# Appendix F.3 Survey Methods

**Appendix F.3**

**Survey Methods**

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# 1 Methodology

## 1.1 Timing and Personnel

All surveys were undertaken by suitably qualified and experienced staff. Staff involved and their qualifications are included in table 1.2 below. Names and qualifications are current for the time of the production of this report with the employer listed as who the person was working for when conducting the survey.

**Table 1.1 Details of ecological surveyors**

| Name | Employer | Qualifications |
|---|---|---|
| Gemma Linacre | MLM | MRes BSc (Hons) AIEEM, GCN licence |
| Vicky Rowe | MLM | BSc (Hons) AIEEM, GCN licence, bat class 1 licence |
| Katie Linehan | MLM | BSc (Hons) MSc AIEMA MCIEEM FGS |
| Alanna Cooper | MLM | BSc (Hons) MCIEEM MCIWEM CEnv CSci |
| Beck Harrington | MLM | BSc (Hons) GradCIEEM, bat class 2 licence |
| Wayne Martin | Native/Non-native UK Ltd | |
| James Patmore | Lockhart Garrett | BSc (Hons) MIEEM MSB CEnv CBiol |

Table 1.2 below summarises the surveys carried out, including the focus and type of survey, when it was carried out and which staff members were involved.

**Table 2.2 Details of surveys carried out including dates and staff involved**

| **Survey type** | **Surveyors (initials)** | **Dates** | **Times** | **Conditions** |
|---|---|---|---|---|
| Phase 1 habitat | KL | 9-10/08/10 | n/a | n/a |
| | KL | 04/04/11 | n/a | n/a |
| | GL | 18/05/16 | n/a | n/a |
| Hedgerow survey | KL | 09/08/10 | n/a | n/a |
| | KL | 10/08/10 | n/a | n/a |
| | KL | 01/09/10 | n/a | n/a |
| Badger | KL & VR | 09/08/10 | n/a | n/a |
| | KL & VR | 10/08/10 | n/a | n/a |
| | KL & VR | 01/09/10 | n/a | n/a |
| | KL & VR | 07/12/10 | n/a | n/a |
| | KL & AC | 31/03/11 | n/a | n/a |
| | KL & AC | 14/04/11 | n/a | n/a |
| | KL & AC | 17/05/11 | n/a | n/a |
| | KL & AC | 26/10/11 | n/a | n/a |
| | KL & VR | 03/12/14 | n/a | n/a |
| | KL & VR | 04/12/14 | n/a | n/a |
| Bat scoping survey | VR | 07/06/11 | n/a | n/a |
| | VR | 28/10/11 | n/a | n/a |
| Bat transect survey | KL, WM & VR | 01/09/10 | 19:40-21:55 | Dry, calm, clear skies, 17°C. |
| | KL, WM & VR | 02/09/10 | 04:10-06:10 | Dry, calm, misty 12°C. |
| | KL, WM & VR | 06/06/11 | 21:15-23:20 | Dry, slight breeze, scattered cloud, 12°C |
| Water vole and otter | KL & AC | 13/04/11 | n/a | Gusty wind, overcast, 8-10°C. |
| | KL & AC | 14/04/11 | n/a | Slight breeze, overcast, 12-16°C. |
| | KL & AC | 25/10/11 | n/a | Calm, partial cloud, 15-18°C. |

| Survey type | Surveyors (initials) | Dates | Times | Conditions |
|---|---|---|---|---|
| | KL & AC | 26/10/11 | n/a | Slight breeze, partial cloud 16-20°C |
| | VR & BH | 03/12/14 | n/a | Dry, overcast, light wind, 4-7°C |
| | VR & BH | 04/12/14 | n/a | Dry, overcast, light wind, 4-7°C |
| Wintering birds | JP | 07/12/10 | 08:00-12:00 | 6°C, clear, still |
| | JP | 17/12/10 | 08:00-12:00 | -2°C, sunny, breezy |
| | JP | 17/01/11 | 08:00-12:00 | 6°C, low cloud, still |
| | JP | 10/02/11 | 08:00-12:00 | 9°C, cloudy, light breeze, mild |
| | AC | 05/01/14 | 08:00-14:00 | 2°C, sunny, still |
| | AC | 02/02/14 | 08:00-14:00 | 7°C, overcast |
| | AC | 02/03/14 | 08:00-14:00 | 8°C, partly cloudy, breezy, dry |
| | AC | 12/03/14 | 08:00-14:00 | 3-6°C. Sunny and partly cloudy, still to slight breeze, rain |
| Breeding birds | JP | 12/04/11 | 06:00-11:00 | 8°C Sunny start, light wind |
| | JP | 18/05/11 | 06:00-11:00 | 14°C cloudy, still |
| Amphibian Habitat Suitability Index (HSI) | VR & GL | 01/04/11 | n/a | n/a |
| Amphibian presence/absence survey | KL, AC, GL & VR | 13/04/11 - 14/04/11 | 18:00-22:00 & 09:15-11:00 | Partial breeze, mild temperature of 6-12°C, with 100% cloud coverage. |
| | KL, AC, GL, WM & VR | 19/04/11 – 20/04/11 | 18:00-23:00 & 08:20-10:30 | Mild temperature of 6-12°C, with a slight breeze and cloud coverage of 60%. |
| | KL, AC, GL, WM & VR | 16/05/11 – 17/05/11 | 21:30-22:45 & 08:30-09:45 | At the start of the survey the weather was dry with a temperature of 9-12°C, with scattered cloud, coverage of 40% and a strong breeze. |
| | GL, KL & WM | 25/05/11 – 26/04/11 | 18:15-22:30 & 09:15-10:30 | During torching- clear skies, approximately 15°C, with a slight breeze and 10% cloud coverage. |
| Reptile presence/ absence survey | AC, GL & VR | 31/03/11 | n/a | n/a (mat placement) |
| | AC, GL & VR | 14/04/11 | 13:30-16:30 | Fine and dry. Approximately 12°C-16°C during survey. Light wind and overcast. |
| | KL, GL, VR & WM | 20/04/11 | 10:00-13:00 | Sunny and bright with no wind. Temperature between 18°C-22°C, site became very hot towards the end of the morning. |

| Survey type | Surveyors (initials) | Dates | Times | Conditions |
|---|---|---|---|---|
| | GL, VR & WM | 03/05/11 | 16:00-19:00 | Weather sunny, temperature recorded at 16°C |
| | GL, VR & WM | 04/05/11 | 08:10-10:35 | Weather was sunny, temperature recorded between 6-15°C. |
| | GL, VR & WM | 16/05/11 | 15:40-18:00 | Start of survey- temperature recorded 20°C with 50% cloud coverage and windy.<br>End of survey - temperature recorded at 15°C with 100% cloud coverage. |
| | KL, WM & VR | 17/05/11 | 10:00-12:30 | Weather was dry with Brisk winds and scattered cloud, temperature recorded at 14-18°C. |
| | GL, WM & KL | 25/05/11 | 16:00-19:20 | Temperature approximately 16-17°C with 90% cloud coverage and strong winds. |
| | WM | a) 01/06/11 &<br>b) 02/06/11 | a) 09:30 - 17:30 &<br>b) 09:50 - 12:20 | a) Sunny, 15 degrees, slight wind, no clouds, becoming overcast finishing at 23 degrees &<br>b) Sunny, slight cloud cover with a mild breeze. Temperature recorded at 18 degrees with 21 degrees finish and a strong breeze. |
| | GL, VR & WM | 06/06/11 | 16:00-18:30 | Temperature recorded at 14°C, weather overcast with a slight breeze. |
| | GL, VR & WM | 14/06/11 | 08:50-11:45 | No cloud coverage, sunny and calm. Temperature recorded at 17°C. |

## 1.2 Habitat Survey

The habitat survey for the application site was undertaken in general accordance with JNCC methodology (ref. 2). The survey included the entire area within Anglian Water ownership and areas immediately to the south and north of the site.

Common names and binomial scientific names of plant species identified are as they appear in Stace (ref. 3). The relative frequency and cover of each species identified as they are distributed in each habitat is estimated using the DAFOR scale (ref. 4) as follows:

- D - Dominant - >75% cover
- A - Abundant – 51-75% cover
- F - Frequent – 26-50% cover
- O- Occasional – 11-25% cover
- R - Rare – 1-10% cover
- LF - Locally frequent is also used where the frequency and distribution is patchy.

## 2 Hedgerow Survey

The hedgerow survey included survey of historical maps as well as a site survey.

The aim of the survey was to assess the importance of hedgerows present on site against the ecological and historical criteria used for the protection of hedgerows under the Hedgerow Regulations (1997). Ecological and historical criteria for determining 'important' hedgerows under the Hedgerow Regulations (ref. 5) were used to assess quality of hedgerows. The survey also aimed to identify species-rich hedgerows under the DEFRA criteria (ref. 6).

The extent of each hedgerow was determined, measured and divided into sample lengths. Ecological attributes as followed were noted:

- Number of woody species within each sample
- Number of ground flora species
- Number of standard trees
- Presence of any rare trees
- Connections to hedgerows, woods and ponds
- Presence and length of wall or bank
- Presence and length of ditch
- Presence of parallel footpath, bridleway or byway open to traffic
- Percentage of gaps within the hedgerow

## 3 Badger Survey

The Badger survey has been carried out in accordance with best practice guidance published by the Highways Agency (ref. 7) and Hill et. al. (ref. 8).

Badgers can be located by searching for signs of activity such as holes, latrines, paths etc. Paths are often the first thing seen, and in such cases are followed to try to find other evidence such as setts or feeding areas. In some cases they cannot be followed into, for example, dense scrub or where they move into neighbouring land for which access is not available.

In this case the paths are searched for evidence of species, for example footprints or hair caught on wire or thorns. Rabbits (*Oryctolagus cuniculus*) frequently leave scattered droppings, and foxes (*Vulpes vulpes*) occasionally do; badgers rarely leave droppings outside of latrines.

For Badgers, any holes, latrines, paths etc. are identified and paths followed wherever possible to try to find holes.

Badger setts found were recorded included an approximate location and number of entrances. The setts were classified according to the criteria in table 4.1 below. Signs of activity were searched for and recorded including recent spoil, bedding, prints and worn paths leading from the entrances.

**Table 3.1 Badger Sett Type Definitions**

| |
|---|
| *From:* Harris, S., Cresswell, P. and Jefferies, D. (1981) *Surveying Badgers*. The Mammal Society, Bristol. (Ref. 2) |
| In most cases each social group of Badgers has more than one sett in its territory, and these vary in status and level of use. Whenever there is a Badger problem in an area, it is essential to undertake a thorough survey to establish (i) how many social groups may be involved and (ii) the distribution and status of any setts on or outside of the site that may be affected by the proposals. The different types of Badger sett occupied by a single group of Badgers are described below. |
| **Main setts**:<br>Normally each group of Badgers has only one main sett, and so by counting all the main setts in an area you can find out how many social groups of Badgers are present. Main setts usually have several holes with large spoil heaps, and the sett generally looks well used. There will be obvious paths to and from the sett and between sett entrances. In the British national Badger survey the average number of holes for a main sett was twelve, although main setts may be much smaller, even a single hole in exceptional circumstances. Although normally the breeding sett, and in continuous use, it is possible to find a main sett that has become disused due to excessive interference, illegal digging, tree felling or some other reason. |
| **Annexe setts**:<br>These are often close to a main sett, normally less than 150 meters away, and are connected to the main sett by one or more obvious well worn paths. Usually they have several holes but may not be in use all the time, even if the main sett is very active. The average number of holes per annexe sett in the British survey was eight. |
| **Subsidiary setts**:<br>These are usually at least 50 metres from a main sett, and do not have an obvious path connecting with another sett. They are not continuously active. The average number of holes per subsidiary sett in the British survey was four. |
| **Outlying setts**:<br>These often have little spoil outside the holes, have no obvious path connecting them with another sett, and are only used sporadically. When not in use by Badgers, they are often taken over by foxes or even rabbits. However, they can still be recognised as Badger setts by the shape of the tunnel (not the actual entrance hole), which is at least 25 centimetres in diameter and rounded or a flattened oval shape (i.e. broader than high). Fox and Rabbit tunnels are smaller and often taller than broad. The average number of holes per outlying sett in the British survey was two. |

| |
|---|
| *From:* Harris, S., Cresswell, P. and Jefferies, D. (1981) *Surveying Badgers*. The Mammal Society, Bristol. (Ref. 2) |
| Note: These sett definitions form part of a continuum, and setts do not always fit neatly into these categories. |

A subjective assessment of the foraging potential of the habitats within the site boundary was made during the assessment. Good foraging habitat provides badgers with a variety of foraging habitats throughout the year (e.g. short grassland, hedgerows). Moderate foraging habitat provides foraging opportunities that are limited by seasonal management (e.g. arable fields, woodland and scrub, back gardens). Poor foraging habitat provides few foraging opportunities (e.g. cereal crops, heath land, moorlands and wetlands).

# 4 Bat Surveys

The methodologies and levels of effort for the various bat surveys were in line with good practice guidelines which were current at the time of the surveys, these guidelines those produced by the JNCC (ref. 9), the Bat Conservation Trust (ref. 10) and Natural England (previously English Nature) (ref. 11). The bat survey consisted of two separate elements:

- An assessment of trees and bridges on site to assess the likelihood of their use by roosting bats and to search for evidence, where possible.
- Activity surveys consisting of transect surveys around the site to determine the species present and the level of their activity.

## 4.1 Survey of Roost Potential in Trees and Bridges

The assessment of the trees and bridges for their potential to support bat roosts consisted of a ground-based search for features of potential use to bats as roosting sites, such as rot holes, cracks, branch/trunk splits, dense ivy and loose bark. Binoculars and a 1,000,000 candle power torch were used to aid the search.

Due to the large number of trees on site, groups of trees or areas were assessed and assigned an expected potential of high, medium or low.

The criteria for determining the level of potential is as follows;

- Low- feature/area has poor habitat connectivity and/or poor quality roosting features such as a light covering of Ivy or downward developing rot holes.

- Medium- good habitat connectivity and features of a moderate quality such as loose or peeling bark.

- High- good habitat connectivity in combination with multiple high quality features such as upward rot holes, large cavities, wood pecker holes and longitudinal splits.

The survey of the bridges was undertaken with the aid of a boat, high powered torch and an endoscope.

## 4.2 Bat Detector Transect Surveys

This method of activity survey involves walking the site along a planned route (transect) with a bat detector stopping at a number of points during the survey to record any activity. Each surveyor is equipped with a Bat Box Duet which is a broadband detector that picks up all the ultrasonic calls bats make and convert them into audible sounds. In addition to this direct observation, the Bat Box Duet is connected to a digital recorder to record all bat calls during the survey. The sound files are analysed with specialist software to aid accurate species identification. The software used is BatSound Version 4.03 produced by Peterson Electronics and Acoustics AB, Sweden.

The intention is to identify species of bats present and areas of activity such as valuable foraging habitat, commuting routes and even roost sites. The transect routes were decided following review of aerial overviews of the site, OS maps and the results of the extended phase 1 habitat survey. The locations of transects and stopping points are shown on the Drawing 772478-DWG-ENV-003.

The site was visited during the day to walk the proposed route to become familiar with the route and identify any health and safety issues. The walkover also served to identify features that were considered to have potential for bats such as mature trees, hedgerows, woodland and woodland edges as well as water features.
Following the walkover survey it was determined that two surveyors would walk two separate routes around the site. The first route covered the northern and eastern boundaries of the site and incorporated a total of eight stops each for three minutes. The second route covered the southern and western aspects of the site and incorporated a total of ten stops each for three minutes. The same routes were walked during both the dawn and dusk survey.

During the surveys all visual observations of bat activity are recorded as well as noting the time and location of any bats heard.

## 5 Water Vole and Otter Surveys

The surveys were undertaken in accordance with best practice (ref. 12 and ref.13) and included searches of banks of rivers and ditches around the site for signs of water vole (*Arvicola* amphibius) and otter (*Lutra lutra*). The rivers and ditches surveyed have been colour coded and are shown in drawing 772478-DWG-ENV-004.

The entire lengths of the drainage ditches on site were surveyed along with a connected drainage ditch immediately north of the site. The survey was undertaken via surveyors walking along each bank side. As the ditches are relatively shallow, waders were worn by the surveyors so that the banks could be fully accessed.

Evidence was searched for in the emergent and bank side vegetation as well as on the top of the bank away from the ditches. In areas of deeper water, such as along the River Nene and the southern section of the central drain, the banks were inspected from an inflatable craft. Access could not be obtained for the ditch along the southern boundary where signs of otter were found by HAD in the previous survey; however it was decided that if signs for otter were identified in the central drain through the site connected to this ditch, that it could be assumed otters still use the southern ditch.

Signs of water vole including latrines, holes in banks, prints, mammal runs, closely cropped vegetation around the holes and raft larders (distinctively cut lengths of green stems stored for later use) were searched for throughout the survey area. When droppings or holes were located these were differentiated from rat (Rattus sp.) signs. Other vole species including field vole (*Microtus agrestis*) and bank vole (*Clethrionomys glareolus*) were also searched for and noted when encountered.

During the survey the wet ditches and waterbodies within the site and immediately outside the boundary were examined for signs of otter such as footprints, holts, slides, spraints, rolled vegetation (whisps/twists), couches (vegetation mattresses), refuges and feeding remains.

# 6 Bird Surveys

Surveys followed a set transect which aimed to include all core habitat types on site. Species and bird activity identified during each visit was recorded onto plans using standard BTO codes as recommended for the Common Bird Census technique (ref. 14).

## 6.1 Wintering Birds

To provide a reasonable level of accuracy for determining the population status of wintering birds on the site it was considered that four separate surveys were required. The survey methodology broadly employed the territory mapping methods (ref. 15) as used for the British Trust for Ornithology's (BTO) Common Bird Census (ref. 14). Standard BTO species codes and symbols were used to identify bird species, activity and direction of flight where appropriate.

Surveys were conducted in good weather conditions to avoid negative effects on results.

## 6.2 Breeding Birds

The breeding bird survey undertaken at the above site was based upon the line transect survey methodology utilised by the British Trust for Ornithology (BTO) Breeding Bird Survey (BBS) (ref. 16). The surveys were undertaken by James Patmore.

The breeding bird survey followed the guidance detailed in the RSPB Bird Monitoring Methods (ref. 17) and Bird Census Techniques (ref. 15).

## 6.3 Amphibian Survey

A Habitat Suitability Index (HSI) (ref. 18) was first undertaken. All water bodies assessed are shown in Drawing 772478-DWG-ENV-005. The HSI assessment identified that the off-site water bodies were large fish-stocked lakes and unlikely to have population of legally protected amphibians. Following this visit, the amphibian survey was planned to target only the ponds on the subject site.

The amphibian survey was undertaken to identify species of amphibians using the water bodies on site, as well as to determine the presence/absence of legally protected species, in particular great crested newts (*Triturus cristatus*, GCN), following the published English Nature (now Natural England) (ref. 19) recommended guidelines for the different methodologies and the timing of the visits during the 2011 newt breeding season. The work was also undertaken in accordance with best practice guidance published by the JNCC (ref. 20) under a current Natural England survey licence. The following methodologies were used during each of the survey visits: bottle traps, night torching and egg searching.

## 6.4 Reptile Survey

A total of 872 bituminous roofing felt mats (1m x 0.5m) were used as refuges and were placed within suitable habitat present on site at a ratio of 6.14 mats per hectare. The refuges were placed in positions that would receive sunlight during the course of the day.

The locations and numbers of mats placed in each section are shown on drawing 772478-DWG-ENV-006. These were spread evenly across the whole survey area within transects along linear features and field margins (numbered 1 to 46) as well as four mats surrounding individual placed canes (numbered A to Z) within open areas.

The mats were checked during suitable weather conditions during which reptiles are likely to be active.

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