501500 502000 502500 503000 503500 504000 504500 505000 505500 506000 506500 507000 507500

192000 191500 191000 190500 190000 189500 189000 188500 188000 187500 187000

West Hyde Lane
M25
Chalfont Lane
A412
West Hyde
Denham Way
Tilehouse Lane
Slade Oak Lane
Taylors Meadow
Harefield Hospital
The Harefield Academy
Northwood Road
Park Lane
Harefield
Harefield Infant School
Preston Park
Ducks Hill Road
Breakspear Road North
BMI Bishops Wood Hospital
Bishops Wood Country Park
Michael Sobell Hospice
Denham Manor Nursing Home
South Harefield
Denham Aerodrome
Bayhurst Wood Country Park
Denham Golf Club
Denham Green
Amersham Road
Harvil Road
Breakspear Road South
A413
Redhill
Oxford Road
Buckinghamshire Golf Club
Denham
Uxbridge Golf

Legend:

Site Boundary

Rev	Date	Description	Drn	Chk	App
00	18/05/2022	2483631	WF	RH	AA

Broadwater Lake

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 1:

Site Location Plan

0 250 500 750
Metres
SCALE: 1:20,000 @ A3

N W E S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 2483631 - Broadwater Lake Ecological Mitigation\06 GIS\03 - APRX\2483631 - Broadwater Lake - Fig 1 - Site Location.aprx

503600 503800 504000 504200 504400 504600 504800 505000 505200 505400 505600

190200 190000 189800 189600 189400 189200 189000 188800 188600

Legend:

- Site Boundary
- Waterbody 1
- Waterbody 2
- Waterbody 3
- Waterbody 4

Rev	Date	Description	Drn	Chk	App
00	18/05/2022	2483631	WF	RH	AA

Broadwater Lake

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:

Pond Locations

0 80 160 240

Metres

SCALE: 1:6,500 @ A3

N W E S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 2483631 - Broadwater Lake Ecological Mitigation\06 GIS\03 - APRX\2483631 - Broadwater Lake - Fig 2 - Pond Locations.aprx

References

ARG UK (2010), ARG UK Advice Note 5: *Great Crested Newt habitat Suitability Index*. Amphibian and Reptile Groups of the United Kingdom.

Biggs J., Ewald N., Valentini A., Gaboriaud C., Griffiths R.A., Foster J., Wilkinson J., Arnett A., Williams P. & Dunn F. (2014). *Analytical and methodological development for improved surveillance of the Great Crested Newt*. Defra Project WC1067. Freshwater Habitats Trust: Oxford.

Oldham, R.S., Keeble, J., Swan, M.J.S. & Jeffcote, M. (2000), *Evaluating the suitability of habitat for the Great Crested Newt* (Triturus cristatus). Herpetological Journal, 10, 143-155.

Appendix 1: Legislation

Great Crested Newt

Triturus cristatus (Great Crested Newt) is listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), and receives full protection under Section 9. Great Crested Newts are also European Protected Species listed on The Conservation of Species and Habitats Regulations 2010 (as amended). This legislation makes it an offence to:

- deliberately capture, injure or kill a Great Crested Newt;
- deliberately disturb a Great Crested Newt (in such a way as to be likely to significantly affect, (i) the ability of a significant group of Great Crested Newt to survive, breed or rear/nurture their young; and (ii) the local distribution or abundance of the species concerned);
- deliberately take or destroys the eggs of such an animal;
- damage or destroy a breeding site or resting place of a Great Crested Newt; and
- possess, control, transport, sell, exchange a Great Crested Newt, or offer a Great Crested Newt for sale or exchange.

All resting and breeding places of Great Crested Newts receive legal protection even when Great Crested Newts are not present.

RSK biocensus
EXPERTS IN ECOLOGY
METHODOLOGY

Appendix 2: eDNA results

Client: Sophie Elliott,
RSK Biocensus

ADAS
Spring Lodge
172 Chester Road
Helsby
WA6 0AR

Tel: 01159 229249
Email: Helen.Rees@adas.co.uk

www.adas.uk

Sample ID: ADAS-3517	Condition on Receipt: Good	Volume: Passed
Client Identifier: Waterbody 3, Broadwater lakes	Description: pond water samples in preservative	
Date of Receipt: 25/04/2022	Material Tested: eDNA from pond water samples	

Determinant	**Result**	**Method**	**Date of Analysis**
Inhibition Control[†]	2 of 2	Real Time PCR	27/04/2022
Degradation Control[§]	Within Limits	Real Time PCR	27/04/2022
Great Crested Newt*	0 of 12 (GCN negative)	Real Time PCR	27/04/2022
Negative PCR Control (Nuclease Free Water)	0 of 4	Real Time PCR	As above for GCN
Positive PCR Control (GCN DNA 10^{-4} ng/µL)[#]	4 of 4	Real Time PCR	As above for GCN

Report Prepared by:	Dr Helen Rees	Report Issued by:	Dr Ben Maddison
Signed:		Signed:	
Position:	Director: Biotechnology	Position:	MD: Biotechnology
Date of preparation:	27/04/2022	Date of issue:	27/04/2022

eDNA analysis was carried out in accordance with the stipulated methodology found in the Technical Advice Note (WC1067 Appendix 5 Technical Advice Note) published by DEFRA and adopted by Natural England.

** If all PCR controls and extraction blanks give the expected results a sample is considered: negative for great crested newt if all of the replicates are negative; positive for great crested newt if one or more of the replicates are positive.*

[†] Recorded as the number of positive replicate reactions at expected C_t value. If the expected C_t value is not achieved, the sample is considered inhibited and is diluted as per the technical advice note prior to amplification with great crested newt primer and probes.

[§] No degradation is expected within time frame of kit preparation, sample collection and analysis.

[#]Additional positive controls (10^{-1}, 10^{-2}, 10^{-3} ng/µL) are also routinely run, results not shown here.

Appendix 1: Interpretation of results

Sample Condition

Upon sample receipt we score your samples according to quality: good, low sediment, medium sediment, high sediment, white precipitate, and presence of algae.

There are three reasons as to why sediment should be avoided:

1. It is possible for DNA to persist within the sediment for longer than it would if it was floating in the water which could lead to a false positive result i.e. in this case GCN not recently present but present a long time ago
2. In some cases sediment can cause inhibition of the PCR analysis used to detect GCN eDNA within samples which could lead to an indeterminate result.
3. In some cases sediment can interfere with the DNA extraction procedure resulting in poor recovery of the eDNA which in turn can lead to an indeterminate result.

Algae can make the DNA extraction more difficult to perform so if it can be avoided then this is helpful.

Sometimes samples contain a white precipitate which we have found makes the recovery of eDNA very difficult. This precipitate can be present in such high amounts that it interferes with the eDNA extraction process meaning that we cannot recover the degradation control (nor most likely the eDNA itself) at sufficient levels for the control to be within the acceptable limits for the assay, therefore we have to classify these type of samples as indeterminate.

What do my results mean?

A positive result means that great crested newts are present in the water or have been present in the water in the recent past (eDNA degrades over around 7-21 days).

A negative result means that DNA from the great crested newt has not been detected in your sample.

On occasion an inconclusive result will be issued. This occurs where the DNA from the great crested newt has not been detected but the controls have indicated that either: the sample has been degraded and/or the eDNA was not fully extracted (poor recovery); or the PCR inhibited in some way. This may be due to the water chemistry or may be due to the presence of high levels of sediment in samples which can interfere with the DNA extraction process. A re-test could be performed but a fresh sample would need to be obtained. We have successfully performed re-tests on samples which have had high sediment content on the first collection and low sediment content (through improved sample collection) on the re-test. If water chemistry was the cause of the indeterminate then a re-test would most likely also return an inconclusive result.

The results will be recorded as indeterminate if the GCN result is negative and the degradation result is recorded as:

1. evidence of decay - meaning that the degradation control was outside of accepted limits
2. evidence of degradation or residual inhibition - meaning that the degradation control was outside of accepted limits but that this could have been due to inhibitors not being removed sufficiently by the dilution of inhibited samples (according to the technical advice note)

Greengage

Brighter strategies
for greener projects

Client: London Borough of Hillingdon

Project: Proposed Hillingdon Water Sports Facility, Broadwater Lake

Report: Breeding Bird Survey

QUALITY ASSURANCE

Issue/Revision:	Draft	Final
Date:	August 2022	August 2022
Comments:		
Prepared by:	Dr Jonty Denton / Mike Harris	Dr Jonty Denton / Mike Harris
Authorised by:	Stephanie Harper	Stephanie Harper
File Reference:	552023MJH09Aug22DV01_Breeding_Birds.docx	552023MJH09Aug22FV01_Breeding_Birds.docx

CONTENTS

Tables

Figures

1.0 EXECUTIVE SUMMARY

Greengage Environmental Ltd was commissioned by London Borough of Hillingdon to undertake a breeding bird survey at a site known as Broadwater Lake in the London Borough of Hillingdon.

This report has been produced in support of a planning application which seeks to develop the Hillingdon Water Sports Facility (HWSF) on the site. At the time of the report, detailed proposals for the development had not been prepared.

The site is part of the wider Lower Colne Valley SSSI, a nationally designated site for nature conservation. The reason for the site's designation is primarily due to the breeding and wintering bird population it supports.

Of the approximately 48 birds recorded during the survey, at least 26 were confirmed breeding on site. The species recorded are a mixture of wetland and woodland bird species.

Any proposed development on site will need to be carefully designed so as not to impact the breeding bird population. Two key recommendations are:

- That Natural England is engaged and consulted as soon as possible and through the design process to discuss the proposals and to gain their thoughts on viability and design; and
- Wintering Bird Surveys should be undertaken to inform the design and considered alongside this breeding bird survey.

Further recommendations on how to minimise any future impact on breeding birds, assuming Natural England agree the scheme is viable, are provided.

Detailed proposals were not available at the time of report production and so compliance with legislation and policy will need to be considered once more detailed plans have been produced and after Natural England have been consulted.

2.0 INTRODUCTION

Greengage Environmental Ltd was commissioned by London Borough of Hillingdon to undertake a breeding bird survey at a site known as Broadwater Lake in the London Borough of Hillingdon.

The survey aims were to survey and identify the breeding bird population present at site in order to inform future development proposals for the HWSF. At this stage, detailed designs for the proposals are not available. The results of this survey will be used to inform the design and, in time, identify appropriate mitigation, compensation and enhancement actions in light of the proposed development at site, ensuring legislative and planning policy compliance.

This document is a report of this survey and has been produced to support a planning submission for the site which seeks to develop the Hillingdon Water Sports Facility (HWSF) on the site.

2.1 SITE CONTEXT & STATUS

The assessment site covers an area of 8 hectares (ha) and is approximately centred on National Grid Reference TQ 0471 8921, OS Co-ordinates 504715 189215.

The site is located in South Harefield approximately 5km north of Uxbridge. The site lies within the Mid Colne Valley Site of Special Scientific Interest (SSSI). The habitats immediately surrounding the site primarily comprise Broadwater Lake to the north and west, woodland and the Grand Union Canal to the east, woodland, scrub and an active quarry to the south. Within the wider area, urban development in the form of South Harefield exists to the east with primarily further lakes, woodland and open grassland being present to the north, south and west.

2.2 PRELIMINARY ECOLOGICAL APPRAISAL

The Phase 1 Habitat Survey was carried out on 9th July 2021 by CGO Ecology Ltd.

Site-specific information was also sourced through Defra's Multi-Agency Geographic Information for the Countryside (MAGIC) website[1] and a biological records search from Green Space Information for Greater London (GiGL) in relation to the presence of protected species, designated sites or areas of regional, national or international importance.

The key findings from the PEA were:

- The site lies within the Mid Colne Valley SSSI, which is designated primarily for the population of breeding and wintering birds it supports
- There were 9no. further statutory protected sites within 2km of the site
- 16no. non-statutory designated sites were identified within 2km of the site
- The GiGL search highlighted 9no. species of bat, and records of badger, water vole, hedgehog, over 100 bird species, GCN, grass snake, invertebrates, plants, and Invasive Non Native Species within 2km

- The PEA walkover recorded 122 plants, 11 birds, and at least 12 invertebrate species. The trees on site were numerous, and likely to hold bat roost potential. No Badger evidence was seen. Japanese knotweed and giant knotweed were present on site.
- Habitats recorded on site included:
    - Semi natural broadleaved woodland
    - Wet woodland
    - Standing water
    - Introduced shrub
    - Buildings and hardstanding
    - Amenity grassland
    - Localised areas of marshy grassland, ephemeral/short perennial and tall ruderal.
- Protected species potential identified on site include:
    - Breeding and wintering birds (a key reason for the SSSI designation)
    - Roosting, foraging and commuting bats
    - Otter and Water vole
    - Reptiles
    - Invertebrates
    - Hedgehog
    - Common toad
    - Fish

Recommendations for further survey and high-level mitigation measures were also recommended.

It is understood that a number of protected species surveys, in addition to the breeding bird survey, are being undertaken by others. At the time of this report production, the results of the other protected species surveys were not known.

3.0 METHODOLOGY

To provide a reasonable level of accuracy for determining the statuses of birds breeding on the site, monthly visits were undertaken between March- July 2022.

The site was walked at dawn on each visit for a minimum of 4 hours. Optics used were 10x42 Leica red spot binoculars and a Swarovski telescope. Surveys were conducted where possible in favourable weather conditions avoiding heavy rain and strong winds which could suppress bird activity especially vocalisations. Details of the prevailing weather conditions are summarized in Table 3.1.

Table 3.1 Survey Dates and conditions

date	Cloud cover	Rain	Wind	visibility
27/03/22	0%	No	Calm	Good
10/04/22	0%	No	Calm	Good
17/05/22	0%	No	Calm	Good
12/06/22	0%	No	Calm	Good
03/07/22	20%	No	Calm	Good

3.1 SURVEYOR COMPETENCIES

Dr Jonty Denton, who undertook the survey visits and contributed to this report, is a freelance Chartered Ecologist of over 30 years experience, with Natural England licenses for Bats, Dormice, Great Crested Newt, Natterjacks, Sand Lizard, Smooth Snake, and White-clawed Crayfish. His clients include Natural England, the National Trust, Crown Estates, County Trusts, Butterfly Conservation, the Ministry of Defence, Royal Parks, and many County and District Councils, as well as the Environment Agency and Thames Water. Jonty is a highly experienced ornithologist having carried out ornithological surveys (for breeding and wintering birds), including pioneering studies of impact on birds of construction of bridge crossings and specialist surveys of impacts of piling works on Brent Geese in Langstone harbour. Jonty has travelled widely across all the continents and has seen over 50% of the world's avifauna.

Mike Harris, who wrote this report, has a Bachelor's degree in Environmental Biology (BSc Hons), a Natural England Great Crested Newt Licence (2015-17819-CLS-CLS) and Dormouse Licence (2016-21291-CLS-CLS) and is a Chartered Environmentalist (CEnv) and Full member of CIEEM. Mike has over 18 years' experience in ecological surveying and has undertaken and managed numerous ecological surveys and assessments.

Dr Stephanie Harper, who reviewed and verified this report, has a bachelors degree in Environmental Biology (BSc Hons), a Natural England CL17 Bat Survey Level 1 Class Licence (2015-14723-CLS-CLS) and 15 years' experience in ecological surveying and consultancy.

This report was written by Dr Jonty Denton and Mike Harris and reviewed and verified by Stephanie Harper who confirms in writing (see the QA sheet at the front of this report) that the report is in line with the following:

- Represents sound industry practice;
- Reports and recommends correctly, truthfully and objectively;
- Is appropriate given the local site conditions and scope of works proposed; and
- Avoids invalid, biased and exaggerated statements.

3.2 CONSTRAINTS

The survey visits were undertaken during a suitable time of year and under suitable conditions. The site was fully accessible on all visits. No significant constraints were encountered.

4.0 RESULTS

4.1 SPECIES RESULTS PER SURVEY

The species of bird recorded per survey visit is provided in Table 4.1. The approximate location of each record is shown on Figure A.1 in Appendix A.

Table 4.1 Species list

Species	Status	27/03/22	10/04/22	17/05/22	12/06/22	03/07/22
Cormorant *Phalacrocorax carbo*		2	(30+)			1
Little Egret *Egretta garzetta*			(6)			1
Grey Heron *Ardea cinerea*		1	(6)	1		1
Great Crested Grebe *Podiceps cristata*		2	4	5	6	8+1
Little Grebe *Tachybaptus ruficollis*		5	4	4	6	6
Mute Swan *Cygnus olor*			1	6	3	5
Canada goose *Branta canadensis*		4	4	10	66	70
Greylag Goose *Answer anser*		6	2			
Egyptian goose *Alopochen aegyptiaca*		2	4	2	2	14
Mallard *Anas platyrhynchus*	A	4	6	2	8+1	11+1
Shoveler *Spatula clypeata*	A		6			
Gadwall *Mareca strepera*	A	4	2	2		2
Wigeon *Mareca penelope*	A	2				2
Tufted Duck *Aythya fuligula*		12	10	4	4+2	2+8
Red Crested Pochard *Netta rufina*						1
Pochard *Aythya ferina*	R	14		2+1	2+4	2+2

Species	Status	27/03/22	10/04/22	17/05/22	12/06/22	03/07/22
Moorhen *Gallinula chloropus*		2	5	3	6	6
Coot *Fulica atra*		10	11	8	8+7	10+9
Oystercatcher *Haematopus ostralegus*	A			1		
Kingfisher *Alcedo atthis*		1		2	1	1
Green Woodpecker *Picus viridis*		1	1			
Great Spotted Woodpecker *Dendrocopus major*			2	2	1	1
Red Kite *Milvus milvus*		1				
Common tern *Sterna hirundo*	A			6	1	3
Black-headed gull *Chroicocephalus ridibundus*	A	6		4	1	1
Lesser Black-backed gull *Larus fucus*				2	1	1
Herring Gull *Larus argentatus*	R	4				
Wood Pigeon *Columba palumbus*		2	4	5		2
Cuckoo *Cuculus canorus*	R				1h	1h
Wren *Troglodytes troglodytes*		8	9	8	10	10
Dunnock *Prunella modularis*	A	4		3	4+3	4+7
Robin *Erithacus rubecula*		9	8	8	7	5
Song Thrush *Turdus philomelos*	A	3	1	2	2	3
Blackbird *Turdus merula*		4	2	2	2	5
Long-tailed Tit *Aegithalos caudatus*		4	3	8	7	8
Great Tit *Parus major*		6	2	4	8	4+5
Blue Tit *Parus caeruleus*		8	7	5	7	7

Species	Status	27/03/22	10/04/22	17/05/22	12/06/22	03/07/22
Treecreeper *Certhia familiaris*		2	2	2+4	8	8
Goldcrest *Regulus regulus*					2	2
Chiffchaff *Phylloscopus collybita*		5	5	4	4	2+ 2
Blackcap *Sylvia atricapilla*		2	3	5	3	4+ 3
Garden Warbler *Sylvia borin*				4	1	2
Cetti's Warbler *Cettia cetti*		2	1	2	2	
Magpie *Pica pica*		1	1	1	1	1
Jackdaw *Corvus monedula*		4				
Carrion Crow *Corvus corone*		2	2		1	1
Jay *Garrulus glandarius*		2	2			
Rose-ringed parakeet *Psittacus krameri*		2	2	2	1	2

Species in Bold were attempted breeders.

Status refers to UK Conservation Status: A = Amber listed and R = Red listed

4.2 SUMMARY OF SIGHTINGS

The following is a summary of sightings during the survey visits.

Cormorant

- Overflyers on 27th March.
- Large nesting colony on island 300m to west

Grey Heron

- Overflyers on 27th March.
- Heronry on island 300m to west

Little Egret

- Six plus in heronry on island 300m to west.

Great Crested Grebe

- Two adults on 27th March and 10th April in east inlet. Four pairs in June but no sign of breeding.
- Four pairs but only one young chick being fed on 3rd July.

Little Grebe

- Two pairs on east lake and a singleton west of peninsula on 27th March.
- Two pairs again on closed pond in May and June.

Canada Goose

- A pair on island in east lake in April.

Greylag Goose

- Skein of 6 flew NE across site on 27th March.
- Two on 10th April in east inlet.

Egyptian Goose

- Resident no evidence of breeding on site.
- Pair in east inlet on 27th march and 10th April.
- On small island in east inlet on 12th June.

- Eight adults in east inlet in July

Mute Swan

- One swan into east inlet under bridge and 10th April. Adults but no sign of breeding.

Mallard

- Resident breeder, bred successfully.
- Two on 10th April in east inlet and four on western edge of peninsula
- Male on NW edge of site on 17th May. Duck with one small duckling west of site on 12th June
- Two groups of eclipse drakes on 12th June.
- Duck with one very young duckling to west of site on 3rd July.

Shoveler

- Pair on closed pond on 10th April, plus 6 west of peninsula.

Wigeon

- Two males west of site on 27th March. Pair west of site on 3rd July.

Gadwall

- Two pairs in east inlet on 27th March. One pair west of peninsula in April and again in May.

Tufted Duck

- Resident breeder, bred successfully.
- At least 20 roughly equal numbers of ducks and drakes on 27th March. Numerous on open water but not on closed pond.
- Only one pair close to area on 17th May.
- Duck with two duckling on closed pond on 12th June

Red-crested Pochard

- Pair west of site on 3rd June

Pochard

- Resident breeder, bred successfully.
- Seven drakes in inlet and 4 and a duck west of peninsula on 27th March. 6 west of peninsula on 10th April.

- Pair with one week old duckling in east inlet on 17th May.
- Duck with 4 small ducklings east of peninsula on 12th June.
- Pair with 2 ducklings on 3rd July off NW corner of main block

Moorhen

- Resident breeder, attempted breeder.
- Pair nesting in pool at south end of site. Also seen in east inlet on 10th April.

Coot

- Resident breeder, bred successfully.
- Nesting on island and inlets. Two pairs with chicks on closed pond on 12th June. Lots of strong juveniles in closed pond and inlet in July.

Oystercatcher

- One flew north just west of site in May.

Kingfisher

- Feeding in shallow water at edge of carr woodland area.
- Two chasing each other around in mid canopy in carr woodland section on 17th May.
- Female bird with fish on bill flew into carr wood on 12th June.

Green Woodpecker

- Heard offsite on 27th March, one calling on 10th April landed in dead trees in carr area.

Great Spotted Woodpecker

- Resident breeder.
- Two drumming and calling foraging and nest prospecting on 17th May.

Black-headed gull

- Frequent flocks on water east of island.

Lesser Black-backed gull

- Adult on first island off peninsula on 17th May.

Red Kite

- One roosting in trees on site on 27th March.

Wood Pigeon

- Resident, Bred successfully.
- Present at edge of site. Nesting in large willow in centre of site in July.

Cuckoo

- Heard off site to west on 12th June

Wren

- Resident, Breed successfully.
- Widespread across site and vocal

Dunnock

- Resident, Breed successfully.
- Widespread in areas with undergrowth. Fledglings seen on 12th June.

Chiffchaff

- Bred successfully.
- Three singing on site on 27th march. Dull individuals likely over-winterers.

Blackcap

- Summer visitor, Bred successfully.
- At least 2 singing on site. A male seen gathering nesting material just off site to SE on 10th April.

Garden Warbler

- Summer visitor, likely successful breeder.
- Four territories on 17th May.

Cetti's Warbler

- Resident breeder
- Vocal and foraging along south creek on 27th March.

- Only heard off site in quicksand area on 10th April. Vocal and mobile along south edge and off site to east by canal in May-June.

Reed Warbler

- Summer visitor
- One singing in quicksand area in May -July

Robin

- Resident breeder
- Widespread in peripheral hedgerows, woodland and shelter belts

Song Thrush

- Resident breeder
- Several across site on 27th March. Two singing from carr area on 12th June.
- Four singing across site on 3rd July.

Blackbird

- Resident breeder, bred successfully.
- Mainly around edge of site. Adults with food on eastern edge of site on fledglings on 12th June.

Long-tailed Tit

- Resident breeder, bred successfully.
- Several small flocks at west end in March.
- Post breeding flock on peninsula on 17th May.
- Two post breeding family groups on 12th June in mixed flock with great tit blue tit on east edge of site

Great Tit

- Resident breeder, bred successfully.
- Numerous on all visits with fledglings on 12th June in mixed flock with blue tit and Long-trailed tit on east edge of site

Blue Tit

- Resident breeder

- Several pairs prospecting in March-early April. fledglings on 12th June in mixed flock with great tit and Long-trailed tit on east edge of site

Goldcrest

- Resident likely attempted breeder.
- Two in conifers in garden on 12th June.

Treecreeper

- Resident breeder, bred successfully.
- Pair on tall trees in carr area in March and April. Pair with four fledglings on peninsula on 17th May. Family parties on peninsula and in quicksand area on 12th June.

Magpie

- One off site to east

Jackdaw

- Four present in March.

Carrion Crow

- Resident breeder.
- Occasional on tree tops around periphery. Possible nesting in carr wood on 10th April

Jay

- Pair on site on 27th March and on 10th April

Goldfinch

- Offsite only to east.

Rose-ringed parakeet

- Present and likely attempted breeder

5.0 DISCUSSION

The site is part of the wider Lower Colne Valley SSSI, a nationally designated site for nature conservation. The reason for the site's designation is primarily due to the breeding and wintering bird population it supports.

Of the approximately 48 birds recorded during the survey, at least 26 were confirmed breeding on site. The species recorded are a mixture of wetland and woodland bird species.

Any proposed development on site will need to be carefully designed so as not to impact the breeding bird population. Two key recommendations are:

- That Natural England is engaged and consulted as soon as possible and through the design process to discuss the proposals and to gain their thoughts on viability and design; and
- Wintering Bird Surveys should be undertaken to inform the design and considered alongside this breeding bird survey.

Should Natural England agree that the scheme is viable, where key habitat suitable for nesting birds is required to be cleared, the following is recommended:

- The loss of any habitat should be avoided and minimised where possible;
- If tree and scrub clearance is required, this should be undertaken outside of most sensitive time of year (March - August inclusive). Note though that clearance should also take in to consideration sensitive times of the year of over wintering birds (October - March), with the consideration informed by the results of a wintering bird survey;
- Compensatory habitat for breeding birds will need to be provided on at least a like-for like, or more, basis. This should also replicate the habitats being lost e.g. woodland, wet woodland, scrub etc. Ideally this should be created and be established prior to the loss of the existing habitat. This creation would ideally be elsewhere on site or within the immediate vicinity. As a last resort, the habitat creation could be offsite within the wider Borough, although this would need to be agreed with the LPA and Natural England;
- The footprint of the proposals should be as limited as possible, allowing for as much undisturbed space as possible to remain on site. This undisturbed space could be fenced off to restrict access;
- Bird boxes should be installed on any structures proposed and could be considered on trees within retained habitat.

6.0 SUMMARY AND CONCLUSIONS

Greengage Environmental Ltd was commissioned by London Borough of Hillingdon to undertake a breeding bird survey at a site known as Broadwater Lake in the London Borough of Hillingdon.

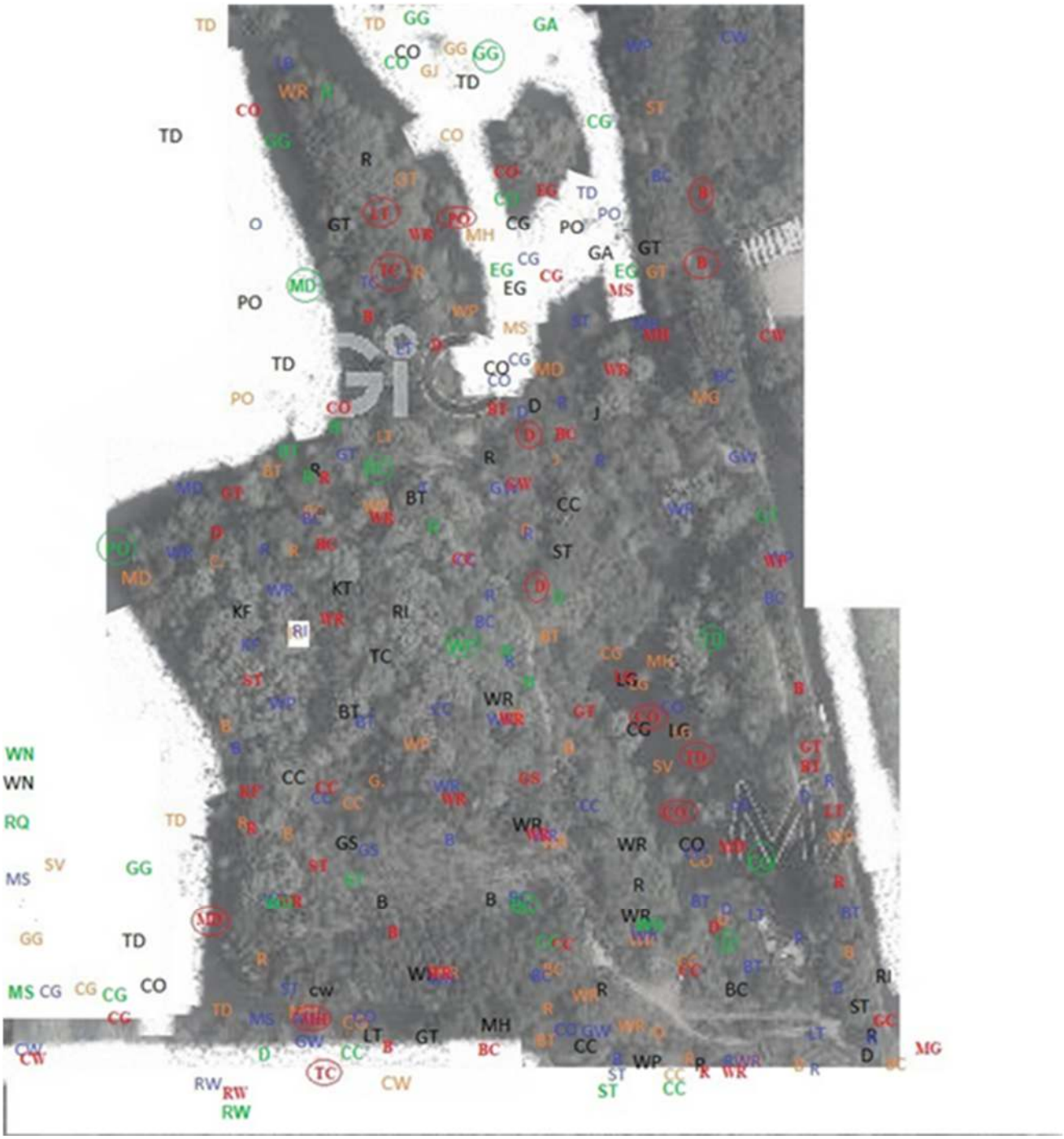
The site sits within the Mid Colne Valley SSSI, a nationally designated site that is primarily designated for the assemblage of breeding and wintering birds it supports. A total of five survey visits between March and July inclusive were undertaken. During the surveys approximately 48 species of bird were recorded, of which 26 were confirmed breeding on site.

High level recommendations have been made within the report, with the two key recommendations being that a wintering bird survey should be completed and that Natural England should be consulted and included in the design process.

Detailed proposals were not available at the time of report production and so compliance with legislation and policy will need to be considered once more detailed plans have been produced and after Natural England have been consulted.

APPENDIX A SURVEY RESULTS AND BTO SPECIES CODES

Figure A.1 Distribution of Sightings



Black Codes = 27/03/2022

Orange Codes = 10/04/2022

Blue Codes = 17/05/2022

Red Codes = 12/06/2022

Green Codes = 03/07/2022

BTO SPECIES CODES

AC	Arctic Skua	GA	Gadwall	LE	Long-eared Owl	SM	Sand Martin
AE	Arctic Tern	GX	Gannet	LT	Long-tailed Tit	SS	Sanderling
AV	Avocet	GW	Garden Warbler	MG	Magpie	TE	Sandwich Tern
BO	Barn Owl	GY	Garganey	MA	Mallard	SV	Savi's Warbler
BY	Barnacle Goose	GC	Goldcrest	MN	Mandarin Duck	SQ	Scarlet Rosefinch
BA	Bar-tailed Godwit	EA	Golden Eagle	MX	Manx Shearwater	SP	Scaup
BR	Bearded Tit	OL	Golden Oriole	MR	Marsh Harrier	CY	Scottish Crossbill
BS	Berwick's Swan	GF	Golden Pheasant	MT	Marsh Tit	SW	Sedge Warbler
BI	Bittern	GP	Golden Plover	MW	Marsh Warbler	NS	Serin
BK	Black Grouse	GN	Goldeneye	MP	Meadow Pipit	SA	Shag
TY	Black Guillemot	GO	Goldfinch	MU	Mediterranean Gull	SU	Shelduck
BX	Black Redstart	GD	Goosander	ML	Merlin	SX	Shorelark
BJ	Black Tern	GI	Goshawk	M.	Mistle Thrush	SE	Short-eared Owl
B.	Blackbird	GH	Grasshopper Warbler	MO	Montagu's Harrier	SV	Shoveler
BC	Blackcap	GB	Great Black-backed Gull	MH	Moorhen	SK	Siskin
BH	Black-headed Gull	GG	Great Crested Grebe	MS	Mute Swan	S.	Skylark
BN	Black-necked Grebe	ND	Great Northern Diver	N.	Nightingale	SZ	Slavonian Grebe
BW	Black-tailed Godwit	NX	Great Skua	NJ	Nightjar	SN	Snipe
BV	Black-throated Diver	GS	Great Spotted Woodpecker	NH	Nuthatch	SB	Snow Bunting
BT	Blue Tit	GT	Great Tit	OP	Osprey	ST	Song Thrush
BU	Bluethroat	GE	Green Sandpiper	OC	Oystercatcher	SH	Sparrowhawk
BL	Brambling	G.	Green Woodpecker	PX	Pealowl/Peacock	AK	Spotted Crake
BG	Brent Goose	GR	Greenfinch	PE	Peregrine	SF	Spotted Flycatcher
BF	Bullfinch	GK	Greenshank	PH	Pheasant	DR	Spotted Redshank
BZ	Buzzard	H.	Grey Heron	PF	Pied Flycatcher	SG	Starling
CG	Canada Goose	P.	Grey Partridge	PW	Pied Wagtail	SD	Stock Dove
CP	Capercaillie	GV	Grey Plover	PG	Pink-footed Goose	SC	Stonechat
C.	Carrion Crow	GL	Grey Wagtail	PT	Pintail	TN	Stone-curlew
CW	Cetti's Warbler	GJ	Greylag Goose	PO	Pochard	TM	Storm Petrel
CH	Chaffinch	GU	Guillemot	PM	Ptarmigan	SL	Swallow
CC	Chiffchaff	FW	Guineafowl (Helmeted)	PU	Puffin	SI	Swift
CF	Chough	HF	Hawfinch	PS	Purple Sandpiper	TO	Tawny Owl
CL	Cirl Bunting	HH	Hen Harrier	Q.	Quail	T.	Teal
CT	Coal Tit	HG	Herring Gull	RN	Raven	TK	Temminck's Stint
CD	Collared Dove	HY	Hobby	RA	Razorbill	TP	Tree Pipit
CM	Common Gull	HZ	Honey Buzzard	RG	Red Grouse	TS	Tree Sparrow
CS	Common Sandpiper	HC	Hooded Crow	KT	Red Kite	TC	Treecreeper
CX	Common Scoter	HP	Hoopoe	ED	Red-backed Shrike	TU	Tufted Duck
CN	Common Tern	HM	House Martin	RM	Red-breasted Merganser	TT	Turnstone
CO	Coot	HS	House Sparrow	RQ	Red-crested Pochard	TD	Turtle Dove
CA	Cormorant	JD	Jackdaw	FV	Red-footed Falcon	TW	Twite
CB	Corn Bunting	J.	Jay	RL	Red-legged Partridge	WA	Water Rail
CE	Corncrake	K.	Kestrel	NK	Red-necked Phalarope	W.	Wheatear
CI	Crested Tit	KF	Kingfisher	LR	Redpoll (Lesser)	WM	Whimbrel
CR	Crossbill (Common)	KI	Kittiwake	RK	Redshank	WC	Whinchat
CK	Cuckoo	KN	Knot	RT	Redstart	WG	White-fronted Goose
CU	Curlew	LM	Lady Amherst's Pheasant	RH	Red-throated Diver	WH	Whitethroat
DW	Dartford Warbler	LA	Lapland Bunting	RE	Redwing	WS	Whooper Swan
DI	Dipper	L.	Lapwing	RB	Reed Bunting	WN	Wigeon
DO	Dotterel	TL	Leach's Petrel	RW	Reed Warbler	WT	Willow Tit
DN	Dunlin	LB	Lesser Black-backed Gull	RZ	Ring Ouzel	WW	Willow Warbler
D.	Dunnock	LS	Lesser Spotted Woodpecker	RP	Ringed Plover	CD	Wood Sandpiper
EG	Egyptian Goose	LW	Lesser Whitethroat	RI	Ring-necked Parakeet	WO	Wood Warbler
E.	Eider	LI	Linnet	R.	Robin	WK	Woodcock
FP	Feral Pigeon	ET	Little Egret	DV	Rock Dove (not feral)	WL	Woodlark
ZL	Feral/hybrid goose	LG	Little Grebe	RC	Rock Pipit	WP	Woodpigeon
ZF	Feral/hybrid mallard type	LU	Little Gull	RO	Rook	WR	Wren
FF	Fieldfare	LO	Little Owl	RS	Roseate Tern	WY	Wryneck
FC	Firecrest	LP	Little Ringed Plover	RY	Ruddy Duck	YW	Yellow Wagtail
F.	Fulmar	AF	Little Tern	RU	Ruff	Y.	Yellowhammer

APPENDIX B LEGISLATION

B.1 BIRDS

All wild birds are protected under Wildlife and Countryside Act 1981[2], as amended, from damage or destruction of their nest whilst in use or construction, some birds listed on Schedule 1 receive additional protection from disturbance during nesting.

In addition some birds are classified according to their conservation status: this includes their position on the amber/red list of Birds of Conservation Concern (BoCC).

REFERENCES

[1] *MAGIC (2019); Interactive Map. (Partnership project involving six government organisations: Defra (Department for Environment, Food and Rural Affairs); English Heritage; Natural England; Environment Agency; Forestry Commission; Department for Communities and Local Government). Available at: www.magic.gov.uk.*
[2] *HM Government, (1981); Part I and Part II of Wildlife and Countryside Act (as amended). HMSO*

Invertebrate Scoping Study, Colne Valley SSSI, Unit 3

Report by Jon Mellings BSc for Ecology by Design Ltd, 6th May, 2022

Contents

Summary

- An invertebrate scoping study was undertaken in response to a planned development within the footprint of unit 3 of the Mid Colne Valley SSSI at Uxbridge, Greater London.
- The survey area comprised c9.5 hectares of habitat comprising, wet and dry woodland, grassland, standing water and swamp areas on the site of a historic gravel quarry. The northern and western margins of the site form the margins of a large gravel pit lake.
- A datasearch undertaken by GiGL within a 2.5km radius of the survey area indicated that a number of statutory and non-statutory sites designated for their nature conservation interest occur within the wider landscape. Several sites support representative wet woodland, wetland and grassland habitat comparable to that recorded within the survey area.
- Invertebrate species data provided within the GiGL datasearch, whilst not exhaustive, included a high proportion of records of Decaying wood associated species. Additional records of s41 and Annex II Desmoulin Whorl Snail *Vertigo moulinsiana*, occur within 0.1km of the survey area, indicate potential value of the site's wetland and riparian marginal habitat.
- Although the habitat within the site as a whole was considered to be unexceptional; from the field survey, in combination with datasearch information, the following habitats were identified as having potential to support invertebrate assemblages of conservation significance:
    - Resource of mature native wet and dry woodland trees and standing and fallen wood-decay habitat with features of potential value to arboreal, wet woodland and decaying wood assermblages.
    - Wetland habitat comprising riparian and lacustrine habitat of potential for supporting aquatic and other wetland associated invertebrate assemblages including potentially, Desmoulin's Whorl Snail.
- Further detailed invertebrate surveys focussing on decaying wood, wet woodland, arboreal are recommended. In addition, surveys of wetland habitat, including in particular in relation to lacustine marginal vegetation stands and wetland associated sedges occurring at the site's southern boundary.
- Survey work should include species-specific survey to establish presence/absence of Desmoulin's Whorl Snail.

Introduction

The following report details the findings of a scoping study evaluating the invertebrate conservation potential of habitat occupying approximately 9.5 hectares of land, at the site of a proposed change of use to a recreational lake, within Unit 3 of the Mid Colne Valley SSSI nr. Uxbridge, West London. The SSSI is designated primarily for its breeding woodland and wetland birds, as well as, its wintering wildfowl populations. The site also supports one of the last remaining examples of unimproved chalk grasslands in Greater London and supports a range of other habitats including wetland and woodland.

The area survey for the purpose of this study comprised primarily of broadleaved wet and dry woodland with areas of standing water/carr habitat and a lacustrine habitat occupying the margin of a former gravel pit lake. The central area of the site supported some semi-improved grassland habitat at the track edges some colonising areas of hardstanding; immediately to the east of the central path, there were also significant areas colonised by dense non-native *Buddleja davidii* scrub.

The survey was a scoping exercise, rather than a detailed survey. Therefore, the evaluation this report is based on the potential quality of habitat recorded during the survey, alongside designated site information and associated invertebrate records. Areas and habitat with potential to support species and assemblages of conservation value, are listed and recommendations for further survey are included.

Aims and objectives

Aim

The main aim of the surveys was to scope the potential conservation value of invertebrate habitat within the site of a proposed recreational lake development occupying part of Unit 3 of the Mid Colne Valley SSSI.

Objectives

1. To undertake a brief desk study based on previously recorded invertebrate species of conservation value and a review of statutory and non-statutory nature conservation sites within and adjacent to the survey area;
2. To conduct a baseline invertebrate habitat scoping survey;
3. To produce a report including findings, an evaluation of key habitat and species assemblages and an appraisal of the potential conservation value of the site for invertebrates;
4. Provide brief recommendations in terms of further survey requirements and potential development constraints.

Method

Desk study

Existing information including sites subject to statutory and non-statutory designation, as well as invertebrates historically recorded and within a two kilometre radius of the site was consulted for the purpose of this study. An independent desk study and datasearch conducted for the purpose of the current project by GiGL/eCountability (Ritchie, 2022) was consulted.

Field survey

Habitat Scoping

Scoping fieldwork was conducted between 9.30 and 15.30 on the 22nd April, 2022. The weather was dry but coolish for the duration of the site visit.

The entire site was walked and brief habitat descriptions were made using target notes. Habitat features with potential to support invertebrate assemblages/species of conservation value were recorded, mapped and geo-referenced. Target notes recorded during the survey are included in Appendix 1, Table 1 and a map of the survey area, with ascribed field numbers is included in Appendix 2, Figure 1.

Particular emphasis was placed on habitat features with potential to support significant species assemblages, including those defined within the Pantheon analytical resource, as well as species listed in section 41 of the Natural Environment and Rural Communities Act (2006) and other species of note which have been recorded within, or close to the survey area. A photographic record of representative habitats was made during the survey and is included in Appendix 3.

The primary aim of the survey was to scope the habitat rather than to record species. However, some incidental species records were made during the survey and are included in Appendix 1. Table 2. The scoping study followed a habitat-based approach and with due consideration to standard invertebrate survey approaches outlined in NERR005 (Drake *et al*, 2007).

Limitations

- The report is a scoping study only. Therefore, any invertebrate species records are incidental only and the report must not be considered as being of sufficient resolution to be used in lieu of a detailed invertebrate survey.
- Habitat conditions recorded during the survey must be seen as a snapshot in time.
- The desk study is based on limited records. Invertebrate records are often based entirely on incidental records made incidentally by amateur naturalists and there can, therefore, be considerable discrepency bewteen locations in terms of recording effort.
- Due to the relatively low temperatures experienced for the most part of the fieldwork element of the project, relatively few incidental invertebrates were seen during the survey.

Results/discussion

Desk study

The following information was souced from an independent desk study and datasearch conducted for the purpose of the current project by GiGL/eCountability (Ritchie, 2022).

Sites subject to statutory and non-statutory nature conservation designations

Sites subject to statutory designation within a 2.5km radius of the Mid Colne Valley SSSI survey area, are listed within the following table:

Site name	Designation(s)	Approximate distance from redline area	Habitat (from citation)	Key species (from citation)
Mid-Colne Valley	SSSI (includes Unit 3 which forms part of the survey area, as well as other Units comprising the SSSI)	Unit 3 comprises part of the survey area;	132 ha site representing a cross-section of the River Colne flood-plain and the adjoining valley slopes which rise abruptly to the east and west and lie on Upper Chalk, with Pebbly Clay capping the higher western slopes. An extensive series of flooded pits occupy much of the floodplain resulting from the gradual and continuing extraction of underlying river gravels. The northerly pit, Broadwater, is one of the largest expanses of open water in the	Site designated primarily for the diversity of breeding woodland and wetland birds and for the numbers of wintering wildfowl. On the eastern valley slope is one of the last remaining examples of unimproved chalk grassland in Greater London.

Site name	Designation(s)	Approximate distance from redline area	Habitat (from citation)	Key species (from citation)
			Colne Valley and is unusual with its scattering of small wooded islands. Around the pits on the dividing causeways are remnants of the original grasslands and valley alderwoods. These grade into various types of beech and hornbeam woodland and mixed scrub on the western slopes.	
Harefield Pit	SSSI	c0.55km (northeast)	Mainly designated for Geological interest, but with remnant calcareous flora in the Reading Beds.	No reference to invertebrates in citation, but site with invertebrate potential
Northmoor Hill Wood	LNR	c0.65km (west)	Ancient woodland	No reference to invertebrates in citation, but site with invertebrate potential
Ruislip Woods	NNR, LNR, SSSI	c1.5km (east)	Extensive, 305 ha ancient, semi-natural woodland site, including some of the largest, unbroken blocks in Greater London. Site also occurs in mosaic with other semi-natural habitats including acid grass-heath mosaic and areas of wetland.	SSSI citation refers to important insect fauna including 'Lepidoptera and Diptera'. Recorded species include rot hole specialist wood soldierfly species *Xylomyia maculata* (classed Nationally Rare with a threat status of 'Vulnerable' under post-2001 IUCN guidelines; also moths including Light Orange Underwing *Archiearis notha;* Lead-coloured Drab *Orthosia populeti* and Great Oak Beauty *Hypomecis roboraria*.
Old Park Wood	SSSI	c1.7km (north)	A 16.7 ha ancient woodland SSSI, supporting some of the most floristically rich ancient woodlands in Greater London. Contains contains a complex transition through widely differing woodland types.	Wet woodland present on site. No mention of invertebrate value on site, but likely to support a significant fauna.
Denham Country Park	LNR	c2.2km south	19.82 ha. Site supports meadows, rivers and woodlands	Potential to support wetland, woodland and grassland invertebrate assemblages, but no details in datasearch documents
Denham Quarry Park	LNR	c2.5km south	22.22 ha. Meadowland and flooded quarry land	Potential to support wetland, woodland and grassland invertebrate assemblages, but no details in datasearch documents. Citation refers to dragonflies and damselflies, but is not specific.
Frays Valley	LNR	c2.5km south	71.84 ha. The whole of the LNR contains a wide diversity of habitats. The flooded gravel pits provide valuable habitat for wildfowl, and Fray's Farm Meadows represent some of the last remaining examples of wet alluvial grassland in Greater London and are important for a variety of plant	Desmoulin's Whorl Snail *Vertigo moulinsiana*, a UK protected species occurs in Denham Lock Woods.

Site name	Designation(s)	Approximate distance from redline area	Habitat (from citation)	Key species (from citation)
			species. A number of ancient woodland herbs that are extremely uncommon in Greater London and the protected Desmoulin's Whorl Snail *Vertigo moulinsiana* is present in Denham Lock Woods.	

Sites subject to non-statutory nature conservation designations

16 SNCIs were recorded within a 2.5km radius of the survey area. No proposed SNCIs or RIGS or LIGS within the search area.

Site name	Designation(s)	Approximate distance from redline area	Habitat (from citation)	Key species (from citation)
London's Canals	SNCI	Uncertain	A composite SNCI comprising canals within the London area. Amenity grassland, Bare ground, Canal, Planted shrubbery, Ruderal, Scattered trees, Scrub, Secondary woodland, Semi-improved neutral grassland, Tall herbs, Vegetated wall/tombstones, Wet marginal vegetation, Wet woodland/carr	Not specified other than generic reference to dragonflies and damselflies. Habitat likely to support diverse aquatic invertebrate fauna
Ruislip Woods and Poor's Field	SNCI (also NNR, LNR, SSSI)	c1.5km (east)	See also under statutory sites (above)	There is also an important invertebrate fauna including several nationally rare and scarce species (see under statutory sites (above)
Old Park Wood	SNCI	c1.5km (north)	See also under Old Park Wood SSSI. A sizeable woodland, mostly ancient, with a good variety of woodland stand-types due to variations in geology and topography. The site supports a particularly rich flora, including nationally scarce species	Wet woodland present on site. No mention of invertebrate value on site, but likely to support a significant fauna
Mid Colne Valley	SNCI (also SSSI)	Partly overlaps with survey area	See also under statutory sites (above). This section of the Colne Valley includes a diverse range of high quality habitats. Several waterways include the Frays River, from which 53 species of aquatic and wetland plants have been recorded. The unimproved wet pastures of Frays Farm Meadows (a Site of Special Scientific Interest and Local Nature Reserve managed by the London Wildlife Trust and Hillingdon Natural History Society) support a very rich flora	Citation mentions Desmoulin's Whorl Snail *Vertigo moulinsiana*, a UK protected species; also Balsam Carpet Moth *Xanthorhoe biriviata* and Glow-worm *Lampyris noctiluca*. Likely to support a range of wet woodland and wetland species

Site name	Designation(s)	Approximate distance from redline area	Habitat (from citation)	Key species (from citation)
Coppermill Down	SNCI	c1km (north)	This site comprises the only natural chalk grassland in London north of the Thames. It supports a diverse flora, with typical downland species such as Upright Brome *Bromopsis erecta*, Dwarf Thistle *Cirsium acaule*, Salad Burnet *Sanguisorba minor*, Fairy Flax *Linum catharticum* and Cowslip *Primula veris*	The site has an important invertebrate fauna. Part of the Mid Colne Valley Site of Special Scientific Interest.
Harefield Chalk Pit	SNCI	c0.25km (northeast)	See also under statutory sites (above). One of four old chalk pits in the east Colne Valley, Harefield Pit comprises a strip of dense woodland on steeply undulating raised ground to the south, and a wooded seasonally damp basin to the north. Part of the southern wood is a Site of Special Scientific Interest	No reference to invertebrates in citation, but site with invertebrate potential
Harefield Churchyard and Wood	SNCI	c0.5km (northeast)	Ancient woodland, Bare ground, Marsh/swamp, Pond/lake, Secondary woodland	No reference to invertebrates in citation, but site with invertebrate potential
Shepherd's Hill Woods and Fields	SNCI	c2.4km (east)	Ancient woodland, Bare ground, Bracken, Coniferous woodland, Hedge, Improved agricultural grassland, Pond/lake, Running water, Scrub, Secondary woodland, Semi- improved neutral grassland, Tall herbs, Unimproved neutral grassland	No reference to invertebrates in citation, but site with invertebrate potential
Dew's Dell	SNCI	c1.2km (southeast)	Bare ground, Pond/lake, Ruderal, Secondary woodland, Semi-improved neutral grassland, Tall herbs, Unimproved neutral grassland, Wet grassland	No reference to invertebrates in citation, but site with invertebrate potential
Newyears Green	SNCI	c2km (southeast)	A woodland believed to have been planted in the late 19th century, surrounded by fields and hedges. Hedge, Scrub, Secondary woodland, Semi-improved neutral grassland, Tall herbs, Wet ditches	No reference to invertebrates in citation, but site with invertebrate potential
Medipark Site	SNCI	c1.5km (northeast)	An interesting mosaic of habitats has developed within the former grounds of a demolished hospital building, including species-rich neutral to chalk grassland, scrub and some marginal secondary woodland. This site adjoins the eastern edge of Old Park Wood	Reference to Marbled White and Common Blue Butterflies. Roesel's Bush-cricket also mentioned as being Nationally Scarce; however, the species has long been downgraded from this status and is widespread and common throughout the southern half of the UK

Site name	Designation(s)	Approximate distance from redline area	Habitat (from citation)	Key species (from citation)
The Dairy Farm, Harefield	SNCI	c1km (northeast)	Hedge, Semi-improved neutral grassland, Unimproved neutral grassland, Wet ditches, Wet grassland	No reference to invertebrates in citation, but site with invertebrate potential
Knightscote Farm Ponds	SNCI	c1.3km (northeast)	Two ponds separated by an area of woodland, one used for fishing. Bracken, marsh/swamp, pond/lake, ruderal, wet woodland/carr	No reference to invertebrates in citation, but site with invertebrate potential
Harefield Green Pond	SNCI	c1.2km (northeast)	A small pond on the edge of the historic village green of Harefield. Marsh/swamp, pond/lake, scattered trees	Citation mentions that the pond is likely to support aquatic invertebrate populations
Breakspear House Wood	SNCI	c1.2km (east)	A small ancient woodland with a footpath running through it. This small woodland is dominated by Ash *Fraxinus excelsior,* with frequent Pedunculate Oak *Quercus robur* and Sycamore *Acer pseudoplatanus.* Stands of Beech *Fagus sylvatica*, with occasional Hornbeam *Carpinus betulus* and Horse Chestnut *Aesculus hippocastanum* make up the rest of the canopy.	Speckled Wood - a common species of butterfly, is mentioned on the citation; however, the age of the wood suggest it may support an interesting invertebrate fauna
Harefield Hospital Ponds and the Old Orchard	SNCI	c1.3km (northeast)	The two ponds in the grounds of Harefield Hospital are examples of mid- and late-successional habitats; the eastern pond being full of water with a well-developed marginal flora and the western one of mainly willow scrub, mud and leaf litter with a small area of water. An old orchard of over-mature Apple *Malus domestica* and plum *Prunus domestica* trees is part of the council-owned Mount Pleasant Farm. These old fruit trees are likely to be valuable for inverebrates.	The orchard and mature oaks may support important invertebrate assemblages

Historic records of invertebrate species of recognised conservation status

Species of conservation status recorded within a 2.5 kilometre radius of the survey area provided within the Gigl dataset are included within the below table:

English Name	Scientific Name	Earliest Year	Latest Year	Total Records	Status	SAT affinities	Habitat-level affinities
Hairy Dragonfly	*Brachytron pratense*	2018	2019	3	Locally Important	N/a	Acid & sedge peats
A long-legged fly	*Hercostomus plagiatus*	1987	1987	1	Formerly NS	N/a	Acid & sedge peats
Purple Emperor	*Apatura iris*	2015	2018	2	NT; protection	N/a	Arboreal
White Admiral	*Limenitis camilla*	1989	2017	8	S41 Vu	N/a	Arboreal
Kent Bent-wing	*Phyllocnistis xenia*	2014	2014	1	RL-VU	N/a	Arboreal
A scraptiid beetle	*Anaspis costai*	2010	2010	2	NS	Bark & sapwood	Decaying wood

English Name	Scientific Name	Earliest Year	Latest Year	Total Records	Status	SAT affinities	Habitat-level affinities
						decay	
Dark-shouldered Sap Hoverfly	*Brachyopa pilosa*	2009	2009	1	NS	Bark & sapwood decay	Decaying wood
A sap beetle	*Epuraea longula*	2009	2009	1	NS	Bark & sapwood decay	Decaying wood
A tumbling flower beetle	*Mordellistena neuwaldeggiana*	2010	2010	2	NS	Bark & sapwood decay	Decaying wood
A minute tree-fungus beetle	*Cis festivus*	2010	2010	1	NS	Fungal fruiting bodies	Decaying wood
A rove beetle	*Gyrophaena munsteri*	2009	2009	1	RDBK	Fungal fruiting bodies	Decaying wood
Brown Tree Ant	*Lasius brunneus*	2009	2010	2	Formerly NS	Heartwood decay	Decaying wood
Stag Beetle	*Lucanus cervus*	1998	2018	8	S41; protection	Heartwood decay	Decaying wood
A tumbling flower beetle	*Mordellistena humeralis*	2010	2010	3	NS	N/a	Decaying wood
Common Club-tail	*Gomphus vulgatissimus*	1968	1968	1	NT	Slow flowing rivers	Running water
Red-girdled Mining Bee	*Andrena labiata*	2011	2011	1	Formerly NS	Rich flower resource	Short sward & bare ground
Silver-washed Fritillary	*Argynnis paphia*	2017	2017	1	Low Priority	Scrub edge	Tall sward & scrub
A flea beetle	*Apteropeda globosa*	2009	2009	1	NS	N/a	Tall sward & scrub
Green Hairstreak	*Callophrys rubi*	2011	2011	2	Low Priority	N/a	Tall sward & scrub
Jersey Tiger	*Euplagia quadripunctaria*	2015	2015	1	HDir2	N/a	Tall sward & scrub
Essex Skipper	*Thymelicus lineola*	1991	2013	2	Low Priority	N/a	Tall sward & scrub
Cinnabar	*Tyria jacobaeae*	2012	2013	2	S41 research only	N/a	Tall sward & scrub
A pollen beetle	*Meligethes atramentarius*	2009	2009	1	NS	N/a	N/a
A tumbling flower beetle	*Mordellistena variegata*	2010	2010	2	NS	N/a	N/a

Conservation status of historically recorded species

A total of 24 invertebrate species, all insects, were listed in the GiGL data search spreadsheet, all having been recorded within a 2.5km radius of the survey area. Of these, three species are afforded a threat status of 'Vulnerable' and two as 'Near Threatened' based on post-2001 IUCN criteria; one species is listed in the RDBK 'unknown' category based on pre-1994 criteria; nine species are currently classed as nationally scarce (or still listed in one of the former Notable A or B categories); one species, the Hairy Dragonfly *Brachytron pratense,* is listed as 'Locally Important' within the Greater London region, whilst three species; Silver-washed Fritillary *Argynnis paphia,* Green Hairstreak *Callophrys rubi* and Essex Skipper *Thymelicus lineola*, have no official status and are listed as 'Low Priority'.

Two of the species including Stag Beetle *Lucanus cervus,* White Admiral *Limenitis camilla* are listed as 'Priority Species' under section 41 of the NERC Act, 2006, whilst a third, the Cinnabar Moth *Tyria jacobaeae* is listed under the section 41 as 'Research only', a status afforded to a number of still widespread and common British moth species, for which a decline has been recorded in recent decades.

A further three species, still listed in the GiGL dataset as Nationally Scarce, have been subject to status revisions and are now considered to be too widely recorded for the NS category. These include *Hercostomus plagiatus* - a species

of long-legged fly; the Red-girdled Mining Bee *Andrena labiata* and the Brown Tree Ant *Lasius brunneus*, a species which has been recorded in numerous sites in the southern UK.

Stag Beetle is also protected under Appendix 1,2 and 3 of the Bern Convention and is listed on Annex 2 of the EU Habitats Directive (Non-priority species) and Purple Emperor *Apatura iris* is also protected for collection and sale under Section 5 of the UK Wildlife and Countryside Act (1981), as amended.

Pantheon affinities of historically recorded species

For the purpose of this review, species records have been analysed using the Pantheon analytical resource https://pantheon.brc.ac.uk/ in order to establish habitat affinities of recorded species. The habitat affinities are represented within the 'Habitat-level' and 'Specific Assemblage Type' (SAT) columns of the table.

Whilst the analysis involved too few species to be robust and should not be viewed as a meaningful analysis under Pantheon/ISIS (Invertebrate Species-habitat Information System) criteria, a useful guage of habitat affinities of species recorded within close-proximity of the survey area can be gained.

Of the 24 species; 9 are attributed to the 'Decaying wood' habitat-level classification and more precisely under one or other of the three SATs nested withinn this assemblage, namely: A212 'Bark and sapwood decay', A213 'Fungal fruiting bodies' and A211 'Heartwood decay'. A further three species were listed at habitat-level under A1 'Arboreal' assemblage.

Of the remaining assemblages; six species were attributed to the F2 'Tall sward and scrub' assemblage and three species to two wetland assemblages; W3 'Acid and sedge peats' and W1 'Running water'.

The most frequently recorded species of these include Stag Beetle and White Admiral; both of which have been recorded on eight occasions. In the UK, Stag Beetle was listed as Nationally Scarce, with the threat status of 'Least Concern' in a status review by Lane and Mann (2016). Stag Beetle is a saproxylic insect, the larvae developing in rotting wood. Stag Beetles take between three and seven years to develop, often in the below ground sections of rotting trees, stumps or larger wooden posts. White Admiral is associated primarily with ancient woodlands, where it frequents sunny rides. The larval foodplant of this butterfly is Honeysuckle *Lonicera periclymenum*. There are post-2000 records for White Admiral from within less than 1km of the survey area and Stag Beetle has been recorded from within 1.5km from Denham Green.

2022 Scoping study survey

Survey Area

The area covered by the survey is outlined in Appendix 2, Figure 1 and a table of habitat specific target notes corresponding to numbers on the map is included in Appendix 1, Table 1.

The survey area comprised approximately 9.5 hectares of land, this occupying the footprint of Unit 3 of the Mid Colne Valley SSSI. This area is contiguous with Unit 4 of the SSSI, which lies immediately south of the survey area, whilst Unit 2 lies a few hundred metres to the west.

General Habitat

The habitat within the main survey area comprised mainly of semi-natural broadleaved woodland, the bulk of this habitat occupying the area immediately to the west of a central path, which more or less divided the site along a central north/south axis. The habitat within this area occupied approximately 4.4 hectares, with a further 0.8 hectare peninsula, also supporting semi-natural broadleaved woodland connected to the main area by a wooden bridge.

The habitat to the east of the central track comprised, for the most part, of habitat of somewhat lower potential conservation value, with extensive areas of dense stands of non-native *Buddleja davidii*, which gave rise to a heavy shaded ground layer. However, a rather inaccessible open water area with emergent native broadleaves characteristic of wet woodland and carr habitat, occurred beyond this, occupying the eastern boundary of the survey area. Also, more mature native broadleaves also occurred as standards within the Buddleia dominated area.

The central track itself was characterised fairly herb-rich, short grazed grassland, which whilst being confined to scallops on either side of the central path, collectively comprosed a reasonable area. Evidence of former human activity was evident throughout the site, with areas of partially vegetated hard standing, as well as concrete constructions and topographical evidence of former quarry activity.

Whilst much of the site was level, there was topographical variation within the eastern part of the site, notably including a steep escarpment between the dense scrub woodland to the east of the main track and the standing water and carr habitat at the sites's easternmost boundary.

The western wooded area included flattish areas, with frequent inundated depressions, including some largish areas of standing water, within the wetter woodland areas.

Semi-natural broadleaved woodland

The woodland occurring to the west of the central track, on the easternmost site boundary and on the narrow northern peninsula of the site, was generally structurally diverse with distinct canopy, understorey, shrub and ground layers. Much of the habitat was wet woodland supporting stands of mature trees typical of such habitat, including Crack Willow *Salix fragilis*, Alder *Alnus glutinosa* and Downy Birch *Betula pubescens*. These occurring in differing levels of relative abundance throughout the site and occasionally other canopy species including Lombardy Poplar *Populus nigra italicum*.

Drier wooded habitat occurred in mosaic with the wetter woodland, with such habitat typically occupying the more elevated banks and raised areas of the site. A fairly significant stand of Silver Birch *Betula pendula* occurred within the western area, with mature trees (Appendix 1, Table 1, TN16; Appendix 3, Photograph 1), as well as young growth colonising an area of partially vegetated bare ground at TN11 (Photograph 2).

Understorey trees typically included Goat/Grey Willow *Salix caprea/cinerea*, the more mature examples of these penetrating the canopy (Photograph ; with saplings and young trees of other species occurring alongside, as well as a range of smaller tree species including Hawthorn *Crataegus monogyna*, Elder Elder *Sambucus nigra,* Hazel *Corylus avellana* and Blackthorn *Prunus spinosa,* occurring more typically on drier, raised banks and plateaux, in mosaic with the lower lying wet woodland habitat. Shrub layer woody species included Bramble *Rubus fruticosus* agg. Common Dog Rose *Rosa canina*, Wild Redcurrant *Ribes rubrum*, Wild Raspberry *Rubus idaea*, Old Man's Beard *Clematis vitalba* and occasional Bittersweet *Solanum dulcamara*. Buddleia *Buddleja davidii* occurred locally in the scrub layer throughout the site, but was most abundant in the dense stand immediately to the east of the central track (See TNs 5 and 6).

The woodland groundflora was most diverse in the western section of the site, particularly around TNs 20 and 16, where species including Bugle *Ajuga reptans*, Common Dog Violet *Viola riviniana,* Primrose *Primula vulgaris*, Wood Dock *Rumex sanguineus*, Enchanter's Nightshade *Circaea lutetiana* and Ground Ivy *Glechoma hederacea*, were present, alongside locally abundant Pendulous Sedge *Carex pendula.* However, Common Nettle *Urtica dioica,* Cleavers *Galium aparine*, Garlic Mustard *Alliaria petiolata* and Wood Avens *Geum urbanum* with Ivy *Hedera helix* and Ground Ivy, were the most frequently occurring groundlayer species (Photograph 3) .

Other species less frequently recorded locally within the woodland groundflora included Carnation Sedge *Carex panicea*, Tutsan *Hypericum andosaemum*, native Bluebell *Hyacinthoides non-scripta*, forget-me-nots *Myosotis* sp., Cow Parsley *Anthriscus sylvestris*, Nipplewort *Lapsana communis* and Lords and Ladies *Arum maculatum* and in the wetter areas and lakeside margins; Water Mint *Mentha aquatica,* Yellow Flag *Iris pseudacorus,* Gipsywort *Lycopus europaeus* and Hemp Agrimony *Eupatoria cannabinum*. Bryophytes were abundant in many parts of the woodland ground layer.

Structurally, the woodland area to the west of the site and on the peninsula was fairly open, with some light reaching the groundlayer (Photographs . Herbs such as Ground Ivy, Bugle and Primrose provided foraging habitat for nectaring insects, including bumblebees *Bombus* spp. and various diptera. There was a significant amount of fallen and some standing wood decay habitat (TNs 18, 21 Photograph 4); frequently trees including Crack Willow had fallen into water and there was a strong resource of saturated wood decay habitat within the areas of partially shaded

standing water within the wet woodland (Photograph 5). The variation in groundlevel provided opportunities for aquatic and hygrophilous invertebrates as well as those associated with drier, woodland floor habitats.

Wetland

Open water habitat within the wet woodland areas occurred both to the east of the site immediately west and south of TN1 (Photograph 6) and more extensively, throughout the wooded area to the west of the main track dividing the site. The open water areas were frequently fairly extensive and were frequently populated with inundated wet woodland trees including Crack Willow, Grey Willow and Alder (TNs 1 and 14; Photograph 7). These often being mature. Fallen wood decay habitat was also a feature of such habitat and the habitat at TN14, in particular, supported some standing wood decay habitat of good potential value for saproxylic invertebrates. Much of the open water was rather anoxic and lacked aquatic vegetation, besides localised marginal stands of species such as Yellow Flag, Gipsywort, Water Mint and Pendulous Sedge.

There was some more interesting habitat along the southernmost site boundary, within an area marked as being dangerous due to 'quick sand' (around TN13). Here, a flattish wet sand/silt substrate with numerous tussocks of Pendulous Sedge and occasional Gipsywort, was present (Photograph 8). The habitat here, whilst being somewhat overshaded, was structurally diverse and had potential to support wetland margin, tussock associated invertebrates.

The western and northern perimeter of the main survey area and the margins of the narrow, northern peninsula constituted the shoreline of the larger, ex-gravel-pit lake. The habitat was frequently shaded by overhanging willows and Alder from the wet woodlands. The lake margins were generally over silt and gravel substrate and shelved shallowly from the margin. However, relatively little aquatic vegetation was visible at the time of survey, with much of the shoreline being entirely devoid emergent, floating-leaved or submerged aquatic vegetation. Exceptions to this rule were observed around TNs 17 and 19. The former of these was the best developed at the time of survey, comprising a stand of emergent vegetation with macrophytes including Lesser Pond Sedge *Carex acutiformis*, Water Mint*,* Bittersweet and Yellow Flag. Terrestrial wet woodland habitat in area of good relative quality (Appendix 3, Photograph 9).

Lacustrine marginal habitat can support hygrophilous invertebrate assemblages, including species associated with wetland edge habitats and seasonally wetted areas. These edge habitats, together with the wet mud habitats at the margins of the various waterbodies within the site's wet woodlands, were relatively extensive and have potential to support some interesting invertebrate fauna. In addition, whilst there was relatively little well vegetated open water aquatic habitat, there may be some potential for the site to support aquatic invertebrate assemblages of some conservation value, especially if considered alongside the hygrophilous species, which jointly comprise habitat-level 'Marshland', 'Peatland' and 'Lake' invertebrate assemblages in Pantheon. There were some tussocky habitats with potential to support 'moss and tussock fen' specific assemblage types, and 'open water on disturbed mineral sediments' and/or 'litter-rich fluctuating marsh' assemblages, may also be represented.

Grassland and other open habitat

The grassland habitat within the survey area was confined to scalloped edges along the central path of the main survey area. The habitat was more or less flat throughout and whilst much of the grassland was characterised by graminoid and herb vegetation representative of drier habitat, there was evidence of localised drainage impedence and wetting, giving rise to vegetation characteristic of damper habitats in some parts. Although some of the grassland comprised a well established sward (e.g. TN 8; Photograph 10); there were also areas of partially vegetated habitat over hardstanding and very thin soils (e.g. TNs 7 and 11; Photographs 11 & 2).

The sward was generally short throughout, with evidence of grazing by rabbit/deer and there was significant bare ground within the open areas, some with evident hard standing, some with sandy soil substrate. A diverse groundflora was recorded within the combined open ground areas on either side of the central path with graminoids including Yorkshire Fog *Holcus lanatus*, Creeping Bent *Agrostis stolonifera*, Common Bent *A. capillaris,* Red Fescue *Festuca rubra*, Smooth-stalked Meadow Grass *Poa pratensis*, Cock's-foot *Dactylis glomerata* and in damper areas, Hard Rush *Juncus inflexus* and herbs including Germander Speedwell *Veronica chamaedrys*, Perforate St John's-wort *Hypericum perforatum*, Selfheal *Prunella vulgaris*, Dandelion *Taraxacum officinale* agg., Yarrow *Achillea millefolium*, Creeping Cinquefoil *Potentilla reptans*, Common Mouse-ear *Cerastium fontanum*, Common Cat's-ear *Hypochaeris radicata*, Common Bird's-foot Trefoil *Lotus corniculatus,* Bulbous Buttercup *Ranunculus bulbosus*, Ground Ivy

Glechoma hederacea, Ribwort Plantain *Plantago lanceolata*, Greater Plantain *P.major*, Dove's-foot Crane's-bill *Geranium molle*, Common Ragwort *Senecio jacobaea,* Hoary Ragwort *S. erucifolius* and locally, a stonecrop *Sedum* sp. and Goat's Rue *Galega officinalis*, Common Stork's-bill *Erodium cicutarium* was locally abundant in sandier areas of vegetated hard standing, with species such as Teasel *Dipsacus fullonum*, Wavy Bittercress *Cardamine flexuosa* occurring in damper areas.

Lichens including *Cladonia* sp. and bryophytes were also abundant, particularly over areas of hard standing. The margins with scrub woodland to the east of the track were generally Buddleia dominated, but with some seedling *Betula* sp. and *Rubus fruticosus* agg. Bare gravel/sand patches present throughout sward. The western side of the path supported more representative native woody species.

A more defined patch of wetter grassland habitat with a good edge succession through Bramble scrub to the wet woodland margin occurred towards the south of the central track, near the site entrance (TN12; Photograph 12) Here, the habitat comprised Yorkshire Fog and Creeping Bent with locally abundant Hard Rush with sedges *Carex* spp. and herbs including Cuckoo-flower *Cardamine pratense*, Greater Bird's-foot Trefoil *Lotus pedunculatus* and Water Mint *Mentha aquatica*, indicating localised wetting, alongside species associated with drier habitats including Ground Ivy, Common Bird's-foot Trefoil, Ribwort Plantain, Greater Plantain, Selfheal, Creeping Cinquefoil and Yarrow.

Collectively the open ground and wet and dry grassland habitats adjacent to the central track provided some potentially valuable habitat for short sward and bare ground invertebrate assemblages, as well as aculeate Hymenoptera and diptera associated with rich-flower resource habitat. In addition the herb rich borders, in close proximity to wood decay habitat, provided potential habitat for beetles developing as larvae within wood decay habitat, many of which require tall herb vegetation as adults.

Incidental invertebrates[1]

In total 22 invertebrate species were recorded incidentally during the scoping study, these are listed in Appendix 1, Table 2. The majority of species recorded were common and widespread and included generalist species of bee, beetle and fly. The weather during the survey was dry and windless; however, the temperature was below average for the time of year and there was, consequently, invertebrate activity was low.

Several species of common bumblebee *Bombus* spp. were recorded, including the Forest Bumblebee Bombus sylvestris, a cuckoo of other bumblebee species such as *B. pratorum*. This species is associated with woodland habitats. Dark-edged Beefly *Bombylius major,* was also recorded within the central grassland area. This species is a brood parasite in the nests of *Andrena* and other genera of mining bees.

Evaluation

Habitat within the survey area comprised predominately wet and dry broadleaved woodland and scrub, with areas of standing water, swamp, wet and dry grassland and lacustrine edge habitat, following much of th site's perimeter. Much of the woodland and scrub habitat to the east of the central track supported habitat of limited invertebrate potential, due to the predominance of non-native *Buddleja davidii* scrub.

The enclosed waterbody adjacent to the extreme, eastern site boundary, held somewhat greater potential for species associated with the wet woodland canopy and standing water, but was heavily shaded, therefore, invertebrate potential was somewhat diminished.

[1] Invertebrate species recorded incidentally during a scoping study such as this typically comprise mainly of more visually distinctive species, which are commonly spotted and easily recorded during what is, fundamentally, a habitat based exercise. Such records frequently include butterflies, some bumblebees and other readily identified taxa. Therefore, incidental records cannot in any way be considered as a substitute for more detailed invertebrate surveys.

The best potential invertebrate habitat occupied the western part of the site and of particular importance, the juxtaposition of mature wet woodland, partially shaded open water, scrub and damp, semi-improved grassland, occupying the southern site boundary, immediately west of the central track/grassland area. Here, the groundlayer was generally sheltered and well-lit, providing structural diversity potentially favourable to wet woodland, swamp and bare-mud associated invertebrates.

There was a significant resource of wood decay habitat, here, as throughout much of the site's woodland; however, fallen and standing wood decay habitat, with potential mainly for bark and sapwood decay assemblages, often occurred under detrimentally dense shade, especially to the north and east of the site.

Standing water within the site was often heavily shaded also and also supportef little in the way of swamp/aquatic macrophyte vegetation. It was, therefore, rather lacking the structural diversity beneficial to aquatic invertebrate assemblages. However, such habitat, including saturated logs and silt edge habitats, can be important for the larvae and adults of certain two-winged fly (Diptera) and beetle (Coleoptera) families.

The open water of the lacustrine margin, was frequently lacking significant aquatic vegetation; however, some small patches of marginal emergent and submerged aquatic vegetation, where it occurred, could support some aquatic invertebrate diversity, reflecting that of habitats within the wider landscape.

The grassland and partially vegetated bare ground areas could be of potential value to short sward and bare ground and tall sward and scrub invertebrates; however, the habitat was unexceptional, except in structural terms, where in combination with Bramble *Rubus fruticosus* agg. scrub, wetland and woodland edge could provide habitat for species requiring different habitat elements at different times of their lifecycle; e.g. wood decay beetles, flies and aculeate Hymenoptera.

A number of both statutory sites and non-statutory SNCIs occur within a 2.5km radius of the site, several of these being much closer. Some sites are large and support habitat similar to, or complementary to the site, with a number of wet and dry broadleaved woodlands, several of which are considered to be ancient woodland. Wetland habitats, including both open water and swamp habitats, as well as unimproved and herb-rich semi-improved grasslands, are also well represented within both statutory and non-statutory sites.

Although the citations rarely mention invertebrates, or invertebrate assemblages specifically, several are known to support significant assemblages. Data provided by GiGL contained relatively few records of invertebrates of higher conservation status; however, this is often the case with local record centre data, even in areas of high diversity. From records analysed using Pantheon, Decaying wood species of higher conservation status, were particularly well represented within the output. Nine species were attributed to this group, with an additional three species being attributed to another tree-associated assemblage, Arboreal.

Whilst not constituting proof, these findings indicate the likelihood of decaying wood assemblages being well represented, this potential being reinforced by the abundance of ancient and secondary wet and dry woodland and wood pasture proxy habitat occurring in the immediate and wider landscape.

Somewhat surprisingly, wetland species of recognised conservation status were not particularly well represented in the Pantheon output. Owing to the extensive wetland resource within the datasearch area, a greater number of species of conservation status would be expected to have resulted from the search. However, certain species did not appear in the datasearch; notably Desmoulin's Whorl Snail *Vertigo moulinsiana*, which is listed within citations both for Frays Valley LNR and Mid Colne Valley SNCI (but not in the SSSI citation). Desmoulin's Whorl Snail is currently classed as Nationally Scarce in the UK, as well as being listed on section 41 of the NERC Act (2006) as a 'priority species'. Importantly the species is listed as a non-priority species in Annex 2 of the European Habitats Directive. The species has, however, been recorded more frequently in recent years, possibly due to greater search effort.

According to the NBN Gateway species dictionary, Desmoulin's Whorl Snail has been recorded, from several locations in the series of wetlands between Uxbridge, in the south and Rickmansworth in the north and there is a record from within 100 metres of the northern extremity of the survey area.

Conclusions

On face-value, the overall value of the site did not appear to be exceptional, there were habitat elements of potential value for supporting decaying wood, wet woodland and arboreal assemblages. Desmoulin's Whorl Snail has been historically recorded within close proximity of the survey area and Despite the lack of an abundance of typical emergent vegetation on site with which this species is usually associated, Desmoulin's Whorl Snail has been historically recorded within close proximity of the survey area.

It is recommended that further survey focussing particularly on the Wood decay, wet woodland and arboreal assemblages should be undertaken. In addition, a study to establish presence/absence of Desmoulin's Whorl Snail on site, should also be undertaken.

Confirmation of important features

From the findings of the 2022 scoping study, habitat resources with potential to support invertebrate assemblages of conservation significance were recorded as follows.

- Resource of mature native wet and dry woodland trees and standing and fallen wood-decay habitat with features of potential value to arboreal, wet woodland and wood-decay assermblages.
- Wetland habitat comprising riparian and lacustrine habitat of potential for supporting aquatic and other wetland associated invertebrate assemblages including potentially, Desmoulin's Whorl Snail.

Recommendations

Further survey

- Based on findings of the scoping study it is recommended that detailed invertebrate surveys are undertaken within the survey area to adequately inform the planning process in relation to this project.
- Surveys should focus on:
    - Wood-decay and arboreal invertebrate assemblages associated with mature native trees and associated wood-decay resources within the survey area;
    - Aquatic and hygrophilous invertebrate assemblages associated with the site's better wetland habitat, with a particular focus on Desmoulin's Whorl Snail.

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Appendices

Appendix 1 – Tables

Table 1 – 2022 Habitat target notes

Target note	Date	Main survey area	Grid reference	Feature	Description	Potential invertebrate assemblages	Potential invertebrate assemblages	Potential invertebrate conservation value
1	22/04/2022	Eastern site boundary	TQ04836 89249	Lane edge hedgebank & open water/carr habitat	Hedgebank on eastern site boundary, adjacent access track. Hedgebank followed enterity of margin of woodland boundary and supported broadleaved canopy trees including mature *Salix fragilis* and occasional *Betula pendula/ pubescens* and *Populus nigra italica*, with an understorey of *S. caprea/cinerea, Crataegus monogyna, Corylus avellana, Sambucus nigra and Buddleja davidii,* with occasional *Clematis vitalba.* Scrub included *Rubus fruticosus agg.* and occasional *Ribes rubrum.* Ground layer with *Alliaria petiolata, Urtica dioica, Galium aparine, Anthriscus sylvestris, Hedera helix, Arum maculatum, Geum urbanum* and *Lapsana communis.* Inundated habitat immediately west of the hedgebank supported stagnant standing water, with little evident aquatic vegetation and mature *Salix* spp. emerging from waterbody, creating shade. Waterbody silted with leaf debris, but with some saturated branches and logs. Scattered marginal vegetation on damp banks with *Iris pseudacorus* and *Lycopus europaeus*.	Limited potential for saproxylics and aquatic invertebrates.	Marshland, Peatland, wet woodland, arboreal, wood decay	Fairly good

Target note	Date	Main survey area	Grid reference	Feature	Description	Potential invertebrate assemblages	Potential invertebrate assemblages	Potential invertebrate conservation value
2	22/04/2022	Northern peninsula	TQ04688 89350	Broadleaved woodland	Wooded peninsula with central raised area, supporting drier woodland and margins with wetter woodland habitat. Some bark and sapwood decay habitat. Dominant canopy trees included mature, multi-stemmed *Salix fragilis, Alnus glutinosa* and *Betula pendula/pubescens*; with *Salix cinerea/caprea* in the understorey and *Crataegus monogyna, Prunus spinosa, Sambucus nigra* and *Ilex aquifolium*; a scrub layer with *Rubus fruticosus* agg., *R. idaeus, Ribes rubrum* and *Rosa canina*. Also *Clematis vitalba* and *Hedera helix.* Ground layer partially shaded with *Urtica dioica, Galium aparine* and *Anthriscus sylvestris* with patches of shade tolerant herbs including *Glechoma hederacea, Lapsana communis, Alliaria petiolata, Stachys sylvatica* and *Arum maculatum* with *Carex pendula* in wetter areas. Also a range of other herbs including *Ranunculus repens, Hypericum perforatum, Prunella vulgaris, Rumex sanguineum, Potentilla reptans, Heracleum sphondylium* and *Arctium minus*. The groundlayer locally open with species including G*alega officinalis.*	Some bark and sapwood decay and arboreal potential	Arboreal, Bark & sapwood decay	Fairly good
3	22/04/2022	Northern peninsula	TQ04639 89461	Marginal habitat	Marginal habitat with Mature *Salix fragilis* and *S. cinerea/caprea* and occasional *Alnus glutinosa* overstanding marginal lacustrine habitat. Groundflora with marginal *Mentha aquatica, Eupatoria cannabinum, Iris pseudacorus, Oenanthe crocata* and *Lycopus europaeus* with areas of bare silt. Marginal open water gently shelving, with silt and gravel substrate; slightly overshaded. No obvious emergent, floating or submerged aquatic vegetation at time of survey. Some aquatic and wet woodland invertebrate potential, also some potential for bark and sapwood decay invertebrates.	Aquatic and hygrophilus invertebrates, some bark and sapwood decay and arboreal habitat	Marshland, Peatland, wet woodland, arboreal, wood decay	Fairly good
4	22/04/2022	Northern peninsula	TQ04694 89341	Channel between main survey area and northern peninsula	Aquatic habitat around bridge to northern peninsula with narrow channel between woodland areas. Shallowly shelving gravel substrate to about 0.5 metres mid-channel. Little or no in-channel aquatic vegetation at time of survey.	Limited potential for aquatic invertebrates due to lack of vegetation structure.	Lake, Marshland, Peatland	Moderate

Target note	Date	Main survey area	Grid reference	Feature	Description	Potential invertebrate assemblages	Potential invertebrate assemblages	Potential invertebrate conservation value
5	22/04/2022	Habitat east of central path	TQ04747 89348	Gravel bank and gravel lacustrine habitat	Man-made gravel bank at edge of lake/northern extremity of the wooded habitat east of central track in the main survey area. Partically vegetated with herbs including Geum urbanum, Potentilla reptans, Myosotis spp., surrounded by dense Buddleja davidii, Rubus fruticosus agg. and Salix cinerea/caprea scrub, merging into dense damp woodland, with heavily shaded ground layer. Some limited interest for marginal/shingle associated invertebrates, but relatively low potential.	Limited potential for shingle associated invertebrates, but surrounding scrub woodland of limited potential.	Lake, Shingle	Moderate
6	22/04/2022	Habitat east of central path	TQ04761 89339	Drier broadleaved woodland	Main, raised wooded area to the east of the central path. Varied topography, evidently resulting from historic landforming/quarrying activity. Plateau supporting woodland culminating in a steep escarpment descending to enclosed waterbody and carr woodland to the east. Scrub woodland on plateau, fairly dense, with shaded groundlayer with leaf-litter, but little ground vegetation. Broadleaves including Corylus avellana, Crataegus monogyna, Betula pendula (some fairly mature) and Salix spp. with dense Buddleja davidii in scrub/understorey. Steep sand and gravel escarpment with Holcus lanatus and Hedera helix, Galium aparine and Rubus fruticosus agg. Relatively low invertebrate potential.	Little invertebrate potential apart for shaded ground layer and arboreal assemblages.	Shaded ground layer, arboreal	Moderate
7	22/04/2022	Central path & adjacent clearings	TQ04715 89325	Path edge grassy scallop	Short, rabbit-grazed semi improved grassland scallop supporting a fairly diverse flora with graminoids including Holcus lanatus, Agrostis stolonifera, Festuca rubra, Poa pratensis, Dactylis glomerata and in damper areas, Juncus inflexus and herbs including Veronica chamaedrys, Hypericum perforatum, Prunella vulgaris, Taraxacum officinale agg., Achillea millefolium, Potentilla reptans, Cerastium fontanum, Hypochaeris radicata, Ranunculus sardous?, Glechoma hederacea, Plantago lanceolata, P.major, Senecio jacobaea and locally, Sedum sp. and Galega officinalis, occupying areas of vegetated hard standing. lichens including Cladonia sp. and bryophytes. Margins with scrub woodland generally with Buddleja davidii dominant, but with some seedling Betula sp.	Good potential for short sward and bare ground associated invertebrates.	Short sward & bare ground	Good

Target note	Date	Main survey area	Grid reference	Feature	Description	Potential invertebrate assemblages	Potential invertebrate assemblages	Potential invertebrate conservation value
					and Rubus fruticosus agg. Bare gravel/sand patches present throughout sward.			
8	22/04/2022	Central path & adjacent clearings	TQ04718 89284	Path edge grassy scallop	Fairly herb-rich scallop, with similar composition to TN7, but slightly taller sward, with additional species including Geranium molle, Cardamine flexuosa and Muscari sp. Ground nesting Andrena scotica recorded.	Good potential for short sward and bare ground associated invertebrates.	Short sward & bare ground	Good
9	22/04/2022	Central path & adjacent clearings	TQ04749 89234	Open, sparsely vegetated clearing	Flat area of sparsely vegetated bare ground immediately to the east of central track. Area around 30m x 20m on granular/sandy/gravel substrate, with concrete blocks, indicating man-made origin, also, localised sandy banks. Habitat with partial cover of bryophyte, lichens including Cladonia sp. and liverworts and herbs including Erodium cicutarium, Dipsacus fullonum, Hypericum spp., Sedum sp., with patches of graminoids including Agrostis capillaris and Festuca rubra.	Some potential for short sward and bare ground associated invertebrates.	Short sward & bare ground	Good
10	22/04/2022	Habitat east of central path	TQ04757 89279	Mature Salix spp. near substation	Localised aggregation of mature Salix caprea amidst +/- continuous low Buddleja davidii dominated scrub/woodland. Trees multi-stemmed, with some potential for supporting bark and sapwood assemblages, but fairly shaded at groundlevel. Remaining scrub/woodland habitat east of main path dense and entangled, with some fallen wood decay habitat (Salix fragilis), often inaccessible and densely planted.	Some bark and sapwood decay and arboreal habitat, but invertebrate potential not considered to be high	Bark & sapwood decay, Arboreal	Moderate

Target note	Date	Main survey area	Grid reference	Feature	Description	Potential invertebrate assemblages	Potential invertebrate assemblages	Potential invertebrate conservation value
11	22/04/2022	Habitat west of central path	TQ04743 89116	Clearing in Birch stand	Largish, sparsely vegetated clearing, west of main path, with bare ground and sandy/gravel substrate. Flattish with some raised banks of deposited rocks and sandy substrate. Habitat with some affinity to OMH and partially developed over hard standing. Grades into fairly extensive, dryish Betula pendula woodland on western side of bank. Groundlayer with extensive broken bryophyte patches, bareground and scattered herbs including Erodium cicutarium, Plantago lanceolata, Cirsium arvense, Ranunculus bulbosus/sardous, Hypericum perforatum, Geranium molle, Cirsium vulgare, Potentilla reptans, Bellis perennis, Senecio erucifolius, Veronica chamaedrys, Lotus corniculatus, Prunella vulgaris and Arctium minus. Some encroaching Betula pendula and Alnus glutinosa seedlings.	Some potential for short sward and bare ground and tall sward and scrub associated invertebrates.	Short sward & bare ground; scrub edge	Good
12	22/04/2022	Central path & adjacent clearings	TQ04793 89054	Juncus dominated damp grassland	Dampish, semi-improved grassland track edge scallop, with good scrub edge succession to woodland. Grassland with Holcus lanatus, Agrostis stolonifera and locally abundant Juncus inflexus with Carex sp. and herbs including Cardamine pratense, Lotus pedunculatus and Mentha aquatica, indicating localised wetting, alongside species associated with drier habitats including Glechoma hederacea, Lotus corniculatus, Plantago lanceolata, P. major, Prunella vulgaris, Potentilla reptans and Achillea millefolium; grading at woodland edge, through Rubus fruticosus agg. scrub, then Betula and Salix cinerea/caprea and S. fragilis, with some standing and fallen wood decay habitat.	Good potential for wetland edge and tall sward and scrub invertebrates. Also edge with woodland with potential wood decay habitat.	Marshland, Peatland, Tall sward & scrub, wood decay, arboreal	Very good
13	22/04/2022	Habitat west of central path	TQ04766 89021	Wet woodland & swamp	Structurally interesting swampy wet woodland, on southern margin of survey area. Habitat with mature Salix fragilis, S. cinerea/caprea and occasional Populus nigra italicum, over soft, saturated mud substrate. Groundlayer with dappled shade and Carex pendula tussocks alongside macrophytes including Lycopus europaeus and Mentha aquatica. Good potential for hygrophilus invertebrates such as	Good potential for hygrophilus invertebrates such as coleoptera and diptera. Possible pitfall trap area.	Marshland, Peatland, wet woodland, arboreal	Very good

Target note	Date	Main survey area	Grid reference	Feature	Description	Potential invertebrate assemblages	Potential invertebrate assemblages	Potential invertebrate conservation value
14	22/04/2022	Habitat west of central path	TQ04793 89054	Standing water & wet woodland	Potentially interesting wet woodland opposite side of path to TN13 close to southern extremity of site. Mixed age stand of Alnus glutinosa, with Salix fragilis and S. cinerea/caprea. Both saturated and standing wood decay habitat. Trees in and around inundated area of standing water, rather stagnant with little aquatic vegetation other than some marginal Iris pseudacorus.	Bark and sapwood decay and arboreal habitat, with some potential for characteristic wet woodland species.	Marshland, Peatland, wet woodland, arboreal	Good
15	22/04/2022	Habitat west of central path	TQ04716 89087	Partially dried out waterbody in wet woodland	Linear wetland strip (c10-15m wide), in wet woodland. Recessed below general ground level of woodland floor. Habitat partially inundated at time of survey, with dried out areas supporting stands of tall herb vegetation including Urtica dioica, Alliaria petiolata. Surrounding woodland with Betula pendula/pubescens and leggy Salix caprea; secondary woodland, with some light reaching woodland floor, but habitat unexceptional in terms of invertebrate potential.	Wetland and ground layer of rather limited invertebrate potential; some arboreal potential	Marshland, Peatland, Arboreal	Moderate
16	22/04/2022	Habitat west of central path	TQ04679 89084	Birch woodland	Relatively dry Betula pendula woodland contiguous to Betula successional habitat described in TN11. Fairly open with relatively mature birch together with Alnus glutinosa and Salix spp. Groundlayer with dappled shade. Patches of Carex panicea, Primula vulgaris, Hypericum andosaemum, Prunella vulgaris, Geum urbanum, Carex pendula, Myosotis sp. and some Hyacinthoides non-scripta. Bryophytes abundant in ground layer. Varied topography and some wood decay habitat.	Some bark and sapwood decay habitat, but unexceptional invertebrate habitat	Bark & sapwood decay, Arboreal	Fairly good
17	22/04/2022	Habitat west of central path	TQ04597 89072	Lacustrine edge habitat	Stand of lacustrine marginal and emergent vegetation at edge of wet woodland stand. With macrophytes including Carex acutiformis, Mentha aquatica, Solanum dulcamara and Iris pseudacorus. Adjacent wet woodland with Alnus glutinosa, Betula pendula/pubescens and Salix caprea/cinerea. Terrestrial wet woodland habitat in area of good relative quality.	Potential aquatic and wet woodland invertebrate sample site	Marshland, Peatland, wet woodland, arboreal	Very good

Target note	Date	Main survey area	Grid reference	Feature	Description	Potential invertebrate assemblages	Potential invertebrate assemblages	Potential invertebrate conservation value
18	22/04/2022	Habitat west of central path	TQ04662 89139	Wet woodland interior	Main woodland interior with Betula pendula/pubescens, Alnus glutinosa and Salix spp. Habitat quite structurally diverse, with both areas of dense canopy, over shaded ground layer and quite open areas. Many trees not fully mature, but some localised wood decay habitat, with potential for vane trap sampling.	Potential for vane trap location iadjacent to wood decay habitat.	Wet woodland, arboreal, Bark & sapwood decay	Good
19	22/04/2022	Habitat west of central path	TQ04635 89322	Lacustrine edge habitat	Lacustrine marginal habitat with gradually sloping, gravel substrate. Stands of developing marginal and emergent vegetation including Sparganium erectum, Iris pseudacorus. Fairly open area cleared of trees, possibly for fishing. Adjacent wet woodland mature.	Potential aquatic sample site	Marshland, Peatland, Lake	Good
20	22/04/2022	Habitat west of central path	TQ04613 89288	Wet woodland interior	Northern wet woodland section fairly mature with Alnus glutinosa, Salix fragilis and occasional Betula pendula/pubescens. Fairly open ground layer with mainly Urtica dioica and Galium aparine, but also more representative woodland groundflora species including Ajuga reptans, Viola riviniana, Primula vulgaris, Rumex sanguineus, Circaea lutetiana and Glechoma hederacea, with extensive, albeit localised patches of Carex pendula, with Iris pseudacorus in damper hollows. Some wood decay habitat.	Wet woodland most representative in this area and with potential for invertebrate survey, vane traps etc.	Wet woodland, arboreal, Bark & sapwood decay	Good
21	22/04/2022	Habitat west of central path	TQ04594 89258	Wet woodland fallen wood decay habitat	Inundated depressions in northern wet woodland section. Habitat with sparsely vegetated open water, with leaf-litter and fallen Salix fragilis; this tree being dominant in the canopy in this area, with Alnus glutinosa and Betula pendula/pubescens occurring to a lesser extent. Water margins with some Mentha aquatica alongside co-dominant Urtica dioica and Galium aparine. Woodland groundflora generally most diverse closest to path.	Some bark and sapwood decay and arboreal habitat, with some potential for characteristic wet woodland species.	Marshland, Peatland, wet woodland, arboreal, wood decay	Good
22	22/04/2022	Boyer's Pit Lane	TQ04905 88985	Mature Crack Willow pollards	Line of mature/veteran, pollarded Salix fragilis on eastern side of access track (parallel to canal). Trees have been subject to limb removal, but have potential to support saproxylic invertebrates.	Bark and sapwood and heart rot potential, but adjacent habitat	Bark & sapwood decay, heart rot	Fairly good

Target note	Date	Main survey area	Grid reference	Feature	Description	Potential invertebrate assemblages	Potential invertebrate assemblages	Potential invertebrate conservation value
						degraded.		

Table 2 – Invertebrate species recorded incidentally during the Mid Colne Valley SSSI invertebrate scoping survey 22/04/2022

Common name	Scientific name	Family	Order/higher taxon	UK status	IUCN status	Recorded site	Recorded habitat
A gnaphosid spider	*Zelotes sp.*	Gnaphosidae	Araneae	Unknown	Unknown	Central path grassland	Under bark & refugia
A ground beetle	*Amara aenea*	Carabidae	Coleoptera	Widespread	LC	Central path grassland	In grassland
A ground beetle	*Nebria brevicollis/salina*	Carabidae	Coleoptera	Unknown	Unknown	Central path grassland	On track
A ground beetle	*Pterostichus madidus*	Carabidae	Coleoptera	Widespread	LC	Central path grassland	Under bark & refugia
Dark-edged Bee-fly	*Bombylius major*	Bombylidae	Diptera	Widespread	LC	Central path grassland	On groundflora
A hoverfly	*Episyrphus balteatus*	Syrphidae	Diptera	Widespread	LC	Central path grassland	On groundflora
A hoverfly	*Heliophilus pendulus*	Syrphidae	Diptera	Widespread	LC	Central path grassland	On groundflora
Chocolate Mining Bee	*Andrena scotica*	Andrenidae	Hymenoptera	Widespread	LC	Central path grassland	On groundflora
Hairy-footed Flower Bee	*Anthophora plumipes*	Apidae	Hymenoptera	Widespread	LC	West of path; wet woodland	On Glechoma hederacea flowers

Common name	Scientific name	Family	Order/higher taxon	UK status	IUCN status	Recorded site	Recorded habitat
Large Red-tailed Bumblebee	*Bombus lapidarius*	Apidae	Hymenoptera	Widespread	LC	West of path; wet woodland	On woodland groundflora
Common Carder Bee	*Bombus pascuorum*	Apidae	Hymenoptera	Widespread	LC	Northern peninsula; Central path grassland	On Glechoma hederacea flowers
Forest Cuckoo Bee	*Bombus sylvestris*	Apidae	Hymenoptera	Widespread	LC	West of path; wet woodland	On Glechoma hederacea flowers
Buff-tailed Bumblebee	*Bombus terrestris*	Apidae	Hymenoptera	Widespread	LC	Central path grassland	On groundflora
Buff-tailed Bumblebee	*Bombus terrestris*	Apidae	Hymenoptera	Widespread	LC	Central path grassland	On groundflora
Black Ant	*Lasius niger*	Formicidae	Hymenoptera	Widespread	LC	Throughout	Under bark & refugia
A myrmicine ant	*Myrmica sp.*	Formicidae	Hymenoptera	Unknown	Unknown	Throughout	Under bark & refugia
Common Pill Woodlouse	*Armadillidium vulgare*	Armadillidiidae	Isopoda	Widespread	LC	Throughout	Under bark & refugia
Common Shiny Woodlouse	*Oniscus asellus*	Oniscidae	Isopoda	Widespread	LC	Throughout	Under bark & refugia
Common Striped Woodlouse	*Philoscia muscorum*	Philosciidae	Isopoda	Widespread	LC	Throughout	Under bark & refugia
Common Rough Woodlouse	*Porcellio scaber*	Porcellionidae	Isopoda	Widespread	LC	Throughout	Under bark & refugia
Peacock Butterfly	*Aglais io*	Nymphalidae	Lepidoptera	Widespread	LC	Central path grassland	On groundflora
Speckled Wood	*Pararge aegeria*	Nymphalidae	Lepidoptera	Widespread	LC	Central path grassland	On woodland margin

Appendix 2 - Figures

Figure 1 - 2022 Invertebrate scoping survey area with Target Note locations.

Appendix 3 - Photographs

Photograph 1 – Established Birch woodland (west of track)

Photograph 2 – Bare ground habitat & encoraching Birch

Photograph 3– Woodland groundflora (west of track)

Photograph 4 – Standing wood decay habitat (west of track)

Photograph 5 – Fallen Crack Willow (west of track)

Photograph 6 – Standing water & carr habitat (eastern perimeter)

Photograph 7 – Open water and wet woodland (south boundary)

Photograph 8 – Pendulous Sedge & wet sand (south boundary)

Photograph 9 – Marginal macrophyte vegetation (west boundary)

Photograph 10 – SI grassland scallop (central track)

Photograph 11 – Colonised bare ground (central track)

Photograph 12 – Wet grassland with Juncus (central track)

BROADWATER LAKE, UXBRIDGE

Terrestrial Invertebrate Survey Report

Dr Ross Piper FRES

SEPTEMBER 2022

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1 Executive summary

To support an outline planning application for a proposed marina development of former sand and gravel workings, a number of ecological surveys have been commissioned, including a terrestrial invertebrate survey.

The site (centred on TQ 04735 89123) is located near Harefield, Uxbridge. The site itself comprises the concrete access roads of the former aggregate workings, large amounts of *Buddleja* scrub and *Salix* woodland, wet woodland (much of which is inaccessible due to quicksand), bare ground and lake margin, scrubby, flower rich margins.

The terrestrial invertebrate fauna of the sites was sampled on five occasions between June and September 2022. The site was surveyed using standardised sampling protocols and involving sweep-netting, suction sampling, beating, pan trapping, direct searching and moth trapping. Survey conditions, especially later in the year, were not ideal because of the extremely hot and dry conditions.

447 terrestrial invertebrate species were recorded, of which 10 have some level of national conservation status. These were as follows: *Agelastica alni, Donacia thalassina, Omalium rugatum, Neopachygaster meromelas, Tipula livida, T. helvola, Ceraleptus lividus*, *Parascotia fuliginaria*, *Bohemannia quadrimaculella* and *Scrobipalpa obsoletella*. *Agelastica alni* has undergone a significant range expansion in recent years and a revision of its conservation status is warranted. Thirty-nine further moth species are classed as ‘Local’.

The site has some habitats that have moderate value for terrestrial invertebrates, particularly the tall, flower-rich sward and scrub edge in Area 1. The large areas of *Buddleja* scrub are of very limited value. The areas of wet woodland and the abundant deadwood resources therein could not be adequately surveyed because of the large swathes of quicksand. Only a relatively small proportion of the species that inhabit a site will be recorded during a survey of this type.

Specific measures will be needed to mitigate for the consequences of the construction process and the eventual use of the site. Pollution will need to be controlled during and after construction and measures taken to minimise disturbance of any retained/created habitats, as well as limiting nutrient and pesticide inputs.

There is a great deal of scope to create habitat for terrestrial invertebrates in the development that will serve to improve habitat connectivity through the wider landscape. Sympathetic habitat creation could increase the value of the site for terrestrial invertebrates. Retaining a network of existing habitat throughout the site and linking these with created habitats and surrounding habitats could provide a

connected, landscape scale mosaic of resources that will become more valuable to terrestrial invertebrates as they evolve.

2 Introduction

2.1 Overview

Ecology by Design, on behalf of the London Borough of Hillingdon (LBH), was commissioned to conduct a terrestrial invertebrate survey of land adjacent to Broadwater Lake, Moorhall Road, Harefield, Uxbridge, UB9 6PE (centred on TQ 04735 89123). LBH proposes to develop the Hillingdon Water Sports Facility (HWSF) on the 8ha site. The Local Planning Authority is Hillingdon Council. The site is a former sand and gravel pit.

2.2 Site location and setting

The site, centred on TQ 04735 89123, is approximately 8ha in size and comprises a former sand and gravel works. The site is bounded to the North and the West by Broadwater Lake and there is small lake within the boundary of the site. Further to the North and South are more lakes – flooded sand and gravel workings. To the East there is Harefield, agricultural land and the edge of Greater London. Further to the west is agricultural land, woodlands, the M25, Gerard's Cross and Chalfont St Peter.

Since cessation of sand and gravel processing on the site, it appears to have been subject to little management, apart from the cutting and maintenance of pathways by an angling club. There are no rights of way on the site, although some locals do walk their dogs there.

Figure 1: Plans of the site (outlined in blue)

2.3 Aims and objectives

2.3.1 Aim

The main aim of this project was to survey the site to gain an understanding of the terrestrial invertebrate assemblage it supports, including the presence of any species of conservation concern.

2.3.2 Objectives

- To conduct a desk study of designated sites and invertebrate species recorded within proximity of the site;
- To conduct an invertebrate survey of the site;
- To produce a report including findings, an evaluation of key habitat and species assemblages and an appraisal of the potential conservation value of the site's habitats for invertebrates.

3 Methodology

3.1 Desk study

Prior to conducting fieldwork, existing information pertaining to the invertebrate fauna of the site was reviewed. Much of this was sourced from a Scoping Survey report (Mellings 2022) and, to a lesser extent, a preliminary Ecological Appraisal (PEA) carried out by CGO Ecology (Gleed-Owen 2021). Mellings 2022 includes a review of historic invertebrate records from within a 2.5km radius of the survey area supplied by the local biological records office.

3.2 Field survey

3.2.1 Timing

The survey the invertebrate diversity of the site, three visits were conducted:

- 9th June 2022
- 7th July 2022
- 19th July 2022 (moth trapping only)
- 11th August 2022
- 7th September 2022

3.2.2 Sampling

Sampling areas were identified from Mellings 2022 and from the initial visit to the site in June 2022. During this initial visit the whole site was walked and the most promising areas noted. During each visit, the following sampling protocol was employed in each of the sampling areas (Figure 2).

- 1 x 10 minutes transects with a sweep net where vegetation is vigorously swept;
- 1 x 2 min suction samples with vacuum sampler;

- 20 mins of beating trees, hedgerows, scrub and taller vegetation with a beating tray;
- 10 yellow pan traps (part filled with water and detergent) placed in transects and left out for the duration of each visit. This was restricted to the warm, sunny areas (Areas, 1, 3, 4 and 5);
- Moth trapping. Five Robinson traps fitted with 125W Mercury-vapour bulbs were run overnight between 21:30 and 05:30. Moths were recorded at several intervals during the night and then the following morning between 05:30 and 07:30. Traps were positioned at: TQ04738911, TQ04758916, TQ04738921, TQ04718931 and TQ04608929.
- Direct searching and spot sampling.

Sweep sampling allows the capture of terrestrial invertebrates in the sward and dense vegetation, including very mobile species. The vacuum sampler allows the capture of ground-dwelling species, including leaf-litter and tussock dwelling invertebrates.

Figure 2: Sampling areas

4 Limitations

Local record centre species data provides positive records of species recorded; however, the species records within a given area are dependent on the recording effort of individuals and are often biased towards certain well-recorded groups e.g. butterflies and moths, dragonflies and damselflies etc. and the paucity of recording of less easily recognised species cannot be proof of a lack or absence of such species.

Every effort was made to record habitat features of potential conservation value for invertebrates at a suitable resolution to inform a robust scoping study. However, the recognition of key habitat features with potential to support important invertebrate species or species assemblages is based on knowledge and experience. It cannot be guaranteed that habitats considered to have high conservation potential would be confirmed as such if surveyed in detail, or conversely, some habitat features supporting uncommon species or species assemblages may have been overlooked during the survey.

The Summer of 2022 was exceptionally hot and dry. Such conditions are not ideal for surveying terrestrial invertebrates as the diversity and abundance of many taxa was lower than expected, especially in the latter part of the Summer. Very few insects were found during the August and September visits.

5 Results

5.1 Desk study

5.1.1 Statutory and Non-statutory Sites

The following information was sourced from an independent desk study and data-search conducted for the purpose of the current project by GiGL/eCountability (Ritchie, 2022). There are eight sites subject to statutory designation within a 2.5km radius of the Mid Colne Valley SSSI survey area. A further 16 sites with non-statutory designations (SNCIs) were recorded within a 2.5km radius of the survey area. No proposed SNCIs or RIGS or LIGS are within the search area. These sites are summarised in the tables below which have been reproduced from the scoping survey report of Jon Mellings (Mellings 2022).

Table 1. Statutory sites within 2.5km of the survey area.

Site name	Designation(s)	Distance from redline area	Habitat (from citation)	Key species (from citation)
Mid-Colne Valley	SSSI (includes Unit 3 which forms part of the survey area, as well as other Units comprising the SSSI)	Unit 3 comprises part of the survey area;	132 ha site representing a cross-section of the River Colne flood-plain and the adjoining valley slopes which rise abruptly to the east and west and lie on Upper Chalk, with Pebbly Clay capping the higher western slopes. An extensive series of flooded pits occupy much of the floodplain resulting from the gradual and continuing extraction of underlying river gravels. The northerly pit, Broadwater, is one of the largest expanses of open water in the Colne Valley and is unusual with its scattering of small wooded islands. Around the pits on the dividing	Site designated primarily for the diversity of breeding woodland and wetland birds and for the numbers of wintering wildfowl. On the eastern valley slope is one of the last remaining examples of unimproved chalk grassland in Greater London

Site name	Designation(s)	Distance from redline area	Habitat (from citation)	Key species (from citation)
			causeways are remnants of the original grasslands and valley alderwoods. These grade into various types of beech and hornbeam woodland and mixed scrub on the western slopes.	
Harefield Pit	SSSI	c0.55km (northeast)	Mainly designated for Geological interest, but with remnant calcareous flora in the Reading Beds.	No reference to invertebrates in citation, but site with
Northmoor Hill Wood	LNR	c0.65km (west)	Ancient woodland	No reference to invertebrates in citation, but site with invertebrate potential
Ruislip Woods	NNR, LNR, SSSI	c1.5km (east)	Extensive, 305 ha ancient, semi-natural woodland site, including some of the largest, unbroken blocks in Greater London. Site also occurs in mosaic with other semi-natural habitats including acid grass-heath mosaic and areas of wetland.	SSSI citation refers to important insect fauna including 'Lepidoptera and Diptera'. Recorded species include rot hole specialist wood soldierfly species *Xylomyia maculata* (classed Nationally Rare with a threat status of 'Vulnerable' under post-2001 IUCN guidelines; also moths including Light Orange Underwing *Archiearis notha*; Lead-coloured Drab *Orthosia populeti* and Great Oak Beauty *Hypomecis roboraria*.
Old Park Wood	SSSI	c1.7km (north)	A 16.7 ha ancient woodland SSSI, supporting some of the most floristically rich ancient woodlands in Greater London. Contains contains a complex transition through widely differing woodland types.	Wet woodland present on site. No mention of invertebrate value on site, but likely to support a significant fauna.
Denham Country Park	LNR	c2.2km south	19.82 ha. Site supports meadows, rivers and woodlands	Potential to support wetland, woodland and grassland invertebrate assemblages, but no details in datasearch documents
Denham Quarry Park	LNR	c2.5km south	22.22 ha. Meadowland and flooded quarry land	Potential to support wetland, woodland and grassland invertebrate assemblages, but no details in datasearch documents. Citation refers to dragonflies and damselflies, but is not specific.
Frays Valley	LNR	c2.5km south	71.84 ha. The whole of the LNR contains a wide diversity of habitats. The flooded gravel pits provide valuable habitat for wildfowl, and Fray's Farm Meadows represent some of the last remaining examples of wet alluvial grassland in Greater	Desmoulin's Whorl Snail Vertigo moulinsiana, a UK protected species occurs in Denham Lock Woods

Site name	Designation(s)	Distance from redline area	Habitat (from citation)	Key species (from citation)
			London and are important for a variety of plant	

Table 2. Non-statutory sites within 2.5km of the survey area

Site name	Designation(s)	Distance from redline area	Habitat (from citation)	Key species (from citation)
London's Canals	SNCI	Uncertain	A composite SNCI comprising canals within the London area. Amenity grassland, Bare ground, Canal, Planted shrubbery, Ruderal, Scattered trees, Scrub, Secondary woodland, Semi-improved neutral grassland, Tall herbs, Vegetated wall/tombstones, Wet marginal vegetation, Wet woodland/carr	Not specified other than generic reference to dragonflies and damselflies. Habitat likely to support diverse aquatic invertebrate fauna
Ruislip Woods and Poor's Field	SNCI (also NNR, LNR, SSSI)	c1.5km (east)	See also under statutory sites (above)	There is also an important invertebrate fauna including several nationally rare and scarce species (see under statutory sites (above)
Old Park Wood	SNCI	c1.5km (north)	See also under Old Park Wood SSSI. A sizeable woodland, mostly ancient, with a good variety of woodland stand-types due to variations in geology and topography. The site supports a particularly rich flora, including nationally scarce species	Wet woodland present on site. No mention of invertebrate value on site, but likely to support a significant fauna
Mid Colne Valley	SNCI (also SSSI)	Partly overlaps with survey area	See also under statutory sites (above). This section of the Colne Valley includes a diverse range of high quality habitats. Several waterways include the Frays River, from which 53 species of aquatic and wetland plants have been recorded. The unimproved wet pastures of Frays Farm Meadows (a Site of Special Scientific Interest and Local Nature Reserve managed by the London Wildlife Trust and Hillingdon Natural History Society) support a very rich flora	Citation mentions Desmoulin's Whorl Snail Vertigo moulinsiana, a UK protected species; also Balsam Carpet Moth Xanthorhoe biriviata and Glow-worm Lampyris noctiluca. Likely to support a range of wet woodland and wetland species
Coppermill Down	SNCI	c1km (north)	This site comprises the only natural chalk grassland in London north of the Thames. It supports a diverse flora, with typical downland species such as Upright Brome Bromopsis erecta, Dwarf Thistle Cirsium acaule, Salad Burnet Sanguisorba minor, Fairy Flax Linum catharticum and Cowslip Primula veris	The site has an important invertebrate fauna. Part of the Mid Colne Valley Site of Special Scientific Interest.

Site name	Designation(s)	Distance from redline area	Habitat (from citation)	Key species (from citation)
Harefield Chalk Pit	SNCI	c0.25km (northeast)	See also under statutory sites (above). One of four old chalk pits in the east Colne Valley, Harefield Pit comprises a strip of dense woodland on steeply undulating raised ground to the south, and a wooded seasonally damp basin to the north. Part of the southern wood is a Site of Special Scientific Interest	No reference to invertebrates in citation, but site with invertebrate potential
Harefield Churchyard and Wood	SNCI	c0.5km (northeast)	Ancient woodland, Bare ground, Marsh/swamp, Pond/lake, Secondary woodland	No reference to invertebrates in citation, but site with invertebrate potential
Shepherd's Hill Woods and Fields	SNCI	c2.4km (east)	Ancient woodland, Bare ground, Bracken, Coniferous woodland, Hedge, Improved agricultural grassland, Pond/lake, Running water, Scrub, Secondary woodland, Semi- improved neutral grassland, Tall herbs, Unimproved neutral grassland	No reference to invertebrates in citation, but site with invertebrate potential
Dew's Dell	SNCI	c1.2km (southeast)	Bare ground, Pond/lake, Ruderal, Secondary woodland, Semi-improved neutral grassland, Tall herbs, Unimproved neutral grassland, Wet grassland	No reference to invertebrates in citation, but site with invertebrate potential
Newyears Green	SNCI	c2km (southeast)	A woodland believed to have been planted in the late 19th century, surrounded by fields and hedges. Hedge, Scrub, Secondary woodland, Semi-improved neutral grassland, Tall herbs, Wet ditches	No reference to invertebrates in citation, but site with invertebrate potential
Medipark Site	SNCI	c1.5km (northeast)	An interesting mosaic of habitats has developed within the former grounds of a demolished hospital building, including species-rich neutral to chalk grassland, scrub and some marginal secondary woodland. This site adjoins the eastern edge of Old Park Wood	Reference to Marbled White and Common Blue Butterflies. Roesel's Bush-cricket also mentioned as being Nationally Scarce; however, the species has long been downgraded from this status and is widespread and common throughout the southern half of the UK
The Dairy Farm, Harefield	SNCI	c1km (northeast)	Hedge, Semi-improved neutral grassland, Unimproved neutral grassland, Wet ditches, Wet grassland	No reference to invertebrates in citation, but site with invertebrate potential
Knightscote Farm Ponds	SNCI	c1.3km (northeast)	Two ponds separated by an area of woodland, one used for fishing. Bracken, marsh/swamp, pond/lake, ruderal, wet woodland/carr	No reference to invertebrates in citation, but site with invertebrate potential
Harefield Green Pond	SNCI	c1.2km (northeast)	A small pond on the edge of the historic village green of Harefield. Marsh/swamp, pond/lake, scattered trees	Citation mentions that the pond is likely to support aquatic invertebrate populations

Site name	Designation(s)	Distance from redline area	Habitat (from citation)	Key species (from citation)
Breakspear House Wood	SNCI	c1.2km (east)	A small ancient woodland with a footpath running through it. This small woodland is dominated by Ash Fraxinus excelsior, with frequent Pedunculate Oak Quercus robur and Sycamore Acer pseudoplatanus. Stands of Beech Fagus sylvatica, with occasional Hornbeam Carpinus betulus and Horse Chestnut Aesculus hippocastanum make up the rest of the canopy.	Speckled Wood - a common species of butterfly, is mentioned on the citation; however, the age of the wood suggest it may support an interesting invertebrate fauna
Harefield Hospital Ponds and the Old Orchard	SNCI	c1.3km (northeast)	The two ponds in the grounds of Harefield Hospital are examples of mid- and late-successional habitats; the eastern pond being full of water with a well-developed marginal flora and the western one of mainly willow scrub, mud and leaf litter with a small area of water. An old orchard of over-mature Apple Malus domestica and plum Prunus domestica trees is part of the council-owned Mount Pleasant Farm. These old fruit trees are likely to be valuable for invertebrates.	The orchard and mature oaks may support important invertebrate assemblages

5.1.2 Historically recorded species

Twenty-four insect species, recorded within a 2.5km radius of the survey area, were returned from the GiGL data search (summarised in the Table below). Of these, three are 'Vulnerable'; two are 'Near Threatened' based on post-2001 IUCN criteria; one species is listed in the RDBK 'unknown' category based on pre-1994 criteria; nine species are currently classed as nationally scarce (or still listed in one of the former Notable A or B categories). One species, the Hairy Dragonfly *Brachytron pratense,* is listed as 'Locally Important' within the Greater London region, whilst three species; Silver-washed Fritillary *Argynnis paphia,* Green Hairstreak *Callophrys rubi* and Essex Skipper *Thymelicus lineola*, have no official status and are listed as 'Low Priority'.

Two of the species including Stag Beetle *Lucanus cervus,* White Admiral *Limenitis camilla* are listed as 'Priority Species' under section 41 of the NERC Act, 2006, whilst a third, the Cinnabar Moth *Tyria jacobaeae* is listed under the section 41 as 'Research only', a status afforded to a number of still widespread and common British moth species, for which a decline has been recorded in recent decades.

A further three species, still listed in the GiGL dataset as Nationally Scarce, have been subject to status revisions and are now considered to be too widely recorded for the NS category. These include *Hercostomus plagiatus* - a species of long-legged fly; the Red-girdled Mining Bee *Andrena labiata* and

the Brown Tree Ant *Lasius brunneus*, a species which has been recorded in numerous sites in the southern UK.

Stag Beetle is also protected under Appendix 1,2 and 3 of the Bern Convention and is listed on Annex 2 of the EU Habitats Directive (Non-priority species) and Purple Emperor *Apatura iris* is also protected for collection and sale under Section 5 of the UK Wildlife and Countryside Act (1981), as amended.

Table 3. Invertebrate species with a conservation status recorded within 2.5km of the survey area.

Scientific Name	English Name	Earliest Year	Latest Year	Total Records	Status	SAT affinities	Habitat-level affinities
Brachytron pratense	Hairy Dragonfly	2018	2019	3	Locally Important	N/a	Acid & sedge peats
Hercostomus plagiatus	A long-legged fly	1987	1987	1	Formerly NS	N/a	Acid & sedge peats
Apatura iris	Purple Emperor	2015	2018	2	NT; protection	N/a	Arboreal
Limenitis camilla	White Admiral	1989	2017	8	S41 Vu	N/a	Arboreal
Phyllocnistis xenia	Kent Bent-wing	2014	2014	1	RL-VU	N/a	Arboreal
Anaspis costai	A scraptiid beetle	2010	2010	2	NS	Bark & sapwood	Decaying wood
Brachyopa pilosa	Dark-shouldered Sap Hoverfly	2009	2009	1	NS	Bark & sapwood decay	Decaying wood
Epuraea longula	A sap beetle	2009	2009	1	NS	Bark & sapwood decay	Decaying wood
Mordellistena neuwaldeggiana	A tumbling flower beetle	2010	2010	2	NS	Bark & sapwood decay	Decaying wood
Cis festivus	A minute treefungus beetle	2010	2010	1	NS	Fungal fruiting bodies	Decaying wood
Gyrophaena munsteri	A rove beetle	2009	2009	1	RDBK	Fungal fruiting bodies	Decaying wood
Lasius brunneus	Brown Tree Ant	2009	2010	2	Formerly NS	Heartwood decay	Decaying wood
Lucanus cervus	Stag Beetle	1998	2018	8	S41; protection	Heartwood decay	Decaying wood
Mordellistena humeralis	A tumbling flower beetle	2010	2010	3	NS	N/a	Decaying wood
Gomphus vulgatissimus	Common Club-tail	1968	1968	1	NT	Slow flowing rivers	Running water
Andrena labiata	Red-girdled Mining Bee	2011	2011	1	Formerly NS	Rich flower resource	Short sward & bare ground
Argynnis paphia	Silver-washed Fritillary	2017	2017	1	Low Priority	Scrub edge	Tall sward & scrub
Apteropeda globosa	A flea beetle	2009	2009	1	NS	N/a	Tall sward & scrub
Callophrys rubi	Green Hairstreak	2011	2011	2	Low Priority	N/a	Tall sward & scrub
Euplagia quadripunctaria	Jersey Tiger	2015	2015	1	HDir2	N/a	Tall sward & scrub
Thymelicus lineola	Essex Skipper	1991	2013	2	Low Priority	N/a	Tall sward & scrub

Tyria jacobaeae	Cinnabar	2012	2013	2	S41 research only	N/a	Tall sward & scrub
Meligethes atramentarius	A pollen beetle	2009	2009	1	NS	N/a	N/a
Mordellistena variegata	A tumbling flower beetle	2010	2010	2	NS	N/a	N/a

5.2 Field survey

5.2.1 Survey area

The site was formerly sand and gravel workings and the vegetation, typical pioneer species, colonised the site when aggregation extraction and processing ceased. In view of the former use, some of the site can be classfied as Open Mosaic Habitats on Previously Developed Land (OMHPDL). Some concrete hardstanding remains on the site and other, demolished parts of the gravel and sand processing facility's infrastructure remain.

5.2.2 Habitats

Very broadly, the site is a mosaic of habitats, but it has low/medium potential for terrestrial invertebrates because of the few open areas and the predominance of *Buddleja*. The small areas of open habitats offer sunlight and warmth, although the substrate is typically too hard to be of much value for species that excavate burrows in the ground, e.g. solitary bees and wasps.

The pioneer vegetation on the site is dominated by Willows/Sallows *Salix fragilis* and *Salix caprea*, *Buddleja*, Silver Birch *Betula pendula* and Alder *Alnus glutinosa*. Buddleja is used by a relatively small number of insect species as a nectar source, but its value to terrestrial invertebrates in general is low. Willows, Sallows, Silver Birch and Alder are much more valuable. Distinct assemblages use these species and Sallows in particular support many species, including pollinators, leaf feeders and saproxylic insects.

The historical use of the site has left small-scale topographical features with hummocks and hollows, but many of these are shaded and the substrate is too hard to be of use for many species. This was further compounded by the drought conditions during the Summer of 2022. The swards that have developed in some of the open areas are botanically quite diverse and support species typically found on low nutrient soils. The margins of the tracks support plants such as St John's Wort *Hypericum perforatum* and Stonecrops *Sedum* sp.

In Area 1, there is a mosaic of bare ground, wet grassland and scrub grading into wet woodland with abundant dead-wood resources, making it the most interesting part of the site in terms of the potential for terrestrial invertebrates. The largest open area within the site, Area 3, also has some interest for terrestrial invertebrates because of the abundant scrub, nectar sources, low nutrient soils and sheltered microclimate. A more friable substrate in this area would increase its value to terrestrial invertebrates generally.

There are wetland habitats throughout the site, i.e. lake margins, which are typically high value for terrestrial invertebrates. However, the value of these is diminished as the site is used by anglers and marginal vegetation in warm sheltered conditions has been cleared for access to the water.

There are deadwood resources throughout the site, although they're concentrated in the south. There are no significant trees on the site, which would support a suite of specialist species. The deadwood resources are typically *Salix fragilis*, which is a rather short-lived tree and supports a relatively small number of specialist saproxylic species. Most of the larger dead and moribund trees are in the southern area where sampling was not possible because of quicksand.

On the whole, the site has a relatively low botanical diversity, which will be reflected in the terrestrial invertebrate diversity as many herbivorous invertebrate species are monophagous (associated with only one species). A low plant diversity is an indicator of poor-quality invertebrate habitat.

5.2.3 Invertebrate species recorded in 2022

447 terrestrial invertebrate species were recorded (see Appendix A for full list). Of these, 10 have some level of national conservation status (see Appendix A). These statuses of these species is sourced from the Pantheon database. A further 39 of the moth species are considered to be 'Local'.

The Alder Leaf Beetle *Agelastica alni* is currently classed as Nationally Rare, but in recent decades it has undergone a very rapid expansion in range and is now found in suitable habitat across much of the UK. Consequently, its status requires revision. The reed beetle *Donacia thalassina* is a Nationally Scarce species associated with Yellow Flag Iris and other aquatic plants. The larvae develop in the roots of aquatic plants. Two individuals were seen on Yellow Flag Iris in the north of the site. The Nationally Notable rove beetle *Omalium rugatum* was found in suction samples. Little is known of the ecology of this species, but it is normally associated with decaying vegetation.

The small, Nationally Notable soldier fly *Neopachygaster meromelas* was found by sweeping the tall, flower-rich sward in Area 1. The larvae develop under decaying bark or tree wounds of various broadleaved trees, although poplars might be the preferred host. The two Nationally Notable crane flies, *Tipula livida* and *T. helvola,* were found during the final visit to the site in September 2022. The larvae are aquatic.

The Nationally Scarce Slender-horned Leatherbug *Ceraleptus lividus* was found in the North and South of the site. It feeds on various herbaceous legumes such as clovers, vetches and trefoils in dry open habitats such as grasslands, sand dunes and gravel pits.

5.2.3.1 Moths

Any moths for which in situ identification could not be determined were retained and dissected for determination by examination of the genitalia – this constituted very few of the overall catch and was largely limited to some of the smaller moths for which this is necessary for identification, or for a few larger moths which were in such poor condition that they could not otherwise be identified.

The weather on the night of the 19th July was cloudy and extremely warm, being the second day of the short, but extremely hot, heatwave where day-time temperatures in the area had reached the high 30's, possibly over 40°C as was recorded nearby at Heathrow. The weather did however break up on the night, and while setting out the traps there was a heavy rain shower, with light showers throughout the night and temperatures dropped significantly compared to the previous night – though still remained between 20-25°C.

Across the five traps a total of 192 moth species were recorded, including three species that are nationally scarce: *Parascotia fuliginaria* (Waved Black); *Bohemannia quadrimaculella* and *Scrobipalpa obsoletella*) and 39 species that are classed as 'Local'. Waved Black requires dead wood with associated fungi on which the larvae feed while the larvae of *B. quadrimaculella* feed within the leaves of Alder (*Alnus glutinosa*). The larvae of *S. obsoletella* feed on Oraches (*Atriplex* spp.), but this species is predominantly coastal in distribution.

A few species which were once regarded as nationally scarce, but have in recent years undergone enormous and rapid expansion, particularly in the south-east, including Middlesex, were also recorded: *Dioryctria sylvestrella*, *Euplagia quadripunctata* (Jersey Tiger) and *Eilemma caniola* (Hoary Footman). These species are now common in the area, although *D. sylvestrella* is likely to be greatly under-recorded due to the need for dissection to attain an accurate species identification.

Local species included some that are associated with wetland habitats including: Silky, Twin-spotted and Southern Wainscots (*Chilodes maritima*, *Lenisa geminipuncta* and *Mythimna straminea*) and *Phalonidia manniana*.

5.2.4 Pantheon analysis

The species lists obtained for the site were analysed with Pantheon. Pantheon is an online resource for recording and analysis of invertebrate assemblages developed jointly by the CEH and Natural England became available. The resource includes a modified version of ISIS which was formerly available in spreadsheet form and then as trial versions. However, these versions were used extensively both for common standards monitoring of entomological features of SSSIs and for EcIA purposes.

The Species Quality Indices (SQIs) reflect the proportion of rarities attributed to an assemblage and scores of around 100 generally indicate assemblages comprised of a high proportion of common species. In broad terms, scores of around 140 indicate the presence of assemblages of some conservation value. However, it is important to note that Species Quality Indices (SQIs) calculated from less than 15 species may not be reliable.

Table 4: Habitats & Resources – Broad Biotopes

Broad biotope	No. of species	% representation	SQI	Species with conservation status	Conservation status

open habitats	196	5	108	45	LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|[RDB 3]|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|VU|LC (Global)|Section 41 Priority Species - research only|NS|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)
tree-associated	125	4	125	49	LC (Global)|LC (Global)|LC (Global)|Notable|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|Notable|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|NR|NT|Section 41 Priority Species - research only|Notable|LC (Global)|LC (Global)|DD|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|NT|LC (Global)|Section 41 Priority Species - research only|LC (Global)|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|LC (Global)|NS|LC (Global)|LC (Global)|LC (Global)
wetland	48	2	118	7	LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|NS|LC (Global)
shaded woodland floor	2	67	100		
coastal	2	<1	400	1	LC (Global)

Table 5: Habitats and Resources – Habitats

Broad biotope	Habitat	No. of species	% representation	SQI	Species with conservation status	Conservation status
open habitats	tall sward & scrub	147	6	107	40	LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)
tree-associated	arboreal	87	7	110	41	LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|NR|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|NT|LC (Global)|LC (Global)|DD|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|Section 41 Priority Species - research only|NT|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)|LC (Global)
open habitats	short sward & bare ground	42	3	115	4	NS|LC (Global)|LC (Global)|LC (Global)

wetland	marshland	28	3	130	1	NS
tree-associated	shaded woodland floor	22	2	141	6	LC (Global)|Notable|LC (Global)|Notable|LC (Global)|Notable
tree-associated	decaying wood	18	2	160	2	LC (Global)|NS
wetland	acid & sedge peats	16	1	100	4	LC (Global)|LC (Global)|LC (Global)|LC (Global)
tree-associated	wet woodland	5	2	100		
wetland	running water	4	<1	100		
wetland	wet woodland	4	1	100		
coastal	sea cliff	1	2	400	1	LC (Global)
open habitats	upland	1	<1	100		
coastal	saltmarsh	1	<1			
wetland	lake	1	<1	100		

Table 6: Habitats and Resources – Specific Assemblage Types

Broad biotope	Habitat	SAT	No. of species	% representation		SQI	Species with conservation status	Conservation status	Code	Reported condition
open habitats		rich flower resource	21	9	100				F002	Favourable (21 species, 15 required)
open habitats		scrub edge	14	6	100	2		LC (Global)|LC (Global)	F001	Favourable (14 species, 11 required)
tree-associated	decaying wood	bark & sapwood decay	9	2	175	1		NS	A212	Unfavourable (9 species, 19 required)
open habitats	short sward & bare ground	bare sand & chalk	6	1	150	1		LC (Global)	F111	Unfavourable (6 species, 19 required)
wetland	acid & sedge peats	reed-fen & pools	4	4	100	4		LC (Global)|LC (Global)|LC (Global)|LC (Global)	W314	Unfavourable (4 species, 11 required)
open habitats		scrub-heath & moorland	4	1	100	2		VU|[RDB 3]	F003	Unfavourable (4 species, 9 required)
open habitats	short sward & bare ground	open short sward	4	2	100				F112	Unfavourable (4 species, 13 required)
		epiphyte fauna	3	15	100	3		LC (Global)|LC (Global)|LC (Global)	A215	Favourable (3 species, 3 required)

tree-associated	decaying wood	heartwood decay	2	1	100			A211	Unfavourable (2 species, 6 required)
tree-associated	decaying wood	fungal fruiting bodies	1	1	400	1	LC (Global)	A213	Unfavourable (1 species, 7 required)
open habitats	short sward & bare ground	exposed sea-cliff	1	2	400	1	LC (Global)	F113	
wetland	running water	slow-flowing rivers	1	4	100			W125	Unfavourable (1 species, 4 required)
wetland	marshland	northern lakes & lochs	1	6	400	1	NS	W212	Unfavourable (1 species, 3 required)

5.3 Discussion

5.3.1 Discussion of results

During this survey 10 species with some level of national conservation concern were recorded. As highlighted above, several of these species have undergone fairly recent range expansions and their conservation status requires revision.

The Pantheon analysis of the species list shows that the value of this site lies in the open habitats it offers. Specifically, the tall sward and scrub and scrub edge habitats. On a landscape (broad biotope) level, the greatest number of recorded species by far was attributed to the 'Open habitats' classification, with 196 recognised species. 125 and 48 species were 'tree-associated' and 'wetland-associated', respectively. Proportionately, the 'Open habitats' classification supports a greater number of species than the other two assemblages in terms of the national pool of species attributed in the Pantheon database. The representation of this entire species pool was 5%, compared with 4% and 2% of the national species pools represented from the survey data for the tree-associated and wetland assemblages, respectively at a biotope level. These findings would be expected in consideration of the habitats available.

On the Pantheon 'habitat' level tier, there were four assemblages attributed with a sufficient number of species recognised in ISIS to be considered robust. 147 species were attributed to the 'tall sward and scrub' habitat, which basically includes species associated with taller grassland, scrub and scrub edge habitats. Eighty-seven, 42, 28, 22, 18 and 16 species were attributed to arboreal, short sward and bare ground, marshland, shaded woodland floor, decaying wood and acid & sedge peats, respectively. In terms of the specific assemblage types (SATs) within these habitats, the only one with more than 15 associated species was the 'rich flower resource' SAT. The number of species associated with the other SATs was lower than the threshold of 15. Anything lower than 15 species and the SQI is not considered to be reliable.

In conservation assessments, SATs are generally regarded as the most valuable metrics for assessing site quality. This is because SATs are made up of species with a high degree of habitat specialisation. Such species tend to be both uncommon and representative of sites supporting habitat of quality in terms of conservation value. However, SATs often require targeted sampling of specific

habitat features and are not always well represented in broad-brushstroke surveys designed to gain an overall, or baseline assessment of a site's value.

5.4 Assessment

The site was found to support some habitat of moderate conservation value for invertebrate assemblages associated with rich flower resources, tall sward and scrub edge. Area 1 had the greatest amount of these habitats, but warm sunlit scrub edges were scattered through the site.

The majority of species recorded during the survey were representative of open habitats, thus reflecting sampling effort and habitat area. The results of the Pantheon analysis did not reveal any assemblages of high conservation value.

It is important to note the caveats associated with surveys of this type, principally the number of visits to the site and the weather in the survey season. Three or four visits is generally accepted as the standard for terrestrial invertebrate surveys, but species in any given area will always be missed. The summer of 2022 was extremely warm and dry. Such conditions are not ideal for surveying terrestrial invertebrates as the diversity and abundance of many taxa will be lower, especially in the peak of the drought.

The site does have potential to support some of the species of conservation concern that have been recorded from the surrounding area, although none of these species were recorded during these surveys.

6 Assessment of Effects

6.1 Approach

The assessment of effects is considered in two main sections (i) effects arising from construction of the development including direct habitat losses and indirect effects such as pollution events or effects on site drainage and hydrology, and (ii) effects arising from 'operation' of the development as the new population takes up residence.

Particular attention is given to effects on those areas of substantive nature conservation value, especially those which support habitats and species which are a priority for conservation in a national context, as well as those which are otherwise notable at a national or regional/county level

6.2 Construction effects

6.2.1 Impacts on the Habitats

It is not known exactly how much of the more valuable invertebrate habitats will be lost during the development. Area 1 is the most interesting of the surveyed areas, having moderate value for terrestrial invertebrates.

The unmitigated, combined loss of all the areas has some significance as a moderately interesting invertebrate assemblage is present. It is important to remember that surveys of this type only reveal a proportion of the species that inhabit a given area.

Pollution arising from construction could affect any retained habitats. Dust could affect retained areas of grassland and scrub if basking sites, nesting areas, foodplants and nectar sources are smothered. Pollution may cause degradation of habitats, reducing their suitability for the existing range of flora and fauna and their overall ecological value.

6.3 Operational effects

The main potential operational effects on nature conservation interests are considered to be as follows:

- Increased human disturbance and damage to any sensitive retained habitats including trampling, fly-tipping, etc.
- Increases in nutrient status of low fertility substrates through littering and fly-tipping;
- Invasion by non-native plant species;
- Changes in drainage regime of the site affecting site hydrology in the medium to long term with possible deleterious effects on the site and surrounding areas.

7 Avoidance, reduction, compensation and enhancement measures

7.1 Avoiding and reducing construction risks

During detailed design and construction of the development, it is likely that additional actions may be required to safeguard the current invertebrate populations. These actions would be specified within a Construction Environmental Management Plan (CEMP) and would include:

- Clear demarcation of areas that are to be retained (if any) with minimal disturbance to the buffers. Many species of invertebrate overwinter as eggs, larvae or adults in the soil, leaf-litter, under bark, etc. so it is imperative that these habitats are not disturbed in the buffers surrounding the more important retained habitats;
- Any trees that are cut in the retained areas should be left as dead-wood with a mixture of standing (2-3m high) and boughs and trunks on the ground;
- Appropriate measures are put in place to control dust and other emissions that could affect air quality and smother retained habitats;
- Site compounds, storage facilities and staff facilities are suitably bunded and located in places that would not have an adverse effect on the environment; in particular, the CEMP would ensure that retained trees are protected;

- In advance of site clearance, protective fencing is installed to protect retained and/or ecologically sensitive habitats and their associated buffer zones to ensure that they are not subject to accidental damage (to be determined on a phase by phase basis);
- Haul routes, storage compounds and staff facilities would be located away from retained habitats to minimise disturbance to the species they support;
- An ecological clerk of works is in place to oversee site operations.

7.2 Enhancement of the retained areas

Any retained areas in the development zone should preserve the habitats that are currently of greatest value to terrestrial invertebrates, principally botanically rich sward and scrub edge. These could be further enhanced by offering additional bare ground, water-bodies and dead wood resources. It is crucial that ornamental species of little or no value to native terrestrial invertebrates are not used in the planting schemes throughout the proposed development.

Areas of bare, hard substrate could be enhanced by over-topping with more friable substrates that favour species that burrow for all or part of their lifecycle.

7.3 Creation of new habitats

There are two tenets for creating habitats for terrestrial invertebrates: maximising plant diversity and structural complexity of the area in question. A plan for the development should be formulated that considers the current habitats and habitat connectivity in the broader landscape.

The emphasis for this green infrastructure needs to be on native species, habitat heterogeneity and connectivity. The habitats in the sites should be replicated and enhanced throughout the development with the provision of nectar-source rich grassland, bare and sparsely vegetated ground, scrub, water-bodies and dead wood resources.

8 Conclusions

Five surveys of the site were conducted of the site between June and September 2022, one of which was solely for the purpose of moth-trapping. Standardised sampling methods and protocols were used to sample the invertebrate fauna of the site, with subsequent identification of material.

447 terrestrial invertebrate species were recorded, of which 10 have some level of national conservation status. One of these species, *Agelastica alni,* has undergone a significant range expansion in recent years and a revision of its conservation status is warranted. The site has some habitats that have moderate value for terrestrial invertebrates, particularly the tall, flower-rich sward and scrub edge in Area 1. The large areas of *Buddleja* scrub are of very limited value.

The areas of wet woodland and the abundant deadwood resources therein could not be adequately surveyed because of the large swathes of quicksand.

Specific measures will be needed to mitigate for the consequences of the construction process and the eventual use of the site. Pollution will need to be controlled during and after construction and measures taken to minimise disturbance of any retained/created habitats, as well as limiting nutrient and pesticide inputs.

There is a great deal of scope to create habitat for terrestrial invertebrates in the development that will serve to improve habitat connectivity through the wider landscape. Sympathetic habitat creation could increase the value of the site for terrestrial invertebrates. Retaining a network of existing habitat throughout the site and linking these with created habitats and surrounding habitats could provide a connected, landscape scale mosaic of resources that will become more valuable to terrestrial invertebrates as they evolve.

9 References

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APPENDIX A: SPECIES LIST FOR THIS SURVEY

Statuses sourced from the Pantheon database. NS= Nationally Scarce; Notable= Notable or Nationally Scarce; DD=Data Deficient [*status*]= Status considered out of date, use with caution.

Species	Common Name	Conservation status
Coleoptera		
Apion frumentarium	An Apionid Weevil	
Protapion assimile	An Apionid Weevil	
Anthonomus pomorum	A Weevil	
Ceutorhynchus pallidactylus	A Weevil	
Dorytomus tortrix	A Weevil	
Euophryum confine	A Weevil	
Hypera nigrirostris	A Weevil	
Sciaphilus asperatus	A Weevil	
Sitona lineatus	A Weevil	
Deporaus betulae	A leaf-rolling weevil	
Altica lythri	A Flea Beetle	
Crepidodera aurea	A Flea Beetle	
Longitarsus jacobaeae	A Flea Beetle	
Longitarsus parvulus	A Flea Beetle	
Phyllotreta nigripes	A Flea Beetle	
Psylliodes chrysocephala	A Flea Beetle	
Agelastica alni	Alder Leaf Beetle	DD;NR
Donacia thalassina	A Reed Beetle	NS
Cryptocephalus moraei	A Pot Beetle	
Grammoptera ruficornis	A Longhorn Beetle	
Cantharis rustica	A Soldier Beetle	
Oedemera nobilis	Thick-Legged Flower Beetle	
Malachius bipustulatus	A Flower Beetle	
Adalia bipunctata	2-spot Ladybird	
Adalia decempunctata	10-spot Ladybird	
Aphidecta obliterata	Larch Ladybird	
Calvia quattuordecimguttata	Cream-spot ladybird	

Coccinella septempunctata	7-spot Ladybird	
Halyzia sedecimguttata	Orange ladybird	
Harmonia axyridis	Harlequin Ladybird	
Harmonia quadripunctata	Cream-streaked Ladybird	
Nephus redtenbacheri	A Ladybird	
Propylea quattuordecimpunctata	14-spot Ladybird	
Psyllobora vigintiduopunctata	22-spot Ladybird	
Rhyzobius chrysomeloides	A Ladybird	
Rhyzobius litura	A Ladybird	
Subcoccinella vigintiquattuorpunctata	24-spot Ladybird	
Anotylus sculpturatus	A Rove Beetle	
Carpelimus corticinus	A Rove Beetle	
Omalium rugatum	A Rove Beetle	Notable
Philonthus carbonarius	A Rove Beetle	
Stenus impressus	A Rove Beetle	
Tachyporus nitidulus	A Rove Beetle	
Stenus flavipes	A Rove Beetle	
Phosphuga atrata	A Carrion Beetle	
Abax parallelepipedus	A carabid beetle	
Acupalpus parvulus	A carabid beetle	
Agonum marginatum	A carabid beetle	
Amara aenea	A carabid beetle	
Amara plebeja	A carabid beetle	
Amara similata	A carabid beetle	
Asaphidion curtum	A carabid beetle	
Bembidion articulatum	A carabid beetle	
Bembidion assimile	A carabid beetle	
Bembidion lunulatum	A carabid beetle	
Carabus violaceus	Violet Ground Beetle	
Dyschirius tristis	A carabid beetle	
Harpalus affinis	A carabid beetle	

Harpalus rufipes	A carabid beetle	
Leistus ferrugineus	A carabid beetle	
Leistus fulvibarbis	A carabid beetle	
Nebria brevicollis	A carabid beetle	
Nebria salina	A carabid beetle	
Notiophilus biguttatus	A carabid beetle	
Notiophilus substriatus	A carabid beetle	
Ophonus puncticeps	A carabid beetle	
Ophonus rufibarbis	A carabid beetle	
Oxypselaphus obscurus	A carabid beetle	
Pterostichus madidus	A carabid beetle	
Pterostichus melanarius	A carabid beetle	
Syntomus foveatus	A carabid beetle	
Syntomus obscuroguttatus	A carabid beetle	
Ocypus olens	Devil's Coach-horse	
Anacaena limbata	A Water Scavenger beetle	
Anacaena lutescens	A Water Scavenger beetle	
Helophorus brevipalpis	A Water Scavenger beetle	
Endomychus coccineus	A handsome fungus beetle	
Melolontha melolontha	Common Cockchafer	
Diptera		
Bombylius major	Dark-edged Bee-fly	
Criorhina berberina	A Hoverfly	
Episyrphus balteatus	A Hoverfly	
Eristalis pertinax	A Drone Fly	
Myathropa florea	A Hoverfly	
Syrphus ribesii	A Hoverfly	
Xylota sylvarum	A Hover Fly	
Pollenia amentaria	A cluster fly	
Chloromyia formosa	Broad Centurion	
Neopachygaster meromelas	Silver-strips Black	NS

Pachygaster leachii	Yellow-legged Black	
Sargus flavipes	Yellow-legged Centurion	
Sepsis fulgens	A sepsid fly	
Themira annulipes	A sepsid fly	
Lonchaea caucasica	A lance fly	
Achyrolimonia decemmaculata	A crane fly	
Erioptera lutea	A crane fly	
Molophilus ochraceus	A crane fly	
Rhipidia maculata	A crane fly	
Tipula livida	A crane fly	Notable
Tipula helvola	A crane fly	Notable
Tipula pagana	A crane fly	
Ptychoptera albimana	A Fold-winged Cranefly	
Machimus atricapillus	Kite-tailed Robberfly	
Dioctria linearis	Small Yellow-legged Robberfly	
Rhagio lineola	Small Fleck-winged Snipefly	
Rhagio scolopaceus	Downlooker Snipefly	
Chrysopilus cristatus	Black Snipefly	
Lepidoptera		
Aglais io	Peacock Butterfly	
Aglais urticae	Small Tortoiseshell Butterfly	
Polyommatus icarus	Common Blue Butterfly	
Gonepteryx rhamni	Brimstone	
Pararge aegeria	Speckled Wood Butterfly	
Pieris rapae	Small White Butterfly	
Pieris brassicae	Large White Butterfly	
Vanessa atalanta	Red Admiral Butterfly	
Vanessa cardui	Painted Lady Butterfly	
Abrostola tripartita	Spectacle	
Abrostola triplasia	Dark Spectacle	
Acentria ephemerella	Water Veneer	

Acleris emargana	Notch Wing Tortix	
Acrobasis advenella	Grey Knot-horn	
Acrobasis consociella	Broad-barred Knot-horn	
Acronicta leporina	Miller	
Acronicta psi	Grey Dagger	
Acronicta rumicis	Knot Grass	
Aethes rubigana	Burdock Conch	
Agonopterix alstromeriana	Brown-spot Flat-body	
Agriphila straminella	Straw Grass-veneer	
Agrotis exclamationis	Heart & Dart	
Agrotis puta	Shuttle-shaped Dart	
Agrotis segetum	Turnip Moth	
Alucita hexadactyla	Twenty-plume Moth	
Amphipoea oculea	Ear Moth	
Amphipyra pyramidea	Copper Underwing	
Anania coronata	Spotted Magpie	
Anania hortulata	Small Magpie	
Apamea epomidion	Clouded Brindle	
Apamea lithoxylaea	Light Arches	
Apamea monoglypha	Dark Arches	
Apamea scolopacina	Slender Brindle	
Apotomis betuletana	Birch Marble	
Archanara dissoluta	Brown-veined Wainscot	
Argyresthia goedartella	Golden Argent	
Axylia putris	Flame	
Bactra lancealana	Rush Marble	
Batrachedra praeangusta	Poplar Cosmet	
Blastobasis adustella	Furness Dowd	
Blastobasis lacticolella	Wakely's Dowd	
Bohemannia quadrimaculella	Four-spot Pigmy	NS
Brachmia blandella	Gorse Crest	

Bryotropha senectella	Dull Red Neb	
Cabera exanthemata	Common Wave	
Cabera pusaria	Common White Wave	
Calamotropha paludella	Bulrush Veneer	
Cameraria ohridella	Horse-Chestnut Leaf-miner	
Carcina quercana	Long-horned Flat-body	
Carpatolechia alburnella	Suffused Groundling	
Cataclysta lemnata	Small China-mark	
Catoptria falsella	Chequered Grass-veneer	
Catoptria pinella	Pearl Grass-veneer	
Celypha striana	Barred Marble	
Chilodes maritima	Silky Wainscot	
Chrysoteuchia culmella	Garden Grass-veneer	
Clepsis consimilana	Privet Twist	
Clepsis spectrana	Cyclamen Tortrix	
Cnephasia asseclana	Flax Tortix	
Cnephasia genitalana	Dover Shade	
Cochylis atricapitana	Black-headed Conch	
Cochylis roseana	Rosy Conch	
Coleophora alcyonipennella	Clover Case-bearer	
Coleophora glaucicolella	Grey Rush Case-bearer	
Coleophora lutipennella	Common Oak Case-bearer	
Coleophora milvipennis	Buff Birch Case-beaerer	
Coleophora serratella	Common Case-bearer	
Colocasia coryli	Nut-tree Tussock	
Cosmia trapezina	Dun-bar	
Craniophora ligustri	Coronet	
Crassa unitella	Golden-brown Tubic	
Crocallis elinguaria	Scalloped Oak	
Cryphia algae	Tree-lichen Beauty	
Cyclophora albipunctata	Birch Mocha	

Cyclophora punctaria	Maiden's Blush	
Cydalima perspectalis	Box Tree Moth	
Cydia fagiglandana	Large Beech Piercer	
Cydia splendana	Marbled Piercer	
Cydia ulicetana	Grey Gorse Piercer	
Deilephila elpenor	Elephant Hawk-moth	
Diachrysia chrysitis	Burnished Brass	
Dioryctria sylvestrella	New Pine Knot-horn	
Drepana falcataria	Pebble Hook-tip	
Eilema caniola	Hoary Footman	
Eilema complana	Scarce Footman	
Eilema depressa	Buff Footman	
Eilema griseola	Dingy Footman	
Eilema lurideola	Common Footman	
Endotricha flammealis	Rosy Tabby	
Ennomos alniaria	Canary-shouldered Thorn	
Ennomos erosaria	September Thorn	
Ennomos fuscantaria	Dusky Thorn	
Epiblema foenella	White-foot Bell	
Epinotia nisella	Grey Poplar Bell	
Epione repandaria	Bordered Beauty	
Epirrhoe alternata	Common Carpet	
Eremobia ochroleuca	Dusky Sallow	
Euchoeca nebulata	Dingy Shell	
Eucosma cana	Hoary Belle	
Eucosma conterminana	Pale Lettuce Bell	
Eucosma hohenwartiana	Bright Bell	
Eudonia lacustrata	Little Grey	
Eudonia mercurella	Small Grey	
Eulithis prunata	Phoenix	
Eupithecia assimilata	Currant Pug	

Eupithecia centaureata	Lime-speck Pug	
Eupithecia haworthiata	Haworth's Pug	
Eupithecia tenuiata	Slender Pug	
Eupithecia tripunctaria	White-spotted Pug	
Euplagia quadripunctaria	Jersey Tiger	
Euproctis similis	Yellow-tail	
Euzophera pinguis	Ash-bark Knot-horn	
Falcaria lacertinaria	Scalloped Hook-tip	
Furcula furcula	Sallow Kitten	
Gymnoscelis rufifasciata	Double-striped Pug	
Gypsonoma dealbana	Common Cloaked Shoot	
Habrosyne pyritoides	Buff Arches	
Hedya salicella	White-backed Marble	
Herminia tarsipennalis	Fan-foot	
Hoplodrina blanda	Rustic	
Hoplodrina octogenaria	Uncertain	
Horisme tersata	Fern	
Hydraecia micacea	Rosy Rustic	
Hypena proboscidalis	Snout	
Hypsopygia costalis	Gold Triangle	
Idaea aversata	Riband Wave	
Idaea biselata	Small Fan-footed Wave	
Idaea dimidiata	Single-dotted Wave	
Idaea emarginata	Small Scallop	
Idaea rusticata	Least Carpet	
Ipimorpha subtusa	Olive	
Lacanobia oleracea	Bright-line Brown-eye	
Laothoe populi	Poplar Hawk-moth	
Lateroligia ophiogramma	Double Lobed	
Lathronympha strigana	Red Piercer	
Lenisa geminipuncta	Twin-spotted Wainscot	

Limnaecia phragmitella	Bulrush Cosmet	
Lomaspilis marginata	Clouded Border	
Lycophotia porphyrea	True Lover's Knot	
Lymantria monacha	Black Arches	
Lyonetia clerkella	Apple Leaf Miner	
Macdunnoughia confusa	Dewick's Plusia	
Mesapamea secalis/didyma	Common/Lesser Rustic	
Mesoligia furuncula	Cloaked Minor	
Metalampra italica	Italian Tubic	
Miltochrista miniata	Rosy Footman	
Monopis crocicapitella	Pale-backed Clothes Moth	
Mythimna conigera	Brown-line Bright-eye	
Mythimna ferrago	Clay	
Mythimna impura	Smoky Wainscot	
Mythimna pallens	Common Wainscot	
Mythimna straminea	Southern Wainscot	
Noctua comes	Lesser Yellow Underwing	
Noctua fimbriata	Broad-bordered Yellow Underwing	
Noctua janthe	Lesser Broad-bordered Yellow Underwing	
Noctua pronuba	Large Yellow Underwing	
Nomophila noctuella	Rush Veneer	
Nonagria typhae	Bulrush Wainscot	
Notodonta dromedarius	Iron Prominent	
Notodonta ziczac	Pebble Prominent	
Nycteola revayana	Oak Nycteoline	
Ochropleura plecta	Flame Shoulder	
Oegoconia quadripuncta	Four-spotted Obscure	
Ostrinia nubilalis	European Corn-borer	
Pandemis heparana	Dark Fruit-tree Tortrix	
Parapoynx stratiotata	Ringed China-mark	
Parascotia fuliginaria	Waved Black	NS

Parastichtis suspecta	Suspected	
Parornix torquillella	Blackthorn Slender	
Peribatodes rhomboidaria	Willow Beauty	
Phalera bucephala	Buff-tip	
Phalonidia manniana	Water-mint Conch	
Photedes minima	Small Dotted Buff	
Phragmatobia fuliginosa	Ruby Tiger	
Phycita roborella	Dotted Oak Knot-horn	
Phyllonorycter harrisella	White Oak Midget	
Phyllonorycter stettinensis	Small Alder Midget	
Pleuroptya ruralis	Mother of Pearl	
Pterapherapteryx sexalata	Small Seraphim	
Pterostoma palpina	Pale Prominent	
Pyrausta aurata	Small Purple & Gold	
Rhopobota naevana	Holly Tortrix	
Rivula sericealis	Straw Dot	
Scoparia ambigualis	Common Grey	
Scoparia basistrigalis	Base-lined Grey	
Scrobipalpa acuminatella	Pointed Groundling	
Scrobipalpa obsoletella	Summer Groundling	NS
Selenia dentaria	Early Thorn	
Sphinx pinastri	Pine Hawk-moth	
Subacronicta megacephala	Poplar Grey	
Synaphe punctalis	Long-legged Tabby	
Thumatha senex	Round-winged Muslin	
Timandra comae	Blood-vein	
Tischeria ekebladella	Oak Carl	
Xanthorhoe fluctuata	Garden Carpet	
Xestia c-nigrum	Setaceous Hebrew Character	
Xestia triangulum	Double-square Spot	
Yponomeuta padella/malinellus/cagnagella	Orchard/Apple/Spindle Ermine	

Yponomeuta evonymella	Bird-cherry Ermine	
Yponomeuta rorrella	Willow Ermine	
Zeiraphera isertana	Cock's-head Bell	
Hymenoptera		
Ancistrocerus trifasciatus	A Mason Wasp	
Crossocerus megacephalus	A solitary wasp	
Tachysphex pompiliformis	A solitary wasp	
Trypoxylon attenuatum	A solitary wasp	
Trypoxylon clavicerum	A solitary wasp	
Hedychridium ardens	A cuckoo wasp	
Chrysis ignita agg	A cuckoo wasp	
Omalus aeneus	A cuckoo wasp	
Vespula vulgaris	Common Wasp	
Vespula germanica	German Wasp	
Andrena chrysosceles	Hawthorn Mining Bee	
Andrena dorsata	A Solitary Bee	
Andrena flavipes	Yellow-legged Mining Bee	
Andrena fulva	Tawny Mining Bee	
Andrena haemorrhoa	Orange-tailed Mining Bee	
Andrena minutula	Common Mini-miner	
Andrena nigroaenea	Buffish Mining Bee	
Andrena scotica	Chocolate Mining Bee	
Lasioglossum calceatum	A Furrow Bee	
Lasioglossum leucopus	A Furrow Bee	
Lasioglossum parvulum	A Furrow Bee	
Lasioglossum smeathmanellum	A Furrow Bee	
Halictus tumulorum	A Solitary Bee	
Hylaeus communis	A Yellow-faced Bee	
Sphecodes monilicornis	A Blood Bee	
Apis mellifera	HoneyBee	
Bombus hortorum	Garden Bumblebee	

Bombus lapidarius	Red-tailed Bumblebee	
Bombus pascuorum	Common Carder Bee	
Bombus pratorum	Early Bumblebee	
Bombus terrestris	Buff-tailed Bumblebee	
Bombus vestalis	Southern Cuckoo Bumblebee	
Lasius niger	An Ant	
Myrmica rubra	An Ant	
Myrmica ruginodis	An Ant	
Myrmica sabuleti	An Ant	
Trichoptera		
Mystacides longicornis	A Caddisfly	
Mecoptera		
Panorpa communis	A Scorpionfly	
Hemiptera		
Conomelus anceps	A Planthopper	
Stenocranus minutus	A Planthopper	
Athysanus argentarius	A Leafhopper	
Cicadula quadrinotata	A Leafhopper	
Neophilaenus lineatus	A Froghopper	
Philaenus spumarius	Common Froghopper	
Aelia acuminata	Bishop's Mitre Shieldbug	
Dolycoris baccarum	Hairy Shieldbug	
Eurygaster testudinaria	Tortoise Shieldbug	
Palomena prasina	Common Green Shieldbug	
Ceraleptus lividus	Slender-horned Leatherbug	NS
Pentatoma rufipes	Red-Legged Shieldbug	
Coreus marginatus	Dock Bug	
Syromastus rhombeus	Rhombic Leatherbug	
Tingis ampliata	A Lacebug	
Tingis cardui	A Lacebug	
Myrmus miriformis	A Rhopalid Bug	

Stictopleurus punctatonervosus	A Rhopalid Bug	
Corizus hyoscyami	A Ground Bug	
Cymus claviculus	A Ground Bug	
Cymus glandicolor	A Ground Bug	
Kleidocerys resedae	Birch Catkin Bug	
Anthocoris nemoralis	A Flower Bug	
Temnostethus pusillus	A Flower Bug	
Nabis ferus	A Damsel Bug	
Nabis limbatus	A Damsel Bug	
Closterotomus norwegicus	A Plant Bug	
Deraeocoris lutescens	A Plant Bug	
Dryophilocoris flavoquadrimaculatus	A Plant Bug	
Heterotoma planicornis	A Plant Bug	
Lygus rugulipennis	A Plant Bug	
Lygus pratensis	A Plant Bug	
Phytocoris varipes	A Plant Bug	
Plagiognathus arbustorum	A Plant Bug	
Psallus varians	A Plant Bug	
Orthoptera		
Tetrix subulata	Slender Ground Hopper	
Leptophyes punctatissima	Speckled Bush Cricket	
Conocephalus dorsalis	Short-winged Cone-head	
Conocephalus fuscus	Long-winged Cone-head	
Pseudochorthippus parallelus	Meadow Grasshopper	
Chorthippus brunneus	Field Grasshopper	
Dermaptera		
Forficula auricularia	Common Earwig	
Odonata		
Calopteryx splendens	Banded demoiselle	
Erythromma najas	Red-eyed Damselfly	
Platycnemis pennipes	White-legged damselfly	

Coenagrion puella	Azure damselfly	
Enallagma cyathigerum	Common Blue Damselfly	
Ischnura elegans	Blue-Tailed Damselfly	
Pyrrhosoma nymphula	Large Red Damselfly	
Sympetrum striolatum	Common Darter	
Sympetrum sanguineum	Ruddy Darter	
Aeshna grandis	Brown Hawker	
Aeshna mixta	Migrant Hawker	
Libellula quadrimaculata	Four-spotted Chaser	
Libellula depressa	Broad-bodied Chaser	
Anax imperator	Emperor Dragonfly	
Aeshna cyanea	Southern Hawker	
Pseudoscorpiones		
Pselaphochernes scorpioides	Common Chernes	
Chernes cimicoides	Common Tree Chernes	
Opiliones		
Leiobunum rotundum	A Harvestman	
Phalangium opilio	A Harvestman	
Araneae		
Agelena labyrinthica	A funnelweb spider	
Araniella cucurbitina	Cucumber Spider	
Clubiona lutescens	A Sac Spider	
Dictyna arundinacea	A Mesh-web Spider	
Nigma walckenaeri	A Mesh-web Spider	
Euophrys frontalis	A Jumping Spider	
Heliophanus flavipes	A Jumping Spider	
Araneus diadematа	An orb web spider	
Araneus marmoreus	An orb web spider	
Gibbaranea gibbosa	An Orb-web Spider	
Hypsosinga pygmaea	An Orb-web Spider	
Nuctenea umbratica	An Orb-web Spider	

Zilla diodia	An Orb-web Spider	
Misumena vatia	A Crab Spider	
Philodromus aureolus	A Running Crab Spider	
Xysticus cristatus	A Crab Spider	
Pachygnatha degeeri	A Large-jawed Orb-web Spider	
Tetragnatha montana	A Large-jawed Orb-weaver	
Anelosimus vittatus	A Comb-footed Spider	
Enoplognatha ovata	A Comb-footed Spider	
Platnickina tincta	A Comb-footed Spider	
Theridion mystaceum	A Comb-footed Spider	
Theridion varians	A Comb-footed Spider	
Steatoda nobilis	Noble False Widow	
Pisaura mirabilis	Nursery-web Spider	
Tibellus oblongus	A grass spider	
Pardosa nigriceps	A Wolf Spider	
Pardosa pullata	A Wolf Spider	
Trochosa terricola	A Wolf Spider	
Diplopoda		
Glomeris marginata	Pill Millipede	
Tachypodoiulus niger	White-legged Snake Millipede	
Polydesmus angustus	Common Flat-backed Millipede	
Polydesmus denticulatus	A Flat-backed Millipede	
Gastropoda		
Candidula intersecta	A Snail	
Cepaea nemoralis	Brown-lipped Snail	
Cornu aspersum	Garden Snail	
Discus rotundatus	Rounded Snail	
Monacha cantiana	Kentish Snail	

APPENDIX B: Photographs

Area 1: One of the better areas on the site in terms of the habitat for terrestrial invertebrates. Flower rich wet grassland and scrub, grading into wet woodland. Near the site entrance at TQ 04789 89047.

Area 1: Wide path bordered by flower rich wet grassland and scrub and backing onto wet woodland. Abundant plant species, nectar sources, dead wood and a warm, sheltered micro-climate. TQ 04789 89040

Area 1. Sunny scrub margin with some nectar sources at ground level and exposed substrate. TQ 04809 89068.

Area 2: Long path with lake to the north and Salix woodland on quicksand to the south. Mostly shaded, with some nectar resources, deadwood and lake margin habitat.

Area 3: Birch and Alder scrub on gravelly substrate. Another one of the better areas for terrestrial invertebrates. Warm, sheltered microclimate, with bareground, although substrate is hard. TQ 04715 89117

Area 3: Birch and Alder scrub on gravelly substrate, grading into Crack Willow woodland. TQ 04715 89143.

Area 4: Track leading through the site. Mostly *Buddleja* scrub on the East and Willow/Sallow scrub and woodland on the West. Some nectar sources on the track margin, including St John's Wort *Hypericum perforatum* and *Sedum* spp. Some bareground, but substrate quite hard. TQ 04738 89230

Area 5: Open area at the north of the site. Bramble and Buddleja scrub backing on to Willow and Sallow woodland. Some nectar sources in the sward. Lake margin to the North. TQ 04715 89318

Area 5. Lake margin at north of site with emergent vegetation and lakeside plants. TQ 04640 89310.

Track running along eastern boundary to Sailing Club. Mostly bramble and nettle in the understorey with poplars and willow above. TQ 04875 89107.

The Alder Leaf Beetle *Agelastica alni*. Once a great rarity, but now spreading rapidly in the UK and found throughout the site on its host-plant.

Area 4: Lake margin with emergent irises and egg masses of Long-jawed orb-web spiders *Tetragnatha* sp.

Further Ecological Survey Report

Prepared for Broadwater Lake

On behalf of

November 2022

Ecology by Design Ltd,

Hampden House, Monument Park, Chalgrove, Oxon OX44 7RW.

Tel 01865 893346 **www.ecologybydesign.co.uk**

Project Code	Title	Date of Issue
EBD01959	Broadwater Lake	28 November 2022

	Name	Date
Updated by	Kate Philpot MSc, BSc, ACIEEM	25 November 2022
Checked by	Laura Grant BSc (Hons), MCIEEM	28 November 2022

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Contents

1 Executive Summary

Report purpose	This report presents the approach and findings of badger, otter, water vole, reptile, dormouse, bat activity transects, and bat fixed point automated surveys undertaken at Broadwater Lake in 2021 and 2022.
Date and methods of survey	Surveys undertaken: • Reptile presence/likely absence surveys were conducted at the site during September 2021 and continued in May and June 2022. • Hazel dormouse nest tube checks were conducted during September-November 2021, and May-August 2022. • Bat activity transect surveys and bat fixed point automated surveys were conducted during August-October 2021 and April-July 2022. • Otter and water vole surveys were conducted in May and August 2022. • Badger walkover survey undertaken in May 2022.
Key findings	• No evidence of reptiles with the exception of anecdotal evidence of one grass snake has been identified. • Hazel dormice are considered likely absent from the site. • Evidence of otter was discovered along the canal and potentially in the north of the site, although DNA analysis of the spraint is required to confirm. No evidence of water vole was discovered. • One badger latrine was discovered within woodland in the north of the site. • Bat activity was considered to be moderate across the site with soprano pipistrelle the dominant species recorded. The site supports a good diversity of species and the lake edge is particularly important for foraging bats.
Potential impacts and recommendations	No specific mitigation with regards to reptiles and/or dormice is required on site but recommendations for enhancements are provided in section 5. Due to the presence of otter in close proximity to the site and possibly on site, it is recommended a check for otter holts is undertaken once plans for the areas around the lake edge are finalised. Due to the presence of a badger latrine, it is evident badger use the site to forage and could build setts in the future (although none were discovered and many parts of the site are unsuitable for sett building). Localised vegetation clearance to enable a detailed walkover of the site in areas to be impacted is recommended three months prior to the construction start date. Due to the moderate levels of bat activity across the site of a variety of bat species, it will be necessary to ensure a sensitive lighting strategy is produced to ensure the lake and woodland is not illuminated by the new development. Any trees to be felled to facilitate the development will need to be inspected for bat roost potential. If works do not start within a year of the surveys undertaken within this report, then update surveys will be required due to animals not previously discovered on site potentially colonising.

2 Introduction

2.1 Background

2.1.1 Ecology by Design were commissioned by Mace Group to undertake water vole (*Arvicola amphibius*), otter (*Lutra lutra*), badger (*Meles meles*), reptile, hazel dormouse (*Muscardinus avellanarius*), bat activity transects and bat fixed-point automated surveys at Broadwater Lake, Uxbridge, UB9 6PE (approximate central grid reference: TQ 04719 89196); hereafter known as 'the site'.

2.1.2 Other consultancies have been instructed to undertake various other protected species surveys on site including, fish surveys, macro invertebrate surveys, terrestrial invertebrate surveys and breeding and wintering bird surveys in 2022. These additional reports should be read in conjunction with this report.

2.1.3 To Ecology by Design's knowledge, no surveys have been undertaken to date on the site for great crested newts or individual tree surveys for bat roosts; but these are recommended by Ecology by Design to be undertaken prior to a planning application submission. It is also recommended that all further species surveys, by all consultancies, are combined into an Ecological Impact Assessment (EcIA) which will assess the impacts for each species once plans are finalised.

2.1.4 Further to this a Biodiversity Impact Assessment (BIA) will also be required as part of the planning application, to assess the loss of biodiversity on site and identify how this will be mitigated.

2.2 Site Description

2.2.1 The site is 9.79ha in extent, forming part of the 44ha Mid Colne Valley SSSI, a lake notified for its important assemblage of breeding and wintering wetland birds. The site is in the south-east corner of the SSSI, comprising a peninsula supporting broadleaved woodland with scattered ponds and areas of bare ground and scrub, as well as marginal vegetation on the lake edge. The Grand Union Canal bounds the site on the eastern boundary although technically the canal is off-site.

2.3 Proposed Works

2.3.1 The proposals are for an outdoor activity centre with landside activities and supporting infrastructure in the south-east corner of the site including an activity and camping field. The northern edge of the lake will house various rowing huts, containers, workshops and boat

stands; carparking and staff accommodation is proposed in the southern part of the site. All or part of the lake will be used for waterside activities (sailing, canoeing, rowing etc). It is understood the site will not be publicly accessible and therefore the small islands to the north of the site will be out of bounds. It is also understood that activities on the lake will not take place after dark; although the centre may still be in use for groups camping on site.

2.4 Aims of Report

2.4.1 This report presents the approach and findings of water vole and otter, badger, reptile, dormouse, bat activity transects, and bat fixed point automated surveys undertaken at Broadwater Lake.

2.4.2 It is understood an Ecological Impact Assessment will be produced to encompass all further protected species surveys and likely impacts as well as a biodiversity impact assessment (BIA) to inform the planning application.

2.4.3 Due to the transitionary nature of many species and the suitability of the site to support a wide range of wildlife, it is recommended that if more than a year passes before works are undertaken that an update is carried out.

2.5 Personnel

2.5.1 Senior Ecologist Kate Philpot MSc, BSc, ACIEEM managed the day to day running of the project and undertook several of the surveys on site. Kate has over seven years' experience in ecological consultancy and is competent at undertaking all protected species surveys on sites of this size, as well as informing on mitigation measures required.

2.5.2 The project was overseen by Associate Laura Grant BSc (Hons) MCIEEM, who has been an ecological consultant for 15 years and who has also been to site.

3 Methods

3.1 Reptile Survey

3.1.1 Three of seven reptile surveys were conducted during September 2021 and an additional four reptile surveys were conducted in May and June 2022 to confirm presence or likely absence of reptiles following standard methodology (Froglife, 1999; Edgar *et al*., 2010).

3.1.2 Checks were conducted as detailed in Table 3.1 by Ecology by Design Director Ben Gardener, Senior Ecologists Emily Power and Kate Philpot, Assistant Ecologist Anna Kogioni, Graduate Ecologists Alys Cervetto and Seasonal Ecologists Aoife Sweeney, Pedro Freitas and Kat Hale, all of whom are suitably qualified and experienced to undertake reptile presence/absence surveys.

Table 3.1: *Reptile survey dates and survey conditions*

Visit Number	Date and time	Weather Conditions	Surveyor
1	20/09/2021; 12:30-13:00	18°C, cloud 2/8[1], wind BF3[2], no rain	Emily Power
2	22/09/2021; 9:50-10:20	14-16°C, cloud 1/8, wind BF0, no rain	Anna Kogioni
3	29/09/2021; 12:15-12:45	13-14°C, cloud 3/8, wind BF3, no rain	Anna Kogioni & Alys Cervetto
4	13/05/2022; 10:30-11:30	14°C, cloud 2/8, wind BF0, no rain	Ben Gardner & Kate Philpot
5	26/05/2022; 12:30-13:00	17°C, cloud 4/8, wind BF0, no rain	Emily Power & Kate Philpot
6	09/06/2022; 08:43-09:49	16-17°C, cloud 0-5/8, wind BF2, no rain, sunny intervals	Pedro Freitas & Aoife Sweeney
7	22/06/2022; 07:40-09:50	16-21°C, cloud 0/8, wind BF0, hot	Anna Kogioni & Kat Hale

3.1.1 Artificial refugia were placed along areas of suitable reptile habitat: grassland, scrub, successional vegetation, bare ground and clearings. The artificial refugia comprised a mix of

[1] Cloud cover is measured using the system called oktas. The visible sky is divided into eight and cloud presence is determined within each section. A value of one to eight is then assigned (1 okta being cloudless to 8 oktas being total cloud cover).

[2] The Beaufort scale is an empirical measure from 0-12 which relates wind speed to observed conditions. . 0- Calm, 1- Light air, 2- Light breeze, 3- Gentle breeze, 4- Moderate breeze, 5- Fresh breeze, 6- Strong breeze, 7- Moderate gale, 8- Fresh gale, 9- Strong gale, 10- Whole gale, 11- Storm, 12- Hurricane force.

1m x 0.5m tiles of roofing felt, 0.5m x 0.5m squares of corrugated metal, and 0.5m x 0.5m square tiles of Onduline (see Figure 1). Refugia locations specifically targeted 'sun-traps' and suitable basking spots, adjacent to cover such as scrub and buddleja (*Buddleja davidii*) thickets.

3.1.2 A total of 100 refugia were distributed in areas of suitable reptile habitats. This equated to a total density of approximately 10 refugia per hectare of suitable habitat, which is in accordance with the recommended density of 5-10 refugia per hectare. All refugia were left on site for two weeks following deployment to 'bed in' and allow any reptiles that may be present to become accustomed to their presence.

3.1.3 After this two-week period, seven checks were made to inspect under and around the refugia in order to record any species utilising them. This included checking existing suitable basking areas and around and above any naturally existing refugia. Both visual observation and observations associated with artificial refugia were recorded. All checks were completed in optimum weather conditions (ambient temperature between 9°C and 18°C, dry, no extreme wind, sunny or sunny spells).

3.2 Hazel Dormouse Survey

3.2.1 Surveys for dormice (*Muscardinus avellanarius*) were undertaken based on techniques set out in the Dormouse Conservation Handbook (Bright *et al*, 2006) and Natural England Interim Guidance Document (Natural England, 2011[3]). Consideration was given to the index of probability of finding dormice present in nest tubes in any one month (based on 50 tubes deployed), as set out in table 3.2. All the monthly scores for the period over which the tubes were surveyed were added together. A minimum score of 20 must be reached to determine presence/likely absence. A score of 25 was reached at Broadwater.

Table 3.2: *Index of probability of finding dormouse within nest tubes*

Month	Index of Probability
April	1
May	4
June	2
July	2
August	5

[3] Whilst this 2011 guidance has been superseded by more recent government guidance (2015), the survey techniques remain the same.

September	7
October	2
November	2

3.2.2 On 3rd and 9th September 2021, 50 nest tubes were deployed at regular intervals within the suitable broadleaved woodland. The zone in which the nest tubes were deployed is shown in Figure 2 in Appendix 1. The tubes and boxes were inspected for dormice and/or their characteristic nests once per month, throughout September-November 2021 and May-August 2022, as detailed in Table 3.3 below.

Table 3.3: *Date, staff and weather conditions during dormouse surveys*

Date	Surveyors*	Type
29/09/21	AC	15°C, wind Bf 1, no rain
29/10/21	JH, OH	13°C, wind Bf 4, no rain
25/11/21	OB, AK	7°C, wind Bf 1, no rain
26/05/22	KP, EP	18°C, wind Bf 2, no rain
20/06/22	BE, OH	22°C, wind Bf 1, no rain
26/07/22	AS, MK	21°C, wind Bf 1, no rain
24/08/22	BE, KH	23°C, wind bf 1, no rain

*Where, AC= Alys Cervetto, JH= James Howsam, OH= Olyvia Hall, OB= Oliver Bulpitt, AK= Anna Kogioni, KP= Kate Philpot, EP= Emily Power, BE= Beth England, AS= Aoife Sweeney, MK= Mollie Kirk, and KH= Kat Hale.

3.3 Bat Activity Walked Transect Survey

3.3.1 The site is considered to have moderate suitability for commuting and foraging bats, with walked transects required monthly April-October in appropriate weather conditions for bats (mild, still and dry) to observe and record bat activity. Surveys were undertaken in August-October 2021 and April-July 2022.

3.3.2 A pair of surveyors slowly walked a pre-determined transect route stopping at regular intervals to observe and record bat activity (using an Elekon Batlogger M) for five minutes before walking to the next stop. The seven surveys completed comprised dusk and dawn transects. The dusk surveys started at sunset and continued for at least two hours after sunset; the dawn

started two hours before sunrise and finished at sunrise. Flight paths were mapped, and notes were made on the behaviours observed (e.g. foraging / commuting / social interactions). The dusk transects were carried out on 1st August 2021, 9th September 2021, 5th October 2021, 21st April 2022 and the 29th June 2022 and the dawn surveys were undertaken on 26th May 2022 and 20th July 2022 as detailed in Table 3.4. See Appendix 1, Figure 3 for a map of the transect route.

Table 3.4: *Dates, surveyors and weather conditions of each walked transect survey*

Date and time	Surveyors	Weather Conditions
12/08/2021; 20:30 - 22:36	Emily Power (bat class licence level 2 holder – 2017-32544-CLS-CLS), George Graham	Start: 21°C, cloud 1/8, wind BF1, no rain End: 15°C, cloud 1/8, wind BF1, no rain
09/09/2021; 19:40 - 21:30	Emily Power (bat class licence level 2 holder), Alys Cervetto	Start: 19°C, cloud 4/8, wind BF1, no rain End: 17°C, cloud 1/8, wind BF1, no rain
05/10/2021; 18:35 - 20:35	Emily Power (bat class licence level 2 holder), Olyvia Hall	Start: 13°C, cloud 8/8, wind BF4, light drizzle End: 11°C, cloud 6/8, wind BF0, no rain
21/04/2022; 20:09 - 22:09	Olyvia Hall, Greg Holland	Start: 14°C, cloud 1/8, wind BF0, no rain End: 11°C, cloud 1/8, wind BF0, no rain
26/05/2022; 02:45 - 04:45	James Howsam (bat class licence level 1 holder – 2019-43198-CLS-CLS), Tony Wells	Start: 11°C, cloud 1/8, wind BF1, no rain End: 10°C, cloud 1/8, wind BF0, no rain
29/06/2022; 21:10 - 23:25	Anna Kogioni, Pedro Freitas	Start: 20°C, cloud 7/8, wind BF3, no rain End: 17°C, cloud 8/8, wind BF2, light drizzle
20/07/2022; 03:24 - 05:24	Oli Bulpitt, Olyvia Hall	Start: 20°C, cloud 6/8, wind BF2, no rain End: 19°C, cloud 8/8, wind BF2, no rain

3.4 Bat Activity Fixed Point Automated Detector Surveys

Automated detectors were used to remotely record bat activity. Given the habitats within the site are of moderate suitability for bats, an AnaBat Swift bat detector is required to be deployed at two locations per transect collecting five consecutive nights of data per month (April to October). The detectors were deployed as required from August to October 2021 and April to July 2022, as set out in Table 3.5.

Table 3.5: *Automated detector monitoring*

Month	Location A recording period	Location B recording period
August	12th-16th (5 nights)	12th-16th (5 nights)
September	20th-24th (4 nights)	20th-24th (5 nights)
October	5th-9th (5 nights)	11th-15th (5 nights)
April	22nd-26th (5 nights)	22nd-26th (5 nights)
May	26th-30th (5 nights)	26th-30th (5 nights)
June	2nd-6th (5 nights)	22nd-26th (5 nights)
July	20th -24th (5 nights)	25th and 27th-30th (5 nights)

3.4.1 Detectors were placed on trees within the centre of the site (location A) facing east and the north-western corner of the site (location B) directed out north west towards the lake and set to record from 30 minutes before sunset until 30 minutes after sunrise (see locations on Figure 3).

3.5 Bat Call Analysis

3.5.1 Data was analysed using automated bat sonogram analysis software: Sonobat v.4.5.4 on default settings in 2021 and then by using Anabat Insight which Ecology by Design had changed to using in 2022. The 'Accepted Species' (the species for which Sonobat and Anabat Insight returns an ID with the highest likelihood) was taken at face value for common pipistrelle (*Pipistrellus pipistrellus*) and soprano pipistrelle (*Pipistrellus pygmaeus*). Any registrations labelled as anything other than common pipistrelle or soprano pipistrelle were also assessed manually as per the methodology below using Sonobat's and Anabat insights vetting table, sonogram viewer and manual classifiers. Registrations that were identified as a 'Leaning Species' (a likely species decision as per 'Accepted Species' but which trigger an indicator of potential misclassification) other than common pipistrelle or soprano pipistrelle were also analysed manually to see if that species was indeed present, in which case they were added to the dataset. See Limitations and Constraints section below for commentary on the validity of using automated ID software.

3.5.2 All files auto identified as being noise (ie: not a bat) were taken at face value - although random checks were undertaken on some of these calls, to ensure the vast majority were indeed noise.

3.5.3 Sonogram analysis was undertaken by suitably experienced ecologists with reference to known sonogram parameters for each species (Russ, 2012; Middleton, *et al.* 2014; Barataud, 2015), once identified, calls were exported into a report to be analysed. Within each file, each species of bat identified was considered to represent one registration of that species.

3.5.4 Where possible, recorded bat calls were identified to species level. The following categories were used for calls which could not be identified with confidence, due to the overlap in call characteristics between species or species groups:

- *Pipistrellus* sp. (Soprano / common pipistrelle)
- SL: Serotine / Leisler's bat
- NSL: Noctule / serotine / Leisler's bat
- *Nyctalus* sp.: Noctule/Leisler's bat
- *Myotis* sp. covers all Myotis species, as this genus cannot reliably be attributed to species level.

3.5.5 However, professional judgement was made where possible to refine identification to species level using factors such as: associated habitats and geographical location as well as other records throughout the survey period/season and desk study data.

3.5.6 The data were exported into a spreadsheet in order to interpret the recordings and work out the number of bat calls per hour. The timing of passes after sunset and before sunrise was calculated in order to interpret any patterns in bat activity. For the purpose of this report a bat pass is the minimum number of bats of a certain species recorded within a single sound file.

3.6 Otter and Water Vole Surveys

3.6.1 Surveys for otter and water vole were undertaken in May and August 2022 as follows:

- May survey completed by Senior Ecologist Kate Philpot and Ecologist Beth England on 23rd May 2022. Weather conditions at the time of survey were warm and dry (17°C, cloud 3/8 oktas, wind Beaufort 1 and no rain).
- August survey completed by Assistant Ecologist Olyvia Hall and Seasonal Ecologist Kat Hale on 12th August 2022. Weather conditions at the time of survey were cool/warm and dry/wet (28°C, cloud 1/8 oktas, wind Beaufort 0 and no rain).

Otter

3.6.2 A detailed assessment of the banks of the lake (where access was possible) and c.100m of the adjacent canal was conducted to search for evidence of otter (*Lutra lutra*) including holts,

slides, feeding remains, footprints and spraints. Any evidence was described, photographed and marked with a GPS waypoint. The banks of islands within the lake were inspected from a distance using binoculars.

Water Vole

3.6.3 The banks of the lake were walked carefully (where access was possible) and c.100m of the adjacent canal, making a search for signs of water vole activity. Water vole signs searched for included: footprints, burrows, runs through vegetation, latrines, lawns, nests and characteristic feeding remains (Strachan *et al*, 2011). Any evidence was described, photographed and marked with a GPS waypoint.

3.6.4 During the visit, an assessment was carried out to identify the suitability of habitat for water voles and to look for any evidence of water vole. The following features were considered:

- Water quality;
- Water regime;
- Extent and character of the water channel;
- Bank structure and substrate;
- Types of vegetation present;
- Level of cover and shading;
- Potential for predation and competition; and
- Any management in place.

3.6.5 A decision was made on the suitability of the habitat for water voles using the following classification:

- Excellent – Habitat with optimum features present to support a population of water voles through all seasons.
- Suitable – Habitat with all appropriate features to support water voles throughout the summer and possibly all year round.
- Marginal – Habitat with some of the features suitable for water vole, but with limitations.
- Unsuitable – Habitat that lacks one or more of the essential features for habitation by water voles (does not preclude the habitat being used for commuting animals).

3.7 Limitations/Constraints

3.7.1 The wildlife and wider ecological interest of a site can change. The report presented here is a statement of the findings of surveys carried out during August-November 2021 and April-

August 2022. Any appreciable delay in making reference to this report may necessitate a re-survey.

3.7.2 Use of automated bat sonogram analysis software is not 100% accurate. While Sonobat v.4.5.4 and Anabat Insight purports high levels of accuracy, it is known to be fallible, particularly with registrations where multiple bats are recorded. As such, manual quality control was undertaken as outlined in Section 3.5. Consequently, the only calls that were not subject to manual quality control were those identified by Sonobat and Anabat Insight to contain only common pipistrelle and/or soprano pipistrelle. This approach is suggested as a good possible approach in the industry standard guidelines to analysing large data sets (Collins, 2016; Section 10.2) and is considered sufficient to inform an assessment of the site.

3.7.3 During September 2021 (Location A) the detector only recorded for four nights (instead of five), however this is not considered to have affected the assessment of the species assemblage using the site as Ecology by Design have collected considerable amounts of data over the survey period. The static bat detector failed to record at location B during October, as such the detector was redeployed to record during October dates 11th- 15th. Data failed to be collected on the 26th July at location B and therefore the night before (25th) has been used to complete the five nights of data as this was available. The data has also been analysed to show bat passes per hour for each location to show the relative levels of bat activity.

3.7.4 The winter of 2020 to 2021 was particularly mild and there was a prolonged cold and wet spell in spring 2021. This may have caused mortality amongst bat populations over winter and/or pregnant mothers to abort embryos and therefore not establish maternity colonies. Across the board, ecological consultants have reported many long-established significant roosts have not been present throughout the maternity season in 2021. Anecdotally, Ecology by Design has also noted generally far lower bat activity than typically expected at suitable sites in 2021. This is considered to be of relevance to the site, where lower levels of activity were recorded than would be expected for a woodland site adjacent to a lake. Interestingly, numbers increased considerably in 2022.

3.7.5 The site is heavily overgrown and large portions were not accessible. The areas of the lake edge not accessible for the water vole ad otter survey have been highlighted on the associated map. The pond in the centre of the site is also not accessible due to the very dense stands of buddleja surrounding it. Recommendations are given below with respect to this limitation.

3.7.6 There were densely vegetated areas of the site which were not accessible and therefore could not be surveyed for badger. Recommendations are given below with respect to this limitation.

3.7.7 A small area to the south of the site was omitted from the survey effort in 2022, due to the client's concern over the proximity of the quicksand, therefore the bat transect route was altered to not include this area and three of the dormouse tubes located in this area were not checked. As this area is small and of similar composition to the rest of the site (in respect of habitat for bats and dormice), it is not considered this will have any impact on the results or assessment of potential impacts of the proposals.

4 Results

4.1 Reptile Survey Results

4.1.1 No reptiles were identified within the site during the surveys completed in 2021 and 2022. A single juvenile smooth or palmate newt was identified and anecdotal evidence from a nearby landowner indicated that a grass snake (*Natrix helvetica*) had been seen on site before.

4.2 Dormouse Survey Results

4.2.1 No dormice or mammal nests were encountered within the nest tubes during the surveys conducted in 2021 and 2022. Evidence of birds in the form of droppings were found in some tubes. It is considered therefore, that dormice are likely absent from the site.

4.3 Bat Activity Walked Transects

Transect 12th August 2021

4.3.1 There was generally a low level of activity on the site. The first bat was recorded at 20:48 (18 minutes after sunset), comprising a soprano pipistrelle commuting north from stop point two to three on the eastern boundary of the site. Further soprano and common pipistrelle were recorded foraging at the south-eastern corner of the site (20:54-21:06) and the southwestern corner between stop points seven to eleven (21:12-21:39). On the lower western boundary soprano pipistrelle and Daubenton's bat (*Myotis daubentonii*) passes were recorded by the water's edge at stop point eleven (21:39-21:41). Further passes of these species were recorded, with individuals foraging between stop points 12 to 14 in the centre of the site. Many soprano pipistrelle passes were recorded on the upper western boundary foraging at the water's edge at stopping point 16 (22:12-22:17). Foraging common and soprano pipistrelle were also noted to the north of the site. Occasional Nathusius' pipistrelle (*Pipistrellus nathusii*) passes were heard throughout the survey.

Transect 9th September 2021

4.3.2 There was generally a low level of activity on the site, comprising predominantly foraging common and soprano pipistrelle along the transect route. The first bat heard was at 20:03 (23 minutes after sunset) comprising a foraging soprano pipistrelle at stopping point 16 in the northwest of site. Along the centre of the site, approximately stop point 12, common pipistrelle, soprano pipistrelle and noctule (*Nyctalus noctula*) passes were noted. By the water's edge to the southwestern corner of site (stop point 11), passes from these species were noted in addition to a single Leisler's bat (*Nyctalus leisleri*) pass. Further common pipistrelle

and soprano pipistrelle passes were recorded in the central-northern portion of the site (stop points 10-9), along the southern boundary (stop points 8-5) and the eastern boundary (stop points 4-1). Along the southern boundary additional passes were noted from *Myotis* sp., and noctule, with a brown long-eared (*Plecotus auritus*) bat pass also noted along the eastern boundary. Occasional Nathusius' pipistrelle calls were noted towards the end of the survey.

Transect 5th October 2021

4.3.3 This survey was quiet, with foraging passes of predominantly soprano pipistrelle (as well as common pipistrelle and occasional noctule) heard infrequently throughout the transect route, with the first bat heard at 18:46 (11 minutes after sunset) comprising a soprano pipistrelle continually foraging around stopping points 3-4 along the eastern boundary of the site.

Transect 21st April 2022

4.3.4 Moderate levels of soprano pipistrelle and common pipistrelle were recorded throughout the survey at most points, with the exception of the route along the canal being very quiet; although this may have been due to this stretch being walked just after sunset when some bats may have not yet emerged. The first bat, a soprano pipistrelle, was heard at 20:26 (17 minutes after sunset). Soprano pipistrelle were observed foraging above the treeline at point 7, 8 and 10. Soprano pipistrelle and common pipistrelle were also observed foraging over the lake edge at 21:07. Constant soprano pipistrelle and common pipistrelle activity was noted between 21:33-21-37 at stopping point 15 which is close to the northern edge of the site, in close proximity to the lake. Four serotine, three *Myotis* sp. and two NSL calls were recoded throughout the survey. All other calls were either soprano or common pipistrelle of which there were just over 400 calls recorded.

Transect 26th May 2022

4.3.5 A similar number of calls to the April transect were recorded in May, with the vast majority being either common pipistrelle or soprano pipistrelle. Bats were regularly heard throughout the survey across the site, with constant foraging by common and soprano pipistrelle and *Myotis* sp. above the water of the lake, noted at point 16 at 02:45-02:50. At 03:04-03:09 common and soprano pipistrelle and *Myotis* sp. were noted foraging over the water of the lake at point 14 and then flying down the woodland track. At 4:10-04:17 both common and soprano pipistrelle bats were observed foraging up and down the track adjacent to the canal path at point 4; showing interest in a poplar tree. One serotine call was recorded, thirty-one Myotis calls and just under 400 calls of soprano and common pipistrelle bats.

Transect 29th June 2022

4.3.6 Slightly less calls were recorded on this survey compared with April and May; 301 calls in total were recorded. Three of these calls were *Myotis* sp. with all others either common or soprano pipistrelle with the vast majority being soprano pipistrelle. Bats were observed foraging at most points along the transect including over the lake at point 14, 15 and 16.

Transect 20th July 2022

4.3.7 The surveyor noted that the transect has moderate activity and bat calls recorded are similar to the numbers recorded in both April and May. The majority of bats were heard and not seen but were recorded at most stops throughout the transect. At 04:04 a soprano pipistrelle bat was recorded foraging over the lake at stop 9; soprano pipistrelle were also observed foraging within the treeline at points 10, and 13. At 04:41 a soprano pipistrelle was observed foraging over the lake at stopping point 14.

Conclusion

4.3.8 The transect surveys in 2021 detected low levels of bat activity across the site. During the three transect surveys at least six different bat species were recorded: common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, noctule, Leisler's bat, brown long-eared bat and *Myotis* sp. Many of the passes were noted at the water's edge on the north-western and south-western corners of the site (stopping points 16 and 11 respectively), and along the southern and eastern boundaries. Bats were also noted utilising the central areas of the site, including along the central path from stop point 12-14 and along the path spanning stop point 9-11. The highest levels of bat activity were recorded during the first and second transects, although these transects are still regarded as having generally lower than anticipated activity levels.

4.3.9 The first and third surveys were undertaken from stopping points 1-18 and the second survey was undertaken from stopping points 18-1. All three surveys were undertaken at sunset.

4.3.10 The transect surveys undertaken in 2022 found moderate levels of activity with, like the previous year's surveys, the vast majority of passes to have been from either common or soprano pipistrelle bats. It was noted on all surveys in 2022 that bats were regularly observed foraging over the lake, although bats were noted at all stopping points throughout the site on most occasions.

4.3.11 With all surveys combined we conclude that the site supports a moderate level of bat activity with suitable bat habitat throughout, although particular suitability along the lake edges. Species diversity is also considered to be moderate, although it is clear that soprano and common pipistrelle bats are the dominant species currently present on site.

4.4 Fixed Point Automated Detector Surveys

4.4.1 All data represents the number of bat passes (n) rather than the number of bats. One bat could pass the detector hundreds of times during the night; therefore, the numbers are an indication of activity level and the relative value of particular habitats and features of the site rather than the actual numbers of bats.

Detector location A – August 2021

4.4.2 Overall activity levels recorded at location A in August were moderate, with 2,236 passes recorded in total during the five nights of recording (equating to 43.5 passes per hour). Across the sampling period, Pipistrelle sp., comprised 92.3% of all bat passes, of which 80.4% comprised soprano pipistrelle (n = 1,797), and 10.8% comprised common pipistrelle (n = 242) and 0.8% comprised Nathusius' pipistrelle (n = 17), with remaining calls classified as unidentified pipistrelle species). All other species comprised a low percentage of bat passes, in descending order of percentage occurrence; *Myotis* sp. (1.70%; n=38), *Nyctalus* sp. including noctule and Leisler's bat (1.70%; n=38), whilst serotine (*Eptesicus serotinus*) and brown long-eared bat and *Plecotus* sp. comprising 1.39% of passes each (n= 31).

Detector location B – August 2021

4.4.3 Overall activity levels recorded at detector location B in August were moderate, with 4,471 passes recorded in total during the five nights of recording (equating to 86.95 passes per hour). Across the sampling period, Pipistrelle sp., comprised 97.4% of all bat passes, of which 95.8% comprised soprano pipistrelle passes (n = 4,284) and 1.1% comprised common pipistrelle passes (n = 48) and 0.4% comprised Nathusius' pipistrelle (n=18). Brown long-eared bat comprised 1.7% (n=74) of passes, *Myotis* sp. comprised 0.8% of passes (n = 34), serotine (n = 5) comprised 0.1% passes, with noctule calls comprising ~0.04% of passes (n = 2).

Detector location A – September 2021

4.4.4 Overall activity levels recorded at detector location A in September were very low, with 593 passes recorded in total during the four nights of recording (equating to 11.9 passes per hour). Across the sampling period, Pipistrelle sp., comprised 92.9% of all bat passes, of which 80.1% comprised soprano pipistrelle passes (n = 475) and 9.1% comprised common pipistrelle passes (n = 54) and 3.4% comprised Nathusius' pipistrelle (n=20). *Myotis* sp. comprised 2.2% of passes (n = 13) and brown long-eared bat comprised 2.0% (n=12) of passes. Serotine (n = 3) comprised 0.5% passes, with noctule calls comprising ~0.2% of passes (n = 1).

Detector location B – September 2021

4.4.5 Overall activity levels recorded at location B during September was moderate, with 2,305 passes recorded in total during the five nights of recording (equating to 35.9 passes per hour). Across the sampling period, Pipistrelle sp., comprised 80.8% of all bat passes, of which 68.1% comprised soprano pipistrelle (n = 1,570), 10.8% comprised Nathusius' pipistrelle (n = 247) and 1.8% comprised common pipistrelle (n = 41) and, with remaining calls classified as unidentified pipistrelle species). Brown long-eared bat calls comprised 7.4% of passes (n = 171), and *Myotis* sp. comprised 6.9% of passes (n=158). All other species comprised a low percentage of bat passes, in descending order of percentage occurrence such that *Nyctalus* sp. comprised 1.8% (n=42), and serotine comprised 1.3% of passes (n=29).

Detector location A – October 2021

4.4.6 Overall activity levels recorded at detector location A during October was low, with 1,044 passes recorded in total during the five nights of recording (equating to 15.4 passes per hour). Across the sampling period, Pipistrelle sp., comprised 84.7% of all bat passes, of which 64.3% comprised soprano pipistrelle (n = 671), 14.5% comprised Nathusius' pipistrelle (n = 151), and 5.6% comprised common pipistrelle (n = 58), with remaining calls classified as unidentified pipistrelle species). All other species comprised a low percentage of bat passes, in descending order of percentage occurrence; *Myotis* sp. (6.2%; n=65), brown long-eared bat (4.7%; n=49) serotine (1.7%; n= 18) and noctule (1.3%; n=14).

Detector location B – October 2021

4.4.7 Overall activity levels recorded at detector location B during October was low, with 896 passes recorded in total during the five nights of recording (equating to 12.6 passes per hour). Across the sampling period, Pipistrelle sp., comprised 75.9% of all bat passes, of which 67.5% comprised soprano pipistrelle (n = 605), 6.9% comprised Nathusius' pipistrelle (n = 62) and 1.3% comprised common pipistrelle (n = 12), with remaining calls classified as unidentified pipistrelle species). *Myotis* sp. comprised 15.7% of passes (n=141), and brown long-eared comprised 5.7% of passes (n=51), whilst *Nyctalus* and serotine comprising less than 1% of passes each (n=7 and n=1 respectively).

Detector location A – April 2022

4.4.8 Overall activity levels recorded at detector location A during April was moderate, with 3,578 passes recorded in total during the five nights of recording (equating to 68.3 passes per hour). Across the sampling period, Pipistrelle sp., comprised 95% of all bat passes, of which 23.95% (n=857) were common pipistrelle and 71.02% (n=2541) were soprano pipistrelle. The other 5%

comprised a mixture of NSL (130), serotine (n=10), *Myotis* (n=13), noctule (n=23), brown long-eared bat (n=2) and serotine/Leisler's bat (n=2).

Detector location B – April 2022

4.4.9 Overall activity levels recorded at detector location B during April was moderate (but much higher than at location A), with 16,904 passes recorded in total during five nights of recording (equating 322.80 passes per hour). Across the sampling period, Pipistrelle sp., comprised 71.7% of all bat passes, of which 17.5% (n=2,949) were common pipistrelle and 54.3% (n=9,170) were soprano pipistrelle. *Myotis* sp. comprised 20.8% (n=3,517) of the calls and NSL 6.5% (n=1,106). The other 1% comprised a mixture of serotine (n=7), noctule (n=22), brown long-eared bat (n=131) and serotine/Leisler's bat (n=2).

Detector location A – May 2022

4.4.10 Overall activity levels recorded at detector location A during May was moderate but considerably higher than the previous month at the same location, with 8,678 passes recorded in total during the five nights of recording (equating to 198.88 passes per hour). Across the sampling period, Pipistrelle sp., comprised 97.8% of all bat passes, of which 52.4% (n=4,548) were common pipistrelle and 45.38% (n=3,938) were soprano pipistrelle. The other 2.2% comprised a mixture of *Myotis sp.* (n=5), NSL[4] (n=186) and brown long-eared bat (n=1).

Detector location B – May 2022

4.4.11 Overall activity levels recorded at detector location B during May was moderate, with 14,113 passes recorded in total during five nights of recording (equating 323.45 passes per hour). Across the sampling period, Pipistrelle sp., comprised 88.1% of all bat passes, of which 34.5% (n=4,864) were common pipistrelle and 53.7% (n=7,574) were soprano pipistrelle. *Myotis* sp. comprised 10.9% (n=1,534) of the calls and the other 1% comprised a mixture of NSL (n=135), brown long-eared bat (n=4) and *Pipistrellus* sp. (n=2).

Detector location A – June 2022

4.4.12 Overall activity levels recorded at detector location A during June was moderate, more than in April but less than May, with 5,111 passes recorded in total during the five nights of recording (equating to 120.07 passes per hour). Across the sampling period, Pipistrelle sp., comprised 97.7% of all bat passes, of which 59% (n=3,017) were common pipistrelle and 38.7% (n=1,977) were soprano pipistrelle. The other 2.3% comprised a mixture of *Myotis* (n=6), NSL (n=103) and brown long-eared bat (n=8).

[4] NSL is an abbreviation used for calls which could be attributed to a big bat: noctule / serotine or Leisler's bat

Detector location B – June 2022

4.4.13 Overall activity levels recorded at detector location B during June was moderate, with 9,300 passes recorded in total during five nights of recording (equating 224.10 passes per hour). Across the sampling period, Pipistrelle sp., comprised 97.9% of all bat passes, of which 22.3% (n=2,079) were common pipistrelle and 75.6% (n=7,030) were soprano pipistrelle. The other 2.1% comprised a mixture of *Myotis* sp. (n=53), NSL (n=130), brown long-eared bat (n=4), noctule (n=2), serotine (n=1) , noctule (n=2) and Leisler's bat (n=1).

Detector location A – July 2022

4.4.14 Overall activity levels recorded at detector location A during July was moderate, with 5,658 passes recorded in total during five nights of recording (equating 124.90 passes per hour). Across the sampling period, Pipistrelle sp., comprised 95.6% of all bat passes, of which 22.85% (n=1,293) were common pipistrelle and 72.71% (n=4,114) were soprano pipistrelle. The other 4.4% comprised a mixture of *Myotis* sp. (n=12), NSL (n=208), brown long-eared bat (n=9), noctule (n=21) and serotine (n=1).

Detector location B – July 2022

4.4.15 Overall activity levels recorded at detector location B during July was moderate but much higher than at location A, with 11,116 passes recorded in total during five nights of recording (equating 238.37 passes per hour). Across the sampling period, Pipistrelle sp., comprised 98.1% of all bat passes, of which 40.5% (n=6,398) were common pipistrelle and 57.6% (n=6,398) were soprano pipistrelle. The other 1.9% comprised a mixture of Myotis sp. (n=28), Serotine (n=1), noctule (n=27), NSL (n=156) brown long-eared bat (n=3) and Nathusius' pipistrelle (n=1).

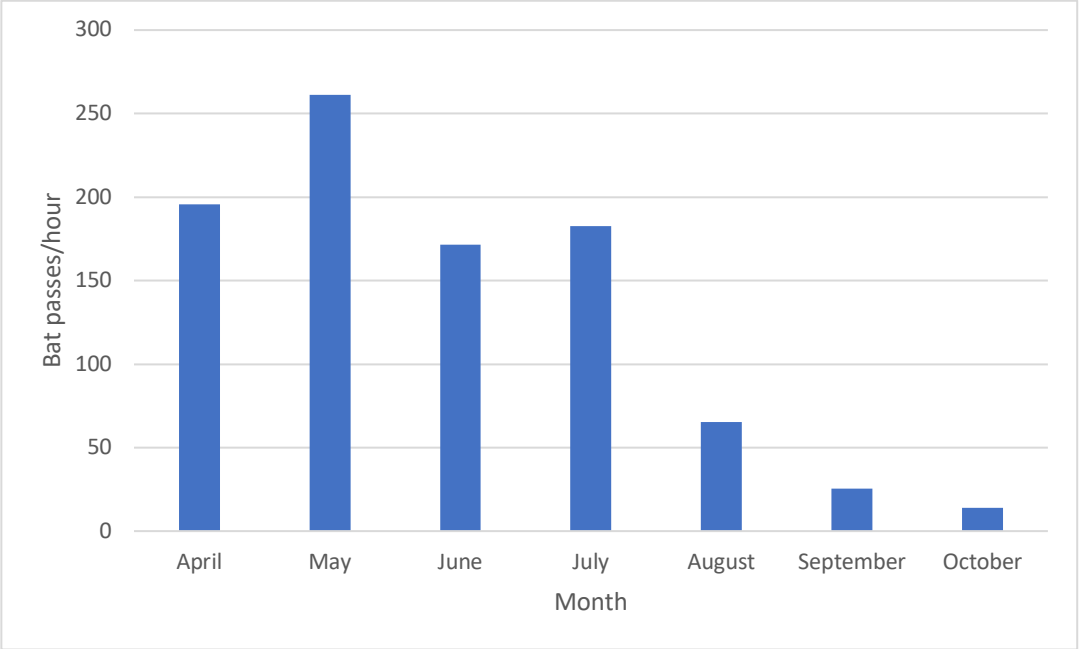
Conclusion

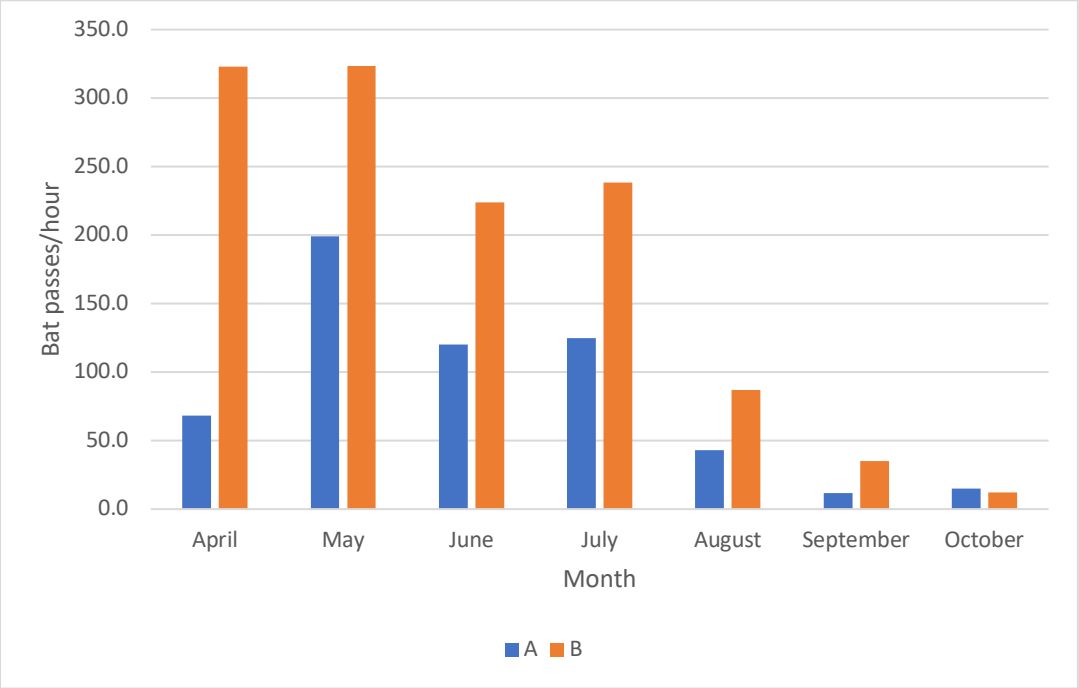
4.4.16 The site is used by at least nine species of foraging and/or commuting bats. The majority of activity comprises *Pipistrelle* sp. passes which exceeds 93% of recorded passes at detector location A and 87% of recorded passes at detector location B during the sampling periods. Occasional passes from *Myotis* sp., serotine, brown long-eared bat, *Nyctalus* sp. were also recorded.

4.4.17 The bat passes (registrations) per hour for each detector location during the sampling periods is outlined in Table 4.1.

Table 4.1: *Bat registrations (passes) per hour throughout the site*

Location	Bat Registrations per Hour (BRPH)												
	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Unidentified pipistrelle (~50 kHz)	Serotine	Leisler' s bat	*Nyctalus* sp.	Brown long-eared bat	*Myotis* sp.	Serotine or Leisler' s bat	Noctule	NSL	Total
August- A	4.71	34.95	0.33	0.04	0.60	0.12	0.74	0.60	0.74	0	0	0	42.83
August- B	0.93	83.31	0.35	0.04	0.10	0	0.04	1.44	0.66	0	0	0	86.87
September- A	3.56	31.29	1.31	0.07	0.20	0	0.07	0.66	0.85	0	0	0	38.01
September- B	0.63	24.4	3.85	0.03	0.45	0.02	0.65	2.67	2.46	0	0	0	35.16
October- A	0.85	9.86	2.21	0.03	0.26	0	0.21	0.72	0.95	0	0	0	15.09
October- B	0.17	8.51	0.87	0.01	0.01	0	0.10	0.71	1.98	0	0	0	12.36
April - A	16.37	48.52	0	0	0.19	0	0	0.04	0.25	0.04	0.44	2.48	68.33
April - B	56.31	175.11	0	0	0.13	0	0	2.50	67.16	0.04	0.42	21.12	322.80
May - A	104.23	90.25	0	0	0	0	0	0.02	0.11	0	0	4.26	198.88
May - B	111.47	173.58	0	0.05	0	0	0	0.09	35.16	0	0	3.09	323.5
June - A	70.88	46.44	0	0	0	0	0	0.19	0.14	0	0	2.42	120.07
June - B	50.10	169.40	0	0	0.02	0.02	0	0.10	1.28	0	0.05	3.13	224.10
July - A	28.54	90.82	0	0	0.02	0	0	0.20	0.26	0	0.46	4.59	124.90
July - B	96.48	137.20	0.02	0	0.02	0	0	0.06	0.6	0.06	0.58	3.35	238.37
Total	545.23	1123.64	8.94	0.27	2	0.16	1.81	10	112.6	0.14	1.95	44.44	**1851.27**
Average	38.95	80.26	0.64	0.02	0.14	0.01	0.13	0.71	8.04	0.01	0.14	3.17	**132.23**





4.4.18 More passes we recorded at both locations A and B during August compared to September and October 2021. Significantly more passes were recorded at location B compared to A during August 2021; a similar level of activity was recorded at both location A and B in September and October 2021, with activity lowest in October at both locations.

4.4.19 Data from 2022 shows much higher levels of activity than in 2021. In April, activity at location A was similar to the previous year in August, whereas as location B the activity was significantly higher with over 16,000 calls, as opposed to 3,578 at location A. During May activity increased

considerably at location A with 8,678 calls in total; over 5,000 more than the previous month. Again, location B in May was much busier than location A with over 14,000 calls.

4.4.20 In June activity appears to reduce slightly with 5,111 calls at location A and 9,300 at location B; however, the same pattern of location B recording higher activity levels is still evident. It is difficult to understand this slight dip in activity as without several years of data, it will not be clear whether this was an anomaly or a frequent occurrence. Dips in activity can be for many reasons, including weather, humidity, mothers staying with their dependant young for longer periods and invertebrate emergence patterns, all of which may impact bat activity from month to month. In July activity remains similar at location A with 5,658 calls recorded but increases dramatically to 11,116 calls at location B.

4.4.21 Overall, the vast majority of calls recorded were from pipistrelle bats with a significantly higher number of soprano pipistrelle calls recorded throughout most months and locations. The site also provides commuting and foraging opportunities along the water's edge and foraging and commuting opportunities within the centre of the site for various other species in relatively small numbers; these included *Myotis*. sp, *Nyctalus* sp., brown long-eared bat and the occasional serotine.

4.4.22 There is no published guidance on what rates of bat activity are considered to be high / medium / low. However, based on thousands of hours of bat data analysed across a wide range of sites by Ecology by Design personnel, high rates are considered to be where tens of thousands of bat passes are recorded per detector per recording period, and low where low hundreds are recorded per detector. Therefore, activity levels are considered to be low to moderate in 2021 and rise to moderate in 2022.

4.5 Otter and Water Vole Surveys

4.5.1 No evidence of otter or water vole was recorded during the survey conducted in May 2022.

4.5.2 During the August survey an otter spraint was discovered on the banks of the Grand Union Canal which runs parallel to the site (see fig 5. in appendix 1). A potential otter spraint next to signal crayfish (*Pacifastacus leniusculus*) remains was also located on the northern bank of the lake (see fig 5. appendix 1). Due to the recent heatwave the sample was very dried out and not typical of otter, therefore it was collected for DNA analysis which is recommended to confirm otter presence on site. Several crayfish remains were also identified on the banks of the lake which are likely to be from otter, although birds such as gulls and herons may also predate crayfish, leaving their remains. No otter holts were discovered on site. As otter evidence was

present along the canal, which is very close proximity to the site and due to the suitable habitat on site, it is considered highly likely that otter are present within the site.

4.5.3 No evidence of water vole was found on site and the lake was considered to offer only very marginal habitat as there is very little bank; the lake edge slopes into pebbly beach-like areas rather than steep banks in most areas, which leaves little opportunity for water vole to form burrows. There is some vegetation along the lake edge, although the beach-like areas are sparsely covered in vegetation and offer little protection to water vole. A few holes were discovered on the northern edge of the lake, although these appeared disused and likely from common rat as no other evidence was present. The pond (TN1) in the centre of the site may provide suitable habitat, however, the buddleja was in such densities it was not possible to access the water's edge in this area.

4.5.4 The nearside bank of the canal was piled and therefore apart from sporadic outflow pipes there was no suitable places for burrowing water vole. The far side bank of the canal did open up in places to form reed bed areas (TN2), which may be highly suitable but this area was not accessible to the surveyors.

4.6 Badger Survey

4.6.1 No evidence of badger setts were discovered on site. One relatively fresh badger latrine was discovered within the woodland in the north west of the site, although no other evidence was found. There were significant areas of the site which were densely vegetated and impenetrable and therefore may have concealed evidence of badger.

5 Discussion and recommendations

5.1 Reptiles

5.1.1 No reptiles were recorded during the site visits in 2021 or 2022. Anecdotal evidence from a local resident indicated that a grass snake had been seen on site previously. Grass snake is a wide-ranging species therefore it is considered that there is likely to be a low population of grass snake, which, due to the sufficient habitat for them on site and within the local landscape, were not discovered during the surveys. Ecology by Design are confident that if a significant population existed, they would have been recorded incidentally during the many site visits that have taken place throughout 2021 and 2022. It is therefore recommended that any site clearance should be undertaken in a phased and careful manner towards areas of the site to be retained; allowing reptiles the chance to escape freely into other suitable areas of the site.

5.2 Dormice

5.2.1 No dormouse or evidence of them have been located during nest tube checks during surveys in 2021 and 2022. It is therefore considered that dormice are likely absent from the site. No further mitigation is required with regard to dormice; however, enhancements have been suggested below.

5.3 Water Vole and Otter

5.3.1 No evidence of water vole was discovered on site and the lake is considered to be of marginal suitability for water vole. The pond (TN3) in the centre of the site may be suitable for water vole but was inaccessible at the time of survey. Proposals involve clearing vegetation on the western side of the pond and therefore it is recommended that some vegetation is cleared in stages and a water vole check undertaken once access is possible (between April-September). Clearance should be undertaken under an ecological clerk of works (ECoW) to ensure initially only minimal amounts of vegetation are removed, to allow an ecologist sufficient access to check for water vole evidence; if no evidence is discovered the vegetation can then be cleared as per the design proposals. If evidence is discovered, works would need to stop and a licence applied for. Alternatively, this pond could be left undisturbed and would then not need to be surveyed any further.

5.3.2 Due to the suitability of the site for otter and the nearby presence and potential presence on site of otter, it is recommended that once plans are finalised, a check for otter holts is conducted 3 months prior to works commencing. So that, if present, appropriate mitigation can be followed.

5.4 Badger

5.4.1 No badger setts were discovered on site. One relatively fresh badger latrine was discovered within woodland in the north west of the site. This evidence suggests that badger are active across the site but it is considered that the site is not optimal for sett building. Large areas of the site are not considered suitable for badger, due to the level of the water table and semi-aquatic vegetation present indicating that certain areas are prone to flooding or seasonal inundation which would not be suitable for sett building. Other areas along the western edge of the lake and along the main track through the site appear to have had concrete deposited in the past making the ground very hard in many places and not suitable for badger to dig. Due to the densely vegetated areas however, there were large areas of the site that were not possible to survey and evidence of badger could have been concealed here; albeit the majority of this area will be retained and not impacted by the development. Due to lack of access across the whole site a precautionary approach is therefore recommended. Once development plans are fixed a 30m buffer zone will be drawn around all areas of the site that require ground works; this buffer zone will then be thoroughly checked which will involve careful phased clearance so that the areas are accessible for surveying. It is recommended that this survey is undertaken at least three months before works start so that if any badger setts are discovered they can be adequately surveyed and a licence applied for, if required.

5.5 Bats

5.5.1 Data collected over seven months in both 2021 and 2022 indicate a low to moderate level of bat activity across the site in both the woodland edge and lakeside areas. Activity varied across months quite considerably; however generally speaking, activity across most months would still be considered to be moderate. The vast majority of bat calls recorded were *Pipistrellus* species with significantly more being soprano pipistrelle. However, many other species were also recorded, albeit in much smaller numbers, including *Myotis* sp., *Nyctalus* sp., serotine, and brown long-eared bat, indicating a good diversity present across the site.

5.5.2 Soprano pipistrelle, are known to hunt over water and woodland edges and therefore it is understandable why they were recorded as the most dominant bat species on site. Location B recorded significantly more bat calls during most months, and this is likely attributed to its location close to the lake edge. Many insects are associated with water and insects such as mosquitoes and midges which soprano pipistrelle (and most bats) prey upon breed within the water or at its edges and therefore location B (and any area around the water's edge on site)

provides ideal hunting ground for emerging insects, which is thought to be the main reason for significantly higher activity at this location.

5.5.3 Numbers for brown long-eared bat are particularly low considering they are a relatively common bat species and that they are suited to woodland environments; however, their calls are particularly quiet and therefore often not picked up by the detector and it is considered their activity on site is likely under-represented.

5.5.4 Bat calls were recorded close to emergence and re-entry times for bats to and from their roosts on multiple occasions and therefore it is likely the site itself may support bat roosts or at least somewhere very close by. Species recorded close to their emerging/re-entering times included the examples below:

- Soprano pipistrelle regularly recorded close to sunset.
- Common pipistrelle occasionally recorded close to sunset.
- NSL recorded within ten minutes of sunrise on sporadic occasions.
- Brown long-eared bat recorded occasionally within 40 mins of sunset during April and May.

5.5.5 Tables 5.1 and 5.2 below, detail the scoring criteria for commuting and foraging bats. Each species found on site is assigned a IEEM Geographic Frame of Reference score (scores based on Appendix 3); results are based upon the level of activity recorded and the areas where bats were identified using a combination of the data from the walked transects and static detectors to make the assessment below. Following this approach, the site is categorised as being of 'county' importance due to the likelihood that soprano pipistrelle bats are roosting on site due to multiple calls being recorded around their typical emergence times. This may also be the case for Nyctalus sp. common pipistrelle and brown long-eared bats, although due to less frequent calls recorded at typical emergence times they have not been included below.

Table 5.1: *Scoring Values for commuting routes*

Species	Species Value	Number of bats	Roosts/ Potential Roosts	Type and complexity of linear features	Geographic Frame of Reference and score
Common pipistrelle	Common (2)	Small number of bats (10)	None (1)	Complex network of mature well-established hedgerows, small fields and rivers/streams (5)	District/ Local/ Parish (18)

Soprano pipistrelle	Common (2)	Small number of bats (10)	Moderate number/Not known (4)	Complex network of mature well-established hedgerows, small fields and rivers/streams (5)	County (21)
Brown long-eared bat	Common (2)	Individual bats (5)	None (1)	Complex network of mature well-established hedgerows, small fields and rivers/streams (5)	District/ Local/ Parish (13)
Noctule	Rarer (5)	Individual bats (5)	None (1)	Complex network of mature well-established hedgerows, small fields and rivers/streams (5)	District/ Local/ Parish (16)
Nathusius' pipistrelle	Rarer (5)	Individual bats (5)	None (1)	Complex network of mature well-established hedgerows, small fields and rivers/streams (5)	District/ Local/ Parish (16)
Myotis sp.	Rarer (5)	Individual bats (5)	None (1)	Complex network of mature well-established hedgerows, small fields and rivers/streams (5)	District/ Local/ Parish (16)
Serotine	Rarer (5)	Individual bats (5)	None (1)	Complex network of mature well-established hedgerows, small fields and rivers/streams (5)	District/ Local/ Parish (16)
Leisler's bat	Rarer (5)	Individual bats (5)	None (1)	Complex network of mature well-established hedgerows, small fields and rivers/streams (5)	District/ Local/ Parish (16)

Table 5.2: *Scoring Values for foraging*

Species	**Species Value**	**Number of bats**	**Roosts/ Potential Roosts**	**Type and complexity of linear features**	**Geographic Frame of Reference and score**
Common pipistrelle	Common (2)	Small number of bats (10)	None (1)	Mosaic of pasture, woodlands and wetland areas (5)	District/ Local/ Parish (18)
Soprano pipistrelle	Common (2)	Small number of bats (10)	Moderate number/Not known (4)	Mosaic of pasture, woodlands and wetland areas (5)	County (21)

Brown long-eared bat	Common (2)	Individual bats (5)	None (1)	Mosaic of pasture, woodlands and wetland areas (5)	District/ Local/ Parish (13)
Noctule	Rarer (5)	Individual bats (5)	None (1)	Mosaic of pasture, woodlands and wetland areas (5)	District/ Local/ Parish (16)
Nathusius' pipistrelle	Rarer (5)	Individual bats (5)	None (1)	Mosaic of pasture, woodlands and wetland areas (5)	District/ Local/ Parish (16)
Myotis sp.	Rarer (5)	Individual bats (5)	None (1)	Mosaic of pasture, woodlands and wetland areas (5)	District/ Local/ Parish (16)
Serotine	Rarer (5)	Individual bats (5)	None (1)	Mosaic of pasture, woodlands and wetland areas (5)	District/ Local/ Parish (16)
Leisler's bat	Rarer (5)	Individual bats (5)	None (1)	Mosaic of pasture, woodlands and wetland areas (5)	District/ Local/ Parish (16)

5.5.6 Once plans have been produced to indicate which trees are proposed for removal, further survey work will be necessary to establish whether or not roosts are present; as well as within the derelict outbuildings on site.

5.5.7 Due to the levels of activity across the site it will be very important that a specialist lighting strategy is designed for the site, to strictly avoid illuminating the lake and its edges as well as the woodland. Lighting should only illuminate the new building areas and these lights will also need to be carefully designed to ensure minimum impact across the site. It is recommended that any buildings that will require lighting during the evenings or camping areas are sited as far away from the lake edges as possible.

5.5.8 A detailed lighting strategy will be required and should be produced with advice from an ecologist to ensure all ecological features are protected and this report further updated once plans have evolved.

5.5.9 Due to the levels of activity across the site it is recommended that the lighting strategy is produced as part of the planning application, to ensure an ecologist can provide specialist input. Any lighting for the development will need to be designed sensitively in accordance with industry standard guidance (BCT & ILP, 2018) and the following principles will need to be adopted:

- Maintaining dark corridors alongside the lake edge and woodland and in proximity to roosts (once/if identified);
- Not illuminating any trees on site; strictly no uplighting;
- Where lighting is required, ensuring:
    - Light levels are less than 3 Lux;
    - LED luminaires with a warm white spectrum ideally <2700 Kelvin (to avoid blue / UV elements);
    - Bollard or low-level downward directional luminaires are used and mounted on the horizontal (with no upward tilt); and
    - Security lighting, if required, is motion-activated with short (< 1 minute) timers.

5.6 Other

5.6.1 A large area of Japanese Knotweed (*Fallopia japonica*) was discovered in the woodland in the north west of the site during the surveys as well as a smaller stand near the entrance to the site. Japanese Knotweed is a schedule 9 invasive species which means it is illegal to allow it to spread in the wild. It is of Ecology by Design's understanding that some areas have already been treated but it appears that the treatment may have not been successful and therefore it is recommended that further treatment applications are undertaken before it spreads any further.

6 Enhancements

6.1 Reptiles

6.1.1 It is recommended that log piles from trees felled to facilitate the development are stacked around edges of the woodland and lake edge. Two hibernacula should also be installed within the retained woodland area where they will remain undisturbed (see appendix 2). This will not only provide habitat for hibernating and sheltering reptiles but also for invertebrates and small mammals.

6.2 Dormice

6.2.1 Hazel (*Corylus avellana*), willow (*Salix* sp.) and honeysuckle (*Lonicera periclymenum*) could be used within the landscape design to provide suitable vegetation for dormice which may encourage then into the area; other small mammals, birds and insects will also benefit from these species being planted.

6.3 Water Vole and Otter

6.3.1 No particular enhancements for these species are required however, it is recommended that the northern edge of the lake is not completely cleared and that stands of marginal vegetation are planted between the pontoons to provide some ground cover in this area; species should include native rushes and reeds. An additional enhancement that could be considered, would be installation of an artificial otter holt in an area of the site to remain undisturbed along the western lake edge.

6.4 Badger

6.4.1 It is recommended that native berry and fruit producing trees are included within the landscape plan to provide food for badgers and other species. Species should include hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), elder (*Sambucus nigra*), dog rose (*Rosa canina*), bramble (*Rubus fruticosus*), crab apple (*Malus sylvestris*), damson (*Prunus domestica insititia*) and cherry (*Prunus avium*). These species could be planted in areas of the site where Japanese Knotweed currently exists which will require removal.

6.5 Bats

6.5.1 At least ten bat boxes (see examples in appendix 2) should be installed across the site. These should include a mixture of different brands/styles but should all be woodcrete/woodstone to ensure longevity (wooden boxes rot quickly and therefore need replacing often). The boxes should be positioned on the south/west aspect of mature trees at the edges of the lake and

edges of the woodland/in clearings, on tree trunks that are free from dense vegetation as bats will not fly through a cluttered (densely vegetated) area to roost. Boxes will be attached using aluminium nails or screws only, the use of copper, zinc or steel affixers in particular must be avoided on trees.

6.5.2 Bat boxes should also be included within the new buildings on site and should be installed within the fabric of the building, using such designs as Habibat boxes which are discreet and designed to fit any type of building.

7 Relevant Legislation and Policy

7.1 Natural Environment & Rural Communities Act 2006

7.1.1 The Natural Environment and Rural Communities (NERC) Act came into force on 1st October 2006. Section 41 (S41) of the Act require the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list has been drawn up in consultation with Natural England as required by the Act. In accordance with the Act the Secretary of State keeps this list under review and will publish a revised list if necessary, in consultation with Natural England.

7.1.2 The S41 list is used to guide decision-makers such as public bodies, including local authorities and utilities companies, in implementing their duty under Section 40 of the NERC Act 2006, to have regard to the conservation of biodiversity in England, when carrying out their normal functions, including development control and planning. This is commonly referred to as the 'Biodiversity Duty.'

7.1.3 Guidance for public authorities on implementing the Biodiversity Duty has been published by Defra. One of the key messages in this document is that 'conserving biodiversity includes restoring and enhancing species populations and habitats, as well as protecting them.' In England the administration of the planning system and licensing schemes are highlighted as having a 'profound influence on biodiversity conservation.' Local authorities are required to take measures to "promote the preservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species. The guidance states that 'the duty aims to raise the profile and visibility of biodiversity, clarify existing commitments with regard to biodiversity, and to make it a natural and integral part of policy and decision making.'

7.1.4 In 2007, the UK Biodiversity Action Plan (BAP) Partnership published an updated list of priority UK species and habitats covering terrestrial, freshwater and marine biodiversity to focus conservation action for rarer species and habitats in the UK. The UK Post-2010 Biodiversity Framework , which covers the period from 2011 to 2020, now succeeds the UK BAP. The UK priority list contained 1150 species and 65 habitats requiring special protection and has been used as a reference to draw up the lists of species and habitats of principal importance in England.

7.1.5 In England, there are 56 habitats of principal importance and 943 species of principal importance on the S41 list. These are all the habitats and species found in England that were

identified as requiring action in the UK BAP and which continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework.

7.2 Wildlife and Countryside Act 1981 (as amended)

7.2.1 All UK reptiles are protected under the Wildlife and Countryside Act 1981 (as amended). It is illegal to kill or injure them. It is not illegal to capture, disturb or to damage the habitats of the four 'widespread' species; however, the reptiles themselves are protected so any works to damage their habitat could risk causing harm to reptiles and hence could be illegal.

7.3 National Planning Policy Framework

7.3.1 The National Planning Policy Framework (NPPF) was updated in July 2021 (MHCLG, 2021) thereby replacing the older version of February 2019. The new framework sets out in section 15 that to protect and enhance biodiversity and geodiversity, plans should:

7.3.2 identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity; wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation and

7.3.3 promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity.

7.3.4 When determining planning applications, local planning authorities should apply the following principles:

7.3.5 if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;

7.3.6 development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest;

7.3.7 development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists; and

7.3.8 development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to incorporate biodiversity improvements in and around developments should be encouraged, especially where this can secure measurable net gains for biodiversity.

7.3.9 The following should be given the same protection as habitats sites:

7.3.10 potential Special Protection Areas and possible Special Areas of Conservation;

7.3.11 listed or proposed Ramsar sites; and

7.3.12 sites identified, or required, as compensatory measures for adverse effects on habitats sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites.

7.3.13 The presumption in favour of sustainable development does not apply where the plan or project is likely to have a significant effect on a habitats site (either alone or in combination with other plans or projects), unless an appropriate assessment has concluded that the plan or project will not adversely affect the integrity of the habitats site.

7.4 Government Circular ODPM 06/2005 Biodiversity and Geological Conservation

7.4.1 Paragraph 98 of Government Circular 06/2005 advises that “the presence of a protected species is a material consideration when a planning authority is considering a development proposal that, if carried out, would be likely to result in harm to the species or its habitat. Local authorities should consult Natural England before granting planning permission. They should consider attaching appropriate planning conditions or entering into planning obligations under which the developer would take steps to secure the long-term protection of the species. They should also advise developers that they must comply with any statutory species’ protection provisions affecting the site concerned...”

7.4.2 Paragraph 99 of Government Circular 06/2005 advises that “it is essential that the presence or otherwise of protected species, and the extent that they may be affected by the proposed development, is established before the planning permission is granted, otherwise all relevant material considerations may not have been addressed in making the decision. The need to ensure ecological surveys are carried out should therefore only be left to coverage under

planning conditions in exceptional circumstances, with the result that the surveys are carried out after planning permission has been granted".

7.5 Local Planning Policy

7.5.1 The Hillingdon Local Plan was adopted in November 2012, which contains the planning strategy and vision for the Borough. The following policies are of relevance to this development:

Policy EM7: Biodiversity and Geological Conservation

7.5.2 "The Council will review all the Borough grade Sites of Importance for Nature Conservation (SINCs). Deletions, amendments and new designations will be made where appropriate within the Hillingdon Local Plan: Part 2- Site Specific Allocations Local Development Document. These designations will be based on previous recommendations made in discussions with the Greater London Authority.

7.5.3 Hillingdon's biodiversity and geological conservation will be preserved and enhanced with particular attention given to:

1. *The conservation and enhancement of the natural state of:*
    - *Harefield Gravel Pits*
    - *Colne Valley Regional Park*
    - *Fray's Farm Meadows*
    - *Harefield Pit*
2. *The protection and enhancement of all Sites of Importance for Nature Conservation. Sites with Metropolitan and Borough Grade 1 importance will be protected from any adverse impacts and loss. Borough Grade 2 and Sites of Local Importance will be protected from loss with harmful impacts mitigated through appropriate compensation.*
3. *The protection and enhancement of populations of protected species as well as priority species and habitats identified within the UK, London and the Hillingdon Biodiversity Action Plans.*
4. *Appropriate contributions from developers to help enhance Sites of Importance for Nature Conservation in close proximity to development and to deliver/ assist in the delivery of actions within the Biodiversity Action Plan.*
5. *The provision of biodiversity improvements from all development, where feasible.*
6. *The provision of green roofs and living walls which contribute to biodiversity and help tackle climate change.*

7. *The use of sustainable drainage systems that promote ecological connectivity and natural habitats. "*

7.6 European Protected Species

7.6.1 European Protected Species of potential relevance to this assessment are bats and hazel dormouse.

7.6.2 The Conservation of Habitats and Species Regulations 2017 (as amended) transpose the EC Habitats Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Council Directive 92/43/EEC) into national law.

7.6.3 "European protected species" (EPS) of animal are those which are shown on Schedule 2 of The Conservation of Habitats and Species Regulations 2017 (as amended). They are subject to the provisions of Regulation 43 of those Regulations. All EPS are also protected under the Wildlife and Countryside Act 1981 (as amended)[1]. Taken together, these pieces of legislation make it an offence to:

- intentionally or deliberately capture, injure or kill any wild animal included amongst these species;
- possess or control any live or dead specimens or any part of, or anything derived from these species;
- deliberately disturb wild animals of any such species;
- deliberately take or destroy the eggs of such an animal; or
- intentionally, deliberately or recklessly damage or destroy a breeding site or resting place of such an animal, or obstruct access to such a place

7.6.4 For the purposes of the above, disturbance of animals includes in particular any disturbance which is likely:

- to impair their ability –
    - To survive, to breed or reproduce, or the rear or nurture their young; or
    - In the case of animals of a hibernating or migratory species, to hibernate or migrate; or
- to affect significantly the local distribution of the species to which they belong.

7.6.5 Although the law provides strict protection to these species, it also allows this protection to be set aside (derogated) through the issuing of licences. The licences in England are currently determined by Natural England (NE) for development works. In accordance with the

requirements of The Conservation of Habitats and Species Regulations 2017 (as amended), a licence can only be issued where the following requirements, known as the "Three Tests", are satisfied:

- the proposal is necessary 'to preserve 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';
- 'there is no satisfactory alternative'; and
- the proposals 'will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

7.7 Reptiles

7.7.1 All native reptile species receive legal protection in Great Britain under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Viviparous lizard, slow-worm, grass snake and adder are protected against killing, injuring and unlicensed trade only. Sand lizard and smooth snake receive additional protection as "English Protected Species" under the provisions of The Conservation of Habitats and Species Regulations 2017 (as amended) and are fully protected under the Wildlife and Countryside Act 1981 (as amended).

7.7.2 All six native species of reptile are included as 'species of principal importance' for the purpose of conserving biodiversity under Section 41 (England) of the NERC Act 2006 and Section 7 of the Environment (Wales) Act 2016.

7.7.3 Current Natural England Guidelines for Developers states that 'where it is predictable that reptiles are likely to be killed or injured by activities such as site clearance, this could legally constitute intentional killing or injuring.' Further the guidance states: 'Normally prohibited activities may not be illegal if 'the act was the incidental result of a lawful operation and could not reasonably have been avoided'. Natural England 'would expect reasonable avoidance to include measures such as altering development layouts to avoid key areas, as well as capture and exclusion of reptiles.'

7.7.4 The Natural England Guidelines for Developers state that 'planning must incorporate two aims where reptiles are present:

- to protect reptiles from any harm that might arise during development work; and
- to ensure that sufficient quality, quantity and connectivity of habitat is provided to accommodate the reptile population, either on-site or at an alternative site, with no net loss of local reptile conservation status.'

7.8 Badger

7.8.1 Badger is protected under the Protection of Badgers Act 1992. It is not permitted to wilfully kill, injure, take, possess or cruelly ill-treat a badger, or to attempt to do so; or to intentionally or recklessly interfere with a sett. Sett interference includes disturbing badgers whilst they are occupying a sett, as well as damaging or destroying a sett or obstructing access to it. A badger sett is defined in the legislation as "a structure or place, which displays signs indicating current use by a badger".

7.8.2 ODPM Circular 06/2005 (ODPM, 20005) provides further guidance on statutory obligations towards badger within the planning system. Of particular note is paragraph 124, which states that "The likelihood of disturbing a badger sett, or adversely affecting badgers' foraging territory, or links between them, or significantly increasing the likelihood of road or rail casualties amongst badger populations, are capable of being material considerations in planning decisions."

7.8.3 Natural England provides Standing Advice (Gov.uk, 2015), which is capable of being a material consideration in planning decisions. Natural England recommends mitigation to avoid impacts on badger setts, which includes maintaining or creating new foraging areas and maintaining or creating access (commuting routes) between setts and foraging/watering areas.

7.9 Water Vole

7.9.1 Water vole is protected under the Wildlife and Countryside Act 1981 (as amended). This makes it an offence to kill, injure or take any water vole, damage, destroy or obstruct access to any place of shelter or protection that the animals are using, or disturb voles while they are using such a place. Water vole is listed as a Species of Principal Importance under the provisions of the NERC Act 2006 in England and under the provisions of the Environment (Wales) Act 2016.

7.10 Otter

7.10.1 Otter are protected under The Conservation of Habitats and Species Regulations 2017 (as amended) and are therefore protected against capturing, disturbing, killing or injury. Their breeding sites and resting places are also protected from damage or destruction.

8 References

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Appendix 1 - Figures

Figure 1: Reptile refugia locations

Figure 2: Dormouse survey methods

Figure 3: Bat survey methods

Figure 4: Badger survey

Figure 5: Water vole and Otter survey

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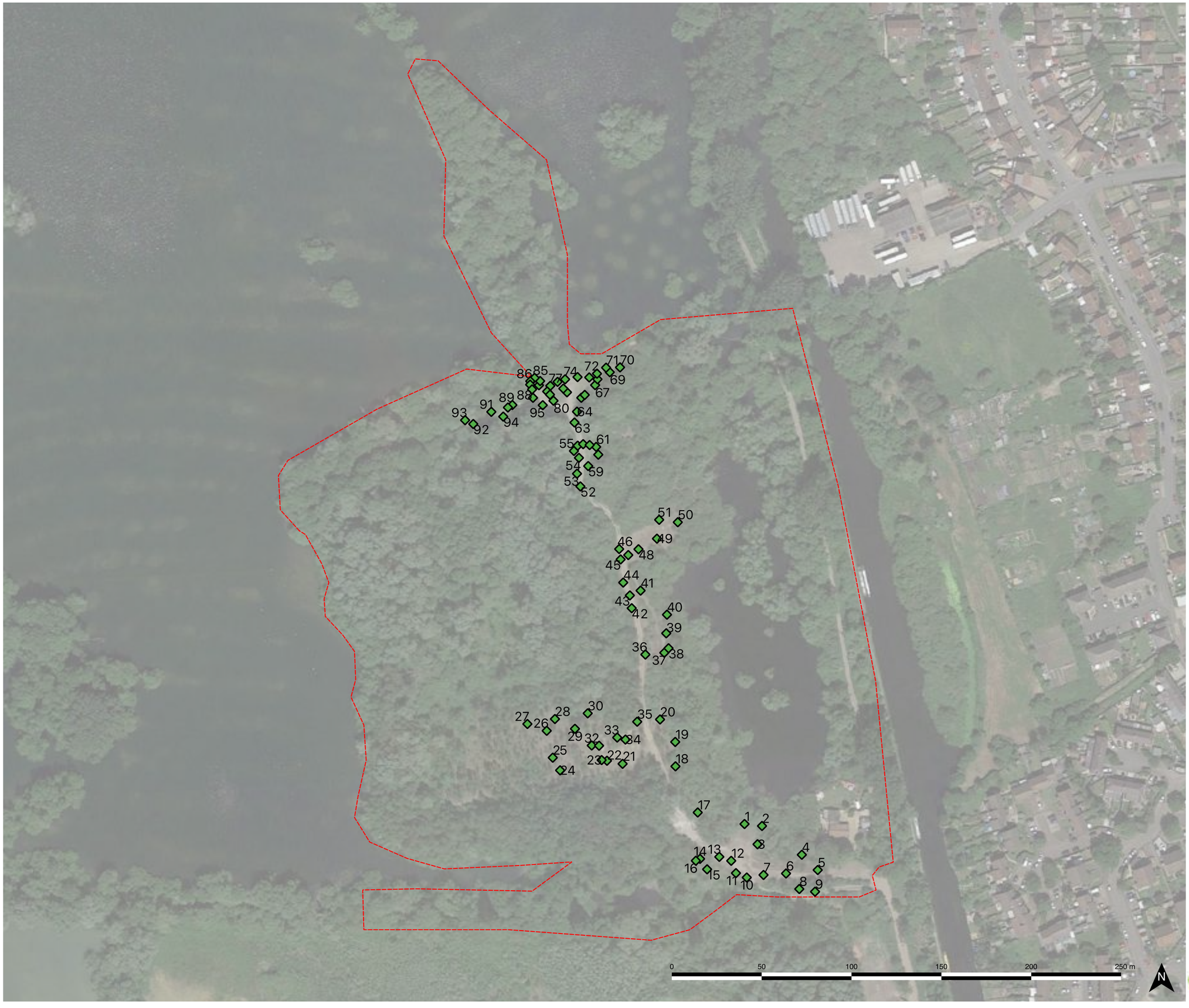

Location (1:75,000):

Project:

Broadwater Lake

Client:

Mace Group

Drawing Title:

Reptile refugia locations

Drawing No.:	*Scale (@A3):*
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Central Eastings, Northings:	*Date Drawn:*
504721, 189251	12/01/2022
Drawn by:	*Approved by:*
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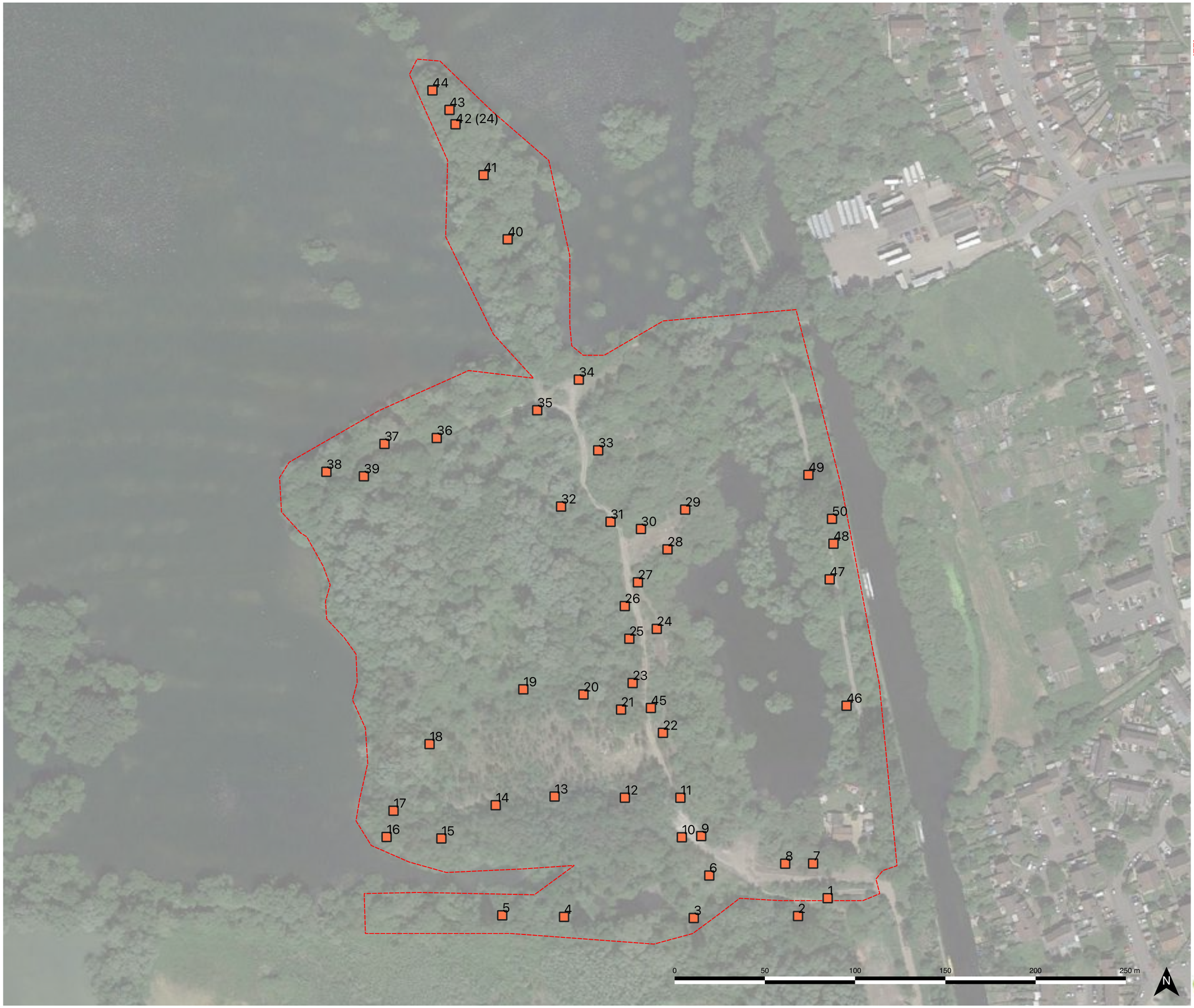

LEGEND

- Dormouse tubes
- Site boundary

Location (1:75,000):

Project:

Broadwater Lake

Client:

Mace Group

Drawing Title:

Dormouse survey methods

Drawing No.:	*Scale (@A3):*
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Central Eastings, Northings:	*Date Drawn:*
504721, 189251	12/01/2022
Drawn by:	*Approved by:*
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LEGEND

Bat Survey

- Point count
- Parking
- Static
- Bat transect
- Site boundary

Location (1:75,000):

Project:

Broadwater Lake

Client:

Mace Group

Drawing Title:

Bat survey methods

Drawing No.:
EBD_1959_DR003

Scale (@A3):
1:2,000

Central Eastings, Northings:
504744, 189233

Date Drawn:
12/01/2022

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