Norfolk County Council

NORWICH WESTERN LINK ROAD

2020 Otter and Water Vole Survey Report

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

1.1.1. The Norwich Western Link (NWL) is a highway scheme linking the A1270 Broadland Northway from its junction with the A1067 Fakenham Road to the A47 trunk road near Honingham.

1.1.2. As part of a separate planned scheme, Highways England proposes to realign and dual the A47 from the existing roundabout at Easton to join the existing dual carriageway section at North Tuddenham. If the above mentioned A47 scheme proceeds, it is expected that Highways England will construct the Honingham junction and the NWL will connect to the north-eastern side of this junction.

1.1.3. From July 2018 to November 2018, an initial optioneering and appraisal process was carried out to assess a list of options which would potentially address the issues identified by NCC, the key stakeholders and project consultants WSP, through a traffic forecasting study.

1.1.4. The process resulted in a shortlist of four highway options (routes A – D) and a series of non-highway options. The non-highway options were reserved to be taken forward for consideration as part of a package of complementary sustainable transport measures. The four highway options, which performed best within the appraisal, consisted of three new dual carriageway highway options and an existing single carriageway highway upgrade option.

1.1.5. The four highway options were presented at a public consultation undertaken between November 2018 and January 2019.

1.1.6. In 2019, a Strategic Outline Business Case (SOBC) was developed and submitted to DfT setting out the assessments undertaken on the shortlisted options. The SOBC, along with an Option Selection Report (OSR), provided the basis for a preferred route to be determined for the NWL. Route C was selected as the preferred route in July 2019.

1.1.7. The NWL preferred route, hereafter referred to as ‘the Scheme’, will comprise a new dual carriageway all-purpose road to the west of Norwich, from the A47 to the A1067/A1270, including a new viaduct bridge over the River Wensum and its floodplain. The Scheme will provide a direct connection between the Strategic Road Network and the A1270 Broadland Northway through the west of Norwich. This will complete an orbital route around Norwich, which forms part of the Major Road Network.

1.1.8. The Scheme will cross the River Wensum and its flood plain by means of a viaduct. The Scheme will also cross four minor roads by means of overpass or underpass bridges. The Scheme will include ancillary works such as provision for non-motorised users, necessary realignment of the local road network and the provision of environmental mitigation measures.

1.1.9. The Scheme will therefore comprise the following elements listed below:

- A dual carriageway road, including a viaduct over the River Wensum and associated floodplain;
- A “grade separated” junction with the A47;
- An “at grade” junction with the A1067;
- Dualling of a section of the existing A1067 between the proposed NWL roundabout and existing A1270 roundabout; and
- A bridge carrying the NWL over Ringland Lane.

1.2 ECOLOGICAL BACKGROUND

1.2.1. The requirement for an otter *Lutra lutra* and water vole *Arvicola amphibius* survey followed the identification of suitable habitats with the potential to support otter and water vole populations, that may be impacted by the Scheme. These habitats were identified following the Phase 1 Habitat Survey (WSP, 2018) and the refined survey in 2020 and comprised the River Wensum, two ponds, two streams and a number of ditches, as shown in separate document Appendix B.

1.2.2. In addition, a local records search obtained through Norfolk Biodiversity Information Service (NBIS) returned records of otter and water vole within 2km of the Scheme. The presence of both species was confirmed incidentally during a macrophyte survey in 2019; otter through an actual sighting and water vole through the presence of a recent latrine. It was therefore recommended that otter and water vole surveys be undertaken to establish a sufficient baseline to inform impact assessment.

1.3 BRIEF AND OBJECTIVES

1.3.1. WSP has been commissioned by Norfolk County Council to complete a comprehensive suite of otter and water vole surveys, with the following objectives as listed below.

- Establish whether otter and water vole are present or likely absent within the Survey Area;
- Determine, if present, the distribution of otter and water vole within the Survey Area; and
- Present the findings of the survey in a baseline report.

1.3.2. The findings of these objectives will be used to inform the impact assessment and proposed mitigation for all otter and water vole present across the Scheme. Details of the impact assessment and mitigation will be included within the Biodiversity Chapter of the Environmental Statement for the Scheme.

1.4 STUDY AND SURVEY AREAS

DESK STUDY

1.4.1. An ecological Desk Study was completed in March 2020 to include recent data relevant to the Scheme. The Study Area for this was defined as a 2km radius of the Scheme, as shown in separate document Appendix A.

OTTER SURVEY AREA

1.4.2. The Survey Area in relation to otter comprised 300m sections up and downstream from the Scheme Alignment. This also included all directly connected water features and associated riparian/holt building habitat. As with water voles the use of the River Wensum by otter is well documented and the species was considered likely to be present and actively moving through suitable habitat.

1.4.3. The Survey Area was selected to focus on the immediate area impacted by the Scheme, particularly focussing on the discovery of holts, couches or evidence of features of importance to otters. All suitable habitat identified as having potential to support otter populations was surveyed within the Survey Area. The Survey Area extents are shown in separate document Appendix B.

WATER VOLE SURVEY AREA

1.4.4. The Survey Area in relation to water vole comprised 300m sections up and downstream from the Scheme Alignment. This also included all directly connected water features and associated riparian habitat. The survey area was informed by The Norfolk Wildlife Trust identifying water vole in the area (Norfolk Wildlife Trust, 2020).

1.4.5. The Survey Area was informed by guidance in The Water Vole Mitigation Handbook (Dean, et al., 2016) which recommends a field survey area of between 200m and 500m upstream and downstream for a scheme with the potential for permanent impacts affecting more than 50m of watercourse. All suitable habitat identified as having potential to support water vole populations was surveyed within the Survey Area. The Survey Area extents are shown in separate document Appendix B.

2 RELEVANT LEGISLATION

2.1 LEGAL COMPLIANCE

2.1.1. Under the Conservation of Habitats and Species Regulations 2017 (as amended) otter is listed on Schedule 2 of the Habitats Directive (Council Directive 92/43/EEC) and as such is a European Protected Species (EPS). Under Part 3 of the Habitat Regulations it is an offence to;

- deliberately capture, injure or kill a wild otter;
- deliberately disturb a wild otter; and
- damage or destroy a breeding site or resting place used by otter.

2.1.2. Otter and water vole are both listed on Schedule 5 of the Wildlife and Countryside Act (WCA) 1981 (as amended), though they receive different levels of protection under this legislation. An otter is protected from sale and from disturbance '*while it is occupying a structure or place which it uses for shelter or protection*'. It is also an offence to '*obstruct access to any structure or place used for shelter or protection*'. Water vole receive full protection under the WCA and it is an offence to;

- intentionally kill, injure or take water vole;
- intentionally or recklessly obstruct, damage or destroy any structure or place used for shelter or protection by water vole, or disturb water vole while they are occupying such a structure; and
- sell or advertise for sale water vole, whether live or dead.

2.1.3. The Natural Environment and Rural Communities (NERC) Act 2006 reinforces the duty upon all public authorities, including planning authorities, to have regard for the conservation of biodiversity when discharging their duties. The Act refines the definition of biodiversity conservation, stating that it includes restoring or enhancing a population or habitat. Section 41 of the NERC Act requires the Secretary of State to list habitats and species of principal importance (HPIs and SPIs) for the conservation of biodiversity in England. The habitats and species listed in accordance with Section 41 largely replicate those listed on the UK Biodiversity Action Plan (BAP) which occur in England and includes otter and water vole.

3 METHODS

3.1 OVERVIEW

3.1.1. A single otter and water vole survey was undertaken in autumn in 2019 which was limited by agreed access. The Scheme subsequently evolved and two further surveys were undertaken in 2020 in the appropriate season for otter (otter surveys can be carried out year-round, but spring is preferable) and water vole (mid-April to September). The surveys were undertaken across multiple days due to the size of the survey area. In addition to this, trail cameras were deployed in habitat suitable for otter and water vole in 2020 and incidental records were noted during other survey work undertaken on site.

3.1.2. All otter and water vole records collected during the 2019 and 2020 surveys will be submitted to Norfolk Biodiversity Information Service (NBIS) in a timely manner.

3.2 DESK STUDY

3.2.1. An ecological desk study was completed in March 2020 to include recent data relevant to the Scheme. Records of any notable or legally protected species, including otter, water vole and American mink *Neovison vison*, from within a 2km radius of the Scheme (see separate document Appendix A) were requested from NBIS. Records of American mink were requested due to their known predation on water vole.

3.3 FIELD SURVEY

3.3.1. All watercourses and ponds identified as suitable habitat in the Survey Area were subject to detailed otter and water vole survey. Watercourses are labelled WC1-WC6, with the exception of the River Wensum which is labelled simply as the River Wensum. The surveyed ponds are labelled as Pond 1 and Pond 2. The River Wensum is located in the north of the Scheme, with WC1-WC5 and Pond 1 and Pond 2 all located within the River Wensum's floodplain. WC6 is located in the south of the Scheme, south of Foxburrow Plantation. The locations of the watercourses and waterbodies are shown in separate document Appendix B.

OTTER SURVEY

3.3.2. The survey for otter was carried out with reference to good practice guidance (Chanin, 2003B) and other standard guidance documents (Chanin, 2003A) (Liles, 2003) and comprised a minimum of two visits to each surveyed watercourse and pond within the appropriate season to look for evidence of otters. The surveys incorporated the following:

- A walked survey of each watercourse, pond and associated riparian/holt building habitat, accessing the channel where possible, to search for field signs of otter[1].

WATER VOLE SURVEY

3.3.3. The survey for water vole was carried out with reference to good practice guidance (Dean, et al., 2016) and comprised a minimum of two visits to each surveyed watercourse and pond within the appropriate season, incorporating the following elements:

- The recording of habitat variables and features relevant to water voles (for example general habitat type, shore/bank substrate, bordering land use, vegetation, disturbance level, bank profile, water depth);
- A walked survey of each watercourse and pond, accessing the channel where possible, to search for field signs of water vole[2]; and
- The recording of any field signs or evidence relating to other relevant wildlife (for example American mink or other rodent species).

TRAIL CAMERA DEPLOYMENT

3.3.4. Trail cameras were deployed along suitable habitat for a period of 13-21 days to gain additional information. The trail camera locations are labelled TC1-TC3 and are shown in separate documents Appendix C and D. The footage was analysed for sightings of otter, water vole and any other relevant species (for example American mink or brown rat).

3.4 DATES OF SURVEY AND PERSONNEL

3.4.1. The otter and water vole surveys were led by ecologists with extensive otter and water vole survey experience with a strong understanding of their ecology and the ability to identify their field signs. All lead surveyors met the criteria within the CIEEM Competencies for Species Survey for Eurasian otter (CIEEM, 2013A) and water vole (CIEEM, 2013B).

Surveys were completed on the dates shown in Table 3-1 for both otter and water vole between 19 September 2019 and 10 September 2020.

[1] Field signs for otter include spraints, footprints, feeding remains, otter slides, holts and couches

[2] Field signs for water vole include faeces, latrines, feeding stations, burrows, 'lawns', nests, footprints and runways in vegetation

Table 3-1 – Otter and Water Vole Survey Dates

Date	Watercourse surveyed	Water vole surveying season (early/late[3])
19 September 2019	WC6	Late
2 October 2019	WC5 (partial), WC4 (partial)	Late
6 May 2020	WC6	Early
30 June 2020	River Wensum, WC1 (western half), Pond 2	Early
1 July 2020	Pond 1, WC5, WC2, WC3, WC1 (eastern half), WC4	Late
12 August 2020	WC6, River Wensum (north bank)	Late
13 August 2020	WC5 (central section of north bank and eastern section of south bank)	Late
8 September 2020	River Wensum (central and eastern section of south bank), WC5 (central and eastern section of north bank and central section of south bank), WC3, WC4, Pond 2	Late
10 September 2020	River Wensum (western section of south bank), WC1, WC2, WC5 (western section of north and south bank), Pond 1	Late

3.4.2. Trail cameras were deployed or collected on the following dates;

- 18 August 2020 – TC1 deployed;
- 27 August 2020 – TC2 deployed;
- 3 September 2020 – TC1 collected;
- 9 September 2020 – TC2 collected;
- 18 November 2020 – TC3 deployed; and
- 8 December 2020 – TC3 collected.

[3] The early surveying season for water vole is between mid-April/early May and the end of June and the late surveying season is between July and September

3.5 NOTES AND LIMITATIONS

3.5.1. All watercourses and waterbodies south of the River Wensum, apart from WC5, were surveyed from within the channel where access allowed. WC5 and the River Wensum comprised a mixture of steep, sloping and poached banks which allowed sufficient visibility for surveying from the bank.

3.5.2. As close contact with water vole during the surveys was unnecessary and undesirable, their genetic clade is undetermined. This does not have an impact on the survey results however if further intervention in the local water vole population was proposed, this may need to be confirmed.

3.5.3. The extent of dense vegetation present within WC1 and Pond 1 meant that access to the full length of their channels was not possible. Spot checks were carried out along the water channel wherever safe access was possible. No field signs were recorded within these waterbodies, but as a result of the accessibility issues the presence of water vole or otter evidence cannot be discounted. Habitat assessments have been used to inform the relative water vole population densities.

3.5.4. The central section of the south bank of WC5 was heavily vegetated and a barbed wire fence was present close to the bank. This meant areas of bank could not be thoroughly examined, however, the watercourse did not exceed approximately 3m in width so non-accessible banks were largely observable across the channel and this is not considered a significant survey limitation.

4 RESULTS

4.1 OVERVIEW

4.1.1. A summary of positive evidence of species occurrence recorded during the surveys is presented in Table 4-1.

Table 4-1 – Summary of Evidence of Species Recorded During 2019 and 2020 Surveys

Species	Watercourse
Water vole	River Wensum, WC3, WC5
Otter	River Wensum
American mink	WC5
Brown rat	River Wensum, WC5, WC6
Small mammals, such as bank vole *Myodes glareolus*	WC3, WC6

4.2 DESK STUDY

4.2.1. The Desk Study returned two records of otter, two records of water vole and eleven records of American mink within the 2km Study Area. The nearest otter record was found dead 860m from the Scheme on Fakenham Road and the most recent sighting of an otter was 2km southeast of the Scheme near Taverham, on the River Wensum. The nearest and most recent record of a water vole was found dead 650m south of the Scheme, near the River Tud in Honingham. The nearest and most recent record of American mink was recorded 250m from the Scheme, near Morton Farm on a camera trap, with eight sightings recorded. Three mink were also recorded on the River Wensum, near Attlebridge. Full detail of the Scheme, Desk Study Area and Desk Study Results are included within separate document Appendix A.

4.3 HABITAT DESCRIPTIONS

4.3.1. The watercourses and waterbodies surveyed comprised two ponds set within broadleaved woodland and semi-improved grassland, the River Wensum, four drainage ditches and two streams which were set within a combination of grassland and floodplain grazing marsh. The locations of the watercourses and waterbodies are shown in separate document Appendix B.

RIVER WENSUM

4.3.2. The River Wensum had a mixture of steep and sloping banks, with the eastern part of the north bank very dry and poached by cattle. Bankside vegetation was dominated by reed sweet grass *Glyceria maxima* with nettle *Urtica dioica* also frequent and occasional willow trees *Salix sp.* present. Areas of steep bank offered burrowing potential and abundant riparian vegetation supplied cover and foraging opportunities, providing optimal habitat for water vole. The River Wensum also offered linear connectivity with other watercourses, providing optimal habitat for otter.

WATERCOURSE 1

4.3.3. An unmanaged ditch that was only accessible for short stretches as the majority of the watercourse was bordered with barbed wire. Accessibility was further decreased by areas of steep banks and thick vegetation. The ditch was choked with reeds, hawthorn *Crataegus monogyna*, goat willow *Salix caprea*, bramble *Rubus fruticosus agg*. and scrub and although damp and sludgy in places, no standing water was observed. As a result of accessibility issues, even though no field signs were observed during surveys the presence of water vole could not be discounted. WC1 offered limited burrowing opportunities in some of the areas accessed with steeper banks and suitable foraging habitat. WC1 also provided links between optimal water vole habitat so was considered to offer limited suitable habitat for water vole.

WATERCOURSE 2

4.3.4. An unmanaged ditch with shallow banks that were heavily poached by cattle. Dense vegetation was present throughout the whole ditch which was generally damp with shallow standing water in places. As the banks were extremely shallow and composed of cattle poached earth WC2 provided low quality habitat for burrowing, however offered suitable foraging habitat and links to areas of optimal water vole habitat. WC2 was therefore considered to provide limited suitable habitat for water vole.

WATERCOURSE 3

4.3.5. An unmanaged ditch with shallow banks that were heavily poached by cattle. Dense vegetation was present throughout the whole ditch and the ditch generally contained only a few centimetres of water. As the banks were extremely shallow and composed of cattle poached earth WC3 provided low quality habitat for burrowing, however offered suitable foraging habitat and links to areas of optimal water vole habitat. WC3 was therefore considered to provide limited suitable habitat for water vole.

WATERCOURSE 4

4.3.6. A ditch with shallow banks that were heavily poached by cattle. The eastern side of the ditch was bordered with a barbed wire fence so was slightly less poached. The ditch was densely vegetated and the majority of it contained shallow standing water. Some hawthorn and willow trees were also present. WC4 provided limited opportunities for burrowing on the eastern bank, as although the bank had less impact from poaching, it was still fairly shallow. Additionally, WC4 offered suitable foraging habitat and links to areas of optimal water vole habitat therefore was considered to provide limited suitable habitat for water vole.

WATERCOURSE 5

4.3.7. A stream approximately 3m wide with frequent yellow flag iris *Iris pseudacorus*. The western section generally had steep loose soil banks, which were more stable on the south where they were bound together by tree roots. The central section had fairly steep banks, with the north bank heavily poached. The south bank in this section was heavily vegetated and bordered by a barbed wire fence, meaning access was limited and it was mainly observed from across the channel. The eastern section had an increased concentration of yellow flag iris along the banks. The south bank was fairly steep; however, the north bank was more gently sloped. The eastern section also had minimal impact from cattle. Areas of steep and moderately sloping bank offered burrowing potential and sections of abundant riparian vegetation supplied cover and foraging opportunities, providing optimal habitat for water vole.

WATERCOURSE 6

4.3.8. A shallow flowing stream with steep earth banks that were poached by cattle in short sections. The stream was heavily vegetated by bramble, nettle, bittersweet *Solanum dulcamara*, bracken *Pteridium aquilinum*, soft rush *Juncus effusus*, creeping thistle *Cirsium arvense*, broad-leaved dock *Rumex obtusifolius* and elder *Sambucus nigra*, with some areas completely choked by the vegetation. The majority of the stream was observed from within the channel. WC6 offered banks with areas of burrowing potential, where poaching was minimal, and abundant foraging opportunities, providing optimal habitat for water vole.

POND 1

4.3.9. A shallow pond with very shallow banks. The pond was dominated by common reed *Phragmites australis* and covered in duckweed *Lemna minor* with bramble present on the banks. The pond was also surrounded by very dense nettle, with the combination of thick nettles, reeds and a shallow sludgy bank meaning that some areas, particularly the northern part of the pond, were inaccessible. The pond offered suboptimal habitat for burrowing as the banks were shallow and very soft, however there were some opportunities for foraging meaning that the habitat had limited suitability for water vole.

POND 2

4.3.10. A pond with largely shallow sloping banks. The pond had limited aquatic vegetation and only a small amount of marginal vegetation, meaning there was limited cover for water voles. The majority of the pond provided suboptimal habitat for burrowing due to shallow banks, however steeper banks were present on the east side where some vegetation cover was present, providing limited suitable habitat for water voles.

4.4 OTTER FIELD SURVEY

4.4.1. An otter sighting and field signs of otter were recorded in the River Wensum; a summary of evidence of otter is given in Table 4-2. Full survey data is included in Appendix E.

4.4.2. The survey did not record any signs of otter within WC1 - WC6 or Pond 1 and Pond 2.

Table 4-2 – Evidence of Otter

Watercourse	Date evidence recorded	Description of evidence present
River Wensum	26/09/2019 Incidental record	Otter sighting recorded in the central section of the River Wensum.
River Wensum	30/06/2020	Potential otter holt recorded on the north bank of the River Wensum in a small section of trees. Potential holt found under tree roots with shell remains with scrapes present inside and several spraints also present.

4.5 WATER VOLE FIELD SURVEY

4.5.1. Field signs of water vole were recorded in the River Wensum, WC3 and WC5; a summary of evidence of water vole is given in Table 4-3. Full survey data is included in Appendix E.

4.5.2. The survey did not record any signs of water vole within WC1, WC2, WC4, WC6, Pond 1 or Pond 2. However, as some of the watercourses and waterbodies were subject to limitations, as shown in section 3.5, and water vole are widespread in the area, habitat suitability was also used to infer water vole presence for certain watercourses and waterbodies, as shown in Table 4-3.

Table 4-3 – Evidence of Water Vole

Watercourse	Survey number	Date	Water vole presence	Water vole presence inferred from habitat suitability	Description of evidence present
River Wensum	Incidental record	26/09/2019	✓	×	A single water vole latrine recorded in the middle section on the south bank.
River Wensum	Survey 1 2020	30/06/2020	✓	×	Three burrows recorded in the middle section on the south bank, including entrances on top of bank. One of the burrows in this area was recorded with associated feeding remains and a latrine. A single additional burrow was recorded further to the west on the north bank and a single latrine was also recorded in the same area.
River Wensum	Survey 2 2020	12/08/2020 (north bank)	✓	×	A single potential burrow and a single old latrine recorded on the north bank at the west end of the River Wensum.
River Wensum	Survey 2 2020	08/09/2020 (central and eastern section of south bank)	✓	×	A single burrow recorded on the south bank at the easternmost end of the River Wensum. Ten records of feeding remains were distributed throughout the central and eastern part of the south bank of the River Wensum.

Watercourse	Survey number	Date	Water vole presence	Water vole presence inferred from habitat suitability	Description of evidence present
					Thirteen latrines were recorded in the same areas, with the majority of feeding remains records associated with a latrine. Two runs were recorded on the south bank at the easternmost end and were both associated with other field signs.
River Wensum	Survey 2 2020	10/09/2020 (western section of south bank)	✓	×	A single latrine recorded on the south bank at the west end of the River Wensum.
WC1	Survey 1 2020	30/06/2020	×	✓	No evidence of water vole recorded. Suitable habitat not fully accessible.
WC1	Survey 1 2020	01/07/2020	×	✓	No evidence of water vole recorded. Suitable habitat not fully accessible.
WC1	Survey 2 2020	10/09/2020	×	✓	No evidence of water vole recorded. Suitable habitat not fully accessible.
WC2	Survey 1 2020	01/07/2020	×	×	No evidence of water vole recorded.
WC2	Survey 2 2020	10/09/2020	×	×	No evidence of water vole recorded.
WC3	Survey 1 2020	01/07/2020	×	×	No evidence of water vole recorded.
WC3	Survey 2 2020	08/09/2020	✓	×	Two records of possible feeding remains recorded.

Watercourse	Survey number	Date	Water vole presence	Water vole presence inferred from habitat suitability	Description of evidence present
WC4	Survey 1 2019	02/10/2019	×	×	No evidence of water vole recorded.
WC4	Survey 1 2020	01/07/2020	×	×	No evidence of water vole recorded.
WC4	Survey 2 2020	08/09/2020	×	×	No evidence of water vole recorded.
WC5	Survey 1 2019	02/10/2019	×	×	No evidence of water vole recorded.
WC5	Survey 1 2020	01/07/2020	✓	×	One record of feeding remains with an associated latrine was recorded on the south bank at the east end of WC5. A single possible burrow recorded 3m east of the bridge at the east end of WC5 on the south bank.
WC5	Survey 2 2020	13/08/2020 (central section of north bank and eastern section of south bank)	✓	✓	Two burrows recorded on the north bank of WC5 in the central section, with one burrow on top of the bank. One burrow was associated with a latrine and feeding remains. Six records of feeding remains were recorded throughout the central and east sections of WC5 on the south bank with a concentration of feeding remains recorded at the east end of WC5.

Watercourse	Survey number	Date	Water vole presence	Water vole presence inferred from habitat suitability	Description of evidence present
WC5	Survey 2 2020	08/09/2020 (central and eastern section of north bank and central section of south bank)	✓	✓	Three records of feeding remains with associated latrines recorded on the north bank of WC5 in the central section.
WC5	Survey 2 2020	10/09/2020 (western section of north and south bank)	×	×	No evidence of water vole recorded.
WC6	Survey 1 2019	19/09/2019	×	×	No evidence of water vole recorded.
WC6	Survey 1 2020	06/05/2020	×	×	No evidence of water vole recorded.
WC6	Survey 2 2020	12/08/2020	×	×	No evidence of water vole recorded.
Pond 1	Survey 1 2020	01/07/2020	×	✓	No evidence of water vole recorded. Suitable habitat not fully accessible.
Pond 1	Survey 2 2020	10/09/2020	×	✓	No evidence of water vole recorded. Suitable habitat not fully accessible.
Pond 2	Survey 1 2020	30/06/2020	×	×	No evidence of water vole recorded.
Pond 2	Survey 2 2020	08/09/2020	×	×	No evidence of water vole recorded.

4.5.3. No evidence of American mink or brown rat were recorded during these surveys. For sightings of American mink and brown rat see trail camera results, shown in section 4.6 below.

4.5.4. Evidence of small mammals, such as bank vole, were recorded in WC3 and WC6.

4.6 TRAIL CAMERA DEPLOYMENT

4.6.1. TC1 and TC3 recorded brown rat and TC2 recorded American mink and brown rat; a summary of evidence is given in Table 4-4. Full survey data is included in Appendix E.

4.6.2. TC1-TC3 did not record any signs of otter or water vole.

Table 4-4 – Evidence of Species Recorded During Deployment of Trail Cameras

Trail camera	Date	Description of species recorded
TC1	18/08/2020 – 03/09/2020	Seven recordings of brown rat.
TC2	27/08/2020 – 09/09/2020	One recording of brown rat and one recording of American mink.
TC3	18/11/2020 – 08/12/2020	Three recordings of brown rat.

4.7 RELATIVE WATER VOLE POPULATION DENSITY

4.7.1. The latrine counts from the surveys can give an indication of relative water vole population density for each watercourse and waterbody (as described in section 4.3 above). This aids in identifying the most valuable parts of the site for water voles, along with areas most suitable for enhancement, however latrine counts cannot provide robust estimates of absolute numbers of animals. The method was informed by guidance in The Water Vole Mitigation Handbook (Dean, et al., 2016).

4.7.2. The thresholds used were based on the approximate number of latrines per 100m of bankside habitat and the overall threshold was decided by taking into account the varying thresholds met throughout the whole watercourse or waterbody. During the early survey season, the thresholds were ≥10 for high density, 3-9 for medium density and ≤2 (or none with other confirmatory field signs) for low density. During the late survey season, the thresholds were ≥20 for high density, 6-19 for medium density and ≤5 (or none with other confirmatory field signs) for low density. Latrine counts from the surveys indicate the following relative population densities, as shown in Table 4-5.

Table 4-5 – Relative Water Vole Population Densities

Watercourse	Relative population densities
River Wensum	Medium density.
WC1	None.
WC2	None.
WC3	None (only two records of possible feeding remains in September).
WC4	None.
WC5	Low density.
WC6	None.
Pond 1	None.
Pond 2	None.

4.7.3. The limitations on surveys (as noted in section 3.5) meant that water vole absence could not be confirmed by the lack of field signs in WC1 and Pond 1, so habitat assessments were used to assist in estimating the water vole population densities present. WC1 and Pond 1 had limited suitable habitat for water vole and an existing water vole population in nearby habitat. However, they both also had mink present in the surrounding area, so were assessed as having low densities of water vole present.

5 REFERENCES

5.1 PROJECT REFERENCES

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5.2 TECHNICAL REFERENCES

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Appendix A

MARCH 2020 DESK STUDY (SEE SEPARATE DOCUMENT)

Appendix B

OTTER AND WATER VOLE SURVEY AREA (SEE SEPARATE DOCUMENT)

Appendix C

OTTER AND WATER VOLE SURVEY RESULTS – NORTH (SEE SEPARATE DOCUMENT)

Appendix D

OTTER AND WATER VOLE SURVEY RESULTS – SOUTH (SEE SEPARATE DOCUMENT)

Appendix E

FIELD SURVEY DATA

Table E-1 – River Wensum Field Survey Results

Date	Grid reference	Field sign	Species	Description
26/09/2019	TG1397915485	Latrine	Water vole	Incidental record.
26/09/2019	TG1393015509	Sighting	Otter	Incidental record.
30/06/2020	TG1375115657	Latrine	Water vole	Old latrine on a log in the water, x9 droppings.
30/06/2020	TG1379215641	Holt	Otter	Possible otter holt under tree roots.
30/06/2020	TG1379215641	Feeding remains	Otter	Shell remains with scrapes present inside.
30/06/2020	TG1379215641	Spraint	Otter	Several spraint present.
30/06/2020	TG1381515640	Burrow	Water vole	
30/06/2020	TG1402715423	Burrow	Water vole	
30/06/2020	TG1402715423	Feeding remains	Water vole	
30/06/2020	TG1402715423	Latrine	Water vole	
30/06/2020	TG1397415479	Burrow	Water vole	Burrow entrance at top of bank. Tunnel leading east.
30/06/2020	TG1397315478	Burrow	Water vole	Burrow on top of bank.
12/08/2020	TG1376215654	Latrine	Water vole	x1 old dropping.
12/08/2020	TG1376215654	Burrow	Water vole	Possible burrow.
08/09/2020	TG1423815321	Latrine	Water vole	x2 droppings.

Date	Grid reference	Field sign	Species	Description
08/09/2020	TG1423815321	Feeding remains	Water vole	
08/09/2020	TG1423815321	Burrow	Water vole	
08/09/2020	TG1424315325	Latrine	Water vole	x2 droppings.
08/09/2020	TG1424315325	Feeding remains	Water vole	
08/09/2020	TG1424315325	Run	Water vole	
08/09/2020	TG1424615319	Latrine	Water vole	x4 droppings.
08/09/2020	TG1424615319	Feeding remains	Water vole	
08/09/2020	TG1424615319	Run	Water vole	
08/09/2020	TG1424815321	Latrine	Water vole	x1 dropping.
08/09/2020	TG1424815321	Feeding remains	Water vole	
08/09/2020	TG1425015320	Latrine	Water vole	x10 droppings.
08/09/2020	TG1417815351	Latrine	Water vole	x10 droppings.
08/09/2020	TG1417815351	Feeding remains	Water vole	
08/09/2020	TG1406915386	Latrine	Water vole	x1 dropping.
08/09/2020	TG1406915386	Feeding remains	Water vole	
08/09/2020	TG1402715429	Latrine	Water vole	x2 droppings.
08/09/2020	TG1402715429	Feeding remains	Water vole	
08/09/2020	TG1396215494	Latrine	Water vole	x13 older droppings.
08/09/2020	TG1396815492	Feeding remains	Water vole	

Date	Grid reference	Field sign	Species	Description
08/09/2020	TG1391115522	Feeding remains	Water vole	
08/09/2020	TG1391115522	Latrine	Water vole	Old latrine largely disintegrated.
08/09/2020	TG1426215313	Latrine	Water vole	x3 droppings.
08/09/2020	TG1421015320	Latrine	Water vole	Minimum of 20 droppings.
08/09/2020	TG1411015373	Latrine	Water vole	x9 droppings, some disintegrating.
08/09/2020	TG1410815374	Feeding remains	Water vole	Possible feeding remains.
10/09/2020	TG1374115650	Latrine	Water vole	x3 droppings.

Table E-2 – Watercourse 3 Field Survey Results

Date	Grid reference	Field sign	Species	Description
08/09/2020	TG1352215449	Feeding remains	Water vole	Possible water vole feeding remains - large and with correct angle.
08/09/2020	TG1354415474	Latrine	Small mammal	
08/09/2020	TG1354415474	Feeding remains	Small mammal	
08/09/2020	TG1354515472	Feeding remains	Water vole	Possible water vole feeding remains as some feeding remains are the correct size - mixture of old and new.

Date	Grid reference	Field sign	Species	Description
08/09/2020	TG1352615456	Latrine	Small mammal	
08/09/2020	TG1352615456	Feeding remains	Small mammal	

Table E-3 – Watercourse 5 Field Survey Results

Date	Grid reference	Field signs	Species	Description
01/07/2020	TG1387315190	Feeding remains	Water vole	
01/07/2020	TG1387315190	Latrine	Water vole	x2 droppings.
01/07/2020	TG1387115194	Burrow	Water vole	Potential water vole burrow 3m east of bridge.
13/08/2020	TG1389115179	Feeding remains	Water vole	
13/08/2020	TG1387515192	Feeding remains	Water vole	
13/08/2020	TG1388015188	Feeding remains	Water vole	
13/08/2020	TG1382915228	Feeding remains	Water vole	
13/08/2020	TG1375615266	Feeding remains	Water vole	Old feeding remains.
13/08/2020	TG1373615279	Burrow	Water vole	Burrow on top of bank.
13/08/2020	TG1372615288	Burrow	Water vole	Burrow entrance at water's edge.
13/08/2020	TG1372615288	Feeding remains	Water vole	
13/08/2020	TG1372615288	Latrine	Water vole	x3 droppings.

Date	Grid reference	Field signs	Species	Description
08/09/2020	TG1369915305	Latrine	Water vole	x4 droppings.
08/09/2020	TG1369915305	Feeding remains	Water vole	
08/09/2020	TG1369815305	Latrine	Water vole	x2 droppings.
08/09/2020	TG1369815305	Feeding remains	Water vole	
08/09/2020	TG1369615307	Latrine	Water vole	x12 droppings.
08/09/2020	TG1369615307	Feeding remains	Water vole	

Table E-4 – Watercourse 6 Field Survey Results

Date	Grid reference	Field signs	Species	Description
06/05/2020	TG1035113478	Feeding remains	Small mammal	
06/05/2020	TG1035513481	Feeding remains	Small mammal	
06/05/2020	TG1035513481	Latrine	Small mammal	
06/05/2020	TG1037213475	Feeding remains	Small mammal	
06/05/2020	TG1051613331	Burrow	Small mammal	

Table E-5 – Trail Camera Results

Trail camera	Date	Description of species recorded
TC1	18/08/2020 – 03/09/2020	360x pheasant *Phasianus colchicus*, 30x cow *Bos taurus*, 14x wood pigeon *Columba palumbus*, 8x feral pigeon *Columba livia*, 7x brown rat, 6x jay *Garrulus glandarius*, 2x mouse *Apodemus sp*. and 1x buzzard *Buteo buteo*.
TC2	27/08/2020 – 09/09/2020	1x American mink and 1x brown rat.
TC3	18/11/2020 – 08/12/2020	8x little egret *Egretta garzetta*, 5x grey heron *Ardea cinerea*, 12x pheasant and 3x brown rat.

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