative context

3.1.1 All stages of the Great Crested Newt life cycle as well as their habitat are fully protected under Schedule 2 of The Conservation of Habitats and Species Regulations 2017 (as amended) (Ref 7-3). Great Crested Newt is listed on Schedule 5 of the Wildlife & Countryside Act 1981 (Ref 7-4), which affords it protection under Section 9, as amended by the Countryside Rights of Way Act (2000) (Ref 7-5). It is also listed on Annex II and VI of the EC Habitats Directive (Ref 7-6), is included as a Species of Principal Importance in England under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (Ref 7-7) and is a UK Post-2010 Biodiversity Framework (Ref 7-8) species listed on the UK Biodiversity Action Plan. In combination, this makes it an offence to:

- deliberately capture, injure or kill a Great Crested Newt;
- deliberately take or destroy their eggs;
- deliberately, intentionally or recklessly disturb an individual; or
- damage, destroy or obstruct access to any structure which a Great Crested Newt used for shelter or protection.

3.1.2 The protection includes both the breeding water body itself and the terrestrial habitat used for foraging and hibernation, which may be distant from the water body.

3.2 European protected species licencing

3.2.1 Where Great Crested Newt habitat, including their breeding sites and resting places, is present on a site and a development has the potential to cause one or more offences under The Conservation of Habitats and Species Regulations 2017 (as amended) (Ref 7-3), a European Protected Species Licence (EPSL) is required from Natural England to allow the development to proceed. This licence allows the development to proceed with exemption from offences, provided works are undertaken with strict accordance of the terms of the licence. A licence cannot, however, be obtained to provide protection against offences under the Wildlife and Countryside Act, 1981 (as amended) (Ref 7-4).

3.2.2 In determining whether to grant a licence, Natural England must apply the requirements of Regulation 535 of the Regulations (Ref 7-3), these being:

- Regulation 53(2)(e) states: *“a licence can be granted for the purposes of “preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment”.*
- Regulation 53(9)(a) states: *“the appropriate authority shall not grant a licence unless they are satisfied “that there is no satisfactory alternative”.*
- Regulation 53(9)(b) states: *“the appropriate authority shall not grant a licence unless they are satisfied “that the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.”*

3.2.3 A determining authority must also apply these tests when determining a planning/DCO application, where a proposed development is likely to cause an offence under The Conservation of Habitats and Species Regulations 2017 (as amended) (Ref 7-3).

3.2.4 In order for a European Protected Species Licence to be approved by Natural England for works with Great Crested Newt, it must be demonstrated that the proposed development will minimise any potential impacts upon Great Crested Newt and will not be detrimental to the

maintenance of the population of the species concerned at a favourable conservation status in their natural range.

- 3.2.5 Offences can be avoided through the implementation of appropriate mitigation that will minimise the potential for any offences to be committed. Mitigation can include the undertaking of vegetation clearance works at an appropriate time of the year and completing works in accordance with methods that will minimise or avoid potential disturbance or destruction of habitats. In such circumstances it is sensible for works to be completed using Reasonable Avoidance Measures (RAMs).

3.3 Priority species

- 3.3.1 The NERC list of Species of Principal Importance (Ref 7-7) is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act (2006); under Section 40 every public authority (e.g. a local authority or local planning authority) must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.
- 3.3.2 In addition, with regard to those species on the list of Species of Principal Importance listed under Section 41, the Secretary of State must:
- “(a) take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or
 - (b) promote the taking by others of such steps.”
- 3.3.3 The UK Biodiversity Action Plan (UKBAP) was launched in 1994 and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority habitats and species of conservation concern were published and have subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012) (Ref 7-8). The UK Post 2010 Development Framework is relevant in the context of Section 40 of the NERC Act 2006, meaning that Priority Species and Habitats are material considerations in planning. These habitats and species are identified as those of conservation concern due to their rarity or a declining population trend.
- 3.3.4 Great Crested Newt was added to the UK Biodiversity Action Plan (UKBAP) as a priority species in September 2007 and subsequently was included as a Species of Principal Importance in England under Section 41 of the NERC Act (2006) meaning that they are of material consideration in planning.

3.4 Local biodiversity action plan

- 3.4.1 The Scheme is located in Lincolnshire and Great Crested Newt is included as a local priority species on the Lincolnshire Biodiversity Action Plan (Ref 7-9). This plan identifies the following threats to Great Crested Newt populations in Lincolnshire:
- loss of suitable breeding ponds due to lowered water-tables; infilling for development, farming or waste disposal; neglect; natural succession; shading from surrounding vegetation;
 - degradation, loss and fragmentation of terrestrial habitats;
 - introduction of fish into breeding ponds, which eat young newts and eggs; and
 - chemical pollution, eutrophication and toxic effects of agrochemicals.

4. Methods

4.1.1 This section describes the survey methods used to determine the likelihood of Great Crested Newt presence or absence within the survey area, which included:

- a desk study;
- a Habitat Suitability Index (HSI) survey; and
- eDNA surveys.

4.2 Desk study

4.2.1 A desk study was undertaken as part of the Preliminary Ecological Appraisal (PEA) in June 2022. This desk study obtained records of Great Crested Newt within the preceding ten years and within a 2km radius of the Site from Lincolnshire Environmental Records Centre (LERC).

4.2.2 Furthermore, aerial photographs and OS maps were reviewed as part of the PEA to identify water bodies of potential value to Great Crested Newt within 500m of the Site that were not separated by major barriers to Great Crested Newt dispersal (such as main roads and large rivers). The review of aerial photography and mapping included identifying any key routes of potential habitat connectivity to the Site from outside water bodies (e.g. ditches, hedgerows) and significant barriers to Great Crested Newt dispersal (e.g. main roads or rivers).

4.3 Field survey

Habitat Suitability Index (HSI)

4.3.1 The Habitat Suitability Index (HSI) is a measure of habitat suitability, developed by Oldham *et al.* (2000) (Ref 7-10) for evaluating the suitability of water bodies as habitat for Great Crested Newt. Ten habitat features of the water body are assessed in the field and from these data a suitability index is calculated (**Table 4-1**).

4.3.2 A value is recorded for each parameter and combined to determine an index of breeding suitability for Great Crested Newt (**Table 4-1**).

Table 4-1: Great Crested Newt suitability indices and description

Suitability Indices	Suitability Indices Title	Suitability indices Description
(SI1)	Geographic location	Different areas of the UK represent different indices scores
(SI2)	Water body area	The optimum water body size is between 500 and 750m ² .
(SI3)	Water body permanence	The optimal frequency of drying is one year per decade.
(SI4)	Water quality	The presence of indicator organisms (the same that are used to assess running water) is the water quality indicator.
(SI5)	Water body shading	Great Crested Newt occurrence is significantly reduced above a threshold of 75% shade.
(SI6)	Impact of waterfowl	Waterfowl impact on water body vegetation and water turbidity is a negative indicator for Great Crested Newt.
(SI7)	Occurrence of fish	The effect of fish presence is related to the species. Some species can have negative impacts and Great Crested Newt hardly ever coexist with

Suitability Indices	Suitability Indices Title	Suitability indices Description
		larger predatory fish species. Other species (depending on conditions) are not detrimental.
(SI8)	Water body density	Water body densities above four water bodies/km2 are taken as optimal.
(SI9)	Terrestrial habitat	In general, scrub, unimproved grassland, woodland (deciduous and coniferous) and gardens are regarded as being suitable terrestrial habitat, unlike improved pasture, arable and hardstanding. The SI9 is the combination between positive factors (suitable habitat) and negative factors (e.g. inherent in barriers to movement such as roads). The surrounding habitat is scored according to the extent of high-quality terrestrial newt habitat.
(SI10)	Macrophyte content	The highest occurrence of Great Crested Newt is found in water bodies with emergent vegetation cover between 25% and 50% and submerged vegetation between 50% and 75%.

4.3.3 The HSI of a water body is a numerical index which scores water bodies on a scale of between 0 and 1, using a geometric mean of the ten suitability indices, with the following suitability categories for the results:

- <0.5: poor likelihood of presence;
- 0.5 – 0.59: below average likelihood of presence;
- 0.6 – 0.69: average likelihood of presence;
- 0.7 – 0.79: good likelihood of presence; and
- >0.8: excellent likelihood of presence.

4.3.4 Any water body with an HSI score of average or greater, should then be surveyed using eDNA analysis or field-based methods, to determine Great Crested Newt presence or absence.

eDNA laboratory analysis

4.3.5 Water samples were taken from water bodies which were sent off for environmental DNA (eDNA) analysis. This method (eDNA analysis) was used to assess the presence or likely absence of Great Crested Newt DNA from a water sample. This survey methodology is approved by Natural England and it provides evidence of presence or absence of Great Crested Newt (WC1067 Technical Advice Note (Biggs *et al.*, 2014)) (Ref 7-11). Natural England has also issued their standing advice, which includes the recommended protocol for eDNA analysis (Gov.UK, 2015) (Ref 7-12). This requires water samples for eDNA to be taken between the 15 April and the 30 June.

4.3.6 Field surveys strictly followed the protocol set out in the WC1067 Technical Advice Note (Ref 7-11) and to prevent contamination of the samples:

- gloves were worn at all times during the sampling process, and gloves were replaced between sample collection from the water body and pipetting into the sterile sub-sample tubes; and
- samples were collected without entering the water, *i.e.* the surveyor stood only on the water body bank or water body edges. This prevented disturbance of the substrate to limit cross-contamination.

4.3.7 The field sampling protocol consisted of the following steps for each surveyed water body:

- the location of sub-samples was spaced as evenly as possible around the margin of the water body or watercourse. Sub-samples generally targeted areas with potential egg laying substrate (e.g. vegetation) and open water areas which newts may be using for displaying. Prior to sampling, the water column was mixed by gently using a ladle to stir through the entire water column, whilst avoiding disturbing the sediment on the bed of the water body. Sampling of very shallow water (less than 5-10cm deep) was avoided where possible;
 - a new pair of gloves was put on to keep the next stage as uncontaminated as possible;
 - using a clear plastic pipette, approximately 15mL of water were taken from the bag and pipetted into six sterile tubes containing 35mL of ethanol to preserve the eDNA sample (i.e. the tube was filled to the 50mL mark)
 - the tube was shaken vigorously for ten seconds to mix the sample and preservative. This is essential to prevent DNA degradation and was also repeated for each of the six conical tubes. Before taking each sample, the water in the bag was shaken to homogenise the sample, as DNA material constantly sinks to the bottom; and
 - the box of preserved sub-samples was kept in a fridge and then later returned to ambient temperature in the laboratory for analysis.
- 4.3.8 Laboratory analysis was consistent with the methods described in Appendix 5 of the WC1067 Technical Advice Note (Ref 7-11), including control analysis for inhibition and degradation.
- 4.3.9 eDNA kits were procured from Surescreen Scientifics (hereafter referred to as Surescreen) and on collection of samples, they were then sent back to Surescreen to be analysed in their laboratory.

4.4 Assumptions and limitations

Desk study

- 4.4.1 The aim of a desk study was to help characterise the baseline context of the Scheme and provide valuable background information that would not be captured by a single site survey alone. Information obtained during the course of a desk study was dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of records for Great Crested Newt does not necessarily mean that this species does not occur in the study area. Likewise, the presence of records of Great Crested Newt does not automatically mean that these still occurred within the area of interest or were relevant in the context of the Scheme.

Field Survey

- 4.4.2 A number of water bodies were dry at the time of survey in mid-June 2022 and ponds that dry annually does not automatically mean that they are unsuitable for Great Crested Newt. Therefore, they would require further survey in April 2023 to check if each water body holds water and then a HSI and further surveys undertaken as appropriate.

5. Results

5.1 Desk study

- 5.1.1 Records of Great Crested Newt were returned from the data search, within 2km of the Site and from within the last ten years (Ref 7-13). The closest record of Great Crested Newt to the Site, was from April 2021 approximately 1.5 km south of the northern site.
- 5.1.2 From the desk study, using maps and aerial photography, 46 water bodies were identified within the survey area (as presented in **Figure 1**).
- 5.1.3 The desk study scoped out the need for HSI and eDNA surveys on 16 water bodies for the following reasons:
- Distance (>250m) and/ or barriers to dispersal – water bodies 1, 2, 14, 15, 22, 23, 25, 30, 34, 38, 39 and 41; or
 - Barriers to dispersal with limited suitable connecting habitat between these water bodies and the Site – water bodies 28, 29, 32 and 33.
- 5.1.4 Furthermore, eight water bodies (11, 12, 13, 19, 20, 21, 28, 31) were off-site with no access. Therefore, these water bodies did not form part of the scope of works reported in this document.

5.2 Field survey

- 5.2.1 A breakdown of the surveys undertaken within the survey area and the rationale for these are presented in **Table 5-2**.

Habitat Suitability Index

- 5.2.2 Twenty-two water bodies identified within the Site, or where access was permitted within the survey area (see **Figure 1**) were subject to surveys to initially check that each water body held water and then a HSI survey, where required, was undertaken between 14th and 15th June 2022. The results of the HSI surveys are presented in **Table 5-1**.

Table 5-1: HSI results

HSI Score	Water body reference (see Figure 1)
Excellent	35 and 37
Good	42
Average	10, 17, 24, 26, 27 and 40
Below Average	None
Poor	6 and 18

- 5.2.3 Eleven water bodies (3, 4, 5, 7, 8, 9, 16, 36, 44, 45, 46) were dry in June 2022 and a full HSI assessment could not be undertaken (see section 4.4.2).
- 5.2.4 The results of the HSI survey are presented in **Annex B, Table A-1**.

eDNA surveys

- 5.2.5 Of the eleven water bodies that held water in June 2022 and were subject to HSI surveys (see **Table 5-1**), eDNA surveys were undertaken on ten water bodies that were within the survey area. Water body 18 was not subject to an eDNA survey as this water body was off site and therefore there was no access. The eDNA water samples were collected between 14th and 15th June 2022.
- 5.2.6 Positive eDNA samples were returned from three water bodies (26, 27, 37). One sample returned was inconclusive for Great Crested Newt DNA due to the presence of inhibitors. The remaining six water bodies returned negative samples for Great Crested Newt eDNA.
- 5.2.7 The results of the eDNA laboratory analysis are presented in **Table 5-2** and included in **Annex C**.

Table 5-2: Summary of Great Crested Newt assessment undertaken for all water bodies

Water body number (see Figure 1 for location)	Distance from Site (metres)	HSI Assessment undertaken? (HSI score: excellent, good, average, below average, poor)	eDNA analysis undertaken? (Great Crested Newt - P = present; A = absent)	Further surveys (population assessment / eDNA) required?	Supporting comments
1	273m from the northern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (wide drains) between Site and this water body. Furthermore, water body greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
2	295m from the northern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (wide drains) between Site and this water body. Furthermore, water body greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
3	On site (northern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at the time of survey (mid-June 2022) and was also noted to be dry during other ecological surveys of the Site between January 2022 and May 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water).
4	On site (northern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at the time of survey (mid-June 2022) and was also noted to be dry during other ecological surveys of the Site between January 2022 and May 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water).
5	On site (northern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at the time of survey (mid-June 2022) and was also noted to be dry during other ecological surveys of the Site between January 2022 and May 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water).
6	On site (northern site)	Yes - poor	Yes – inconclusive	Yes	Poor HSI score, but eDNA sample taken as a precaution. Water body nearly dry at the time of survey (June 2022). eDNA results were inconclusive during laboratory analysis and therefore it is recommended a further eDNA sample is take in spring 2023.

Water body number (see Figure 1 for location)	Distance from Site (metres)	HSI Assessment undertaken? (HSI score: excellent, good, average, below average, poor)	eDNA analysis undertaken? (Great Crested Newt - P = present; A = absent)	Further surveys (population assessment / eDNA) required?	Supporting comments
7	On site (northern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at the time of survey (mid-June 2022) and was also noted to be dry during other ecological surveys of the Site between January 2022 and May 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water).
8	On site (northern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at the time of survey (mid-June 2022) and was also noted to be dry during other ecological surveys of the Site between January 2022 and May 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water)
9	On site (northern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at the time of survey (mid-June 2022) and was also noted to be dry during other ecological surveys of the Site between January 2022 and May 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water)
10	On site (northern site)	Yes -average	Yes – (A)	No	Water body does not support breeding Great Crested Newt, no further action required.
11	22m from the northern site	No	No	Yes	Outside of the Site (and scope of works) but this water body is close enough to the Site to trigger the need for further survey.
12	42m from the northern site	No	No	Yes	Outside of the Site (and scope of works) but this water body is close enough to the Site to trigger the need for further survey.
13	23m from the northern site	No	No	Yes	Outside of the Site (and scope of works) but this water body is close enough to the Site to trigger the need for further survey.
14	303m from the northern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (roads and infrastructure) between Site and this water body. Furthermore, water body greater than 250m

Water body number (see Figure 1 for location)	Distance from Site (metres)	HSI Assessment undertaken? (HSI score: excellent, good, average, below average, poor)	eDNA analysis undertaken? (Great Crested Newt - P = present; A = absent)	Further surveys (population assessment / eDNA) required?	Supporting comments
					from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
15	327m from the northern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (roads and infrastructure) between Site and this water body. Furthermore, water body greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
16	On site (southern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at the time of survey (mid-June 2022) and was also noted to be dry during other ecological surveys of the Site between January 2022 and May 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water).
17	On site (southern site)	Yes - average	Yes – (A)	No	Water body does not support breeding Great Crested Newt, no further action required.
18	Adjacent to the southern site	Yes - poor	No	No	HSI survey undertaken from inside the Site boundary. This water body is a man-made fishing lake, stocked full of Carp and supporting waterfowl and is therefore unlikely to support breeding Great Crested Newt.
19	95m from the southern site	No	No	Yes	Water body appears, from aerial imagery, to be within a private residential garden. Water body separated from the Site by a railway line, but within 100m of the Site. Whilst the railway line does limit Great Crested Newt dispersal, there are no other barriers (such as intensively managed arable land) between the water body and the Site and therefore, this water body would require a HSI and eDNA survey in spring 2023.
20	134m from the southern site	No	No	Yes	Water body appears, from aerial imagery, to be within a private residential garden. Water body separated from the Site by a railway line. Whilst the railway line does limit Great Crested Newt dispersal, there are no other apparent barriers (such as intensively managed arable land) between the water body and the Site and therefore, this water body would require a HSI and eDNA survey in spring 2023.

Water body number (see Figure 1 for location)	Distance from Site (metres)	HSI Assessment undertaken? (HSI score: excellent, good, average, below average, poor)	eDNA analysis undertaken? (Great Crested Newt - P = present; A = absent)	Further surveys (population assessment / eDNA) required?	Supporting comments
21	99m from the southern site	No	No	Yes	Water body appears, from aerial imagery, to be within a private residential garden. Water body separated from the Site by a railway line, but within 100m of the Site. Whilst the railway line does limit Great Crested Newt dispersal, there are no other barriers (such as intensively managed arable land) between the water body and the Site and therefore, this water body would require a HSI and eDNA survey in spring 2023.
22	275m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (roads and intensively managed farmland) between Site and this water body. Furthermore, water body greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
23	482m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (roads and intensively managed farmland) between Site and this water body. Furthermore, water body greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
24	On site (southern site)	Yes - average	Yes – (A)	No	Water body does not support breeding Great Crested Newt, no further action required.
25	322m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (roads and intensively managed farmland) between Site and this water body. Furthermore, water body greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
26	On site (southern site)	Yes – average	Yes – (P)	Yes	Great Crested Newt present. Population assessment required to quantify the population, determine appropriate mitigation and inform a development (mitigation) licence application.
27	On site (southern site)	Yes - average	Yes – (P)	Yes	Great Crested Newt present. Population assessment required to quantify the population, determine appropriate mitigation and inform a development (mitigation) licence application.

Water body number (see Figure 1 for location)	Distance from Site (metres)	HSI Assessment undertaken? (HSI score: excellent, good, average, below average, poor)	eDNA analysis undertaken? (Great Crested Newt - P = present; A = absent)	Further surveys (population assessment / eDNA) required?	Supporting comments
28	188m from the southern site	No	No	No	Water body appears, from aerial imagery, to be within a private residential garden. Water body separated from the Site by a railway line and other habitats (such as gardens, residential properties and farm land). Furthermore, water body is >150m from the Site and therefore any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
29	241m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (railway line and intensively managed farmland) between Site and this water body. Furthermore, water body is nearly 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
30	280m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (railway line and intensively managed farmland) between Site and this water body. Furthermore, water body greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
31	27m from the southern site	No	No	Yes	Water body separated from the Site by a railway line. Whilst this does limit Great Crested Newt dispersal, there are no other barriers (such as intensively managed arable land) between the water body and the Site and therefore, this water bodies would require a HSI and eDNA survey in spring 2023.
32	172m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (railway line and 'North Beck' main drain) between Site and this water body. Furthermore, water body is >150m from the Site and therefore any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
33	127m from the southern site	No	No	No	Water body separated from the Site by a railway line and industrial units which would act as a barrier to Great Crested Newt dispersal. Furthermore, the water body is >100m from the Site and therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.

Water body number (see Figure 1 for location)	Distance from Site (metres)	HSI Assessment undertaken? (HSI score: excellent, good, average, below average, poor)	eDNA analysis undertaken? (Great Crested Newt - P = present; A = absent)	Further surveys (population assessment / eDNA) required?	Supporting comments
34	246m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (railway line and intensively managed farmland) between Site and this water body. Furthermore, water body is nearly 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
35	On site (southern site)	Yes - excellent	Yes – (A)	No	Water body does not support breeding Great Crested Newt, no further action required.
36	On site (southern site)	No - dry	No	Yes – if holding water in spring 2023	Water body dry at time of survey in mid-June 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water) as it is in close proximity to water bodies 37 which supports Great Crested Newt.
37	On site (southern site)	Yes - excellent	Yes – (P)	Yes	Great Crested Newt present. Population assessment required to quantify the population, determine appropriate mitigation and inform a development (mitigation) licence application.
38	378m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (roads and intensively managed farmland) between Site and this water body. Furthermore, water body greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
39	278m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (roads and intensively managed farmland) between Site and this water body. Furthermore, water body greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
40	10m from the southern site	Yes - average	Yes – (A)	No	Off-site, but survey undertaken as owned by landowner of on-site water bodies. Great Crested Newt absent, no further action required.
41	469m from the southern site	No	No	No	Scoped out during desk study due to barriers for Great Crested Newt dispersal (roads and intensively managed farmland) between Site and this water body. Furthermore, water body

Water body number (see Figure 1 for location)	Distance from Site (metres)	HSI Assessment undertaken? (HSI score: excellent, good, average, below average, poor)	eDNA analysis undertaken? (Great Crested Newt - P = present; A = absent)	Further surveys (population assessment / eDNA) required?	Supporting comments
					greater than 250m from the Site. Therefore, any impacts from the Scheme on Great Crested Newt, even if present, will not occur.
42	48m from the southern site	Yes - good	Yes – (A)	No	Off-site, but survey undertaken as owned by landowner of on-site water bodies. Great Crested Newt absent, no further action required.
43	124m from the southern site	No	No	No	Water body separated from the Site by two main drains which would limit Great Crested Newt dispersal (if present). Water body >100m from the Site and therefore no impacts on Great Crested Newt (if present) would occur and no further survey recommended.
44	On site (southern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at time of survey in mid-June 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water).
45	On site (northern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at time of survey in mid-June 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water).
46	On site (southern site)	No – dry	No	Yes – if holding water in spring 2023	Water body dry at time of survey in mid-June 2022. This water body should be checked in spring 2023 for water (and an eDNA sample taken as a minimum, if holding water).

6. Conclusions & Recommendations

- 6.1.1 The desk study identified 46 water bodies within 500m of the Site. Of the 46 water bodies, 16 were scoped out of requiring any, or further, survey for the reasons outlined in **Table 5-2**. A further eight water bodies are off-site and did not form part of the scope of works.
- 6.1.2 Twenty-two water bodies within the survey area were surveyed for their suitability to support Great Crested Newt in June 2022 and water samples were collected from ten water bodies. Of these ten water bodies, three water bodies (26, 27, 37, see **Figure 1**) were positive for Great Crested Newt eDNA and confirmed presence of Great Crested Newt. These water bodies will require population assessment surveys in spring 2023.
- 6.1.3 The desk and field-based surveys, undertaken in June 2022, have identified twenty-two water bodies within the survey area (500m from the Site) that require further survey in spring 2023, either because they were dry in June 2022, fell outside of the Site boundary (and therefore the scope of works) or that eDNA samples were positive for the presence of Great Crested Newt. As a minimum, any water bodies outside of the Site boundary or that were dry in June 2022 should be checked in mid-April 2023 for their water levels and an eDNA sample taken at that time. Further surveys, such as population assessment surveys, may follow and would be dependent on the results of the eDNA surveys. A summary of the recommended further surveys for each water body 'scoped in' is presented in **Table 6-1**.

Table 6-1: Recommended further survey in spring 2023

Water body number (see Figure 1 for location)	Supporting comments
3, 4, 5, 7, 8, 9, 16, 36, 44, 45, 46	Water body should be checked in mid-April 2023 for water and, as a minimum an eDNA sample should be taken if holding water. Further surveys (population assessment) may be required, dependent on the eDNA results.
6	eDNA survey in June 2022 was inconclusive. As a minimum, eDNA sample in mid-April 2023, to confirm presence or absence.
11	As a minimum, eDNA sample in mid-April 2023, to confirm presence or absence (if water body holds water).
12	As a minimum, eDNA sample in mid-April 2023, to confirm presence or absence (if water body holds water).
13	As a minimum, eDNA sample in mid-April 2023, to confirm presence or absence (if water body holds water).
19	As a minimum, eDNA sample in mid-April 2023, to confirm presence or absence (if water body holds water).
20	As a minimum, eDNA sample in mid-April 2023, to confirm presence or absence (if water body holds water).

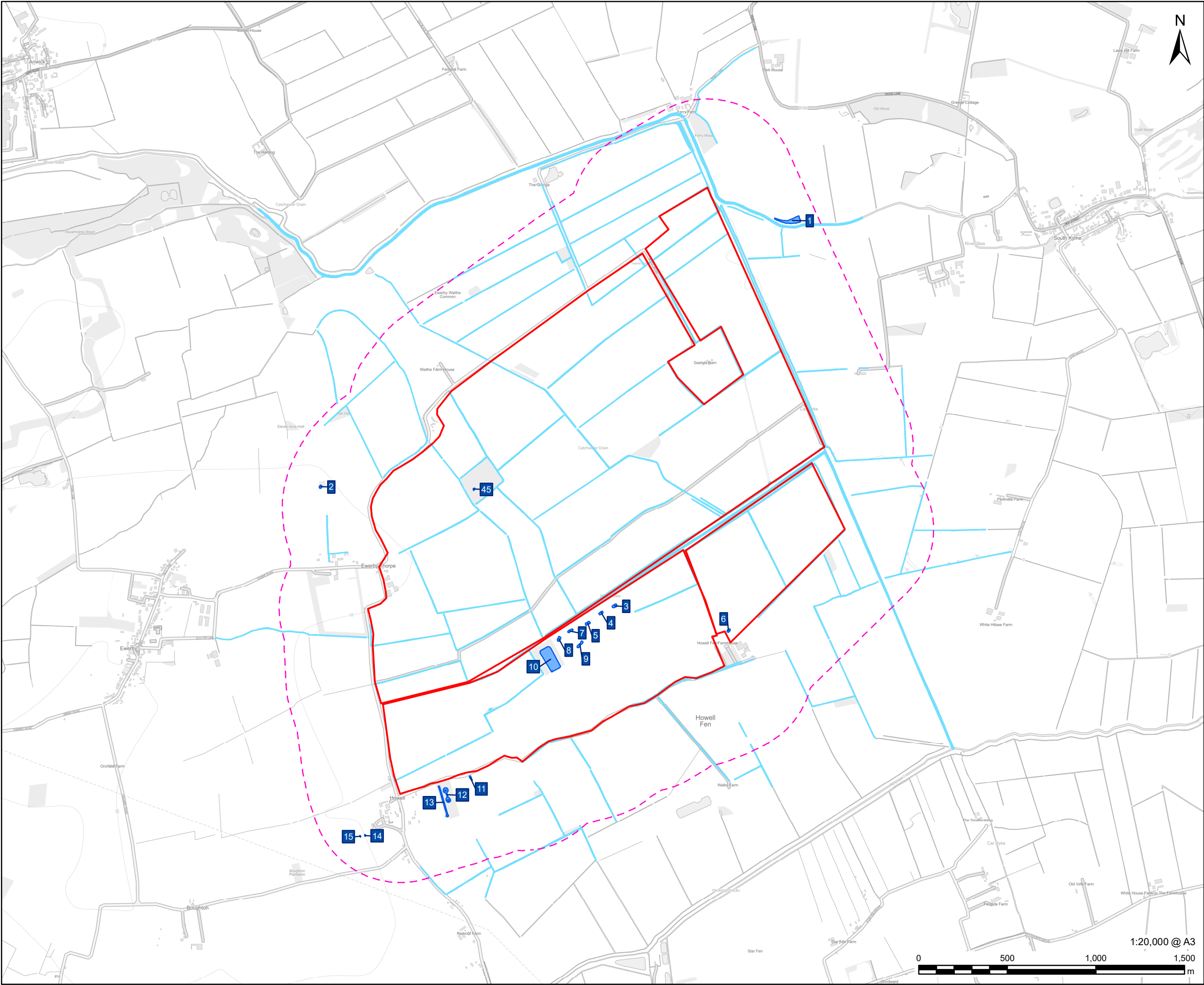
Water body number (see Figure 1 for location)	Supporting comments
21	As a minimum, eDNA sample in mid-April 2023, to confirm presence or absence (if water body holds water).
26	Population assessment (comprising six visits) between mid-April and June 2023.
27	Population assessment (comprising six visits) between mid-April and June 2023.
31	As a minimum, eDNA sample in mid-April 2023, to confirm presence or absence (if water body holds water).
37	Population assessment (comprising six visits) between mid-April and June 2023.

7. References

- Ref 7-1 Natural England (2004) An assessment of the efficiency of capture techniques and the value of different habitats for the great crested newt.
<http://publications.naturalengland.org.uk/publication/134002>
- Ref 7-2 English Nature. 2001. Great Crested Newt Mitigation Guidelines. English Nature, Peterborough
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- Ref 7-7 HMSO. 2006. The Natural Environment and Rural Communities Act. HMSO, London.
- Ref 7-8 JNCC, UK Post-2010 Biodiversity Framework. 2012. Available at <http://jncc.defra.gov.uk/page-6189> (Accessed July 2020)
- Ref 7-9 Lincolnshire Biodiversity Partnership. Lincolnshire Biodiversity Action Plan (3rd edition). Available at: <http://www.southkesteven.gov.uk/CHttpHandler.ashx?id=7371&p=0>
- Ref 7-10 Oldham, R.S., Keeble, J., Swan, M.J.S., and Jeffcote, M. 2000. Evaluating the Suitability of Habitat for the Great Crested Newt (*Triturus cristatus*). *Herpetological Journal*, 10, 143-155.
- Ref 7-11 Biggs, J., Ewald N., Valentini, A., Gaboriaud C., Griffiths, R.A., Foster, J., Wilkinson, J., Arnett, A., Williams, P. and Dunn, F. 2014. Analytical and methodological development for improved surveillance of the Great Crested Newt. Defra Project WC1067. Freshwater Habitats Trust: Oxford.
- Ref 7-12 Natural England Standing Advice: <https://www.gov.uk/guidance/great-crested-newts-surveys-and-mitigation-for-development-projects>
- Ref 7-13 AECOM (2022) Bicker Fen Solar Farm: Preliminary Ecological Appraisal

Annex A Figures

Figure 1 Site boundary and water body locations



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LEGEND

- Site boundary
- Study Area (500m Site Buffer)
- Waterbody/Watercourse for study
- Other watercourses

PAGE LAYOUT



NOTES

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ISSUE PURPOSE

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PROJECT NUMBER

60644715

FIGURE TITLE

WATERBODIES WITHIN 500M OF THE
PROPOSED SCHEME; HOWE BICKER,
SARDESON 280, GODSON 110

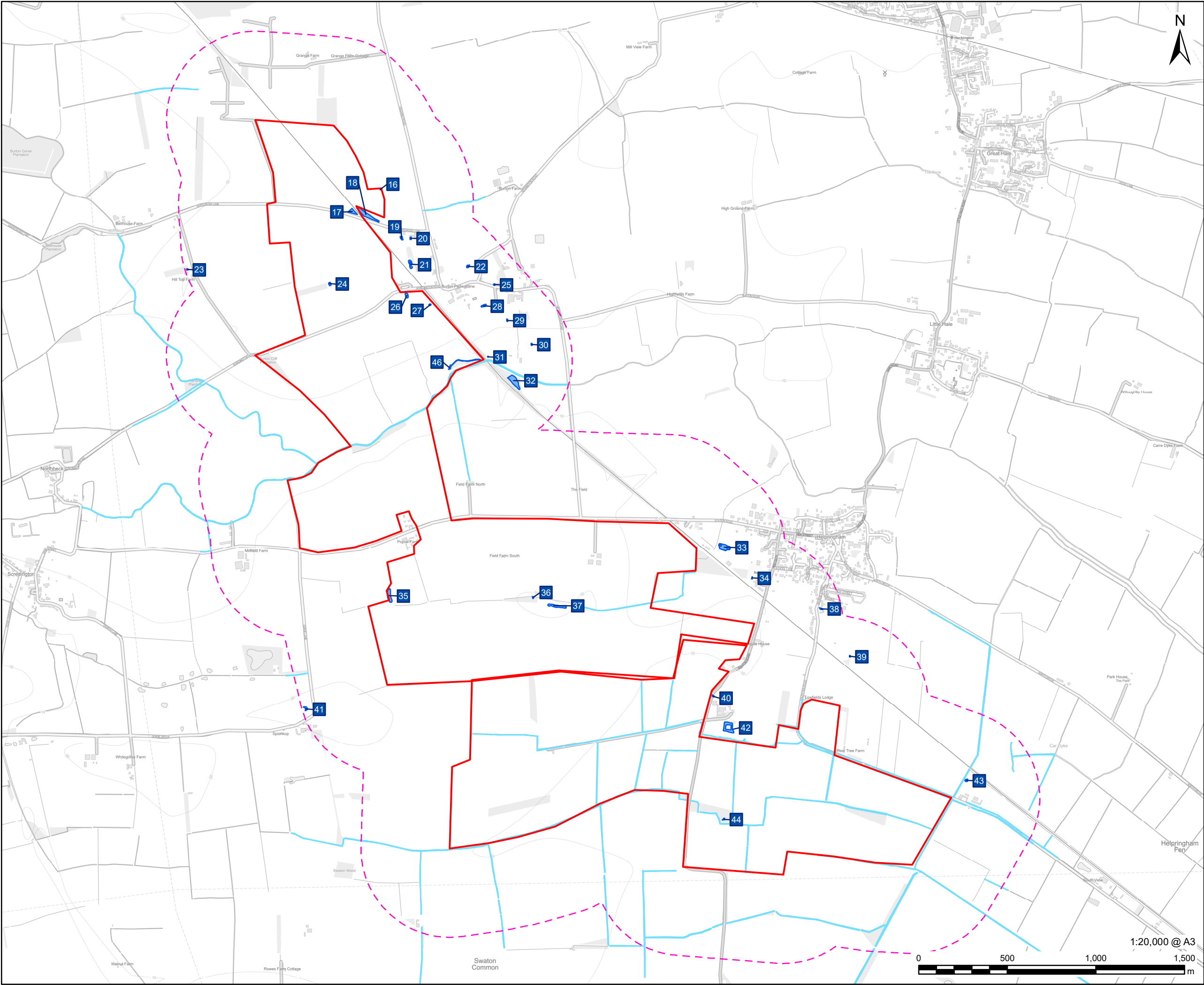
FIGURE NUMBER

FIGURE 4.1

1:20,000 @ A3



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LEGEND
Site boundary
Study Area (500m Site Buffer)
Waterbody/Watercourse for study
Other watercourses

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ISSUE PURPOSE
FOR INFORMATION

PROJECT NUMBER
60644715

FIGURE TITLE
WATERBODIES WITHIN 500M OF THE
PROPOSED SCHEME; COY LAND
BICKER FEN, WATTS LAND

FIGURE NUMBER
FIGURE 4.2

1:20,000 @ A3



Annex B HSI scores

Table A-1: Habitat Suitability Index scores for water bodies assessed

Water body Reference (see Figure 1)	Water body Area (m ²)	Water body Drying	Quality	Shade (%)	Fowl	Fish	Water body within 1km	Terrestrial Habitat	Macrophytes (%)	HSI Score
3	Water body location dry in June 2022									
4	Water body location dry in June 2022									
5	Water body location dry in June 2022									
6	223	Annually	Poor	100	Absent	Absent	0	Poor	0	<0.50
7	Water body location dry in June 2022									
8	Water body location dry in June 2022									
9	Water body location dry in June 2022									
10	8494	Never	Good	10	Minor	Minor	0	Good	30	0.62
16	Water body location dry in June 2022									
17	688	Sometimes	Moderate	90	Absent	Absent	1	Moderate	<5	0.65
18	2072	Never	Moderate	30	Major	Major	1	Moderate	<10	<0.50
24	184	Never	Good	20	Minor	Absent	0	Good	0-10	0.62
26	341	Sometimes	Moderate	50-60	Absent	Absent	1	Moderate	10	0.69

Water body Reference (see Figure 1)	Water body Area (m ²)	Water body Drying	Quality	Shade (%)	Fowl	Fish	Water body within 1km	Terrestrial Habitat	Macrophytes (%)	HSI Score
27	71	Sometimes	Moderate	0	Absent	Absent	1	Good	70	0.65
35	1249	Never	Good	20	Minor	Absent	1	Good	30	0.82
36	Water body location dry in June 2022									
37	1059	Never	Good	20	Minor	Absent	1	Good	30	0.83
40	77	Never	Good	0	Minor	Absent	1	Moderate	<10	0.61
42	1794	Rarely	Good	60	Minor	Absent	1	Good	<10	0.79
44	Water body location dry in June 2022									
45	Water body location dry in June 2022									
46	Water body location dry in June 2022									

HSI Score colour coding – Dark green: Excellent likelihood of Great Crested Newt present; Light green – Good likelihood of Great Crested Newt present; Yellow – Average likelihood of Great Crested Newt present; Orange – Below average likelihood of Great Crested Newt present; and Red – Poor likelihood of Great Crested Newt present.

Annex C: eDNA results

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN POND WATER FOR THE DETECTION OF GREAT CRESTED NEWTS (TRITURUS CRISTATUS)

SUMMARY

When great crested newts (GCN), *Triturus cristatus*, inhabit a pond, they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm GCN habitation or establish GCN absence.

RESULTS

Date sample received at Laboratory: 20/06/2022
Date Reported: 30/06/2022
Matters Affecting Results: 3240 - Inhibition detected

Lab Sample No.	Site Name	O/S Reference	SIC	DC	IC	Result	Positive Replicates
3234	27 Bicker Fen	TF 116 420	Pass	Pass	Pass	Positive	9
3235	35 Bicker Fen	TF 114 404	Pass	Pass	Pass	Negative	0
3236	40 Bicker Fen	TF 132 398	Pass	Pass	Pass	Negative	0
3237	42 Bicker Fen	TF 133 396	Pass	Pass	Pass	Negative	0
3238	26 Bicker Fen	TF 115 421	Pass	Pass	Pass	Positive	5
3240	6 Bicker Fen	TF 154 473	Pass	Pass	Fail	Inconclusive	0
3242	24 Bicker Fen	TF 111 421	Pass	Pass	Pass	Negative	0
3243	37 Bicker Fen	TF 123 403	Pass	Pass	Pass	Positive	5
3248	10 Bicker Fen	TF 143 471	Pass	Pass	Pass	Negative	0
3249	17 Bicker Fen	TF 112 425	Pass	Pass	Pass	Negative	0



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