



Land at Oak Road, Wrexham Industrial Estate

Ecological Assessment Report Report Number K1720.2

Version 4

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1 Introduction

1.1 Background

Kingdom Ecology have carried out an Ecological Assessment of a large area of scrub and woodland located on Oak Road, Wrexham Industrial Estate. The assessment has been carried out to determine the overall ecological value of the site, identify features of ecological importance, identify opportunities for ecological enhancement and to identify features that could pose ecological constraints to any future development of the site.

In 2016, the site underwent a full set of Ecological Surveys. Initial Field surveys were undertaken on the 28th March and 1st April 2016 with follow-on surveys completed throughout spring and summer 2016. A further great crested newt eDNA survey of a pond at the site was completed in Spring 2017.

Following the completion of the 2016/2017 ecology surveys, proposals have been drawn up to redevelop part of the site. The development location has been selected to avoid impacts upon areas of the site of greatest ecological value. Proposals would see 75% of the site retained and managed for its nature conservation benefit with the remainder of the site developed to provide industrial units and associated infrastructure.

An update ecological walkover of the site was completed in Spring 2019 to determine whether site conditions had significantly changed and whether the original survey findings were likely to remain valid.

Surveys (other than invertebrate assessments) were carried out by Richard Roe (BSc, MSc, MIEEM, CEnv). Richard has extensive experience of undertaking habitat and protected species surveys as a professional ecological consultant with over eighteen years' experience. Richard is a licensed bat and great crested newt worker.

Invertebrate surveys were carried out by Andy Jukes (BSc, MCIEEM, FRES) of Conops Entomology. Andy has over 20 years' experience working with invertebrates and is a Fellow of the Royal Entomological Society. Andy is also an associate lecturer at the University of Staffordshire teaching Invertebrate Taxonomy to both undergraduate and postgraduate students.

1.2 Purpose of Report

This report provides and outlines the findings of a desk study and field surveys undertaken in 2016, 2017 and 2019. Field surveys comprised of habitat and botanical surveys plus further specific bat, badger, reptile, great crested newt, breeding bird and invertebrate surveys.

The field surveys and desk study aimed to map and identify broad habitat types at the site and to identify and evaluate species and habitats which would be either of importance in terms of their conservation value or afforded statutory legal protection.

Species considered during the assessment included breeding birds, badger, otter, great crested newt, bats, reptiles and invertebrates.

1.3 Study Area

The study area is located between Oak Road and Redwither Brook to the south of Wrexham Industrial Estate LL13 9PW (Ordnance Survey Grid SJ386494).

The site measures approximately 21.5ha in area and comprises of previously developed land (PDL) and is therefore considered 'brownfield' in nature.

1.4 Site History

The site comprises of part of the former Wrexham Royal Ordnance Factory which produced cordite for artillery shells during World War II. The site closed down in 1945 and was largely abandoned.

Other than these actions the site has been left relatively undisturbed and has developed into a mosaic of woodland and scrub habitats at various successional stages.

The site was designated a County Wildlife Site in 1998. The extent of the wildlife site is shown on Figure 1.4.2 below.

However, planning permission to develop an area in the north of the site (approximately 12.5ha) was provided July 2000. The planning permission was conditional on the retention of an approximate 9.2ha area of land within the south of the site as a nature conservation area which would be maintained under a 25 year Habitat Management Plan. The approved plans for this scheme are shown in Figure 1.4.1 below.

No development of the site was ultimately carried out and other than some initial scrub clearance, the site was left largely undisturbed although paintballing, war games and motorised activities have taken place.

The north part of the site for which planning permission was granted for development in 2000 currently lies within the Wrexham Industrial Estate UDP Settlement Limit (as adopted by Wrexham CBC in 2009). Whilst the southern part of the site which was to be retained as a nature conservation area lies outside of the settlement limit. The Wrexham Industrial Estate Settle Limit boundary, in relation to the Oaks Road site is shown below on Figure 1.4.2.

Figure 1.4.1- Extent of 2000 Approved Plan Showing Development Area and Mitigation Area

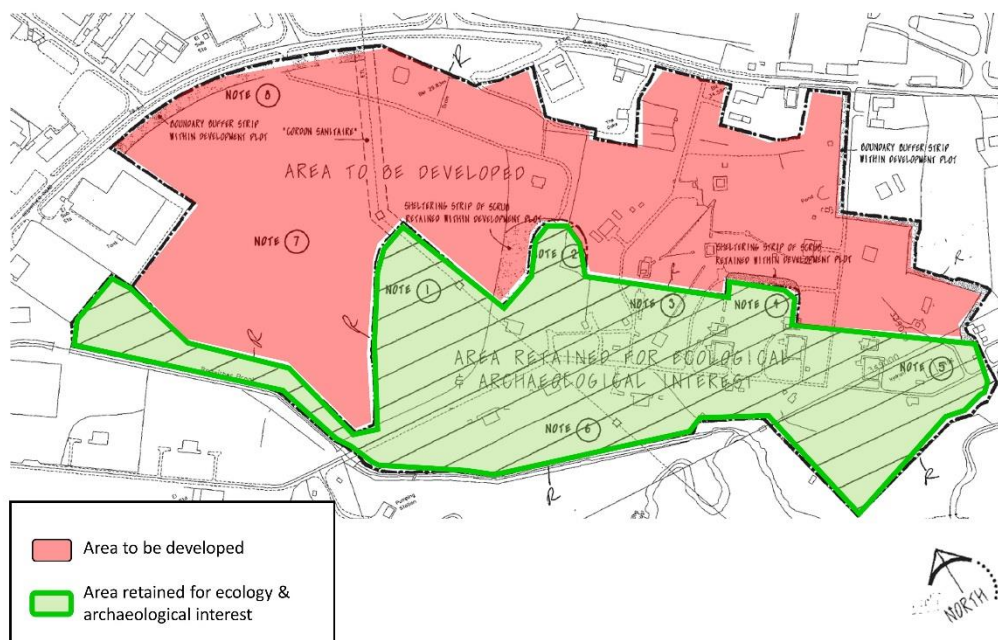
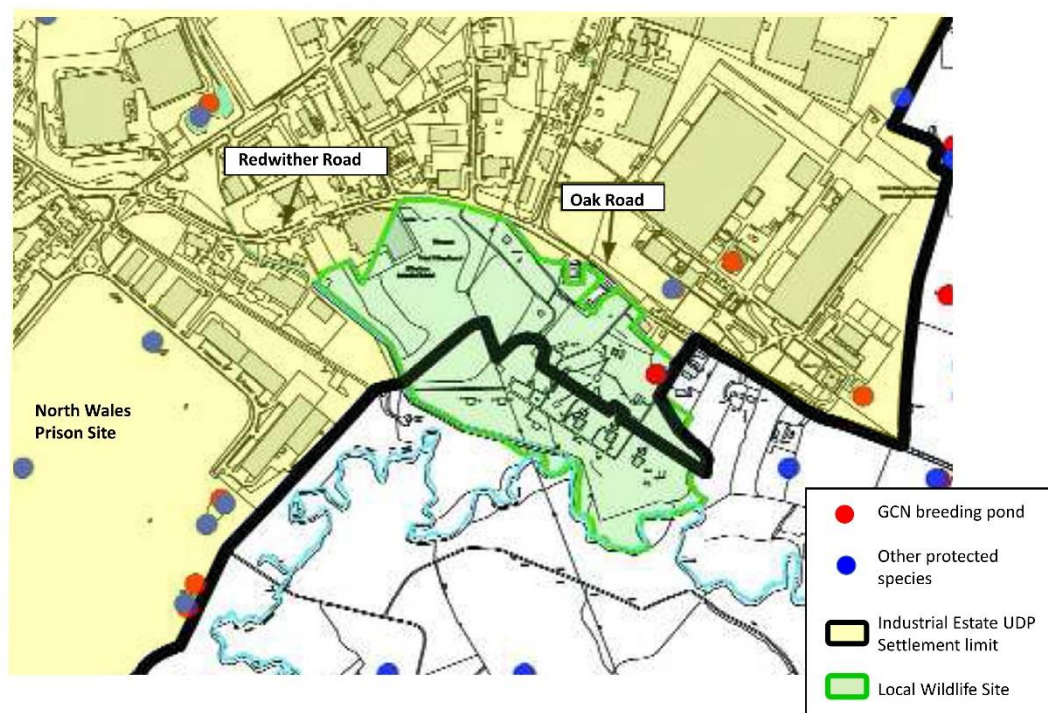


Figure 1.4.2- Wrexham Industrial Estate Settlement Boundary and Oaks Local Wildlife Site extent (taken from Wrexham CBC Local Planning Guidance Note 29)



1.5 Recent Planning History

A planning application to develop roughly 6.5ha area of the site was submitted in November 2019. This application was refused in October 2020.

The reasons identified for the refusal included that:-

1. The proposals would result in the loss of 7 x TPO's oak trees and damage a further two trees.
2. The application was not considered to have demonstrated that it would not be detrimental to great crested newts. It was considered that insufficient information was provided within a Management Plan for the site to demonstrate that the mitigation area can be created, maintained and managed in perpetuity. The application site is a designated Local Wildlife Site. Insufficient
3. information has been submitted to demonstrate that the habitats and species at risk within the site, would be improved, enhanced and managed as part of the development proposal.

With a view to addressing these concerns, the latest development area has been further reduced to avoid impacts to the TPO's trees and the area of proposed habitat mitigation has been increased. With proposed development area comprising of 25% of the site and the remaining 75% to be managed for its nature conservation value and its heritage value.

Furthermore, supplementary information has been provided and further studies have been undertaken. These include:-

- 1) Additional Modelling evidence in respect of potential impacts on great crested newt connectivity and dispersal. This has been reviewed by NRW and deemed to be satisfactory (see Kingdom Ecology Report '*The Oaks, Wrexham Ind Est- Ecology Addendum, GCN Dispersal Corridors, Aug 2020*' (Document Reference KE2020/0301));
- 2) An updated Mitigation Plan which includes the enlarged area of proposed Mitigation habitat; additional detail and consideration of Sustainable Urban Drainage System proposals at the site; provides additional recommendations for habitat enhancement including specific habitat targets and management for invertebrates, plus further detail on monitoring measures (see Kingdom Ecology Report '*Land Oak Road, Wrexham Industrial Estate- Outline Habitat Management Plan April 2021*' (Document Reference K1950.01 Version 5)).
- 3) An updated Heads of Terms agreement has been produced to include the additional areas of habitat and also includes additional clauses to provide reassurance of mitigation habitat delivery with the land to be handed over to an appropriate nature conservation body and with trigger points identified for ownership transfer.

1.6 Evaluation Methodology

The results of the desktop and field surveys are used to identify ecological resources that may be of relevance to the proposals. The CIEEM *Guidelines for Ecological Impact Assessment* (CIEEM, 2006) sets out the recommended approach for valuing ecological resources, and for assessing the effects of proposed activities on them. It suggests that three types of value can be attributed to ecological resources – biodiversity value, community/social value and economic value, and that these should, as far as possible, be considered separately. CIEEM (2006) also advises that legal protection should be considered separately from value, and that the value of an ecological or nature conservation resource should be determined within a defined geographical context; it recommends that the following frame of reference be used:

- International
- UK
- National
- Regional
- County or Metropolitan
- District (or Unitary Authority, City or Borough)
- Local or Parish
- Within zone of influence only (this may be the project site or a larger area)

Designated sites (e.g. SSSIs, SPAs etc.) are generally straightforward to evaluate in relation to this frame of reference. Evaluation of other habitats and species needs to take into consideration a range of criteria, such as their rarity, diversity levels, population sizes and trends, whether they are replaceable or ‘re-creatable’ (for habitats) etc.

Appropriate criteria are proposed and discussed in various documents, such as in *A Nature Conservation Review* (Ratcliffe, 1977)¹, *Guidelines for the selection of biological SSSIs* (JNCC, 1989)², *Local Sites* (Defra, 2006³; Wales Biodiversity Partnership 2008⁴) and also in local and national Biodiversity Plans (BAPs) including Species and Habitat Action Plans (SAPs and HAPs)(see Anon, 1995 for UK BAP)⁵.

Species may be evaluated by reference to their rarity and status in the national or local context. In addition to protected species, rare species, as defined in the Red Data Books/Red Lists/Scarce species lists and in the national and local Biodiversity Action Plans, are recognised to hold value.

Section 7 of the Environment (Wales) Act 2016 requires Welsh Ministers to publish and maintain lists of species and types of habitats in Wales that are regarded as of 'principal importance' for the purpose of maintaining and enhancing biodiversity.

The presence at any proposed development site, of any priority habitat or priority species identified on these lists is of importance within the local authority planning process.

The conservation status of declining British birds has been defined in the *Birds of Conservation Concern Report 2015* (Eaton et al. 2015)⁶; where appropriate, this assigns bird species to the Red or Amber list of birds of either high or medium conservation concern, according to a range of defined criteria.

1.7 Legislative and Policy Context

This report and its recommendations have been produced in accordance with relevant legislation, best practice guidance and local biodiversity targets. They also take into account nature conservation policies within local and regional planning policy documents.

¹ Ratcliffe, D.A. 1977. *A Nature Conservation Review*. Cambridge University Press.

² JNCC, 1989. *Guidelines for the selection of Biological SSSIs*. Nature Conservancy Council, Peterborough.

³ DEFRA 2006. *Local Sites Guidance on their Identification, Selection and Management*

⁴ Wales Biodiversity Partnership (2008) *Guidelines for the Selection of Local Sites in Wales*, <http://www.biodiversitywales.org.uk/>

⁵ Anon, 1995. *Biodiversity: The UK Biodiversity Steering Group Report*. Vol. 2. Action Plans. HMSO.

⁶ Eaton et al (2015) *The Population Status of Birds in the UK, Channel Islands and the Isle of Man*, British Birds

The principal legislation relating to ecological resources that are relevant to this appraisal are as follows:

Conservation of Habitats and Species Regulations (as amended) 2010 - these Regulations implement protection for European protected sites and species, updating and consolidating the Conservation (Natural Habitats &c.) Regulations (as amended) 1994. The level of protection afforded to habitats and species remains the same. The Regulations implement the Council Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (92/43/EEC).

Wildlife and Countryside Act (1981) (as amended) - this Act comprises the principal means of protecting wildlife in the UK and provides the mechanism by which a number of international directives are implemented in the UK.

Countryside and Rights of Way (CROW) Act (2000) - this Act strengthens the Wildlife and Countryside Act in relation to SSSIs and threatened species.

Environment (Wales) Act (2016) - this Act places an obligation on public bodies and statutory undertakers to ensure due regard to the conservation of biodiversity.

Section 7 of that Act includes lists of species and types of habitats in Wales that are regarded as of 'principal importance' for the purpose of maintaining and enhancing biodiversity.

This section of the Act replaces the biodiversity duty originally outlined in Section 42 of the NERC Act 2006.

1.8 Protected Species Legislation

1.8.1 Birds

All wild birds in England and Wales are protected under Section 1 of the Wildlife and Countryside Act 1981 (as amended), which makes it an offence to intentionally kill, injure or take any wild bird, or take, damage or destroy the nest (whilst being built or in use) or its eggs.

1.8.2 Bats

All British bat species are fully protected under the Wildlife and Countryside Act 1981 (as amended) and through their inclusion in Schedule II of the Habitats Regulations 2010 which transpose Annex II of the Council Directive 92/43/EEC 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora ("EC Habitats Directive") which defines European protected species of animals.

British bats species are afforded further protection by the Countryside and Rights of Way Act 2000; and the Natural Environment and Rural Communities Act 2006.

Taken together, this legislation makes it an offence to:

- Intentionally or deliberately kill, injure or capture bats.
- Deliberately disturb bats, whether at roost or not.
- Damage, destroy or obstruct access to bat roosts.
- Possess or transport bats, unless acquired legally.
- Sell, barter or exchange bats.

A bat roost is interpreted as “any structure or place, which any wild bat uses for shelter or protection.” (Bat Conservation Trust 2012⁷). A bat roost is protected whether or not bats are present at the time.

All species of British bat are considered a European Protected Species (EPS). The Conservation of Habitat and Species Regulations (2010) provide derogation against certain offences which could potentially affect an EPS through the EPS Licensing system.

1.8.3 Badger

Badgers are afforded protection under the Protection of Badgers Act (PBA) 1992; this act was introduced on welfare grounds. The Act is based primarily on the need to protect badgers from baiting and deliberate harm or injury. Badgers are not considered to be a species of any conservation concern. However the Act contains restrictions that apply more widely and can have implications where badgers and development come into conflict. All the following are considered criminal offences:

- to wilfully kill, injure, take, possess or cruelly ill-treat a badger;
- to attempt to do so; or
- to intentionally or recklessly interfere with a sett.

Sett interference includes damaging or destroying a sett, obstructing access to a sett, and disturbing a badger whilst it is occupying a sett. It is not illegal, and therefore a licence is not required, to carry out disturbing activities in the vicinity of a sett if no badger is disturbed and the sett is not damaged or obstructed.

1.8.4 Great Crested Newt

The great crested newt (*Triturus cristatus*) receives full protection under the Wildlife and Countryside Act 1981 (as amended) and through their inclusion in Schedule II of the Habitats Regulations 2010. This legislation makes it an offence to:

⁷ Bat Conservation Trust (2012) ‘Bat Surveys: Good Practice Guidelines 2nd Edition’

-
- intentionally kill, injure or take a great crested newt;
 - disturb a great crested newt;
 - intentionally or recklessly damage, destroy, obstruct access to a breeding site or resting place of a great crested newt;
 - sell, offer for sale, possess or transport a great crested newt for the purpose of sale.

The great crested newt is listed as a priority species within the UK Biodiversity Action Plan and under the NERC Act 2006.

2 Desktop Study

2.1 Sources of Information

Ecological information on habitats, species and designated nature conservation sites has been sought from COFNOD who are the local biological records centre for the North Wales Region.

The desk study also examined previous ecological reports for the site describing surveys carried out at the site in 1999 and 2000.

The Environmental Statement for the proposed North Wales Prison on the former Firestone Site was also examined. This site is located approximately 300m west of the study site. The Firestone Site measures approximately 45ha in area. It is a brownfield site supporting a mosaic of scrub and grassland habitats that is of a similar origin to the study site albeit at a much earlier successional stage.

2.2 COFNOD Data

2.2.1 Species

COFNOD holds several records of protected species within 2km of the site including the following:

- Barn owl
- Goshawk
- Common pipistrelle
- Whiskered bat
- Polecat
- Badger
- Otter
- Great crested newt
- Adder
- Slow-worm

COFNOD hold records of badger setts within the southern half of the site. There are no further records of protected species at the site itself however there are several records of dingy and grizzled skipper butterfly at the site. The dingy and grizzled skipper are priority species as listed under Section 42 of the NERC Act.

There are numerous records of great crested newt within 500m of the study site however these are largely located to the north of the site within Wrexham Industrial Estate and on the opposite side of Oak Road. There are records of great crested newt at the former Firestone Site. There is one record from 1992 of great crested newt located within a pond at Lower Oak Farm which lies 180m to the east of the site. This pond no longer exists. Further great crested newt are recorded within ponds located over 500m to the east of the site.

2.2.2 Designated Sites

The study site is designated as a local wildlife site in its entirety and forms part of the wider Wrexham Industrial Estate LWS.

The site is described under the LWS citation as follows:

'The derelict land known as Cefn Park, on the southern edge of the Industrial Estate, consists of a complex mosaic of scrub, grassland and tall herb. Species-rich grassland occurs where there is rabbit grazing with cowslip, restharrow, yellowwort, common centuary and bird'sfoot trefoil. Other species of interest include dyer's greenweed in among scrub and grass vetchling in rank grassland. Worn paths and motorbike tracks criss-cross the site and many species present such as prickly lettuce, smith's pepperwort and bristly ox-tongue typify disturbed ground. A mosaic of woodland and damp grassland occurs adjacent to the River Clywedog. The woodland is dominated by mature hawthorn with alder and crack willow along the river. The ground flora is sparse but dog's mercury, hart's tongue and male fern do occur. Meadowsweet, great willowherb, and canary reed grass occur in the damper patches.'

This citation is based upon field surveys carried out at the site in the late 1990's and so may not be representative of current habitats and species at the site. The extent of the Local Wildlife Site designation is shown in Figure 1.4.2 in Section 1.4 of the report.

No statutory designated sites are located within 2km of the study area itself.

A further two LWS are located within 2km of the site comprising of Peter's Dingle LWS and Cefn Park LWS.

2.3 Previous Survey Information

Young Associates were commissioned to produce an ecological assessment of the site in 1999 on behalf of Cefn Park Developments Ltd. The full report is provided in the Appendix.

In summary the Young Associates assessment included a desk study using data collected by various organisations and individuals; a Phase 1 Habitat survey plus some limited bat, breeding bird, great crested newt and badger surveys.

Habitats at the site have significantly changed since the 1999 surveys with much of the open grassland habitats now succeeding to dense scrub so the findings of these earlier surveys may not be representative of the current site with some of the species identified now potentially absent.

Nevertheless the Young associates report identified the following species and habitats of conservation value.

2.3.1 Habitats

The 1999 survey recorded that the site supports areas of mature woodland to the south of the site with areas of extensive hawthorn scrub. Habitats to the north east and at the centre of the site included areas of species-rich grassland.

2.3.2 Invertebrates

Invertebrate records were provided by a local recorder (Mr. B. Formstone). The records were collected at the site between 1991 and 1998.

The invertebrate records showed that the site supports a range of insect species of conservation interest mainly associated with scrub and grassland habitats at the site.

Invertebrates of note recorded included:

- a colony of grizzled skipper butterfly located in the central and northern part of the site;
- Two species of robber fly that are scarce in North Wales (*Dioctria atricapilla*, and *Leptogaster cylindrica*);
- A Red Data Book Picture-winged fly that has only been recorded in Wales on two other occasions (*Oxyna nebulos*);
- The only record in North East Wales of a species of spider hunting wasp (*Priocnemis exaltata*);
- A notable solitary bee (*Andrena labiata*).

2.3.3 Breeding birds

A single breeding bird survey was carried out at the site in May 1999. 43 species of bird were recorded including 7 warbler species mainly recorded around scrub and grassland/scrub interfaces. The site was considered to have developed high quality habitat for birds.

2.3.4 Badgers

A badger survey of the site recorded no significant badger setts however one active outlier sett, two inactive outlier setts and two day nests were recorded.

2.3.5 Bats

Past occupancy by bats (old bat droppings) were found within two pill boxes at the site. A single male Daubenton's bat was found within a third pill box.

2.3.6 Reptiles and Amphibians

No amphibians were recorded within a water tank at the site or within scattered ephemeral pools or within water tanks within the buildings present.

Several slow worms and a juvenile adder were encountered during field visits to the site.

2.4 Former Firestone Site

2.4.1 Overview of Comparative Adjacent Site

The former Firestone Site located approximately 300m to the west of the study site comprises of the former Firestone Factory which closed down in 1994.

The site was cleared and left undisturbed as brownfield land until works to construct a new prison were started in 2015. The location of the North Wales Prison Site in relation to the Oak Road site is shown in Figure 1.4.2 in Section 1.4 of the report.

The site had developed into a mosaic of species-rich, neutral grassland habitats interspersed with areas of scattered and continuous scrub with further areas of tall ruderal vegetation.

Scrub habitats were beginning to spread across the site and it was likely that with time, the site would have developed to offer similar habitat types as are currently present on the Oak Road site.

A full ecological assessment was carried out as part of the Environmental Statement in support of the North Wales Prison Project (Ministry of Justice, North Wales Prison Project, Wrexham 2012).

Planning permission for the prison site was granted in 2014 and the prison is currently under construction with a view to being fully operational by late 2017. The prison proposals include the retention of an approximate 18.7ha area of scrub and grassland to be managed for its conservation benefit around the southern and eastern edges of the Firestone Site.

The plans for the prison layout along with the extent of the adjacent Ecology Area are shown in Figure 2.4.1 below.

Figure 2.4.1- Prison layout with the extent of the adjacent Ecology Area. Taken from North Wales Prison Environmental Statement (Ministry of Justice, North Wales Prison Project, Wrexham 2012)



2.4.2 Species

A number of surveys were carried out as part of the North Wales Prison environmental assessment including terrestrial invertebrate, reptile, breeding bird, bat, badger, otter and water vole surveys. In summary the Environmental Statement found the following:

- **Terrestrial Invertebrates**- Survey noted six species of principal importance and a number of Red Data Book status. The assemblage as a whole is considered to be of County Importance.
- **Grizzled Skipper**- The Firestone Site is noted as potentially being one of the most important locations for grizzled skipper in Wales
- **Reptiles**- population likely to be limited to a small number of individuals
- **Great Crested Newt**- a low population of great crested newt recorded in two ponds. Individuals likely to be present within terrestrial habitats at the site.
- **Breeding Birds**- diversity of breeding birds listed as BAP Priority species and/ or Red and Amber listed.
- **Bats**- Low level of bat activity on site.
- **Badger**- No badger setts

-
- **Otter-** limited to occasional visits by small numbers of individuals
 - **Water Vole-** no records of presence on site or in surrounding area. Habitats sub-optimal
 - **Hedgehog-** site could support small numbers of individuals.

2.4.3 Prison Site Clearance Works

Whilst the original surveys only recorded a low population of great crested newt within water bodies at the site, works to remove great crested newt during site clearance captured just less than 500 individuals. These newts were moved into the ecology area around the site's southern and western boundaries.

3 Field Survey Methods

3.1 Survey Aims and Objectives

The survey aim was to identify and evaluate habitats and species of conservation importance at the site with a view to identifying any constraints to future development and to identify opportunities for ecological enhancement.

Field surveys comprised of an Extended Phase 1 Habitat survey, reptile surveys, great crested newt surveys, bat surveys, badger surveys, breeding bird surveys, invertebrate surveys and an assessment of other habitats at the site in terms of their suitability to support protected species including a search for evidence of badger activity

Species that are considered highly unlikely to be affected by the proposed development, even if known to be present in the general vicinity, were 'scoped out' of the assessment.

The original field surveys were largely completed in 2016 and 2017. An update ecological walkover survey of the site was completed on the 20th and 22nd March 2019.

3.2 Extended Phase 1 Habitat Survey

3.2.1 Methods

An Extended Phase 1 Habitat Survey of the study site was initially undertaken on the 28th March and the 1st April 2016 with update visits to key habitats carried out June- August 2016. The habitat surveys were undertaken from the various tracks and rides that pass through the site with data supplemented by a drone survey with high resolution photography conducted in July 2016 which allowed assessment of areas of the site dominated by impenetrable thorny scrub.

The 2016 survey was carried out following standard methodologies as described in the '*Handbook for Phase 1 Habitat Survey - a technique for environmental audit*' (JNCC, 2004⁸).

The aims of the Extended Phase 1 Habitat Survey were to:

- identify and map all areas of semi-natural habitat within the study area;
- provide a botanical description of the semi-natural habitats surveyed;

⁸ JNCC (2004) '*Handbook for Phase 1 Habitat Survey - a technique for environmental audit*'

- identify areas or habitats that are of particular ecological interest for nature conservation;
- provide additional information regarding incidental observations of protected species and the potential of habitats to support such species.

A list of plant species recorded has been produced and dominant or notable vascular plant species have been noted for each habitat area in order to characterise habitat types and assess their conservation importance. A habitat map of the site is provided in the Appendix.

3.3 Reptile Survey

3.3.1 Overview

The initial site walkover survey carried out in spring 2016 identified the site as supporting suitable habitat for reptiles with areas of dense scrub and occasional areas of more open habitat providing potential basking sites.

Previous surveys of the site in 1999 recorded slow worm and a juvenile adder during field visits.

Further surveys comprised of artificial refugia searches and visual surveys. Surveys were carried out following methods described in the Herpetofauna Workers' Manual (JNCC, 2003) and Froglife Advice Sheet 10, 'Reptile Surveys' (Froglife 1999).

3.3.2 Artificial Refugia Survey

Reptiles must bask in the morning and evening before becoming active. Artificial refugia surveys take advantage of this need by providing artificial basking and sheltering habitat. The artificial refugia used for this survey comprised of black corrugated and flat roofing sheets measuring 0.5m x 0.5m.

200 artificial refugia were deployed on the 26th April 2016 in suitable locations and habitats across the site. Refugia deployment focusing on the open rides and paths across the site and small patches of open grassland habitats towards the west of the site.

The refugia were allowed to bed down for 1 week before being checked for the presence of reptiles. The refugia survey was carried out between 08:00-11:00 and 16:00-20:00. Survey was carried out throughout the spring and summer 2016.

Survey avoided taking place during wet or windy weather conditions.

3.3.3 Visual Survey

Visual surveys were undertaken in conjunction with and in addition to the artificial refugia checks. These surveys involved slowly walking across the study area during suitable weather conditions and watching for basking reptiles and searching beneath other refugia such as logs, stones, discarded corrugated sheeting etc for sheltering reptiles.

3.3.4 Constraints

Survey was partially constrained by members of the public tampering with the artificial refugia throughout the survey season, either deliberately by throwing the refugia into the adjacent dense scrub habitats or through damaging and displacing the refugia with motor bikes and quad bikes.

Areas of open habitat at the site are limited and so many of the refugia deployed within areas of open habitat had become over shaded by scrub and tall herb by mid-summer and no longer offered suitable basking sites.

It is estimate that by mid-June 75% of the refugia had been displaced or no longer offered suitable basking habitat.

These limitations were addressed by completing additional walkover surveys of suitable open basking sites including areas of open track, bare ground and open grassland throughout the field season and in conjunction with other field surveys at the site.

Six refugia checks were completed before the end of May and before refugia had been significantly depleted (surveys completed on the 3rd, 4th, 5th, 25th, 27th and 28th May).

Further visual checks were completed in conjunction with other field surveys on the 19th May, 18th June, 5th July, 20th July, 10th August, 19th August, 26th August, 7th September, 9th September, 21st September and 2nd October. Survey dates and weather conditions are shown in Table 8.1 in the Appendix.

3.4 Bird Survey

3.4.1 Methods

Bird surveys comprised of three walked transects covering all habitat types at the site. The survey used an adaptation of the Common Birds Census (CBC) methodology (Bibby et al, 1992) as used by the British Trust for Ornithology's (BTO) Common Bird Census. The surveys involved recording all birds observed, their locations and activity/behaviour.

Bird surveys were carried out during the mornings and started within an hour and a half of sunrise. Surveys were carried out under suitable calm, dry weather conditions with unrestricted visibility. Survey dates and weather conditions are shown in Table 8.1 in the Appendix.

The survey consisted of three survey visits during the bird breeding period (mid-March to mid-July) with at least 10 days between each survey visit. Surveys were conducted on the 26th April, 6th May and the 25th May 2016. It was considered that this time frame would ensure that birds that begin breeding early and later in the season would be recorded. Survey data was supplemented by additional bird observations recorded during other ecological surveys undertaken at the site throughout spring/summer 2016.

Transects sampled representative habitats at the site with the aim of assessing all semi-natural habitat within at least 50m of the transect route, depending on habitats present. High-powered binoculars were used to identify bird species.

Observations (of song, call or sighting) were marked on the survey map using British Trust for Ornithology (BTO) two-letter species codes. Following the completion of surveys, the survey maps were analysed and the breeding status of recorded birds was split as follows:

Breeding (B)- This category includes birds confirmed as breeding or considered likely to be breeding at the site. It is assigned through a combination of registrations recorded on two or more survey visits including the following criteria:

- male in song (on the ground or in flight);
- male and/or female calling (on the ground or in flight);
- male and/or female repeatedly calling (on the ground or in flight);
- aggressive encounters between species (including the same species) perceived to be in the defence of territory, nest or young (on the ground or in flight);
- a nest (with or without an adult in attendance) or man-made structure (e.g. nest box) containing either eggs or young;
- adult bird/s carrying nesting material or entering/leaving nesting-site with nesting material;
- adult bird/s carrying food or faecal sack or entering/leaving nesting-site with food or faecal sack; and
- calling and/or silent juveniles with or without parents in attendance.

Possible breeding (P) –A combination of registrations recorded on a single survey visit including the above criteria and the following:

- pair observed in suitable habitat in breeding season; and
- building or excavating a nest site.

Non-breeding (NB) –One or more registration (not including the criteria listed above) recorded on one or more survey visit including the following criteria:

- adult bird/s carrying or foraging for food not presumed to be for young/juveniles; and
- species observed during the breeding season but not in habitat deemed to suitable for nesting.

The conservation status of all species detected was recorded according to their position in the BoCC3 Red and Amber lists, and inclusion in Section 42 of the NERC Act.

3.4.2 Constraints

The recognised survey window for breeding birds is mid-March to mid-June. The first survey visit was not carried out until late April. However had any early breeders nested on site, the first visit would still have been sufficiently early as to have detected their presence. Given this, the delay in commencement of the survey is not considered to have adversely affected the survey results obtained.

3.5 Bat Surveys

The initial site walkover survey carried out in spring 2016 identified the site as supporting suitable habitat for bats with areas of woodland, dense scrub, occasional mature trees, riparian habitats and buildings.

Consequently, further surveys were completed during the 2016 field season comprising of bat activity transects, building roost inspections and bat tree inspections. Buildings and trees were revisited during the update ecological walkover survey completed on the 20th and 22nd March 2019.

The bat activity transects surveys comprised of nine walked activity transects completed May-October 2016. Survey aimed to identify and evaluate bat assemblages present and to assess and evaluate existing habitats in terms of their importance to local bat populations.

The building and tree inspections aimed to assess the suitability of these features to support bat roosts.

3.5.1 Building Bat Inspection

All buildings on site (buildings B1-B10 on Figure 8.2 in the Appendix) were assessed as to their suitability to support bats following standard methodologies prescribed in English Nature's *Bat Mitigation Guidelines* (Mitchell-Jones 2004)⁹ and the Bat Conservation Trust's *Bat Surveys: Good Practice Guidelines* 3rd Edition (BCT 2016)¹⁰.

Survey, comprising of an inspection of the interior and exterior of the buildings, was undertaken during daylight conditions using binoculars, endoscope and a high-powered torch. The survey was undertaken during daylight hours on the 1st April and repeated over several dates in July/August 2016. Buildings were revisited during the update ecological walkover survey completed on the 20th and 22nd March 2019.

In addition to searching for evidence of an actual bat roost the survey also aimed to assess the suitability of the buildings to support bats and consequently the likelihood of a bat roost being present but with no obvious field signs.

Survey assessed the buildings' roost suitability by examining structural features and the surrounding habitat. Structural features that will influence the suitability of a building to support roosting bats include the presence of a roof void; access points into a building including gaps beneath barge boards, gaps under lead flashing, gaps within masonry, loose tiles etc, complexity of any roof void, daytime light levels in roof void etc.

Important habitat features surrounding the structures which could influence roost potential include: whether the structure is in a semi-rural or parkland location, proximity to a significant linear feature (e.g. watercourse, mature hedgerow, wooded lane) or an area of woodland etc.

Taking account of these architectural and habitat features, the buildings were assigned a level of roost suitability based upon professional judgement.

⁹ Mitchell-Jones, A.J. 2004. *Bat Mitigation Guidelines*. English Nature, Peterborough.

¹⁰ Bat Conservation Trust (2016) *Bat surveys – Good Practice Guidelines* 3rd Edition. Bat Conservation Trust, London.

3.5.2 Tree Bat Roost Suitability Surveys

A visual inspection of mature trees located within scrub habitat within the northern half of the site was made to assess their bat roosting potential (Trees T1-T10 shown on Figure 8.2 in the Appendix). The inspection was made from ground level during daylight conditions using binoculars and a high-powered torch to assess the potential of any cracks and holes to support bat roosts, and to search for evidence of bat use such as droppings, scratch marks, staining etc.

In addition to identifying actual bat roosts the surveys also aimed to assess the suitability of the trees to support bats and consequently the likelihood of a bat roost being present that did not exhibit obvious field signs. Roost suitability was assessed by examining structural features and surrounding habitat. Structural features that could influence the suitability of a tree to support roosting bats include:

- frost cracks
- trunk and branch splits
- woodpecker holes
- rot holes where branches have been removed
- hollow sections of trunk, branches and roots
- loose bark
- cavities beneath old root buttresses and coppice stools
- dense ivy
- bat or bird boxes

Important habitat features surrounding individual trees, which could influence roost potential include; whether the trees are in a semi-rural or parkland location, proximity to a significant linear feature (e.g. watercourse, mature hedgerow, wooded lane) or proximity to known bat roosts etc.

Taking account of these structural and habitat features, trees were assigned a level of roost suitability based upon professional judgement.

Surveys were undertaken on July/August 2016 and repeated in March 2019.

3.5.3 Bat Activity Transects

The survey objectives were to identify and evaluate bat foraging and commuting habitat at the site and to identify and evaluate bat species assemblages present.

Surveys were based upon recommendations provided in the Bat Conservation Trust's *Bat Surveys: Good Practice Guidelines* 3rd Edition (BCT 2016)¹¹.

Transect Methodology

Bat activity transect surveys were targeted at identifying the type and intensity of bat activity, both spatially and temporally, as well as the bat species present. The survey also aimed to assess the relative abundance of species present and the importance of different habitat features/areas.

Surveys were carried out along a pre-determined transect route, devised to encompass a wide range of habitats within the assessment area including grassland, hawthorn scrub, woodland, bramble scrub, tall herb, ponds and riparian habitats.

Transects were interspaced by thirteen 'listening station' stops or 'point counts', where the surveyor would pause for five minutes to record levels of bat activity, including the number and species of bat, number of bat passes (discrete bursts of echolocation) of each species, and activity types i.e. commuting, foraging and/or social calling. An average of the number of the number of bat passes at each point count location was taken for the entire survey period to produce an index of activity. Where constant bat activity was recorded at a point count location, 20 bat passes were attributed. The bat activity index was scored as follows:

- 0.1-3 passes- Low bat activity
- 3.1-7 passes- Moderate bat activity
- 7.1-12 passes- High bat activity
- 12.1-20 passes- Very high bat activity

Information on incidental bat activity and species encountered were also target noted when walking between point counts, including direction of bat travel and bat use of features in the landscape.

Notes on weather conditions and survey times were also recorded. Surveys were undertaken during suitable weather conditions i.e. >8°C with minimal rainfall and wind.

¹¹ Bat Conservation Trust (2016) Bat surveys – Good Practice Guidelines 3rd Edition. Bat Conservation Trust, London.

Surveys were carried out using heterodyne and time expansion bat detector (Anabat Walkabout) combined with an Anabat Express frequency division bat detector to record calls in real time in a zero crossing format to permit further call analysis with AnalookW software.

Eight dusk transects were walked in total on the 5th and 17th May, 30th June, 12th July, 2nd August, 27th August, 7th September and 2nd October 2016. One dawn transect was also walked on the 6th May 2016. This level of survey effort allowed full assessment of the site across the main bat activity season.

Dusk transect surveys commenced within 10 minutes of sunset and ended approximately two hours after thus coinciding with the peak periods of bat activity.

The dawn transect survey started two hours and fifteen minutes before sunrise and continued until ten minutes after sunrise.

The transect route followed a figure of eight pattern taking in all habitat types at the site. Point Count 1 and Point Count 13 are at the same location allowing sampling of this area at both the start and end of survey.

3.5.4 Evaluation of Bat Habitats

Using the activity survey results, the site was assessed in terms of its value as foraging and commuting habitat for bats.

The process for determining this evaluation is based upon a scoring system presented at the Mammal Society/CIEEM *Advances in Ecological Impact Assessment for Mammals Symposium* 2007 (Wray *et al.* unpublished).

This scoring system assesses the following factors when determining the value of a site for bats:-

- Rarity of species present
- Numbers of bats of each species encountered
- Presence of roosts nearby
- Landscape characteristics

Each of these factors is examined and allocated a 'point score'. The points are then totalled to produce a value for the site based upon the CIEEM *Guidelines for Ecological Impact Assessment* geographical frames of reference as described in Section 1.4 and shown in Table 3.1 below.

Table 3.1 - Bat habitat evaluation - assessment score in relation to ecological evaluation category

Score	Evaluation Category
0-10	Site only
11-20	Locally important
21-30	Important at District Level
31-40	Important at County Level
41-50	Regionally important
>50	Nationally/internationally important

Each individual factor is determined and scored as follows:-

Rarity of Species

The rarity of each species encountered on site is determined using the JNCC's UK Mammals: Species *Status and Population Trends* (Battersby 2005¹²). This document provides an estimate of population number, rarity and conservation status in Wales and the rest of the UK.

- Common species (population over 100,000) include: common pipistrelle, soprano pipistrelle, brown long-eared, Natterer's and Daubenton's bat.
- Rarer species (population between 10,000-100,000) include:, lesser horseshoe, whiskered, Brandt's, Leisler's and noctule bat
- Rarest species (population less than 10,000) include: Nathusius' pipistrelle, greater horseshoe, barbastelle, Bechstein's and serotine bat.

Scores are attributed as follows:

- Common species – 2 points
- Rarer species – 5 points
- Rarest – 20 points

¹² Battersby, J. (Ed) & Tracking Mammals Partnership. 2005. *UK Mammals: Species Status and Population Trends. First Report by the Tracking Mammals Partnership*. JNCC/Tracking Mammals Partnership, Peterborough.

The presence of bat species at the site is determined from the evening activity surveys.

Number of bats encountered

Across the three activity surveys, the highest numbers of bats recorded is used to determine the points score for the 'number of bats encountered'.

- Individual bats – 2 points
- Small numbers – 5 points
- Moderate numbers – 10 points
- Large numbers – 20 points

The number of bats present at the site is determined through the evening activity surveys.

Proximity of roosts/potential roosts

The score for the proximity of actual or potential roosts is determined as follows:-

- No roosts or suitable roosting habitat – 1 point
- Small number of roosts– 3 points
- Moderate number of roosts/unknown number of roosts- 4 points
- Large number of roosts or close to SSSI for species- 5 points
- Close to SAC for species- 20 points

Habitat Characteristics

Habitat at the study site is assessed and scored with regards to suitability for foraging or commuting bats. This assessment takes account of likely aerial insect densities, connectivity of habitats, diversity of habitats available and suitability of foraging habitat.

Where habitats do not fit in to the descriptions below, a score has been attributed based upon professional judgement. Scores are calculated as follows:-

- Limited suitable habitat e.g. industrial landscape or new housing estate with no established planting – 1 point
- Low value suitable habitat e.g. suburban or intensive agricultural landscape – 2 points
- Moderate value suitable habitat e.g. isolated patches of woodland within less intensive agricultural landscape- 3 points
- High value suitable habitat e.g. mixed agricultural landscape with small patches of woodland – 4 points
- Very high value suitable habitat e.g. complex mosaic – 5 points

3.6 Great Crested Newt

3.6.1 Habitat Suitability Index Assessment

Four ponds were identified within the study site from ordnance survey maps, aerial photography and the site walkover (Ponds 1-4 on Figures 8.1 & 8.3).

In terms of other ponds located within 500m of the study site, one pond is located 125m to the north of the site on the opposite side of Oak Road and within an adjacent industrial estate (Pond 5 on Figure 8.3).

A further pond is located approximately 425m to the southwest of the site within the adjacent former Firestone Site (Pond 6 on Figure 8.3). Great crested newt have been recorded in both of these off-site ponds.

The four ponds located within the study site were visited during 2016 Extended Phase 1 Habitat Surveys and were re-visited during the march 2019 ecology walkover survey. The ponds were assessed as to their suitability to support great crested newt by assessing habitats present. This assessment followed the Habitat Suitability Index (HSI) Guidelines as produced by the National Amphibian and Reptile Recording Scheme (NARRS 2008¹³) which in turn are based on a paper produced by Oldham et al. (2000¹⁴). The HSI examines ten key habitat features of a site in order to produce a numerical score of between 0 and 1. This score signifies the suitability of a pond as defined in Table 3.2.

The habitat features evaluated/measured to obtain the habitat suitability index are as follows: -

- Geographic location,
- Pond area,
- Pond permanence,
- Water quality,
- Pond shading,
- Number of waterfowl,
- Occurrence of fish,
- Pond density,
- Terrestrial habitat,
- Macrophyte cover.

¹³ NARRS (2008) 'Great Crested Newt Habitat Suitability Index'

¹⁴ Oldham R.S et al (2000) 'Evaluating the suitability of habitat of the Great Crested Newt (*Triturus cristatus*)'. Herpetological Journal 10 (4), 142-155

Table 3.2- HSI Score Categories

<i>HSI</i>	<i>Pond Suitability</i>
<0.5	Poor
0.5-0.59	Below Average
0.6-0.69	Average
0.7-0.79	Above Average
>0.8	Excellent

3.6.2 Presence/absence eDNA Survey

The eDNA sampling method requires the collection of water samples which are sent to a laboratory for analysis.

This technique aims to detect DNA that is present in the environment in which an animal lives. Great crested newt DNA can enter ponds via their urine, faeces, skin cells etc. Natural Resources Wales accepts eDNA test results as evidence of presence or absence of great crested newt.

The survey was undertaken on 3rd May 2016 by Richard Roe, a licensed great crested newt worker.

The survey was carried out following the protocol recommended by Natural Resources Wales¹⁵. In summary, this involved taking 20 water samples from around the waterbody's margins using a sample kit provided by Surescreen Scientifics. The location of sub-samples was spaced evenly around the waterbody's margins and targeted areas where there is vegetation suitable for use as egg laying material but avoiding areas less than 50 - 100mm deep.

Before each sample was taken, the water column was mixed gently to maximise the chances of detecting GCN eDNA. Once all the samples had been collected, they were vigorously shaken for ten seconds in a whirl

¹⁵ Biggs J et al (2014). Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (*Triturus cristatus*) environmental DNA. Freshwater Habitats Trust, Oxford

bag to ensure any eDNA was mixed across the whole water sample. A pipette was then used to add water samples to sterile tubes containing ethanol to preserve any eDNA present. Each tube was then mixed for a further ten seconds to prevent eDNA degradation. Preserved samples were then stored at a cool ambient temperature before being returned to Surescreen Scientifics on the 4th May 2016 for analysis.

Surveyed Ponds

Four ponds are located within the study site (Ponds 1-4 on Figure 8.3). Ponds 5 and 6 which are located beyond the site boundary but within 500m, were excluded from further assessment as they are already known to support great crested newt. Populations within these ponds are likely to form part of the wider Wrexham Industrial Estate Great Crested Newt metapopulation.

Pond 2 was assessed as being unsuitable for great crested newt and unsuitable for survey (the pond is very shallow and so cannot be bottle trapped or eDNA surveyed, the pond was found to be dry by mid-summer). This pond was found to completely dry by the March 2019 walkover survey.

Ponds 1 and 3 were further assessed for great crested newt presence or absence using eDNA sampling techniques in Spring 2016. Pond 1 was found to be dry by March 2019. No great crested newt were recorded within this pond.

Pond 4 was not identified until August 2016 following the completion of an aerial drone survey which provided up to date aerial photography of the site. The pond is located within dense, impenetrable thorn scrub. A route was cut through to the pond in April 2017 and an eDNA presence/absence survey was completed on the 17th April 2019 with the aid of a 4m fishing pole. The results came back positive for GCN.

It was not possible to complete further bottle trapping, torch counts or egg searches at Pond 4. The pond itself is very deep with relatively sheer sides. The edges of the pond either comprise of dense, impenetrable thorn scrub or unstable piles of rubble. To access the pond, a surveyor must either climb over and down the rubble or climb through the thorn scrub. It was not considered safe to carry out further surveys of this pond. The pond cannot be torched as the pond surface is covered with duckweed.

3.7 Badger Surveys

Field signs indicative of badger activity (prints, latrines, setts foraging signs etc) were recorded during the various surveys completed at the site.

Given the dense thorn scrub present across the majority of the site, it was not possible to complete a full search of all habitats present. A search for badger setts was carried out from the various tracks and paths through the site, with the surveyor searching for evidence of spoil heaps or badger paths passing into the dense scrub.

3.8 Invertebrate Survey

3.8.1 Methods

Invertebrate surveys have been undertaken at the site. The full invertebrate survey report with methods, results and analysis is provided in the Appendix.

In summary, the aim of the survey was to examine and determine the value of the areas of the site that were most likely to support scarce invertebrates or rich assemblages.

The methods used for the assessment are those recommended in the Natural England guidance document '*Surveying terrestrial and freshwater invertebrates for conservation evaluation*' (2007)¹⁶. In some instances the method has been made bespoke for the site assessment but still retains the overall approach to assessing features and habitats for conservation assessment.

Collection methods used comprised of:

Sweep netting

This method provides the main proportion of the survey element, and is the most efficient method of cataloguing a site's invertebrate resource.

Spot sampling

Spot sampling is employed to collect large, conspicuous invertebrates such as bees and wasps from flowering plants and to supplement the sweep samples. Spot sampling is often the most effective method of recording species from high-fidelity niches.

¹⁶ Drake, C.M. et al. (2007) NERR005. *Surveying terrestrial and freshwater invertebrates for conservation evaluation*. Natural England.

Grubbing

Fallen deadwood, piles of rotting timber (for deadwood beetles) and short turf (for surface running beetles) are fingertip searched for any hiding or crawling invertebrates, principally beetles.

Beating

The woodland trees were beaten for arboreal beetles and bugs. The beating dislodges any individuals from overhanging branches on to a clean, white sheet from which the specimens can be examined.

Collected specimens were identified in the laboratory with species data analysed using the ISIS software package. The analysis of data can help assess the quality of habitats and features recorded on a site. This is a particularly useful tool for identifying key areas of interest and for monitoring site changes associated with habitat management. Full details of the ISIS analysis tool is provided in the Appendix.

3.8.2 Survey timing

The site was visited on five optimal dates:

- 19/05/16 - sunny 16°C (targeting grizzled skipper)
- 28/05/16 - sunny 18+°C (targeting grizzled and dingy skipper)
- 18/06/16 - light cloud and sun 16-21°C (targeting dingy skipper)
- 05/07/16 - high cloud 16-19°C
- 10/08/16 - sun and cloud 15-18°C

4 Habitats and Flora

4.1 Overview

The study site measures approximately 21.5ha in total. It is bounded by Oak Road along its northern boundary and by Redwither Brook and the River Clywedog on its southern boundary. Land use to the east and south of the site comprises of agricultural land; whilst land uses to the north and west comprise of industrial units associated with Wrexham Industrial Estate. Similar early successional brownfield land is located approximately 300m to the west of the site. This land forms part of a habitat conservation area associated with the new North Wales Prison.

The Oak Road site comprises of part of the former Wrexham Royal Ordnance Factory which produced cordite for artillery shells during World War II. The site closed down in 1945 and was largely abandoned.

Some reclamation including demolition of some ordnance factory buildings and re-grading of part of the site was carried out in the 1970's. Further scrub clearance was carried out within the northern and western part of the sites in the mid-2000's.

Other than these actions the site has been left relatively undisturbed and has developed into a mosaic of woodland and scrub habitats at various successional stages. Several of the former ordnance factory buildings remain standing. These are largely located around the eastern and southern half of the site.

The topography around the main complex of buildings is undulating with various short steep embankments. These are associated with the former ordnance factory and were put in place to protect buildings at the site from bomb blasts.

The site is regularly used informally by members of the public for dog walking, mountain biking, airsoft, walking, quad-biking, motor biking, 4x4 off-roading and for horse riding. Consequently, the site is criss-crossed by various tracks, rides and trails. In early 2019, new tracks and trails were cut through the thorn scrub to provide access for geotechnical surveys. In March 2019, the tracks comprised of bare mud.

Hardstanding tracks and former railway lines associated with the ordnance factory are still present providing further thorough-fares through the site.

A habitat map of the site is shown on Figure 8.1 in the Appendix. Photographs showing typical habitat at the site are also given in the Appendix.

4.2 Habitat Descriptions

The site comprises of various woodland, scrub and grassland habitats at various stages of succession.

The northern and western half of the site have undergone scrub clearance in the 1970's and in the 2000's. These areas have since been left relatively undisturbed and left to naturally regenerate. These areas previously supported some large areas of open, unimproved grassland habitat in the early 2000's and also likely following scrub clearance in the mid-2000's. However, the site now largely comprises of dense, continuous hawthorn scrub. The scrub habitat has invaded the previous grassland habitats with no large areas of open grassland identified during the 2016 field surveys.

Within the wider area of dense, thorny scrub are some small glades of flower-rich, short sward grassland along with ribbons of further flower-rich grassland along the various bike and off-roading tracks. Interspersed amongst these areas are patches of bramble underscrub and taller swards of coarser grasses. These habitats provide a mosaic of grassland habitats at various successional stages.

Habitats at the site are considered to be relatively dynamic. By the time of the 2019 surveys, the extent of thorn scrub had increased with hawthorn, blackthorn, bramble and rose beginning to encroach upon and close over parts of the open tracks identified in 2016.

Habitats within the southern half of the site have been largely left undisturbed since the closure of the munitions factory in 1945. The southern half of the site now supports various types of broadleaved woodland habitat.

Habitats recorded are shown on Figure 8.1 in the Appendix.

4.2.1 Woodland Habitats

The woodland comprises of two broad habitat types with mature riparian woodland along the edge of the River Clywedog and much younger hawthorn woodland located within the northern half of the woodland block.

Woodland habitats along Redwither Brook and along the River Clywedog include mature crack willow and alder with occasional open patches of tall herb vegetation with extensive stands of Himalayan balsam (TNs 6,7 and 8 on Figure 8.1) plus frequent great willowherb, meadowsweet, creeping thistle, hogweed, nettle, bramble, great burdock, teasel, mugwort, Yorkshire fog and creeping buttercup. There is a small stand of Japanese knotweed located near Redwither Brook at the eastern end of the site (TN9).

At the southern end of the site and adjacent to the River Clywedog is an area of mixed deciduous woodland with mature oak, sycamore, ash, birch, alder, willow and hawthorn (TN10).

These older stands of woodland support patches of dog's mercury, ramsons, cowslip, lords and ladies and lesser celandine.

The northern edge of the woodland block comprises of tall (approximately 6m) hawthorn woodland with a dense understorey of bramble and dog rose. There are occasional blocks of birch and elder scattered within the surrounding hawthorn dominated woodland.

There are occasional patches where bramble underscrub is thinner or has died back. These open patches support a more varied ground flora with occasional ground ivy, lord's-and-ladies, nettles, mosses, ramsons, cowslip, lesser celandine and dog's mercury. There are also frequent areas of bare ground where the soil within this more open woodland has been churned up by motorbikes.

Parts of the northern woodland edge habitats support flushes of common spotted orchid in the early summer (TN11).

4.2.2 Scrub Habitats

To the north of the woodland block, the remainder of the site is principally covered by dense, continuous thorny scrub which mainly comprises of hawthorn with stands of blackthorn plus occasional elder, goat willow, alder, sycamore, ash, damson and oak. The scrub habitat ranges in height from 2m to over 5m.

The scrub supports scrambling plants with frequent bramble, dog rose, nettle, ivy and patches of traveller's joy and hedge bindweed.

The dense canopy of the scrub creates heavy shade over the field layer and consequently this is rather impoverished. However, around the edges of the scrub areas, where they join the various track and rides through the site, it supports occasional fringes of dog's mercury with lords and ladies, crosswort, lesser celandine, ground ivy and cowslip during the spring. Whilst later in the summer, scrub edge habitats support a more varied herb layer with occasional or rare rosebay willow-herb, great willow-herb, agrimony, perforate St. John's wort, imperforate St John's wort, bristly ox-tongue, common toadflax, common knapweed, ox-eye daisy, creeping buttercup, ribwort plantain, hogweed, teasel, silverweed, hoary ragwort, selfheal, tufted vetch, red clover and black medick.

Interspersed around the dense hawthorn scrub are patches of bramble underscrub which comprises of abundant bramble with frequent nettle, Yorkshire fog and red fescue with occasional hedge bindweed, great burdock, cleavers, cow parsley, great willowherb, false oat-grass, rough chervil, meadow vetchling, wild carrot, teasel, hogweed, black knapweed, creeping thistle, agrimony, meadowsweet, tufted vetch, crosswort, meadow fescue, meadow fox-tail, common couch and cock's-foot with scattered patches of invading hawthorn.

4.2.3 Neutral Unimproved Grassland

The site has various paths and trackways passing through the areas of scrub. Some of these tracks are of hardstanding and formed part of the infrastructure of the previous munitions factory. Other tracks have been formed informally through use of the site by motor bikes, 4x4s, quad bikes etc. The more frequently used tracks comprise of bare ground whilst some of the less frequently used have developed into areas of unimproved neutral grassland where the trampling effect of human activity has restricted the encroachment of scrub. These areas of grassland are then in turn grazed by rabbit maintaining a relatively short sward. There are some larger glade type areas near the southern end of the site where tracks have intersected and areas of trampled vegetation is more extensive. These have created three areas of open grassland habitat each measuring approximately 500m² in area (TNs 12, 13 and 14). Historic aerial imagery of the site shows that these habitats have developed within areas which have previously been worn down to bare ground through off-road use.

The grassland areas comprise of frequent annual meadow-grass, red fescue and Yorkshire fog with occasional glaucous sedge, perennial ryegrass, common bent, crested dog's-tail, hard rush and sweet vernal-grass. Herbs present include frequent common knapweed, black medick, creeping cinquefoil, ox-eye daisy, red bartsia, ribwort plantain, selfheal, agrimony, bird's-foot trefoil, common centaury, perforate St. John's wort, red clover and white clover with occasional bristly ox-tongue, imperforate St. John's wort, meadow buttercup, common ragwort, creeping buttercup, daisy, meadowsweet, pignut, ribbed melilot, scarlet pimpernel, silverweed, meadow vetchling and yarrow with rare bramble, common fleabane, common mouse-ear, cow parsley, creeping bent, creeping thistle, curled dock, dandelion, dog rose, dyer's greenweed, false oat-grass, greater plantain, hawthorn, meadow fescue, meadow foxtail, pepper saxifrage, scented mayweed, smooth meadow-grass, smooth tare, tufted hair-grass, teasel, yellow-wort, common dog-violet, cuckoo flower, common spotted-orchid, field wood-rush and cowslip.

As the season progressed, the tracks towards the southern end of the site developed tall stands of herb dominated by localised stands of ribbed melilot with great burdock and common knapweed (TN15).

Without continued management of the site (either formal or informal through continued use of the bike tracks) it is likely that these grassland habitats will succeed to bramble underscrub and ultimately to further dense hawthorn scrub.

As stated previously, by March 2019, the extent of thorn scrub at the site had increased with hawthorn, blackthorn, bramble and rose beginning to encroach upon and close over parts of the open tracks identified in 2016.

4.2.4 Other Features

There are a number of mature pendunculate oak trees scattered around the site.

There are numerous large log piles scattered around the site. These are likely to be attributable to the previous scrub clearance carried out in the mid-2000s. The log piles principally comprise of hawthorn brash.

There are also frequent rubble piles associated with previous clearance of buildings at the site carried out in the 1970's.

Two permanent ponds (Ponds 3 and 4) were identified at the site (these are described in Section 5.4).

Ponds 1 and 2 are ponds within shallow hollows. These were found to be dry during the march 2019 walkover assessment.

Several other small ephemeral pools are also present within wheel ruts and various shallow hollows. These small pools were found to largely be dried up by June/July.

4.2.5 Evaluation

The site has clearly been of some nature conservation in the recent past hence its designation as a local wildlife site. However, neglect and an absence of management has resulted in the site developing from a botanically interesting mosaic of species-rich grassland with patches of rank grasses and scattered scrub to being almost completely overrun by floristically less-interesting, dense hawthorn scrub.

Some small remnants of species-rich grassland are maintained at the site through intermittent use by motorbikes, quad bikes and 4x4s whereby trampling effects have restricted the encroachment of scrub. These areas of grassland are then in turn grazed by rabbit maintaining a relatively short, flower-rich sward. These areas of grassland support a diverse albeit small community of neutral grassland species with species of note including yellow-wort and pepper saxifrage. These two species are listed as 'contributory species' for local wildlife site designation in the Wales Biodiversity Partnership's 'Guidelines for the Selection of Local Sites in Wales'¹⁷

It was noted that the small areas of rank grassland and bramble scrub at the site are also relatively species rich, maintaining some plant species that are present within the more interesting grassland habitats.

¹⁷ Wales Biodiversity Partnership (2008) Guidelines for the Selection of Local Sites in Wales, <http://www.biodiversitywales.org.uk/>

It is therefore likely that negative effects of scrub encroachment could be reversed through scrub clearance and management as the soils are likely to still retain a diverse seed bank appropriate for the restoration of neutral grassland habitats.

Other botanical features of biodiversity interest include the individual mature oak trees scattered around the site and the areas of mature woodland near the southern boundary of the site.

Although, botanically less interesting and relatively common, the continuous scrub habitat is also of some biodiversity interest as it provides one of the larger areas of this habitat type in the county.

The site is likely to act as a wildlife corridor providing a continuous stretch of relatively little disturbed and sheltered habitat. The site is also well linked to the wider landscape by the Redwither Brook and the River Clywedog riparian corridors.

In terms of its botanical value and the habitats present, the site is currently considered to be of **District** importance.

However, considering the relatively recent degradation of grassland habitats and the likely viability of the existing seed bank, it is considered that sensitive management of the site could successfully extend the remnant grasslands to cover a greater proportion of the site, creating a much more ecologically valuable landscape.

The 2019 walkover survey found the site to be more-or-less the same as previously recorded in 2016. However, some previous off-road tracks were beginning to become enclosed by encroaching thorn scrub whilst some new trackways had been recently cut through the scrub to provide access for geotechnical surveys. These new trackways currently comprise of just bare ground however it will be interesting to monitor whether more botanically interesting habitats develop along these new tracks.

5 Protected Species and Fauna

5.1 Reptile Survey

5.1.1 Results

Six refugia checks were completed before the end of May and before refugia had been significantly depleted (3rd, 4th, 5th, 25th, 27th and 28th May 2016).

Further visual checks were completed in conjunction with other field surveys on the 19th May, 18th June, 5th July, 20th July, 10th August, 19th August, 26th August, 7th September, 9th September, 21st September and 2nd October 2016.

Survey was carried out in dry and calm conditions with the majority of the surveys conducted on days with some sun. No reptiles were recorded at the site whatsoever. Occasional common toad were recorded under artificial refugia near the northwest corner of the site.

Weather conditions during survey are provided in Table 8.1 in the Appendix.

5.1.2 Evaluation

Surveys recorded no reptiles at the site despite extensive survey effort.

Surveys at the adjacent former Firestone Factory recorded small numbers of grass snake however this site is more open and also wetter than the Oaks Site offering more suitable basking and foraging opportunities for grass snake.

Surveys at the Oaks Site, carried out in 1999/2000, recorded several slow worms and a juvenile adder. However, at the time, the site was much more open, with extensive areas of grassland offering good basking habitat. The encroaching scrub has effectively covered the majority of the site in dense, closed canopy woodland.

The Oaks Site supports suitable reptile hibernation sites within piles of brash and rubble and supports good foraging habitats within bramble underscrub. However, the dense hawthorn scrub and woodland habitat that covers the majority of the site is likely to restrict basking opportunities with areas of open habitat confined to the three small glades near the south west corner (TNs 12-14 on Figure 8.1) and the hardstanding tracks that run through the centre and north of the site (TN1 and TN16).

It is considered that the site could be enhanced for reptiles, potentially allowing them to recolonise the site, through the creation of further open grassland glades and by widening the grassland rides to allow more light and provide more extensive basking opportunities.

Taking account of the survey results, the presence of some marginal value reptile habitat, the historic presence of reptiles at the site and the presence of reptiles within the wider landscape, it is considered unlikely that reptiles are completely absent however they are only likely to be present in low numbers which has resulted in them going undetected during survey.

Reptiles populations at the site are currently considered to be **site only** importance.

5.2 Breeding Birds

5.2.1 Overview

Surveys were undertaken on the 26th April, 6th May and 25th May 2016. All surveys were commenced within an hour and half of sunrise and completed within four hours of sunrise. Weather conditions during all surveys were dry with no more than a light breeze.

In total 40 bird species were recorded during survey. This total includes incidental records of tawny owl, kestrel and linnet which were not recorded during breeding bird surveys (linnet were recorded at the site in late summer).

Habitats at the study site can be divided into two broad habitat types- hawthorn/bramble scrub at the north and west of the site and broadleaved woodland towards the south and east of the site. The areas of open grassland habitat are considered too small to represent a discreet separate bird habitat and are included with the scrub habitat type. Redwither Brook and the River Clywedog flow along the southern boundary of the site.

A full list of bird species encountered with breeding and conservation status is presented in Table 8.2 in the Appendix. Figure 8.4 in the Appendix shows the approximate location of assumed bird territories overlaid on a Habitat map for the site. Territory location is based upon where 'possible breeding' or 'breeding' birds were encountered across the three surveys.

5.2.2 Breeding status

Following survey, 16 species (40%) are categorised as 'breeding' at the site, 15 (37.5%) are categorised as 'possible breeding species' and 8 species (21.5%) are not considered to be breeding on site. The non-breeding birds mainly comprise of colonially nesting birds and birds requiring suitable buildings in which to nest including swallows and swift- no such nesting sites were identified during internal checks of buildings.

5.2.3 Conservation Status

Details of the conservation status of individual birds recorded are given in Table 8.2 and summarised as follows:-

- 3 red list species were recorded on site (Song thrush, linnet, starling)
- 8 amber listed species were recorded on site (willow warbler, kestrel, mallard, dunnock, bullfinch, herring gull, tree creeper, swift and tawny owl)
- No Schedule 1 Wildlife and Countryside Act Species were recorded.
- Section 42 species recorded at the site include linnet, kestrel, herring gull, dunnock, bullfinch, starling and song thrush.

5.2.4 Evaluation

The extensive hawthorn scrub habitat is considered to be the feature of greatest value at the site for breeding birds. The scrub habitat provides shelter and nesting habitat and is also likely to provide a good food resource during the spring breeding season, when the hawthorn and blackthorn is in bloom and likely to attract high densities of nectar feeding insects.

The suitability of the scrub habitat is demonstrated by the survey results which recorded high densities of song birds at the site, particularly warbler species with 7 species recorded in total comprising of chiffchaff, blackcap, garden warbler, whitethroat, lesser whitethroat, sedge warbler and willow warbler. It was noted during survey that the site supports particularly high numbers of willow warbler and chiffchaff. There are also recent reports of Savi's warbler recorded calling along Redwither Brook, at the southern boundary of the site in Spring 2018.

Although the site was found to support good numbers of individual birds, the bird species recorded are considered to be relatively common.

Several species recorded at the site, although relatively common, are considered to be species whose populations are in decline and are so are listed as either red or amber species on the list of Birds of Conservation Concern¹⁸

¹⁸ Eaton *et al* (2015) *The Population Status of Birds in the UK, Channel Islands and the Isle of Man*, British Birds

Bird species of conservation concern recorded within the scrub habitats included song thrush (with four singing males recorded throughout the site on the second and third visits); willow warbler (which was recorded in good numbers at the site with at least 9 signing males); bullfinch (three pairs were recorded on the first and second surveys); and dunnock (which was recorded singing and calling throughout the site). Song thrush is a red list species of conservation concern, dunnock and willow warbler are amber list species of conservation concern. Song thrush, dunnock and bullfinch are listed under Section 42 of the NERC (2006) Act.

The more mature woodland at the south of the site, recorded similar species to the dense hawthorn scrub but with fewer numbers of individual birds. Song thrush, bullfinch, dunnock and willow warbler were also recorded in this area along with tree creeper, another amber list species of conservation concern.

Notable bird species recorded at the site during other ecological surveys include tawny owl (which was recorded on several occasions near the site boundary at Redwither Brook during bat surveys) and linnet (a party of linnet were recorded in August and September within scrub habitats at the site). Linnet are a red list species of conservation concern. Tawny owl is an amber list species of conservation concern.

Mallard, an amber list species of conservation concern, were recorded roosting at the site within Pond 3 during bat surveys but are considered unlikely to be breeding.

Kestrel, an amber list species of conservation concern, were recorded overflying the site but are considered unlikely to be breeding.

Outside of the breeding season, the site is likely to provide an important autumn and winter foraging resource to frugivorous birds with extensive foraging opportunities offered by the fruiting hawthorn, blackthorn and bramble scrub at the site.

Given the relatively high numbers of individual birds recorded at the site, albeit of relatively common species, the site is considered to be of **local** conservation importance for breeding birds.

5.3 Bats

5.3.1 Bat Tree Roost Assessment

The bat tree assessment focused on mature oak trees scattered around the northern and western half of the site (Trees 1-10 on Figure 8.2).

Further mature trees including mature ash, poplar, oak and crack willow are located within woodland located on the River Clywedog. This area is likely to support suitable bat roosting trees however, this part of the site would be very unlikely to be affected by any potential future development of the site.

In summary, no moderate or high value potential bat roosting features were identified associated with the scattered oak trees. Low potential bat roosting features were identified within areas of lifting bark, minor dead wood and snag ends associated with five of the trees (T1, T2, T7, T8 and T9).

T10 supports further low suitability bat roosting features. The tree also supports a cavity relatively low down the tree's trunk (at a height of 1-2m). The cavity is within a north facing tree wound which runs longitudinally up the trunk of the tree. A honey bee colony was present within the cavity during the 2019 survey- the cavity is therefore considered to currently be unsuitable for roosting bats. The cavity would offer suitable roosting habitat when the bees are not present however it is not ideal owing to its relatively low height.

Given the trees' relatively low suitability for roosting bats no further nocturnal surveys or roped tree inspections were carried out.

No field signs indicative of roosting bats were found during the 2016 or 2019 surveys.

The locations of the trees are shown on Figure 8.2 in the Appendix.

Tree descriptions are provided in Table 8.3 the Appendix.

5.3.2 Bat Building Assessment

There are numerous former munitions factory buildings scattered around the site. Twenty-three buildings were encountered during the walkover survey. The buildings are all brick-built, single storey structures with flat, concrete beamed roofs. The buildings comprise of a mixture of small pill boxes which measure approximately 3m x 3m to larger structures which measure approximately 15m x 8m and are up to 8m tall. The buildings are all open plan, with open doorways, windows and firing slits.

An assessment of the buildings' suitability for bats was made. The buildings are all considered to be unsuitable for a significant bat roost (such as a maternity site) but could be used by individual bats as a night roost or feeding perch or as an irregularly used day roost.

The buildings are relatively draughty and bright with limited potential deep roosting crevices. There are several locations internally and externally where the brick work has partially decayed providing shallow, superficial recesses which could be used occasionally by individual bats. Where encountered, these were inspected with a bright torch and binoculars during the 2016 and 2019 spring assessment and the 2016 summer assessments. No roosting bats or bat field signs were identified.

The pill boxes are considered to offer the most suitable roosting habitat as although they are small, they are generally darker with a more stable internal temperature than the larger buildings on site.

Low numbers of scattered droppings (2-3 droppings) were found within the interior of two of the larger buildings (B3 and B8 on Figure 8.2) in Summer 2016. These are considered likely to be attributable to bats foraging within the building as opposed to roosting.

No evidence of roosting bats was found.

Given that the identified low value, potential bat roosting features could be fully examined during the daytime inspections and an absence of deep crevice features, further bat emergence or dawn surveys were considered unnecessary.

Previous surveys of the site in 1999 identified field signs indicative of small numbers of bats occasionally roosting within pill boxes at the site (comprising of old decayed droppings within two of the small pill boxes and a roosting Daubenton's bat recorded in a third small pill box).

Building descriptions are provided in Table 8.4 the Appendix.

The locations of the buildings are shown on Figure 8.2 in the Appendix. Photographs of typical buildings are also shown in the Appendix.

5.3.3 Activity Survey Results

Bat surveys were carried out from May through to October 2016.

Dates, weather conditions and sunset times are given in Table 8.1 in the Appendix.

Figure 8.2 shows the walked transect route and Point Count locations (with activity index levels) overlaid on top of the Phase 1 Habitat Survey results. Summary data of Point Count results are given in Table 8.5 in the Appendix.

5.3.4 Results Summary and Evaluation of Habitat Features for Bats

The activity surveys identified the site as supporting relatively low numbers of foraging bats. Bats were generally encountered individually.

Species encountered comprised mainly of common pipistrelle and soprano pipistrelle.

Other species recorded included Noctule, Daubenton's Bat and Natterer's bat.

Noctule was recorded overflying the site during six of the nine surveys. Daubenton's bat was recorded close to Redwither Brook and the River Clywedog (Point Counts 4 and 10) and also foraging within the site's interior (Point Counts 10 and 13). Natterer's bat was recorded within the mature woodland at the southeast of the site and also around the oak trees near the centre of the site (Point Counts 5 and 13).

Common pipistrelle, soprano pipistrelle, Natterer's bat and Daubenton's bat are considered common in the North Wales area and the UK as a whole.

Noctule bat (a rarer species) was recorded overflying the site but was not recorded using the site as a foraging resource.

Relatively limited levels of bat activity were recorded over the open scrub habitats and within the mature woodland with the activity index for 9 of the 13 point counts registering as 'low'.

Moderate levels of bat activity were recorded only over the pond at Point Count 3, at the River Clywedog at Point Count 4 and at Point Count 6 which was carried out next to one of the mature oak trees at the site.

Encounters with bats between point counts were also infrequent, with general activity over the site considered to be limited.

These results are considered to be relatively surprising, as on the surface, the site appears to offer high quality bat foraging opportunities with the extensive areas of woodland and scrub likely to support high densities of aerial insect prey.

The low levels of activity by be attributable to limited potential roosting habitat within the surrounding landscape. Buildings on site comprise of brick built, flat-roofed bunkers with limited potential roosting features. Wider buildings largely comprise of large industrial warehouses that are also likely to offer limited roosting opportunities. It is likely that some of the mature trees on the River Clywedog offer some roosting potential for tree roosting bats but these are unlikely to be extensive.

5.3.5 Habitat Evaluation

The overall value of the site has been assessed and scored following the methods described in section 2.2.2.

In summary the site was found to support common species of bats in individual numbers with low numbers of surrounding bat roosts. The habitats at the site and surrounding the site are considered to be of good value for bats.

The assessment scored a total of **11 points** which equates to an assessment of '**local**' value for the site with regards to the CIEEM (2006) evaluation framework.

The assessment results and scores are given in Table 5.1 below.

Table 5.1 – Site Results and Evaluation Score

Category	Results	Score
Species rarity?	Common species	2
Numbers of bats?	Individual bats	2
Nearby roosts?	Low number of roosts	3
Landscape character?	High	4
Total Score		11

5.4 Great Crested Newt

5.4.1 Pond Suitability Assessment and eDNA Survey Results

Four reasonably sized ponds were identified within the Oaks Site (Ponds 1-4), these ponds were assessed as to their suitability to support great crested newts (Full Habitat Suitability Index Results presented in Table 5.2 below). The ponds were visited on the 1st April, 4th May and 27th August 2016. The ponds were also revisited on the 20th and 22nd March 2019. Ponds 1 and 2 were found to be dry in March 2019.

Several other small ephemeral pools are located at the site within wheel ruts and various shallow hollows. These smaller pools were found to largely be dried up by June/July and were scoped out of further assessment.

The first pond is located within dense willow scrub where a pipe emerges from the ground (P1 on Figure 8.1 & 8.3, National Grid Reference SJ 384 493). The pond measures approximately 5m in diameter. The pond supports a fringe of marsh bedstraw with emergent willow. The pond was found to be approximately 40cm deep in 2016. The pond was dry in 2019.

The pond achieved a habitat suitability index assessment score of 0.51 indicating the pond to be of 'below average' suitability for great crested newt.

Water samples from the pond were collected and these were analysed for great crested newt eDNA. The laboratory at Surescreen Scientifics returned a negative result for great crested newt eDNA.

The second pond is located within dense hawthorn woodland (P2 on Figure 8.1 & 8.3, National Grid Reference SJ 386 491). The pond was found to be approximately 10cm deep at its maximum depth in early May and had dried up by late June 2016. The pond was already completely dry in March 2019.

The pond measures approximately 8m in diameter. The pond is heavily shaded and supports no macrophytic vegetation, the pond was found to be clogged with blanket weed.

The pond achieved a habitat suitability index assessment score of 0.46 indicating the pond to be of 'poor' suitability for great crested newt.

The pond was considered unsuitable for breeding great crested newt and so no further survey was completed.

The third pond is located within a concrete tank (P3 on Figure 8.1 & 8.3, National Grid Reference SJ 390 489). The tank measures approximately 14m x 16m in size and is raised 600mm from the ground. The tank ranges in depth from 600mm to approximately 2m. The tank supports a good covering of broad-leaved pondweed. Smooth newt and common toad were observed within the tank during the daytime surveys in 2016 and 2019. Newts may be able to move in and out of the tank via a small patch of bramble and deadwood which extends on to the top of the water tank on its east side.

The pond achieved a habitat suitability index assessment score of 0.69 indicating the pond to be of 'average' suitability for great crested newt.

Water samples from the pond were collected and these were analysed for great crested newt eDNA. The laboratory at Surescreen Scientifics returned a negative result for great crested newt eDNA.

The fourth pond (P4 on Figure 8.1 & 8.3, National Grid Reference SJ 389 491) is located within a hollow amongst dense hawthorn scrub. The pond measures approximately 4m x 6m in area. It supports a fringe of bulrush and yellow flag iris with encroaching willow scrub. The surface of the pond is blanketed in duckweed.

The pond achieved a habitat suitability index assessment score of 0.62 indicating the pond to be of 'average' suitability for great crested newt.

A further eDNA presence/absence survey of the pond was undertaken in April 2017. The eDNA survey recorded great crested newt as present within the pond.

It was not possible to undertake a population size class assessment of the pond owing to safety concerns. The pond is deep (approximately 1.5m) with relatively sheer sides. The edges of the pond either comprise of dense, impenetrable thorn scrub or unstable piles of rubble. To access the pond, a surveyor must either climb over and down the rubble or climb through the thorn scrub. The pond could not be torched as the pond surface was covered with duckweed.

Table 5.2- Habitat Suitability Index Assessment Results

<i>HSI Feature</i>	<i>Pond 1</i>	<i>Pond 2</i>	<i>Pond 3</i>	<i>Pond 4</i>
Location	1	1	1	1
Pond area	0.05	0.4	0.4	0.05
Pond drying	0.9	0.1	0.9	0.9
Water quality	0.67	0.33	0.67	0.67
Shade	0.2	0.2	0.2	1
Fowl	1	1	1	1
Fish	1	1	0.67	0.67
Ponds	0.5	0.5	0.8	0.8
Terrestrial habitat	1	1	1	1
Macrophytes	0.4	0.3	1	0.5
HSI	0.51	0.46	0.69	0.62

5.4.2 Great Crested Newt Terrestrial Habitats

Terrestrial habitats throughout the site are considered to offer high value potential great crested newt habitat with extensive areas of scrub and woodland offering foraging and refuge habitat plus suitable overwintering habitat within rubble piles, mammal burrows and earth mounds.

The core area of great crested newt terrestrial habitat and consequently the highest densities of great crested newt are likely to be within an approximate 100m radius of Pond 4. Newts tend to be present within terrestrial habitats at lower densities the further these are from the associated breeding ponds.

Ponds 1 and 3 were also assessed for the presence of great crested newt eDNA. These ponds are located close to the southeast corner and the western edge of the site. These ponds returned a negative result.

Where great crested newt are present within the landscape they will often visit waterbodies to feed, even if they are not breeding sites. Consequently, great crested newt eDNA can be identified within non-breeding ponds and can indicate that they are present within the surrounding landscape.

This negative result suggests that there are not high populations of great crested newt within terrestrial habitats within proximity to either Ponds 1 or 3.

5.4.3 Ponds within the Surrounding Landscape

There are two further ponds located within 500m of the Oaks site and not isolated by significant barriers.

One pond is located 125m to the north of the site on the opposite side of Oak Road and within amenity grassland of an adjacent industrial estate (Pond 5 on Figure 8.3). This pond is known to support a breeding population of great crested newt. Oak Road and various industrial premises located either side of the road are likely to act as partial barriers between the Oaks Site and this pond however, it is likely that there is at least some movement of great crested newt between the terrestrial habitats at the site and this pond.

A further pond is located approximately 425m to the southwest of the site within the HMP Berwyn Ecology Area (Pond 6 on Figure 8.3). This pond is known to support moderate numbers of great crested newt. Given the distance of this pond from the Oaks Site, its location on the opposite side of Redwither Brook and the presence of good habitat surrounding this pond, it is considered to be unlikely that terrestrial habitats at the Oaks are significantly used by newts breeding within this pond.

No further assessment of these ponds was carried out as they are already known to support great crested newt. Populations within these ponds are likely to form part of the wider Wrexham Industrial Estate Great Crested Newt metapopulation. (see 5.4.3 below).

5.4.4 GCN dispersal and the wider WIE Metapopulation

The Wrexham Industrial Estate as a whole supports support a nationally significant population of great crested newt but this population is considered to be declining. The estate supports scattered subpopulations of newts largely fragmented by the surrounding built environment. These discreet subpopulations are interlinked by dispersing newts to form a wider metapopulation across the Industrial Estate.

Movements of newts between these discreet subpopulations is an important factor ensuring the overall viability of the wider Industrial Estate Metapopulation by preventing inbreeding depression and allowing recolonization of suitable habitats when these become available.

Surrounding the Oaks Site, industrial units with associated areas of hardstanding are likely to act as barriers to newt dispersal. Likewise, the River Clywedog and Redwither Brook along the southern boundary of the site, and Oak Road along the northern boundary are likely to act at least as partial barriers to dispersal.

Notwithstanding any partial barriers to newt dispersal, the Oaks site is located between good populations of great crested newt at the HMP Berwyn Prison Complex and further good populations located approximately 500m to the north of the Oaks, on Bryn Lane.

The Oaks site is linked by the River Clywedog habitat corridor to newt populations located within the HMP Berwyn Prison Complex.

Although the original GCN surveys for the prison development only recorded a low population of great crested newt within water bodies present, works to capture great crested newt during site clearance recorded just less than 500 individuals.

The Prison Site Ecology Area supports a number of mitigation ponds. Moderate numbers of great crested newt have been recorded at the site during monitoring works. The closest mitigation pond is located approximately 425m to the southwest of the Oaks site.

The Bryn Lane newt population is considered to be more isolated from the Oaks by the intervening road network and surrounding industrial units however there may still be some movement between the two sites albeit dispersing newts would need to traverse Bryn Lane and Oaks Road and navigate between several pinch points between developed areas.

A further assessment was undertaken in August 2020 to consider the impact of the development proposals on great crested newt in the wider landscape.

This assessment provides further information and study concerning potential dispersal routes for great crested newt between fragmented newt populations distributed around the wider Industrial Estate and passing through the Oaks. This has been undertaken by examining GCN records within the surrounding landscape, examining potential dispersal barriers and potential dispersal routes.

This additional study goes on to examine the impacts of development proposals and opportunities to enhance and strengthen dispersal corridors through the industrial estate.

This additional study is provided in the Appendix (see Kingdom Ecology Addendum '*The Oaks, Wrexham Ind Est- Ecology Addendum, GCN Dispersal Corridors, Aug 2020*' (Document Reference KE2020/0301))

5.4.5 Evaluation

There are two permanent ponds present at the Oaks site. Great crested newt presence has been recorded in one of these ponds (Pond 4). It was not possible to safely complete a Population Size Class Assessment of this pond.

Nevertheless, it is understood that for developments within similar habitats at the Industrial Estate, there have been some inconsistencies between numbers of great crested newt recorded in ponds during survey and the ultimate numbers of great crested newt present within affected terrestrial habitats, with much larger numbers of great crested newt present than originally predicted.

Given the suitability of terrestrial habitats at the site, it is likely that the pond supports good numbers of great crested newt. It is likely that greatest density of great crested newt are located within 100m of Pond 4.

Great crested newt are likely to be present within more distant habitats at the site albeit at lower densities.

In addition to supporting a great crested newt population in its own right, the Oaks site is located between good populations of great crested newt at the HMP Berwyn Prison Complex and further good populations located on Bryn Lane. There are some partial barriers to newt dispersal between all three of these sites but there is still the possibility of some movement between sites.

Consequently, given the Oaks strategic location between these two newt populations, the presence of a breeding pond on the site itself and that the HMP Berwyn, Oaks and Bryn Lane newt populations are not entirely isolated from one another, the Oaks may form an important stepping stone providing a dispersal route between the three populations. The Oaks site may therefore represent a valuable feature within the overall Wrexham Industrial estate Great Crested Newt metapopulation.

Taking account of these factors, the Oaks site is considered to be of **District** importance for great crested newt.

5.5 Invertebrates

5.5.1 Overview

Full results are provided in the Appendix.

Key species recorded at the site comprised of:

Scientific name	Vernacular name	National status	Habitat preferences and species notes	Site notes
<i>Coenonympha pamphilus</i>	Small heath	S42	Dry grasslands, brownfields and heaths with fine-leaved grasses. Likes patchworks of short and taller sward grasslands.	A number of individuals recorded.
<i>Erynnis tages</i>	Dingy skipper	S42	Early successional habitat with common bird's-foot trefoil (<i>Lotus corniculatus</i>) over bare ground.	Probable fragile population on the site due to lack of significant habitat.
<i>Pyrgus malvae</i>	Grizzled skipper	S42	Early successional habitat with low growing Rosaceae, such as wild strawberry (<i>Fragaria vesca</i>) and creeping cinquefoil (<i>Potentilla reptans</i>).	Only a single male noted during the surveys on 19/05/16. If breeding on site, then likely to be very susceptible to site loss.

5.5.2 Broad Assemblage Types

The site is represented by a wide range of broad assemblage types (BATs). There are, however, three principal key habitats that dominate the site in terms of species associations and physical extent.

The BAT with the greatest number of species associations is the grassland and scrub BAT (F2), which holds 39% of species recorded. This BAT is widely distributed around the site and dominates the sampling area. It includes a wide range of species, from common and ubiquitous species of open habitats to some higher-fidelity species and those that require mosaics of different habitats in close proximity to one another, such as the bees and wasps.

The unshaded early successional mosaic BAT (F1) is represented by only 12% of all species recorded from the surveys. This assemblage is not extensive across the site but is concentrated in three key locations on the western side of the site in 'glade' type path intersections. These are only small, however, and possess some populations of key species, including the S42 grizzled and dingy skippers, the former only being noted by a single male.

There are a few small waterbodies on the site that dry up periodically. Despite this, there is a small resource of aquatic and semi-aquatic invertebrates utilising these features. Other species associated with this W3 permanent wet mire BAT are recorded from the damp areas along the Redwither Brook along the southern boundary to the site.

The woodland compartment to the east of the site is also noted in the BAT analysis through the presence of three key woodland BATs. None is highlighted by ISIS as being significant, but the combined scores of A1, A2 and F3 amount to 16% of the total species recorded from the site, indicating that the woodland, or at least the mature trees and partial shade, is of value. The dense shaded hawthorn stands are of less value.

5.5.3 Specific assemblage types

The specific assemblage types (SATs) are the high-fidelity niches and situations in which many scarce species can be found. The species tend not to be found in wider situations, as they are fussy or demanding of a site or landscape.

As there is a long list of BATs recorded from the site, the list of SATs is also comparatively long; however, none is of significant value. The most notable SATs are the scrub edge and rich flower resource (both with seven associated species of fidelity). This is not surprising given that these two features are probably the most extensive and strongest across the site.

The bark and sapwood decay SAT (A212) is represented by a range of species from both wooded habitat and also open habitats. Deadwood beetles prefer semi-shaded woodlands and trees, and aerial nesting solitary wasps and bees prefer deadwood in open and sunny situations.

Other complementary SATs to the above include the open short sward (F112), which is surprising to not be highlighted as of greater value given the small but high-quality character of the open flowery areas. The reason it is not highlighted more significantly is, in part, due to the lack of a bee and wasp resource on the site.

5.5.4 Assessment Summary

The site includes a range of habitats from woodland and dense scrub, flower short sward grassland and ephemeral pools.

The habitats of greatest value are those associated with the industrial heritage of the site, including the flowery short swards, taller swards, ephemeral pools and scrub fringe. The woodland of the eastern side of the site also presents opportunities for localised and high-fidelity species, but the area is currently degraded owing to off-road biking and lack of suitable management. It could be made to be of higher value through suitable management.

This mosaic of habitats is of value to invertebrates as it offers a range of opportunities for nesting and breeding in close proximity to the foraging locations. This juxtaposition of habitats and features is what elevates many brownfield sites above the wider landscape, which tends towards homogenous swards and habitats; early successional vegetation, short swards and mosaics of other habitats in close juxtaposition are categorised as heterogeneous habitats.

It is this heterogeneity that is of principal value, and the juxtaposed habitats and features that should be retained wherever possible: if they cannot be retained then they should be adequately replicated as part of a mitigation scheme.

The survey recorded three species of importance from the site. These are grizzled skipper, dingy skipper and small heath. All of these species are Section 42 species of principal importance. However, populations of both the dingy and grizzled skippers are on the decline, most likely through unauthorised off-road vehicle activity impacting the limited open resources and also habitat succession including encroachment by scrub.

The spring of 2016 was dominated by poor weather and it may be that this year was poor for the species and that subsequent years may result in better numbers. However, even if greater numbers are recorded in optimal years, it does not detract from the site progressively losing value through degradation.

No other species of importance were recorded at the time of the survey (2016). There are however historic records for the site, although there are no accurate dates attributed to them, they may be from survey work undertaken during the 1990's. Table 1 below lists the previously recorded species and summarises their status and habitat preferences, in particular with reference to current habitats present at the Oaks site.

Table 1- Previous Records of Invertebrates

Species name	Taxonomic group	UK status	Habitat preferences	Notes
<i>Dioctria atricapilla</i>	Robberfly	Local	Tall open sward grassland	A local species recorded across most parts of the UK. Not recorded from the site during the 2016 survey. Most likely due to unsuitable habitat.
<i>Leptogaster cylindrica</i>	Robberfly	Common	Tall sward grassland	A common and sometimes abundant species of tall grassland. Recorded during the 2016 survey.
<i>Oxyna nebulosa</i>	A fruitfly	Red Data Book 3 (may require revision)	Tall sward grassland with yarrow (<i>Achillea millefolium</i>)	A scarce fly with total fidelity to yarrow. Not recorded during the 2016 surveys. Possibly due to insufficient habitat and disturbance through off-road vehicular activity.
<i>Priocnemis exaltata</i>	A spider hunting wasp	Not regarded as scarce or threatened (no UK status)	Wide range of habitat types, though has a preference for open habitats such as brownfield, heathland and coastal dunes	Not recorded during 2016 surveys. Spider hunting wasps are elusive so may still be present. However, decrease in open habitat and off-road vehicle disturbance may have affected its status on the site.
<i>Andrena labiata</i>	A mining bee	Nationally Scarce A (will be downgraded in up coming status review)	Open grassland, heathland, gardens and woodland rides with a range of flowers. Has a particular preference for speedwells (<i>Veronica</i> spp).	Not uncommon now in many parts including the English Midlands and also eastern Wales, including Wrexham. The site is still suitable for the species and therefore it may still be present on site.

The results of the survey highlighted that the site does not currently (as of 2016) have a well-developed open short sward fauna with only 2 species of fidelity noted from the national pool of species associated with the feature.

In total, only 12 species associated with early successional mosaics were recorded during the surveys. This highlights the limited value of the habitat at the time of survey. This is in part due to the small and fragmented areas of open mosaics on the site and possibly the result of regular negative impacted from off-road vehicular activity. See Jukes (2016¹⁹) page 7-9 for more details on the assemblages present on the site and their relative value.

5.5.5 Site Evaluation

There are three scarce and important species associated with the site, solely with the post-industrial habitat mosaic of flowery short swards, taller swards and scrub fringe. The other habitats and areas are also of value to invertebrates, potentially with some further scarce species being recorded from early successional vegetation because of the close location of this site to other high-value or formerly high-value invertebrate sites. The mature oak trees are also likely to present species of value, but large trees are difficult to sample effectively, especially where inhibited by surrounding scrub and other trees.

The evaluation of the site takes into consideration the range of species recorded, including the scarce species, the overall assemblages and the importance of the mosaic habitats to the species. The valuation also considers the potential for other scarce species to be present, including those that are difficult to sample for, such as the deadwood beetles associated with living trees. By using the experience of the surveyor, his knowledge of invertebrates and site assessment and also by consulting the guidance notes prepared by Colin Plant Associates for CIEEM (Chartered Institute of Environmental Managers and Ecologists) (Appendix II) it is suggested that the site's key features should be considered as of at least **District (low) importance** (Plant, 2009).

The site is not thought to be of County (medium) importance, largely due to the degraded nature of the site to hold viable populations of a range of species including the grizzled skipper. The dingy skipper population is small, with no more than six to eight individuals recorded during any single visit. However, it is likely that this site forms a matrix with other small sites in the area.

¹⁹ Jukes, A (2016) *Land off Oak Road, Wrexham. An Invertebrate Assessment*. Unpublished report for Kingdom Ecology.

5.6 Badgers

A single badger sett was identified at the site. The sett is located near to the southern boundary of the site within a embanked pile of building rubble above Redwither Brook (located at grid reference SJ 3850 4922, Target Note 6 on Figure 8.1). At least five sett entrances are present however, the badger sett is located within dense rose and bramble scrub so further unidentified entrances may also be present. The sett was observed to be active during the March 2019 surveys with evidence of fresh runs, fresh digging and fresh bedding. The badger sett is likely to either represent a main sett or a well-used subsidiary sett. No further badger setts were recorded at the site.

Occasional badger footprints and latrines were identified scattered around the site. Badger fields sign are identified with Target Notes (TN) on Figure 8.1 in the Appendix.

A badger latrine was identified adjacent to the hardstanding track near the north of the site (TN1). Badger prints were identified within muddy tracks site near the River Clywedog (TN 2), near the bridge of Redwither Brook (TN3) and on earth tracks at TNs 4, 5, 11, 13, 14 and 16.

Other than around the sett at TN6, the badger field signs identified are not considered to be representative of high levels of badger activity with field signs only sporadically encountered.

It is considered likely that if a further significant badger sett such as a main sett or subsidiary sett were present elsewhere at the site, higher densities of badger footprints, latrines and snuffle holes would have been encountered on the nearby trackways with obvious badger runs leading into the dense scrub. No such high densities of field signs were observed.

Nevertheless, given the dense nature of scrub habitats, the potential presence of further badger setts cannot be ruled out.

Previous surveys of the site in 1999 did not record any significant badger setts at the site.

The site itself is considered likely to offer marginal value foraging habitat for badgers with more suitable foraging habitats located within pasture fields to the east and south of the site. However, the site may offer a valuable foraging resource in late summer/autumn when bramble, elder, damson and hawthorn come into fruit. Acorns can also provide a valuable foraging resource.

The site is accessible to badgers via its eastern boundary which adjoins open pasture fields and via the bridge over Redwither Brook at the sites southern boundary.

The presence of badger at the site is considered to be of **local** significance.

5.7 Otter

Otter have been recently recorded (three sightings between 2016-2018) on Redwither Brook to the northwest of the study site. Otter have also been recorded on the River Clywedog.

It is likely that otter regularly pass through the site and may use some of the dense scrub areas as resting sites.

Mature trees along the River Clywedog may also offer otter holt habitat.

It is unlikely that the interior of the site is significantly used by otter.

The use of Redwither Brook and the River Clywedog as a foraging and dispersal route along with potential use of habitat at the south of the site as a resting habitat is considered to be of **local** conservation significance.

6 Summary and Evaluation

In summary the features of greatest importance are considered to be the habitats present (principally the small patches of remnant species-rich grassland) and their associated invertebrate assemblages; and the sites potential importance to the wider Wrexham Industrial Estate great crested newt metapopulation. The site is considered to be of at least **District** importance for great crested newt, invertebrates and for its habitat value.

However, the habitats and the invertebrate assemblages that they support, are considered to be in a degraded state largely attributable to natural succession with former areas of species-rich grassland developing into dense hawthorn scrub.

It is considered that continued neglect of the site will ultimately result in further deterioration of the habitats present resulting in the complete loss of open grassland habitats and the invertebrates that rely upon these habitats.

The remnant patches of grassland are currently only maintained by infrequent use of the site by off-road vehicles, which create small areas of habitat that is hostile to encroaching bramble and hawthorn scrub.

Although beneficial to the areas of open grassland, the off-road activity is having a detrimental effect on areas of mature hawthorn woodland near the southern boundary of the site. Excessive use in these areas has resulted in a severely depleted ground flora through soil compaction and trampling. This effect is likely exacerbated by the dense canopy cover which allows limited light through to the woodland field layer. It is likely that with a more open canopy and less vehicular use, the ground flora would develop into a much more diverse woodland field layer.

The site has previously been of a much greater ecological value and was consequently designated a Local Wildlife Site in 1998. The site was previously designated on account of the complex mosaic of species-rich grassland and scrub. The areas identified as being of interest in 1998 and the areas of greatest interest identified during latest field surveys are directly linked to a process of past disturbance through scrub clearance in recent decades followed by abandonment.

It is considered that sensitive management of the site could allow the restoration and expansion of both species-rich grassland habitats and woodland ground flora habitats. Thereby restoring parts of the site to a similar condition as to when originally designated. This in turn would likely be beneficial to other ecological receptors including invertebrate, bird and reptile assemblages.

It is also considered that management of the site could enhance habitats for great crested newt. Whilst the site supports extensive terrestrial habitat of potential value for amphibians, the site supports limited

aquatic breeding habitat. The site currently supports a single great crested newt breeding pond (Pond 4). Pond 3 is located within a raised tank which may have prevented great crested newt access.

The creation of additional waterbodies, would likely enhance breeding success at the site and would also provide alternative breeding habitats should Pond 4 become unsuitable.

Other ecological receptors considered to be of conservation value include the site's breeding bird and bat assemblages plus the site's value to local otter populations through offering foraging, dispersal and resting sites along the Redwither Brook and the River Clywedog. These receptors are considered to be of **local** conservation importance.

All identified significant ecological receptors are summarised in Table 6.1 below along with the assessment of their ecological value and a summary of the rationale behind this assessment.

Table 6.1- Ecological Assessment Summary

Receptor	Importance	Rationale
Habitats	District	Site supports small remnant patches of species-rich grassland within dense hawthorn and bramble scrub. Areas of valuable broadleaved woodland along the River Clywedog to south of the site. Site is likely to act as a wildlife corridor providing a continuous stretch of relatively little disturbed and sheltered habitat. The site is also well linked to the wider landscape by the Redwither Brook and the River Clywedog riparian corridors.
Reptiles	Site	Common species likely to be present in low numbers.
Birds	Local	Diversity of breeding birds recorded with relatively high numbers of individual birds, albeit of relatively common species. Several species recorded that are considered to be of conservation concern.
Bats	Local	Low numbers of bats recorded of five commoner species. Site supports good bat foraging habitat. Numbers of individual bats may be restricted owing to limited high value roosting opportunities in the vicinity.
Great crested newt	District	Site supports a great crested newt breeding pond and high-quality terrestrial habitat. Site may form an important part of the wider WIE GCN metapopulation.
Invertebrates	District	The site includes a range of habitats from woodland and dense scrub, flower-rich short sward grassland and ephemeral pools.

		Three scarce and important species associated with the site- grizzled skipper, dingy skipper and small heath. However populations of both the dingy and grizzled skippers on the decline, most likely through unauthorised off-road vehicle activity impacting the limited open resources and habitat succession including encroachment by scrub.
Badgers	Local	Low levels of badger activity. Badger subsidiary/main sett located near southern boundary of the site.
Otters	Local	Site offers foraging, dispersal and resting sites along the Redwither Brook and the River Clywedog. Otters on these watercourses likely to regularly pass through the site.

7 Mitigation Proposals

7.1 Overview

7.1.1 Development Proposals and Impacts

The extent of outline development proposals are shown on Figure 8.5 in the Appendix. This figure shows the development extent overlaid over the Phase 1 Habitat map for the site.

The footprint of the development has been informed by the original 2016 surveys and the updated 2019 walkover survey.

With regards to the proposed development extent, this has been significantly scaled back since the initial 2016 surveys with 25% (Approximately 5.5ha) of the site proposed for development whilst the remaining 75% (16ha) would be managed and maintained for a combination of nature conservation and heritage value.

The proposed development will seek to avoid habitats of greatest biodiversity value this includes retaining areas which offer the greatest opportunities for habitat restoration. The areas of retained habitat will be managed as an 'Ecology Zone'.

The development layout will also seek to retain potential wildlife corridors and dispersal routes through the site in both an east/west direction and a north/south direction.

The proposed development area is located broadly within the centre of the site and will be accessed from Oak Road.

The Ecology Zone will comprise of areas of habitat retained and managed for their conservation value within the eastern third of the site (around the great crested newt pond (Pond 4); along the southern boundary of the site and within the western third of the site. These locations offer opportunities for woodland habitat restoration and grassland restoration. This layout will also limit any high impacts upon newts in Pond 4 (no development will take place within 150m of the pond) and will retain newt dispersal corridors to the east, west and south of the development area. The area of retained habitat will measure approximately 16ha and will be linked to further areas of habitat of nature conservation value located along the River Clywedog.

The proposed development will cover an area of approximately 5.5ha and will result in the loss of areas of dense bramble scrub, dense hawthorn scrub, dense hawthorn woodland and some areas of neutral grassland along off-road tracks. These habitats are all considered to be of some intrinsic nature conservation value and provide habitat for various wildlife at the site.

The proposed development has been revised to avoid impacts to mature oak trees and to avoid the loss of munitions factory structures; however one structure would be lost.

The development footprint will likely result in the loss of some great crested newt terrestrial habitat; some bird foraging and nesting habitat, invertebrate habitats (including some habitats of marginal value for grizzled and dingy skipper butterflies), the loss of some bat foraging habitat and low value potential bat roosting habitat within trees and buildings. The development may also impact upon reptiles and any unidentified badger setts present.

The impact of the development may extend beyond the footprint of the scheme through impacts relating to noise, light and human disturbance during the operation of the industrial units.

The development will seek to compensate for these negative impacts through the retention and management of the remainder of the site for its wildlife benefit.

Habitat mitigation measures would seek to retain and expand key areas of conservation value and also to make species specific enhancements as described below.

The North Wales Wildlife Trust's Living Landscapes Project seeks to conserve wildlife around the Wrexham Industrial Estate whilst also integrating public access for the local community and workers at the wider Industrial Estate. It may therefore also be desirable to allow public access to the retained wildlife area through the incorporation of paths and trails thereby assisting in the aims of this project.

7.1.2 Habitat Areas to be Retained

The most valuable parts of the site are considered to be the remnant areas of species-rich grassland and their surrounding areas of bramble and hawthorn scrub. Although the scrub habitat itself is currently of relatively low botanical interest, it offers the potential to be reverted to species-rich grassland. The scrub is of relatively recent origin and is likely to support a viable seed bank for grassland restoration. Furthermore, the scrub's proximity to the adjacent patches of flower-rich grassland would allow some natural colonisation of any new grassland habitats if carried out under appropriate management.

Other habitats of importance at the site include the river corridor along Redwither Brook and the River Clywedog. The river corridor is likely to form an important wildlife corridor for various wildlife including bats, birds and otter. This part of the site supports areas of mature broadleaved woodland plus some areas of open ground supporting a reasonably diverse tall herb community.

Where possible the development will retain as much of these habitats as practicable, appropriately manage the habitats and seek to expand the areas of species-rich grassland. These areas will form the development's 'Ecology Zone'.

Individual oak trees and Ponds 3 and 4 are also considered to be of conservation value. Where possible the development of the site has tried to retain these features.

Retained areas of habitat would be linked to one another by habitat corridors including the Redwither Brook/ Clywedog flood plain.

7.2 Ecology Zone and Habitat Management Plan

7.2.1 Overview

A habitat management plan should be developed for the proposed Ecology Zone and these habitats should be managed for their biodiversity value.

The overall ecological management plan would include habitat management recommendations that will be of benefit to a broad range of receptors at the site plus species specific site enhancements.

The habitat management plan would aim to create and maintain an intricate mosaic of different habitat types including short sward flower-rich grassland, coarser tall grassland, bramble underscrub, taller hawthorn scrub, ponds and patches of bare ground.

The habitat management plan should also seek to enhance habitats within the woodland blocks at the site.

The proposed Ecology zone would be divided into three broad areas with a view to creating different broadly different habitat types within each area. The different habitats would comprise of:-

- Grassland scrub mosaic
- Woodland habitat
- Riparian corridor habitat

An Outline Habitat Management Plan is shown on Figure 8.6 in the Appendix. This plan shows the extent of the three proposed habitat types.

7.2.2 Management Plan Delivery

The developer will make provision to appoint an appropriate managing organisation who will be responsible for the maintenance and management of the proposed Ecology Zone. The detail of this will be arranged at an appropriate stage in the future.

Detail on areas of habitat creation, management prescriptions and timetabling would be provided within detailed Habitat Management Method Statements to be produced at a later stage.

Funding for the ongoing management of the site would be secured ideally through a unilateral undertaking. This amount paid would need to include for the following:-

- Initial habitat preparation and creation
- Ongoing management and maintenance over a 25-year period
- Wardening and monitoring of the site
- Production of an annual report for the site
- A contingency fund to allow for any modifications to the habitat management plan or ad-hoc remediation works

7.2.3 Grassland and Scrub Mosaic Management.

Areas of grassland and scrub mosaic would be managed within habitats to the east, south and west of the main development area (See Figure 8.6).

The habitat management plan should aim to retain existing areas of species-rich grassland and to facilitate the expansion of this habitat into adjacent lower value scrub habitats.

This can be achieved through scrub clearance with the cutting back of areas of more recent hawthorn and bramble scrub.

It is envisaged that this would be best achieved by creating a series of mown paths and tracks through the existing scrub habitats with larger glade areas and wildlife ponds located immediately adjacent to the tracks.

Scrub and woodland would also be cleared from around retained heritage buildings located within the eastern part of the site.

The arisings from scrub clearance should be removed from the proposed grassland expansion areas with some of the cut hawthorn and larger scrub retained as log piles at the site. Hawthorn stumps should be left in the ground and allowed to rot away as opposed to being grubbed out.

There is likely to be little benefit in clearing the more established, older areas of dense scrub. In these areas it is likely that the underlying soils will have been altered considerably through nutrient enrichment from fallen leaves. Clearance of older scrub is likely to lead to the development of coarse herbaceous vegetation dominated by nettles and bramble as opposed to further species-rich grassland. It may be more beneficial to manage these areas as thorn woodland (see 7.3.3).

The scrub clearance should seek to retain some areas of hawthorn scrub and bramble scrub and manage grasslands to create a mosaic of different habitat types including short sward flower-rich grassland, coarser tall grassland, bramble underscrub and taller hawthorn scrub.

Scrub clearance should aim to avoid impacts upon existing rabbit warrens at the site. It is likely that rabbit grazing has been a key factor in allowing the retention of the site's remnant flower-rich grasslands.

Rabbit grazing can encourage diverse habitats and can be particularly beneficial for invertebrates. Rabbits feed regularly in small well-defined areas producing mosaics of close-grazed lawns surrounded by taller tussocky grasses; whilst rabbit scrapes produce areas of bare ground providing opportunities for the growth and germination of annual plants.

It will not be possible to rely solely on rabbit grazing for management of the site. Rather rabbits should be considered an additional tool to complement a structured mowing regime.

Once established, the management plan would seek to encourage a diverse range of habitats. This will be achieved within grassland habitats through the maintenance of low nutrient soils, through the control of scrub encroachment and by careful timing of cuts to allow grasses and herbs to flower and set seed. No fertiliser should be applied to the mitigation grasslands.

Mowing regimes should aim to provide a variety of grassland habitat types with an uneven sward in order to provide suitable habitats for dingy and grizzled skipper as well as to promote their botanical diversity.

More intensive mowing regimes/management may be required in the early stages of grassland restoration in order to suppress bramble regrowth. However, once grassland habitats have begun to re-establish, habitat management should be carried out twice a year in early April and in September/October and should comprise of mowing/strimming of some areas whilst others would be left to provide a patchwork of grassland habitats with retained scrub and tall herb habitats. These works would be overseen by an ECoW.

The grassland habitats would be managed to provide a mosaic of long (10-50cm) and short (<10cm) grassland with an abundance of spring nectar sources, butterfly larval food plants in short or bare ground, seed heads from the previous years as roosting sites for adult butterflies and scrub patches/edge for shelter. Grassland management therefore needs to be piecemeal and rotational with bare areas (min size 2x2m) created periodically to provide suitable butterfly breeding habitat.

Some parts of the site would be cut several times a year (e.g. along the line of any proposed footpaths); some parts annually; some parts every two or three years and some parts of the scrub habitat once every 10 years.

Grassland mowing should be carried out on a rotation so that there are always uncut areas on-site, allowing plants to flower and set seed and insects to nectar and overwinter in uncut areas.

Where a single annual cut of grassland and scrub is proposed, this should be undertaken as late in the season as possible thereby giving plants time to set seed and also limiting impacts upon invertebrates and breeding birds.

After each cut, the mown material should always be removed from the sward. Failure to do so will result in a build-up of litter forming a dense mat which can impact upon plant diversity.

7.2.4 Woodland Habitat Management

The young hawthorn woodland is largely of a poor character due to the domination of hawthorn and off-road activity. To increase the value of this woodland it is recommended that the woodland is thinned out and that potential high value trees are encouraged to come through (e.g. young oaks trees). This can be achieved through 'haloing' (haloing involves the felling and pruning back of surrounding low-value trees and scrub so that they do not shade out and stunt the development of the older, slow-growing oak trees). The thinning out of the woodland should allow more light through to the field layer potentially enhancing conditions for woodland ground flora.

It is also recommended that the variety of habitat niches within the woodland are increased by creating a glade/woodland ride type habitat alongside the existing hardstanding track (TN17 on Figure 8.1). The ride should be approximately 8-10m wide.

The ride should be maintained through a variety of mowing/cutting regimes with parts of the ride cleared on a rotational basis with various frequencies of cut. The aim would be to maintain linear parallel belts of herbaceous and scrubby vegetation at a variety of successional stages.

Further open glade habitats will be created through the clearance of scrub and woodland from around retained heritage buildings located within the eastern part of the site.

Some log piles and areas of dead wood should be retained within the woodland to provide additional habitat for invertebrates.

7.2.5 Riparian Corridor Habitat

This area would be managed to provide a mosaic of coarser grassland/tall herb habitat, wetland areas, scrub and woodland habitats.

This would be achieved through some scrub/young woodland clearance with grassland, herb and scrub managed through varying, rotational mowing regimes similar to those described in Section 7.2.3.

There are stands of Himalayan balsam in this area which would be controlled in order to promote the biodiversity value of this part of the site (See Section 7.2.7).

Wetland habitats would include areas of marsh and dedicated wildlife ponds plus the creation of larger attenuation ponds which would also be designed to be of value to wildlife.

The pockets of woodland would also be managed with woodland thinned out and high value trees encouraged to come through. The woodland habitats would be managed following similar practices to those described in section 7.2.4.

7.2.6 Pond Creation

It is recommended that wildlife ponds are created at the site. Ponds should vary from shallow ephemeral pools to those that contain water for longer periods.

Ephemeral ponds are ideal for invertebrates, as they prevent fish from establishing and the fluctuating water level provides dynamic habitats that include diverse margins.

Further pond and wetland habitat will be created through the use of Sustainable Urban Drainage Systems (SuDS) for the treatment and storage of surface runoff from the proposed development.

The SuDS pond should be designed to be of benefit to wildlife as well as providing adequate drainage. *Chapter 6- Designing for Biodiversity* of the CIRIA SuDS Manual 2015 provides guidance and design criteria that should be considered in order to help maximize the nature conservation of SuDS ponds.

The SuDS ponds and wetlands should be designed in collaboration with an ecologist and should include the following design considerations.

The proposed wildlife and SuDS ponds should have gently sloping sides that allow fauna to easily move between the terrestrial and aquatic habitats and to encourage a 'draw-down' zone at the pond margin which will be seasonally wet. These marginal habitats can be of value to invertebrates and aquatic vegetation. The pond should have an irregular shape to increase the length of pond margin habitat.

Some of the wildlife ponds should reach a depth of at least 1m in some parts so the ponds will be permanently wet.

If ground conditions dictate, the wildlife ponds should be lined with either butyl pond lining or clay and be overlaid with a subsoil substrate. Ponds should be planted up with appropriate marginal vegetation (to be determined by an ecologist). Marginal planting should be located around the northern edge of the pond to limit over-shading.

Any areas of damaged grassland around the ponds will need to be re-seeded with an appropriate wildflower mix (e.g. Emorsgate Seeds EM3).

Intermittent management and control of vegetation within the wildlife ponds and the SuDS pond may be required on a 3-5 year basis. The ponds should be managed to retain at least 30% open water.

Any invasive aquatic plant species should be monitored and treated as appropriate to prevent colonisation of the ponds.

If water levels within the deepest parts of the ponds fall regularly below 500mm, de-silting of the pond should be carried out by a long-armed excavator. Where possible this should be carried out from one entry point to limit disturbance to the pond and adjacent habitats. These works would ideally be carried out over the winter months.

Annual monitoring of the sites will be undertaken to assess the success of the management regimes. The ecologist will also determine whether any pond and scrub maintenance is required.

7.2.7 Invasive Species Management

There are stands of Himalayan balsam located at the southern end of the site within proximity to Redwither Brook and the River Clywedog.

Himalayan balsam is listed as a non-native, invasive species and can completely dominate habitat where it grows, sometimes excluding native plant species.

Himalayan balsam is able to rapidly spread by seed dispersal. On contact or slight disturbance of the seed pods, the parent plant can catapult seeds up to 6m away.

It is recommended that Himalayan balsam located within the Ecology Zone is controlled thereby encouraging a more diverse plant species composition.

Himalayan balsam is listed under Schedule 9 of the Wildlife and Countryside Act 1981 with respect to England and Wales. As such, it is an offence to plant or otherwise allow these species to grow in the wild.

It is recommended that further surveys are undertaken in advance of the start of works in order to identify the presence and extent of Himalayan balsam at the site.

This survey should be undertaken April/May. The extent of any stands of the plant within either the Ecology Zone or the construction area should be identified and recorded during these pre-construction surveys.

Where Himalayan balsam is confirmed as present, then a suitable method statement for its removal should be produced by an appropriately qualified ecologist or invasive species specialist

Control measures for Himalayan balsam should aim to prevent seeding (generally August-October). Measures to remove the plant and to limit the risk of its spread are likely to require:-

- Removal of plants by hand pulling or herbicides to remove plants before they set seed. This should be carried out May-July to be the most effective. Cutting should be carried out at ground level and below the first node to achieve the best results.

- Cut Himalayan balsam and contaminated soils should be removed from site to licensed landfill as controlled waste or dealt with on-site in appropriate waste management areas.

7.2.8 Wildlife Corridors

The main developed area will allow movement of wildlife through the site to link habitats immediately to the north, south, east and west. This will be achieved by maintaining a large block of semi-natural habitat to the south, west and east of the proposed development area with a network of smaller corridors between the proposed commercial units.

The network of wildlife corridors will retain and encompass the great crested newt breeding pond (pond 4) at the northern edge of the site providing a link close to the breeding pond on the opposite side of Oak Road.

The corridors could include SUDS ponds or swales with areas of rough grassland, hedgerows or scrub. The corridors should retain patches of larger habitat along the corridor length e.g. occasional stands of trees/shrubbery or larger SUDS/wildlife ponds. These would provide stepping stones of habitat along the corridor.

Habitat connectivity across the entire site would be promoted by having an interconnecting network of SUDS swales providing narrow corridors of wetland between the individual unit plots.

With regards to its place within the wider Wrexham Industrial Estate, The Oaks site is located within an important location in terms of its strategic biodiversity value.

The site is located on the River Clywedog which forms an important green corridor through the county.

The site is also located less than 300m from the managed Ecology Zone at HMP Berwyn and linked to the site by the River Clywedog with intervening habitats comprising of farmland.

The active management of a significant proportion of the Oaks Site exclusively for its biodiversity value, in conjunction with the nearby managed habitats at the Prison Site would create an extensive area of high value habitat at the southern end of the Wrexham Industrial Estate.

The sustainable development of the Oaks site with the provision of a large Ecology Zone would contribute towards Wrexham County Borough Council's aims to provide a functioning Green Network of interlinked conservation sites running through the Industrial Estate and also assists in meeting the goals of North Wales Wildlife Trust's 'Wrexham Industrial Estate Living Landscapes Project'.

7.2.9 Site Clearance

Works to clear the site in advance of development would have the potential to impact nesting birds, great crested newt, reptiles, badgers and invertebrates within scrub habitats and roosting bats within buildings and trees.

Owing to the presence of great crested newt, development of the site will need to be completed under a Natural Resources Wales European Protected Species License and following a strict great crested newt method statement. Great crested newt have been recorded in Pond 4. Given the suitability of terrestrial habitats at the site, it is likely that the pond supports good numbers of great crested newt.

The development will impact approximately 0.6ha of land located between 150-250m from Pond 4 and approximately 4.7ha of land located between 250-500m from the pond. No land will be developed within 150m of Pond 4.

Great crested newt will need to be translocated out of the proposed development area in advance of vegetation/site clearance.

The entire development area will need to be fenced with amphibian fencing and pitfall traps will need to be installed. The trapping area will need to be divided into compartments to increase trapping efficiency. The trapping period would be decided in consultation with NRW but would last for at least 30 days during suitable weather conditions (temperature above 5 degrees) and until 5 days have passed with no further great crested newt captures.

The great crested newt clearance programme should also remove any reptiles that are present at the site.

It is recommended that any site clearance works are carried out following an Ecological Method Statement and are completed under a watching brief with an ecological clerk of works on site for all initial vegetation and building removal works.

Any removal of scrub or buildings would need to be completed outside of the breeding bird season (March-August inclusive) and should also avoid the badger breeding season (December-July inclusive).

It is therefore recommended that vegetation clearance is completed between 1st September and 1st December. Ideally, clearance works would be phased to allow any wildlife present to escape into adjacent patches of retained scrub habitat.

The ecological clerk of works would need to investigate areas of dense scrub in advance of any clearance works. Although no badger setts were identified within the proposed development area, there is a risk that unidentified setts could be present within the denser scrub habitats.

If any badger setts are identified, a suitable buffer area would need to be marked out and a license for sett closure would be sought from NRW.

The ecologist would also need to complete pre-demolition checks of any buildings on site and a re-appraisal of any trees to be felled with regards to their suitability to support bat roosts.

However, the development layout has been modified to avoid impacts to mature oak trees at the site.

Likewise with regards to the former munitions buildings these will largely be avoided. However, former munitions building B1 and B2 would be lost to the development. Low value, potential bat roosting features are offered within exposed superficial crevices to the exterior of these buildings and so it is considered that these can be checked through a visual assessment immediately prior to demolition. If any evidence of roosting bats is found, works would need to progress under an NRW European Protected Species License.

7.3 Species Specific Recommendations

7.3.1 Reptiles

The recommendations described as part of the habitat management plan would appreciably enhance the site for reptiles by creating a more open site with a greater variety of habitat niches including basking, foraging and refuge areas.

7.3.2 Breeding Birds

The proposals to enhance grassland and woodland habitats at the site will create additional habitats for breeding birds including areas of open grassland, woodland glades and wetland areas. The rotational cutting of scrub habitats will ensure that these habitat are retained in their early stages of growth with closed canopies of dense foliage extending to the ground as opposed to less valuable, older 'leggy' hawthorn growth.

It is also recommended that a bird box scheme is implemented at the site. This could include the incorporation of barn owl boxes into retained buildings within more open habitats at the site. Following the implementation of grassland management proposals, the site is likely to offer high quality barn owl foraging opportunities. Barn owl have been recorded within habitats surrounding the site but not at the site itself in recent years.

In spite of the habitat management and creation proposals, the development will result in a net loss of valuable bird nesting and foraging habitat as a consequence of the removal of thorn scrub.

7.3.3 Bats

The site is considered to offer relatively good bat foraging opportunities however levels of bat activity at the site were found to be low. This is considered likely to be on account of limited bat roosting opportunities in the locality.

It is therefore recommended that new roosting provision for bats is created. This should comprise of a bat box scheme with bat boxes fitted to retained mature trees at the site and also through the conversion of existing bunkers and former munitions buildings to provide high quality roosting habitat for both summer roosts and winter hibernation sites. This can be relatively easily achieved by providing crevice roosting features within the building interiors and through sealing of some of the building entrances to create darker more stable micro climates within the buildings.

Several of the large buildings located within the woodland to the southeast of the site support deep concrete tanks that hold water permanently (buildings B8-B10 on Figure 8.2).

It is considered that with some minor modifications these buildings could be adapted to provide the dark, stable, humid microclimates required by hibernating bats.

Proposals to create new ponds plus additional woodland edge habitat along woodland rides and to create a generally more open woodland structure is likely to provide high quality foraging opportunities for bats.

7.3.4 Great Crested Newt

As described in section 7.3.6, The site development will need to be completed under a European Protected Species License.

As described in Section 7.3.5, the site layout has been designed to retain potential dispersal corridors in both a north-south and east-west direction through the site. This will allow the site to continue to function as a stepping stone between great crested newt subpopulations at HMP Berwyn and on Bryn Lane.

Habitat management proposals will also seek to create new great crested newt aquatic habitats at the site. This will comprise of new dedicated wildlife ponds plus SuDS ponds which would be designed to also promote their biodiversity value (see Section 7.3.4).

Whilst the site currently supports extensive terrestrial habitat of potential value for amphibians, the site supports limited aquatic breeding habitat.

The creation of additional suitable waterbodies would likely enhance breeding success at the site and would also provide alternative breeding habitats should Pond 4 become unsuitable.

With regards to the final design of the proposed new industrial units and access roads, site design should try to minimise the use of gully pots on hard surface areas around the factory buildings and on access roads.

Where practicable, the use of permeable surfaces to parking areas is also recommended.

7.3.5 Invertebrates

Habitat management proposals would seek to improve the site for a variety of invertebrate communities through the creation and maintenance of an intricate mosaic of different habitat types including short sward flower-rich grassland, coarser tall grassland, bramble underscrub, taller hawthorn scrub, ephemeral pools, permanent ponds, woodland edge and patches of bare ground.

Butterfly banks

Additional specific mitigation recommendations include the creation of at least 5 x butterfly banks with occasional vertical exposures of bare ground. Each butterfly bank would be at least 10m in length.

Butterfly banks would provide benefits to a wide range of open mosaic and flower foraging invertebrates. They are especially valuable, and have demonstrated success to butterflies including the dingy skipper and grizzled skipper.

They are essentially banks of mounded nutrient-poor materials. These features are partially compacted with machinery, but other parts of the banks can be allowed to settle naturally to encourage niche variation, through slumping.

Medium, coarse aggregate material can be used for these banks. A limestone or other high pH material is preferable, as this gives rise to a richer flora, including bird's-foot trefoil. Crushed material from demolished buildings at the site would also be suitable.

Optimally, the banks would be in a southerly facing aspect for greatest sun exposure and in a crescent or sinuous shape, which further elevates the microclimate of the feature.

Ideally, the banks would be sown with a suitable flower mix and allowed to colonise naturally. It is suggested that both techniques for establishment are used. This can be further complimented through plug planting of key plant species, most notably common bird's-foot trefoil and creeping cinquefoil, wild strawberry and/or agrimony.

Open Mosaic Swards

Butterfly banks are only one method to promote and bolster local populations of key butterfly species. The creation of a mosaic of bare ground and short flowery turf is also required. This would be dominated by trefoils such as common bird's-foot trefoil, wild strawberry, agrimony and creeping cinquefoil. Short yellow composites

are also important as nectar resources. It is important that a strict criteria is adhered to for this mosaic in order to provide a wide range of opportunities for these butterflies and the wider brownfield assemblage.

The mosaic would be created on low-fertility material. Where these areas are to be created on former scrub areas some remediation will be required including topsoil removal or vegetation control. The early succession mosaics would include using coarse aggregate material and others comprising fine, sandy material to create a range of conditions on the site for a wide range of bare ground species including ground-nesting bees and wasps.

To be successful, the sparse flowery swards should be exposed to full sun for much of the day, including the key period between 10:00 and 16:00.

Bare ground would comprise approximately 50% of the total habitat mosaic. This may be as a large unit of newly scraped bare ground (as part of the management cycle) and also as patchy bare ground and short turf mosaics.

A mosaic of fine-leaved grasses and a range of flowering plants are required to fulfil the requirements of the open mosaics. It is likely that a commercially sourced seed mixture may not be suitable, but a bespoke mix would be specified to include the following species:

- Common bird's-foot trefoil (*Lotus corniculatus*) for dingy skipper (30% plant coverage);
- Agrimony (*Agrimonia eupatoria*) for grizzled skipper (10% plant coverage);
- Wild strawberry (*Fragraria vesca*) for grizzled skipper (10% plant coverage);
- Creeping cinquefoil (*Potentilla reptans*) for grizzled skipper (10% plant coverage);
- Grasses comprising of fescues (*Festuca* spp) and bents (*Agrostis* spp) for small heath (10% plant coverage)

Other plants would make up the remaining 30% of plant coverage. This can be a diverse range of typical plants of the area including:

- Short yellow composites including hawkbits and cat's-ears (*Leontodon* and *Hypochoeris* spp.) (no less than 5% plant coverage);
- Trefoils (Fabaceae) and vetches (*Vicia* spp.) (no less than 5% plant coverage); and
- Red clover (*Trifolium pratense*) (no less than 5% plant coverage).

This short turf mosaic would be further complimented by a tall flowery grassland that is managed on rotation. This grassland can be created using a commercial seed mix that most closely replicates the existing

flowery composition of the site. A mix such as EM4F – wildflowers for clay soils may be suitable.

Deadwood

Through hawthorn thinning and removal, a resource of deadwood will be made available to repurpose into the newly created open mosaics. Where retained stumps are of sufficient diameter (minimum 15cm) they will be cut to a height of 1m or above. These features are primarily to provide nesting opportunities for stem-nesting bees and wasps. Where stumps are not of sufficient diameter or height, deadwood will be introduced to the edges of the open mosaics and inserted in to the ground to replicate standing deadwood. These posts will be positioned in sunny situations on the northern side of any grassland areas and allowed to rot *in situ*. A minimum of 20 standing deadwood features of a minimum of 15cm diameter and minimum height of 1m will be incorporated in to the ecological zone.

Viability of new habitat mosaics

There is currently less than 0.25ha of open mosaics and associated features on the site and over time, with no interventions, this area will decrease. The habitat expansion and creation proposals detailed in this document equates to an area in excess of 3.25ha of open mosaic habitat, designed specifically for invertebrates.

This is a meaningful area of high priority habitat being created on a site that is losing its value as an open mosaic resource for invertebrates. As a result of the open mosaic expansion on the site, it is suggested that once optimal, the key butterfly species and broader invertebrate resources that are associated with it should all be bolstered locally from this scheme.

The important feature of this habitat creation is that it is predominantly in one large unit, providing a wide range of subtle niche features across the resource that will be beneficial to the high fidelity species. A suite of these niche species is seldom recorded from the wider countryside and as a consequence many are scarce and threatened. It is hoped that through the creation and on-going commitments to manage the site, it will quickly develop into a key invertebrate site that will hold strong and robust populations that can help support other populations on similar key local sites.

7.3.6 Otter

It is likely that otter regularly pass through the site on the Redwither Brook and on the River Clywedog. It is recommended that artificial otter holts are installed in suitable locations along both Redwither Brook and the River Clywedog to provide high quality resting sites.

7.4 Wardening, Monitoring and Reporting

Land at Wrexham Industrial Estate can suffer some anti-social behaviour including fly tipping, unauthorised use of off-road vehicles and use of land by unauthorised gypsy and traveller encampments.

The Ecology Area at the Oaks Site is located within a relatively isolated and therefore vulnerable location and so already suffers from off-road use, fly-tipping etc. Fencing around the site would be maintained to prevent any unauthorised vehicular access and twice monthly wardening would be carried out.

Where identified during wardening visits, remediation works would be promptly carried out. This could include repair of fencing, clearance of fly-tipped debris, litter picking etc.

Monitoring of the site would be carried out annually during the summer to assess the success of the habitat management plan, to allow for any refinement of management practices and to check on the integrity of bat and bird boxes. The monitoring works would be completed by an appropriately qualified ecologist.

Monitoring would include an assessment of the botanical value of the site and also a specific assessment of the suitability of habitats for dingy and grizzled skipper butterflies.

Monitoring of great crested newt populations at the site will also be required as part of the requisite Natural Resources Wales License. This will require on-going assessment of existing waterbodies as well as newly created waterbodies.

Monitoring of the site would follow the ARC/COFNOD methodologies. Levels of monitoring and management would be determined during the EPS license application.

An annual monitoring report with a record of the site's aquatic and terrestrial habitat condition in relation to great crested newt, findings of the monitoring survey plus any recommendations for pond management would be produced and submitted to the council and NRW.

The areas of grassland are principally to be managed for their butterfly conservation value, therefore the ecologist will determine whether any modifications or additional works to the management plan are required including any strimming of the butterfly banks and whether any patches of earth should be scraped back to provide areas of bare ground habitat, including on the butterfly banks. The aims of the management will be to maintain suitable food plants and a complex mosaic of bare ground, short sward and tall grassland habitats. Management for the butterflies, and broader invertebrate interest, will be informed through monitoring of key species and assemblages.

Butterflies, specifically the dingy and grizzled skippers will be subjected to annual monitoring during their peak periods for 5 years

following habitat creation. After 5 years, they will be monitored in years 7 and 10, after which a re-evaluation will be undertaken relating to their population and the site's status. If the populations are deemed to still be vulnerable, a further five years monitoring period will be initiated following modification to their breeding habitat.

The butterfly monitoring will comprise of two visits for each species, undertaken between mid-May and mid-June. The monitoring will take the form of a transect walk and count of adults butterflies. Each visit will comprise of two transect walks and therefore two sets of counts for each visit. This monitoring will help inform management alterations, if needed, and developing robustness of the populations of the key species. At the same time as the butterfly counts, a habitat assessment will be undertaken. Feedback from this monitoring will be used to instruct adjustments to the management regimes, as required.

The broader invertebrate resources associated with the open mosaics and scrub fringe will also be monitored to assess changes and help inform site management. Although extensive surveying provides long lists of species that provide a broad and deep understanding of a site's resources, they can be time consuming and consequently expensive.

To undertake these monitoring events regularly is therefore prohibitive and in part, unnecessary. One option that bridges this financial constraint but still enables analysis and evaluation of a site's ecological condition is Common Standards Monitoring (CSM).

Natural England's CSM method for evaluating condition status of Sites of Special Scientific Interest (SSSI) may be the most appropriate method of assessment at this site as it is effective, proven and cost effective. As it is a standardised method of surveying, monitoring a site over time can therefore be fairly evaluated against previous survey results, highlighting changes that are both positive and negative.

The survey consists of two visits, one in spring and the second in summer and targets key invertebrate groups that are useful indicators of habitat quality, such as bees and wasps and ground beetles. Monitoring would be undertaken annually for the first 3 years following habitat creation then at years 5, 7 and 10 years. After 10 years a re-evaluation of the site would be undertaken that would detail any further monitoring should it be thought necessary.

An annual monitoring report with a record of the site's habitat condition in relation to grizzled and dingy skippers, findings of the monitoring survey plus any recommendations for changes to the management plan (where relevant) would be produced and submitted to the council.

8 Conclusions

The Oak Road Site is considered to be a site of ecological importance supporting a great crested newt population plus botanical and invertebrate communities that are assessed as being of District value in addition to locally important breeding bird and bat assemblages.

It is considered that sensitive management of habitats at the site could enhance habitats for several of the wildlife species and groups encountered.

With regards to great crested newt, the site supports extensive terrestrial habitat of potential value for amphibians, however the site supports limited aquatic breeding habitat.

The creation of additional waterbodies would likely enhance breeding success at the site and would also provide alternative breeding habitats should Pond 4 become unsuitable.

The Oaks site is located between subpopulations of great crested newt at the HMP Berwyn Prison Complex and on Bryn Lane. The site may therefore represent a valuable feature with regards to the overall Wrexham Industrial Estate Great Crested Newt metapopulation. In addition to providing additional aquatic habitats, the design of the development will seek to retain appropriate dispersal corridors to allow the continued potential movement of newts through the site.

The other key feature of the site is considered to be the mosaic of habitats present. In particular, the remnant patches of flower-rich grassland which are considered to be the habitats of greatest and rarest value and in turn support some of the rarer and more interesting species recorded at the site.

However, the scrub/grassland mosaic is a dynamic system which without intervention, will ultimately lead to the site becoming completely invaded with dense hawthorn scrub.

Much of this invasion has already occurred with areas of flower-rich grassland now restricted to bike tracks and glades where off-road tracks have overlapped.

The site has previously been of a much greater ecological value and was consequently designated a Local Wildlife Site in 1998. The site was previously designated on account of the complex mosaic of species-rich grassland and scrub.

It is considered that without further management of the site, key habitats will further deteriorate, ultimately resulting in the complete loss of flower-rich grassland habitats and the various wildlife that rely upon them.

Recommendations for extensive habitat management would seek to reverse the impacts of scrub invasion and to restore the intricate mosaic of varying habitat types by encouraging much more extensive areas of flower-rich grassland interspersed amongst coarser tall grassland, bramble underscrub, wetlands and retained areas of hawthorn scrub.

If development proposals retain an appropriately sized area of the key habitats and obligations through the planning system can secure the long-term management of the site, it is considered that the Oaks Road Site could be appreciably enhanced in terms of its nature conservation value by securing the future retention and recovery of its most valuable habitats and species.

Appendix

Tables

Table 8.1.1-8.1.4 Weather Conditions during Survey

Table 8.1.1- Bird Survey Weather Conditions

Date	Weather	Temperature
19/05/2016	Dry, calm, sunny	16°C
28/05/2016	Dry, calm, sunny	18°C
18/06/2016	Dry, calm, sunny spells	16°C
05/07/2016	Dry, calm, high cloud	16°C
10/08/2016	Dry, calm, sunny spells	15°C

Table 8.1.2- Invertebrate Survey Weather Conditions

Date	Weather	Temperature
19/05/2016	Dry, calm, sunny	16°C
28/05/2016	Dry, calm, sunny	18°C
18/06/2016	Dry, calm, sunny spells	16°C
05/07/2016	Dry, calm, high cloud	16°C
10/08/2016	Dry, calm, sunny spells	15°C

Table 8.1.3- Reptile Survey Conditions

Date	Weather	Temp.	Survey Type
03/05/2016	Dry, sunny spells, calm	13°C	Refuge & Visual
04/05/2016	Dry, sunny, calm	18°C	Refuge & Visual
05/05/2016	Dry, clear, calm	19°C	Refuge & Visual
25/05/2016	Dry, calm, overcast	12°C	Refuge & Visual
27/05/2016	Dry, calm, overcast	18°C	Refuge & Visual
28/05/2016	Dry, calm, hazy	12°C	Refuge & Visual
20/07/2016	Dry, calm, sunny spells	22°C	Visual & reduced refuge
19/08/2016	Dry, sunny after rain, light breeze	19°C	Visual & reduced refuge
26/08/2016	Dry, calm, overcast	18°C	Visual & reduced refuge
07/09/2016	Dry, calm, sunny spells	23°C	Visual & reduced refuge
09/09/2016	Dry, calm, overcast	19°C	Visual & reduced refuge
21/09/2016	Dry, calm, hazy	16°C	Visual & reduced refuge
02/10/2016	Dry, clear, calm	14°C	Visual & reduced refuge

Table 8.1.4- Bat Survey Weather Conditions

Date	Sunset	Sunrise	Weather	Temp.
05/05/2016	20.48		Dry, Clear and Calm	17°C
06/05/2016		5.30	Dry, Clear and Calm	8°C
27/05/2016	21.21		Dry, Calm, Muggy and Overcast	17°C
30/06/2016	21.42		Calm, Overcast, Dry following rain	14°C
12/07/2016	21.34		Dry, Still and Clear	14°C
02/08/2016	21.05		Dry, Overcast and Calm	18°C
27/08/2016	20.15		Light Breeze, Overcast and Dry	18°C
07/09/2016	19.45		Overcast, Clear, Dry and Still	20°C
02/10/2016	18.48		Dry, Clear and Calm	13°C

Table 8.2- Bird Species Recorded (2016)

Species	Breeding Status	BOCC Status
Blackbird	B	
Blackcap	B	
Blue tit	B	
Bullfinch	B	Amber
Buzzard	P	
Carrion crow	P	
Chaffinch	P	
Chiffchaff	B	
Dunnock	B	Amber
Garden warbler	P	
Goldcrest	P	
Goldfinch	P	
Great spotted woodpecker	P	
Great tit	B	
Green woodpecker	P	
Heron	NB	
Herring gull	NB	
Jackdaw	P	
Jay	P	
Lesser whitethroat	B	
Linnet	P	Red
Long-tailed tit	B	
Magpie	P	
Mallard	NB	Amber
Oyster catcher	NB	
Pied wagtail	P	
Robin	B	
Rook	NB	
Sedge warbler	B	
Song thrush	B	Red
Starling	NB	Red
Swallow	NB	
Swift	NB	Amber
Tawny owl	P	Amber
Tree creeper	P	Amber
Whitethroat	B	
Willow warbler	B	Amber
Wood pigeon	B	
Wren	B	

B- Breeding/Probable Breeding, P- Possible Breeding, NB- Non-breeding

Table 8.3- Bat Oak Tree Descriptions

Tree Reference	Description	Bat Roosting Potential
T1	Mature oak, some low value potential bat roosting features within lifting bark and dead wood where limbs removed	Low
T2	Mature oak, some low value potential bat roosting features behind lifting bark	Low
T3	Mature oak, minor areas of dead wood and lifting bark	Negligible-low
T4	Mature oak, minor areas of dead wood and lifting bark	Negligible-low
T5	Mature oak, minor areas of dead wood and lifting bark	Negligible-low
T6	Mature oak, minor areas of dead wood and lifting bark	Negligible-low
T7	Mature oak, some low value potential bat roosting features within snag ends, lifting bark and dead wood.	Low
T8	Mature oak, some low value potential bat roosting features within minor dead wood.	Low
T9	Mature oak, some low value potential bat roosting features within minor dead wood.	Low
T10	Mature oak, split in dead branch at 7m offer some low value bat roosting potential. Larger cavity within wound on trees north face at height of 1-2m. Relatively low height. No droppings or bats found in 2016. Bee nest present in cavity in 2019.	Low/moderate

Table 8.4- Bat Building Descriptions

Building Reference	Description	Bat Roosting Potential
B1	Large brick built bunker with concrete roof. Approx. 8m x 15m in area and 8m tall. Bright and draughty. No obvious potential bat roosting features. Accessible to bats via open doorways and windows. No bat field signs found.	Low
B2	Large brick built bunker with concrete roof. Approx. 8m x 15m in area and 8m tall. Bright and draughty. No obvious potential bat roosting features. Accessible to bats via open doorways and windows. No bat field signs found.	Low
B3	Small complex of three structures comprising of large brick built bunker (15m x 8m x 8m) and two small brick built pill boxes (3m x 3m x 2m). Low roosting potential offered in decaying bricks in large building but no obvious deep crevice features. 3 x old pipistrelle droppings found scattered on floor internally. All buildings relatively bright and draughty. All buildings accessible to bats via open doorways, windows and firing slits.	Low
B4	Tall brick built tower. 3m x 3m x 10m tall. Tower accessible to bats via open doorway and hole in roof. Tower completely open inside. No obvious potential roosting crevices.	Low
B5	Small complex of three structures comprising of small, open brick bunker, series of short concrete tunnels leading to open pit and open-sided, concrete shelter mounted on concrete supports. No obvious potential bat roosting features,	Negligible-Low
B6	Small complex of three, brick built structures comprising of a medium sized brick bunker (6mx10m x 4m) and two small brick bunkers. Open, draughty and bright. No obvious potential bat roosting crevices.	Low
B7	Two buildings comprising of small brick built pill box and larger brick built bunker. Low roosting potential offered in decaying bricks in large building but no obvious deep crevice features. All buildings relatively bright and draughty. All buildings accessible to bats via open doorways, windows and firing slits.	Low
B8	Large brick built bunker with concrete roof. Comprises of three internal rooms. Main room measures Approx. 20m x 16m in area and 4.5m tall with sunken pit at far end. Pit is two meters deep and holds approximately 20cm of water. Two smaller chambers rooms also present measuring approximately 2mx 7m and 2m x 10m. Bright and draughty. No obvious potential bat roosting features. Accessible to bats via open doorways and windows. Two pipistrelle droppings found scattered on floor.	Low
B9	Large brick built bunker with concrete roof. Comprises of three internal rooms. Main room measures Approx. 20m x 16m in area and 4.5m tall with sunken pit at far end. Pit is two meters deep and holds approximately 20cm of water. Two smaller chambers rooms also present measuring approximately 2mx 7m and 2m x 10m. Bright and draughty. No obvious potential bat roosting features. Accessible to bats via open doorways and windows. No bat field signs found. Other structures nearby include small derelict brick built structures with no roof.	Low

Building Reference	Description	Bat Roosting Potential
B10	Large brick built bunker with concrete roof. Comprises of three internal rooms. Main room measures Approx. 20m x 16m in area and 4.5m tall with sunken pit at far end. Pit is two meters deep and holds approximately 20cm of water. Two smaller chambers rooms also present measuring approximately 2mx 7m and 2m x 10m. Bright and draughty. No obvious potential bat roosting features. Accessible to bats via open doorways and windows. No bat field signs found. Other structures nearby include small derelict brick built structures with no roof and two small brick built pill boxes.	Low

Tables 8.5.1-8.5.4- Bat Activity Transect Results

Point Count	05/05/2016			06/05/2016 (Dawn)			27/05/2016		
	Species	Time	Passes	Species	Time	Passes	Species	Time	Passes
1		20.54			3.50			21.32	
2	P45	21.04	2	Noctule	4.52		P45	21.42	4
3	P55	21.14	20		5.02		P55, P45	21.51	10
4	P55	21.22	20		5.10		P55, P45	22.08	
5		21.36			5.22		P45	22.14	
6	P45	21.43	5		4.00			22.20	
7		21.51			4.06			22.28	
8		21.58			4.15			22.34	
9		22.07			4.22		P45	22.40	12
10	P55	22.14	1		4.29		Daubenton's	22.51	1
11		22.21			4.36			22.58	
12		22.28			4.43		P55	23.06	1
13		22.35			5.32		P45, Daubenton's	23.19	

Point Count	30/06/2016			12/07/2016			02/08/2016		
	Species	Time	Passes	Species	Time	Passes	Species	Time	Passes
1		21.50			21.34			21.11	
2		22.07			21.45		P45	21.19	1
3	P45	22.15	5	Noctule	21.55	1	P55	21.28	8
4	P55	22.25			22.04		P45	21.34	4
5		22.33			22.11		P45	21.47	1
6	P45, P55, Natterer's	22.41	8	P45, P55	22.19	6	P55	21.54	1
7	P45	22.47	2		22.27			22.01	
8		22.52		P45	22.34	3	P45	22.09	1
9		22.56			22.43		P45, Noctule	22.18	2
10		23.08		P45	22.56	2		22.28	
11		23.15		P45	23.04	3		22.39	
12		23.22		P45, P55	23.13	4	Daubenton's	22.46	6
13		23.27			23.22		P45, Natterer's	22.52	2

Point Count	27/08/2016			07/09/2016			02/10/2016		
	Species	Time	Passes	Species	Time	Passes	Species	Time	Passes
1	Noctule	20.16			19.51			18.48	
2		20.27		P45, P55	20.03	3		19.00	
3	P45	20.38		P45	20.15	1	P55	19.09	5
4	Daubenton's	20.48	3	Noctule, Pip sp.	20.25	1		19.18	
5	P45, Natterer's	20.56	3		20.34		P45	19.26	2
6		21.05		P55	20.43	1	P45, Noctule	19.35	13
7		21.13		P55	20.5	1	Noctule	19.43	1
8		21.21			20.58		Noctule, P45	19.5	2
9	Noctule, P45	21.38	2		21.08			19.58	
10	P45	21.43	2	P45	21.16	1		20.07	
11		21.55		Noctule	21.27	1	P45	20.17	1
12		22.02		P45	21.34	1		20.24	
13	P55, Noctule	22.08	2	P55	21.41	1		20.31	

Summary Point Count Results

Point Count	Habitat at Point Count	Average No. of Passes	Activity Level
1	Path through dense hawthorn scrub.	0	Low
2	Path through dense hawthorn scrub with open glade grassland glade.	1.11	Low
3	Mature hawthorn woodland, next to pond	5.56	Moderate
4	Mature riparian woodland next River Clywedog	3.11	Moderate
5	Path and glade in mature hawthorn woodland	0.67	Low
6	Path through hawthorn scrub, next to mature oak tree	3.77	Moderate
7	Path through continuous bramble underscrub	0.44	Low
8	Path and glade in continuous hawthorn scrub	0.67	Low
9	Path and glade in continuous hawthorn scrub	1.78	Low
10	Tall herb vegetation and riparian woodland next to Redwither Brook	0.78	Low
11	Mature hawthorn woodland	0.56	Low
12	Open area on path around buildings and close to mature oak tree, and dense hawthorn scrub	1.33	Low
13	Path through dense hawthorn scrub.	0.56	Low

Table 8.6- Plant Species Recorded (2016)

Common Name	Scientific Name
Agrimony	<i>Agrimonia eupatoria</i>
Alder	<i>Alnus glutinosa</i>
Annual Meadow-grass	<i>Poa annua</i>
Apple	<i>Malus domestica</i>
Ash	<i>Fraxinus excelsior</i>
Black Bryony	<i>Tamus communis</i>
Black Knapweed	<i>Centaurea nigra</i>
Black Medick	<i>Medicago lupulina</i>
Blackthorn	<i>Prunus spinosa</i>
Bracken	<i>Pteridium aquilinum</i>
Bramble	<i>Rubus fruticosus agg.</i>
Bristly Oxtongue	<i>Picris echioides</i>
Broad Buckler-fern	<i>Dryopteris dilitata</i>
Broad-leaved Pond Weed	<i>Potamogeton natans</i>
Broad-leaved Willowherb	<i>Epilobium montanum</i>
Brooklime	<i>Veronica beccabunga</i>
Bulrush	<i>Typha latifolia</i>
Burnet- saxifrage	<i>Pimpinella saxifraga</i>
Cat's- ear	<i>Hypochaeris radicata</i>
Cleavers	<i>Galium aparine</i>
Cock's-foot	<i>Dactylis glomerata</i>
Common Bird's-foot-trefoil	<i>Lotus corniculatus</i>
Common Centaury	<i>Centaureum erythraea</i>
Common Couch	<i>Elytrigia repens</i>
Common Dog Violet	<i>Viola riviniana</i>
Common duckweed	<i>Lemna minor</i>
Common Field- Speedwell	<i>Veronica persicaca</i>
Common Fleabane	<i>Pulicaria dysenterica</i>
Common Gorse	<i>Ulex europaeus</i>
Common Marsh-bedstraw	<i>Galium palustre ssp. Palustre</i>
Common Mouse Ear	<i>Cerastium fontanum</i>
Common Nettle	<i>Urtica dioica</i>
Common Poly Pody	<i>Polypodium vulgare</i>
Common Ragwort	<i>Senecio jacobaea</i>
Common Sedge	<i>Carex nigra</i>
Common Sorrel	<i>Rumex acetosa</i>
Common Spotted-orchid	<i>Dactylorhiza fuchsii</i>
Common Toadflax	<i>Linaria vulgaris</i>
Common Vetch	<i>Vicia sativa ssp. nigra</i>

Common Name	Scientific Name
Compact Rush	<i>Juncus conglomeratus</i>
Corn Mint	<i>Mentha arvensis</i>
Cowslip	<i>Primula veris</i>
Crack Willow	<i>Salix fragilis</i>
Creeping Bent	<i>Agrostis stolonifera</i>
Creeping Buttercup	<i>Ranunculus repens</i>
Creeping Cinquefoil	<i>Potentilla reptans</i>
Crested Dog's-tail	<i>Cynosurus cristatus</i>
Crosswort	<i>Cruciata laevipes</i>
Crosswort	<i>Galium cruciata</i>
Cuckoo Flower	<i>Cardamine pratensis</i>
Curled Dock	<i>Rumex crispus</i>
Cut-leaved Crane's-bill	<i>Geranium dissectum</i>
Daisy	<i>Bellis perennis</i>
Dandelion	<i>Taraxacum officinale</i>
Dog Rose	<i>Rosa canina</i>
Dog's Mercury	<i>Mercurialis perennis</i>
Dyer's Greenweed	<i>Genista tinctoria</i>
Elder	<i>Sambucus nigra</i>
False Brome	<i>Brachypodium sylvaticum</i>
False Fox Sedge	<i>Carex otrubae</i>
False Oat-Grass	<i>Arrhenatherum elatius</i>
Field Forget-me-not	<i>Myosotis arvensis</i>
Field Maple	<i>Acer campestre</i>
Field Rose	<i>Rosa arvensis</i>
Field Woodrush	<i>Luzula campestris</i>
Foxglove	<i>Digitalis purpurea</i>
Garlic Mustard	<i>Alliaria petiolata</i>
Germander Speedwell	<i>Veronica chamaedrys</i>
Glaucous Sedge	<i>Carex flacca</i>
Goat Willow	<i>Salix caprea</i>
Great Willowherb	<i>Epilobium hirsutum</i>
Greater Plantain	<i>Plantago major</i>
Greater Burdock	<i>Arctium lappa</i>
Grey Willow	<i>Salix cinerea ssp. oleifolia</i>
Ground-ivy	<i>Glechoma hederacea</i>
Groundsel	<i>Senecio squalidus</i>
Hairy Vetch	<i>Vicia hirsuta</i>
Hard Rush	<i>Juncus inflexus</i>
Hart's-tongue	<i>Phyllitis scolopendrium</i>
Hawthorn	<i>Crataegus monogyna</i>

Common Name	Scientific Name
Hedge Bindweed	<i>Calystegia</i>
Hedge Woundwort	<i>Stachys sylvatica</i>
Herb- Robert	<i>Geranium robertianum</i>
Hoary ragwort	<i>Senecio erucifolia</i>
Hogweed	<i>Heracleum sphondylium</i>
imperfectorate St.John's wort	<i>Hypericum maculatum</i>
Ivy	<i>Hedera helix</i>
Japanese knotweed	<i>Fallopia japonica</i>
Lesser Stitchwort	<i>Stellaria graminea</i>
Lords and Ladies	<i>Arum maculatum</i>
Maidenhair Spleenwort	<i>Asplenium trichomanes</i>
Male Fern	<i>Dryopteris filix-mas</i>
Meadow Buttercup	<i>Ranunculus acris</i>
Meadow Fescue	<i>Festuca pratensis</i>
Meadow Foxtail	<i>Alopecurus pratensis</i>
Meadow Vetchling	<i>Lathyrus pratensis</i>
Meadowsweet	<i>Filipendula ulmaria</i>
Mint	<i>Mentha sp.</i>
Mugwort	<i>Artemisia vulgaris</i>
Musk Mallow	<i>Malva moschata</i>
Nipplewort	<i>Lapsana communis</i>
Oval Sedge	<i>Carex ovalis</i>
Oxeye Daisy	<i>Leucanthemum vulgare</i>
Pedunculate Oak	<i>Quercus robur</i>
Pepper-saxifrage	<i>Silaum silaus</i>
Perennial Rye-grass	<i>Lolium perenne</i>
Perforate St.John's wort	<i>Hypericum perforatum</i>
Pineappleweed	<i>Matricaria discoidea</i>
Prickly Lettuce	<i>Lactuca serriola</i>
Prickly Sow-thistle	<i>Sonchus asper</i>
Red Bartsia	<i>Odontites vernus</i>
Red Campion	<i>Silene dioica</i>
Red Clover	<i>Trifolium pratense</i>
Red Fescue	<i>Festuca rubra</i>
Redshank	<i>Persicaria maculosa</i>
Reed Canary-grass	<i>Phalaris arundinacea</i>
Ribbed Melilot	<i>Melilotus officinalis</i>
Ribwort Plantain	<i>Plantago lanceolata</i>
Rosebay Willowherb	<i>Chamerion angustifolium</i>
Rough Hawkbit	<i>Leontodon hispidus</i>

Common Name	Scientific Name
Rough Meadow-grass	<i>Poa trivialis</i>
Rowan	<i>Sorbus aucuparia</i>
Scarlett Pimpernel	<i>Anagallis arvensis</i>
Scentless Mayweed	<i>Tripleurospermum inodorum</i>
Selfheal	<i>Prunella vulgaris</i>
Silver Birch	<i>Betula pendula</i>
Silverweed	<i>Potentilla anserina</i>
Smooth Tare	<i>Vicia tetrasperma</i>
Sneezewort	<i>Achillea ptarmica</i>
Soft-rush	<i>Juncus effusus</i>
Spear Thistle	<i>Cirsium vulgare</i>
Sweet Vernal-Grass	<i>Anthoxanthum odoratum</i>
Sycamore	<i>Acer pseudoplatanus</i>
Teasel	<i>Dipsacus fullonum</i>
Traveller's Joy	<i>Clematis vitalba</i>
Tufted hair-grass	<i>Deschampsia cespitosa</i>
Tufted Vetch	<i>Vicia cracca</i>
White Campion	<i>Silene latifolia</i>
White Clover	<i>Tifolium repens</i>
White Stonecrop	<i>Sedum album</i>
Wild Carrot	<i>Daucus carota</i>
Wild Cherry	<i>Prunus avium</i>
Wood Avens	<i>Geum urbanum</i>
Wood Dock	<i>Rumex sanguineus</i>
Yarrow	<i>Achillea millefolium</i>
Yellow Flag-Iris	<i>Iris pseudacorus</i>
Yellow-Wort	<i>Blackstonia perfoliata</i>
Yorkshire fog	<i>Holcus lanatus</i>

FIGURE 8.1- Phase 1 Habitat Map



KEY

- | | |
|---------------------------|--------------|
| Continuous bramble scrub | Hardstanding |
| Continuous hawthorn scrub | Bare ground |
| Broadleaved woodland | Tree |
| Neutral grassland | Pylon |
| Tall herb community | Log pile |
| Amenity grassland | Building |
| Pond | Target Note |

FIGURE 8.2- Bat Survey Map



KEY

- B1** Building (with reference No.)
- T1** Tree (with reference No.)
- Bat transect route
- 1 Point count (low bat activity)
- 3 Point count (moderate bat activity)

FIGURE 8.3- Pond Locations



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Ordnance Survey 100054686

P1
Pond location with
reference number

 Study site boundary

FIGURE 8.4- Bird Survey Map

KEY

B	Blackbird
BC	Blackcap
BT	Blue tit
BF	Bullfinch
CC	Chiffchaff
CH	Chaffinch
D	Dunnock
GW	Garden warbler
GC	Goldcrest
GF	Goldfinch
GS	G. Spotted w/pecker
GT	Great tit
G	Green w/pecker
LW	Lesser whitethroat
LT	Long-tailed tit
R	Robin
SW	Sedge warbler
ST	Song thrush
TC	Tree creeper
WH	Whitethroat
WW	Willow warbler
WR	Wren

 Red list species

 Amber List Species

 Green List Species

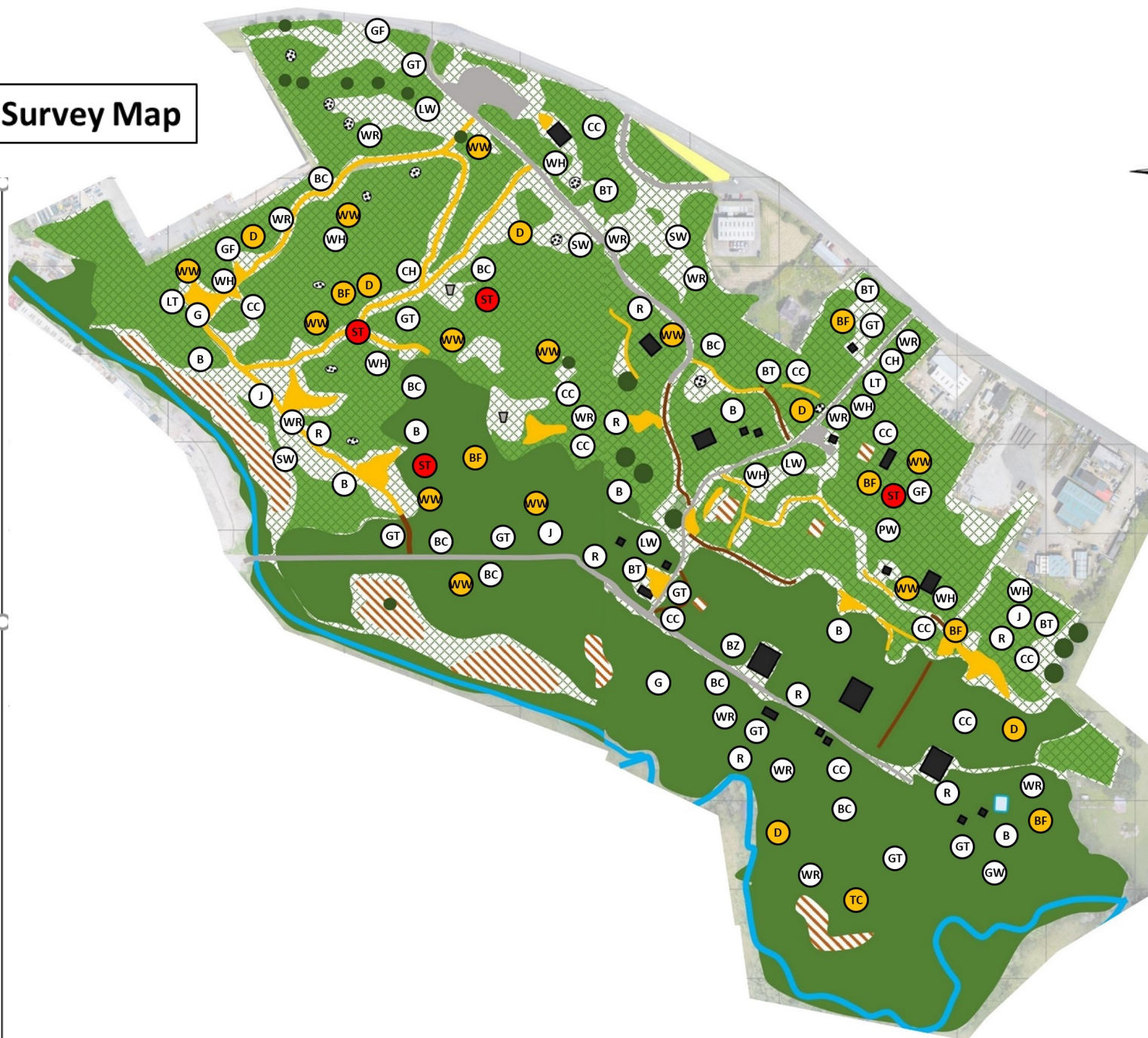
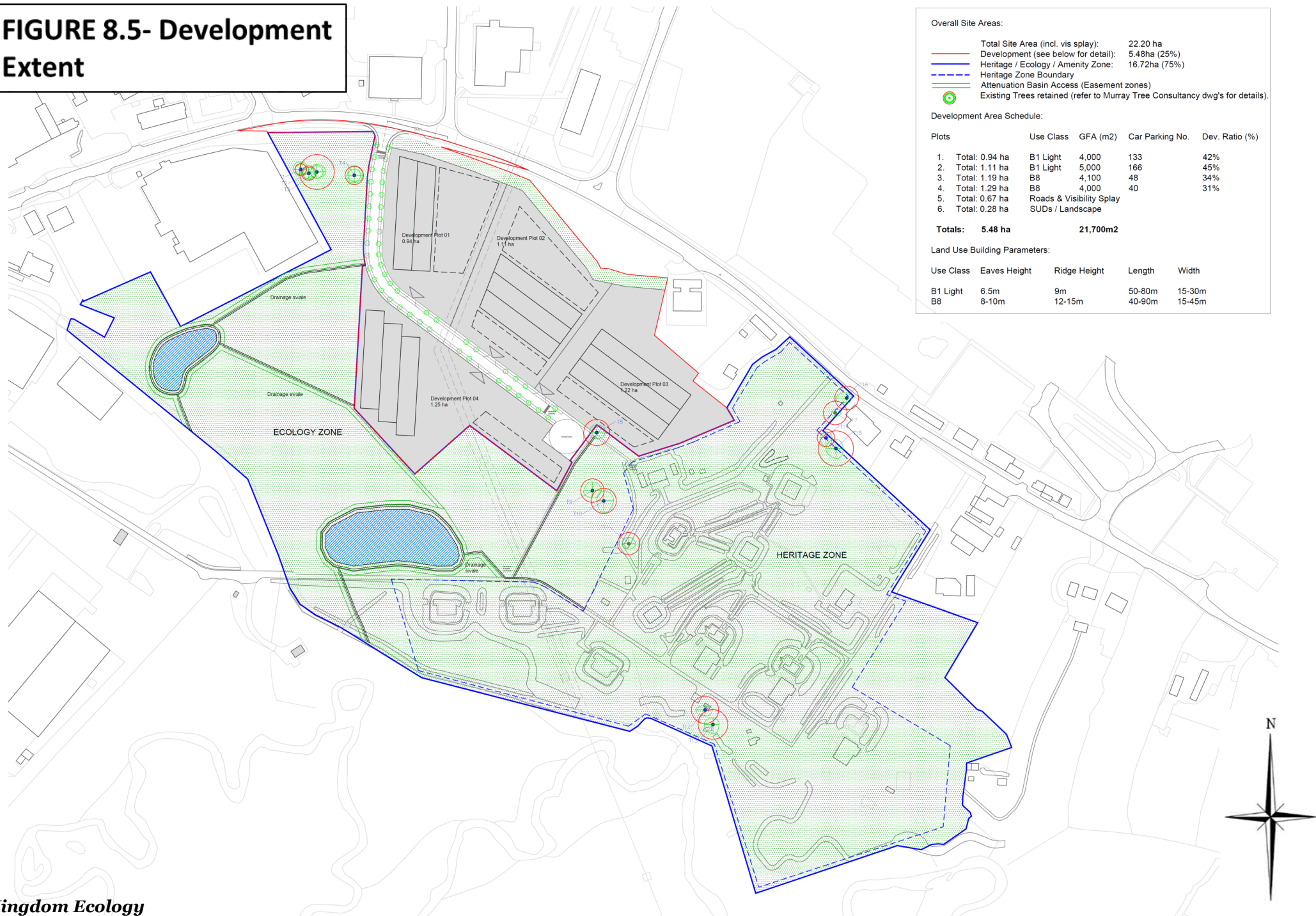
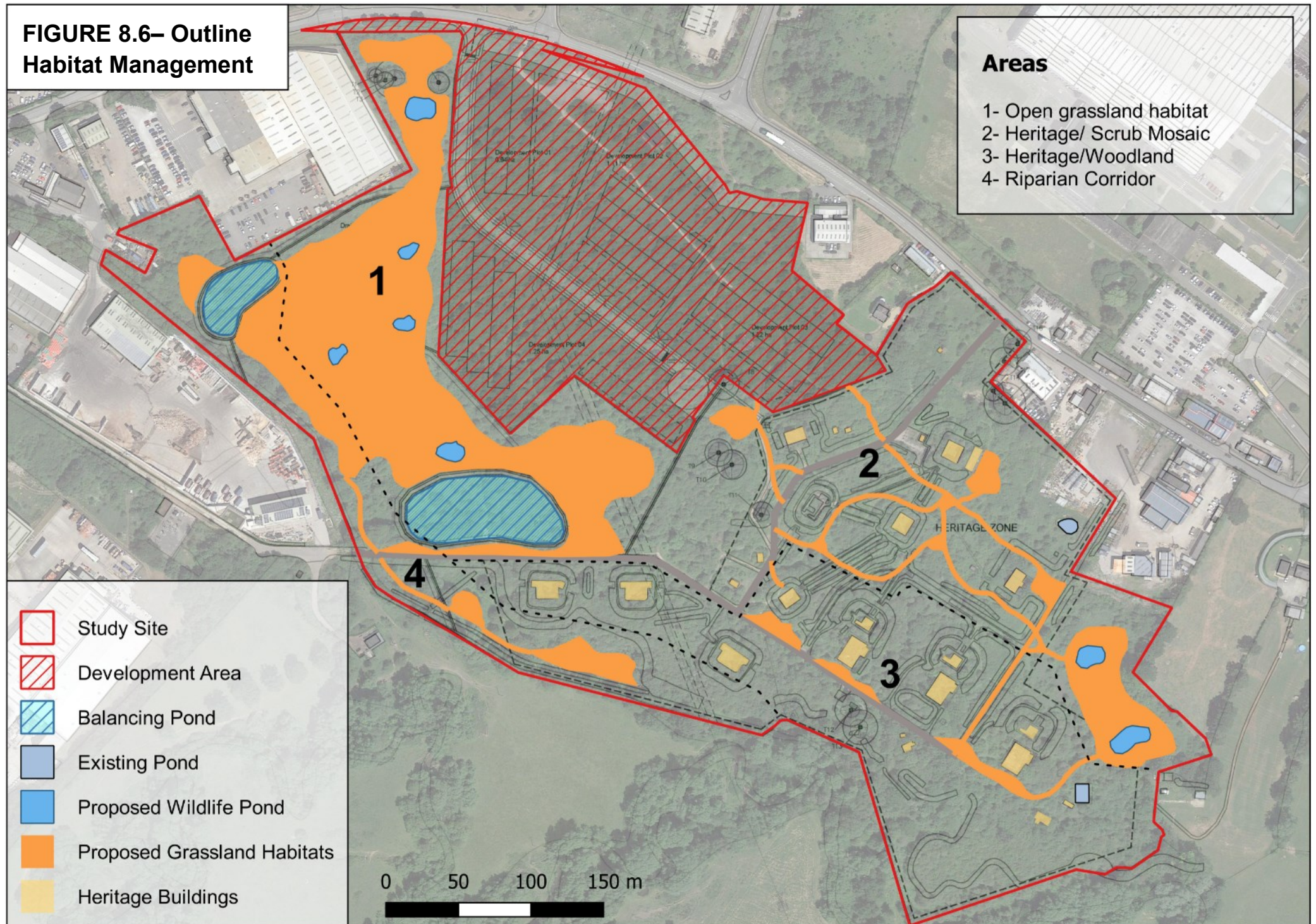


FIGURE 8.5- Development Extent



**FIGURE 8.6– Outline
Habitat Management**



Photographs of Habitats at Site

1- Grassland scrub mosaic



2- Flower-rich glade



3- Flower-rich track



4- Flower-rich glade



5- Track overgrown with ribbed melilot



6- Flower-rich bramble underscrub



Photographs of Habitats at Site

7- Scrub habitats at site



8- Short sward/tall sward/scrub mosaic



9- Scrub habitat at site



10- Tall herb by Redwither Brook



11- Bramble underscrub



12- Bramble scrub field layer



Photographs of Habitats at Site

13- Oak tree at site (T3)



14- Mature woodland near River Clywedog



15- hardstanding track through hawthorn woodland



16- Mature hawthorn woodland near south-east of site



17- Ephemeral pool (April 2016)



18- Pond 1 (May 2016)



Photographs of Habitats at Site

19 - Pond 2 (April 2016)



20- Pond 3 (April 2016)



21- Pond 4 (August 2016)



22- Building 4



23- Interior of Building 3



24- Exterior of Building 8



Photographs of Habitats at Site

25- Typical pill box at site (B7)



26- Interior of pill box



27- Exterior of Building 3



28- Exterior of Building 1



29- Interior of Building 3



30- Exterior of Building 5 showing tunnel



**Land off Oak Road
Wrexham
An invertebrate assessment**

**A report for:
Kingdom Ecology**

06/10/2016

**By:
Conops Entomology Ltd**

Report Number: 19.16





**Report title: Land off Oak Road, Wrexham
An invertebrate assessment**

Report number: 09.16

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1 Introduction

- 1.1 To undertake an invertebrate assessment of land off Oak Road at Wrexham Industrial Estate, on the eastern side of Wrexham, prior to possible development. The survey location is referred to as ‘the site’ from this point forward. The assessment was to appraise the key habitats and/or features of the site through the recording of invertebrates. These data were to be used to assess the value to invertebrates of those habitats or features in order to undertake a valuation of the site for its importance as an invertebrate resource. From the collection of data and subsequent assessment and valuation, suitable recommendations could then be put forward in the event that some or all of those features or key habitats may be impacted by a proposed development.
- 1.2 The site is located at OS grid reference SJ 386493.
- 1.3 The site comprises extensive dense scrub bisected by narrow paths, flower-rich short sward grassland. There is also a woodland compartment to the east of the site and the Redwither Brook borders and near borders the southern boundary of the site.
- 1.4 The main emphasis of the survey work was to examine and determine the value of the areas that were most likely to support scarce invertebrates or rich assemblages, namely the areas of post-industrial land.

2 Methods and timings

- 2.1 The methods utilised for the assessment are those recommended in the Natural England guidance document ‘Surveying terrestrial and freshwater invertebrates for conservation evaluation’ (2007). In some instances the method has been made bespoke for the site assessment but still retains the overall approach to assessing features and habitats for conservation assessment.

Sweep netting

- 2.2 This method provides the main proportion of the survey element, and is the most efficient method of cataloguing a site’s invertebrate resource.

Spot sampling

- 2.3 Spot sampling is employed to collect large, conspicuous invertebrates such as bees and wasps from flowering plants and to supplement the sweep samples. Spot sampling is often the most effective method of recording species from high-fidelity niches.

Grubbing

- 2.4 Fallen deadwood, piles of rotting timber (for deadwood beetles) and short turf (for surface running beetles) are fingertip searched for any hiding or crawling invertebrates, principally beetles.

Beating

- 2.5 The woodland trees were beaten for arboreal beetles and bugs. The beating dislodges any individuals from overhanging branches on to a clean, white sheet from which the specimens can be examined.

Survey timing

2.6 The site was visited on five optimal dates:

19/05/16 – sunny 16°C (targeting grizzled skipper)

28/05/16 – sunny 18+°C (targeting grizzled and dingy skipper)

18/06/16 – light cloud and sun 16–21°C (targeting dingy skipper)

05/07/16 – high cloud 16–19°C

10/08/16 – sun and cloud 15–18°C

3 Results summary

The full list of species recorded can be found in Appendix III.

Scientific name	Vernacular name	National status	Habitat preferences and species notes	Site notes
<i>Coenonympha pamphilus</i>	Small heath	S42	Dry grasslands, brownfields and heaths with fine-leaved grasses. Likes patchworks of short and taller sward grasslands.	A number of individuals recorded.
<i>Erynnis tages</i>	Dingy skipper	S42	Early successional habitat with common bird's-foot trefoil (<i>Lotus corniculatus</i>) over bare ground.	Probable fragile population on the site due to lack of significant habitat.
<i>Pyrgus malvae</i>	Grizzled skipper	S42	Early successional habitat with low growing Rosaceae, such as wild strawberry (<i>Fragaria vesca</i>) and creeping cinquefoil (<i>Potentilla reptans</i>).	Only a single male noted during the surveys on 19/05/16. If breeding on site, then likely to be very susceptible to site loss.

Table 1 Species of importance

3.1 The most up-to-date information or species reviews are used in the assessment. Where there is no up-to-date review, Recorder 6 (JNCC, 2006¹) is used.

Resources for determining status

Alexander, K.N.A. and Denton, J.S. (2014) *A review of the beetles of Great Britain: The darkling beetles and their allies. Species Status No. 18.* Natural England Commissioning Reports, Number 148.

Bantock, T. (2016) *A review of the Hemiptera of Great Britain: The shield bugs and their allies. Species Status No. 26.* Natural England Commissioning Reports, Number 190.

Duff, A. (2007) *Identification – Longhorn beetles: Part 2.* British Wildlife 19: 35–43.

Hubble, D.S. (2014) *A review of the scarce and threatened beetles of Great Britain: The leaf beetles and their allies. Species Status No. 19.* Natural England Commissioning Reports, Number 161.

Shirt, D.B. (1987) *British Red Data Books: 2. Insects.* Nature Conservancy Council Peterborough.

Sutton, P. (2015) *A review of the Orthoptera (grasshoppers and crickets) of Great Britain: Species Status No. 21.* Natural England Commissioning Reports, Number 187.

Telfer, M.G. (2016) *A review of the beetles of Great Britain: Ground beetles (Carabidae): Species Status No. 25.* Natural England Commissioning Reports, Number 189.

¹ JNCC (2006) Recorder 6. Version 6.15.4.238 (22 July 2010). Joint Nature Conservation Committee.

Results analysis

- 3.2 The tables in this section have been generated using the ISIS software package. The tables are useful, as the analysis of data can help assess the quality of habitats and features recorded on a site. For a full description of ISIS, see Appendix IV.

ISIS SAT and BAT tables

SAT code	SAT name	No. spp.	Condition	Percentage of national species pool	Related BAT rarity score
A215	epiphyte fauna	1		5	
F001	scrub edge	7		4	
F002	rich flower resource	7		3	
F006	dung	2		2	
A212	bark & sapwood decay	6		1	
F112	open short sward	2		1	132
F003	scrub-heath & moorland	1		0	

The broad assemblage types represented in this list are as follows:

BAT code	BAT name	Representation (1-100)	Rarity score	Condition	BAT species richness	IEC
F2	grassland & scrub matrix	39	113		71	
F1	unshaded early successional mosaic	12	132		22	
W3	permanent wet mire	9	138		16	
F3	shaded field & ground layer	7			13	
A2	wood decay	5			9	0
W2	mineral marsh & open water	5			9	
W1	flowing water	4			8	
A1	arboreal canopy	4			7	

Rarity scores are shown only for BATS represented by more than 15 species in the assemblage / fauna being analysed

4 Discussion

Broad assemblage types

- 4.1 The site is represented by a wide range of broad assemblage types (BATs). There are, however, three principal key habitats that dominate the site in terms of species associations and physical extent.
- 4.2 The BAT with the greatest number of species associations is the grassland and scrub BAT (F2), which holds 39% of species recorded. This BAT is widely distributed around the site and dominates the sampling area. It includes a wide range of species, from common and ubiquitous species of open habitats to some higher-fidelity species and those that require mosaics of different habitats in close proximity to one another, such as the bees and wasps.
- 4.3 The unshaded early successional mosaic BAT (F1) is represented by only 12% of all species recorded from the surveys. This assemblage is not extensive across the site but is concentrated in three key locations on the western side of the site in 'glade' type path intersections. These are only small, however, and possess some populations of key species, including the S42 grizzled and dingy skippers, the former only being noted by a single male.
- 4.4 There are a few small waterbodies on the site that dry up periodically. Despite this, there is a small resource of aquatic and semi-aquatic invertebrates utilising these features. Other species associated with this W3 permanent wet mire BAT are recorded from the damp areas along the Redwither Brook along the southern boundary to the site.
- 4.5 The woodland compartment to the east of the site is also noted in the BAT analysis through the presence of three key woodland BATs. None is highlighted by ISIS as being significant, but the combined scores of A1, A2 and F3 amount to 16% of the total species recorded from the site, indicating that the woodland, or at least the mature trees and partial shade, is of value. The dense shaded hawthorn stands are of less value.

Specific assemblage types

- 4.6 The specific assemblage types (SATs) are the high-fidelity niches and situations in which many scarce species can be found. The species tend not to be found in wider situations, as they are fussy or demanding of a site or landscape.
- 4.7 As there is a long list of BATs recorded from the site, the list of SATs is also comparatively long; however, none is of significant value. The most notable SATs are the scrub edge and rich flower resource (both with seven associated species of fidelity). This is not surprising given that these two features are probably the most extensive and strongest across the site.
- 4.8 The bark and sapwood decay SAT (A212) is represented by a range of species from both wooded habitat and also open habitats. Deadwood beetles prefer semi-shaded woodlands and trees, and aerial nesting solitary wasps and bees prefer deadwood in open and sunny situations.

- 4.9 Other complementary SATs to the above include the open short sward (F112), which is surprising to not be highlighted as of greater value given the small but high-quality character of the open flowery areas. The reason it is not highlighted more significantly is, in part, due to the lack of a bee and wasp resource on the site.

5 Assessment summary

Site assessment

- 5.1 The site includes a range of habitats from woodland and dense scrub, flower short sward grassland and ephemeral pools.
- 5.2 The habitats of greatest value are those associated with the industrial heritage of the site, including the flowery short swards, taller swards, ephemeral pools and scrub fringe. The woodland of the eastern side of the site also presents opportunities for localised and high-fidelity species, but the area is currently degraded owing to off-road biking and lack of suitable management. It could be made to be of higher value through suitable management. See Section 6 for recommendations.
- 5.3 This mosaic of habitats is of value to invertebrates as it offers a range of opportunities for nesting and breeding in close proximity to the foraging locations. This juxtaposition of habitats and features is what elevates many brownfield sites above the wider landscape, which tends towards homogenous swards and habitats; early successional vegetation, short swards and mosaics of other habitats in close juxtaposition are categorised as heterogeneous habitats.
- 5.4 It is this heterogeneity that is of principal value, and the juxtaposed habitats and features that should be retained wherever possible: if they cannot be retained then they should be adequately replicated as part of a mitigation scheme.
- 5.5 The lack of strong populations of both the dingy and grizzled skippers suggest the site is on the decline, most likely through unauthorised off-road vehicle activity impacting the limited open resources and also the small areas of suitable breeding for the two key S42 butterfly species due to habitat succession including encroachment by scrub. The spring of 2016 was dominated by poor weather and it may be that this year was poor for the species and that subsequent years may result in better numbers. However, even if greater numbers are recorded in optimal years, it does not detract from the site progressively losing value through degradation.

Site evaluation

- 5.6 There are three scarce and important species associated with the site, solely with the post-industrial habitat mosaic of flowery short swards, taller swards and scrub fringe. The other habitats and areas are also of value to invertebrates, potentially with some further scarce species being recorded from early successional vegetation because of the close location of this site to other high-value or formerly high-value invertebrate sites. The mature oak trees are also likely to present species of value, but large trees are difficult to sample effectively, especially where inhibited by surrounding scrub and other trees.
- 5.7 The valuation of the site takes into consideration the range of species recorded, including the scarce species, the overall assemblages and the importance of the mosaic habitats to the species. The valuation also considers the potential for other scarce species to be present, including those that are difficult to sample for, such as the deadwood beetles associated with living trees. By using the experience of the surveyor, his knowledge of invertebrates and site assessment and also by consulting the guidance notes prepared by Colin Plant Associates for CIEEM (Chartered Institute of Environmental Managers and Ecologists) (Appendix II) it is suggested that the site's key features should be considered as of at least **District (low) importance** (Plant, 2009).
- 5.8 The site is not thought to be of County (medium) importance, largely due to the degrading nature of the site to hold viable populations of a range of species including the grizzled skipper. The dingy skipper population is small, with no more than six to eight individuals recorded during any single visit. However, it is likely that this site forms a matrix with other small sites in the area.
- 5.9 Regardless of whether grizzled skipper and dingy skipper are declining on the site, the following recommendations will consider these species, to support any colonies that are on the site or periodically use it and to support the probable metapopulation in the local area.

6 Recommendations

- 6.1 The success of any mitigation for loss of part or all of the site's key features will be dependent on incorporating the following habitats and features in juxtaposition with one another and creating features that are both extensive and optimal.
- 6.2 All invertebrate-related mitigation should be undertaken on low-fertility soils. Only peripheral ruderal areas can be created on nutrient-rich topsoils.

Bare ground

- 6.3 It is important that all of the features noted in the recommendations form a mosaic and are retained or created in close proximity to one another and are in an optimal state. An optimal state for most of the features will be relatively easily achieved when utilising nutrient-poor subsoils.
- 6.4 The bare ground constituent of the mitigation should include open areas that are exposed to full sun for much of the day, including the key period between 10:00 and 16:00 hours. Vertical or near vertical exposures will help diversify the nesting opportunities for ground-nesting bees and wasps at the site. Some slumping of the vertical faces is permissible and for some species a desirable feature and should not be viewed negatively.
- 6.5 The bare ground should include 100% open ground and also areas of patchy open swards (50%) and bare ground (50%). The ground surface can be uneven, with divots and shallow depressions. The microtopography is an important feature, as it increases the value of the mitigation. Overworking of the material should be avoided, as this tends to result in an even surface, which is undesirable for invertebrate mitigation.

Butterfly banks

- 6.6 A useful feature that benefits a wide range of open mosaic and flower foraging invertebrates is that of a flower-rich bund or bank. This is especially valuable to butterflies (such as the dingy skipper and grizzled skipper) and pollinating invertebrates that require thermophilic features and high-density flower stands.
 - Invertebrate banks are essentially mounded materials. These features are partially compacted with machinery, but other parts of the banks can be allowed to settle naturally to encourage niche variation, through slumping.
 - Medium, coarse aggregate material can be used for these banks. A limestone or other high pH material is preferable, as this gives rise to a richer flora, including bird's-foot trefoil. Crushed material from on site would be suitable.
 - Optimally, the banks should be in a southerly facing aspect for greatest sun exposure and in a crescent or sinuous shape, which further elevates the microclimate of the feature.
 - Ideally, the banks should be sown with a suitable flower mix, allowed to colonise naturally, or topped with existing flower-rich turf from on site, especially where it contains common bird's-foot trefoil and/or creeping cinquefoil or other useful plants. A mixture of all three options can also be undertaken.
 - These banks can be further diversified through the creation of small cliff faces dug into the bank to provide nesting locations for solitary bee and wasp species.

To promote dingy and grizzled skippers, some key plants are suggested for inclusion on the banks:

- Dingy skipper
 - Common bird's-foot trefoil (*Lotus corniculatus*)
- Grizzled skipper
 - Creeping cinquefoil (*Potentilla reptans*)
 - Wild strawberry (*Fragaria vesca*)
 - Agrimony (*Agrimonia eupatoria*)

Flowering swards

6.7 The flowering areas should be sown with an appropriate mix of flowering plants. This mix should benefit the pollen- and nectar-foraging invertebrates and therefore include the following:

- Hawkweeds (*Hieracium* spp.)
- Common bird's-foot trefoil (*Lotus corniculatus*)
- St. John's wort (*Hieracium* spp.)
- Vetches (*Vicia* spp.)
- Hawkbits (*Leontodon* spp.)
- Red clover (*Trifolium pratense*)
- Other trefoils (Fabaceae)
- Meadow vetchling (*Lathyrus pratensis*)
- Woundworts (*Stachys* spp.)
- Wild carrot (*Daucus carota*).

The flowering swards should have a high density of flowers, and most standard mixes do not have a high enough proportion of flowering plants that are suitable for brownfield site mitigation, so a bespoke mix or additional ordering of supplementary flower seed is advised.

Scrub fringe

6.8 Scrub, or specifically spring blossom, is an integral part of a healthy and functioning invertebrate site. It is a key provider of pollen and nectar in spring from March to late June before the grassland flowers dominate. A range of species that provide flowers through this period is recommended, including willows (*Salix* spp.), blackthorn (*Prunus spinosa*) and hawthorn (*Crataegus monogyna*). Planting of scrub can be undertaken in suitable locations across the site, especially near to or adjacent to key bee and wasp locations.

Waterbodies

- 6.9 The waterbodies at the site are shallow and ephemeral. These are ideal, as they prevent fish from establishing and the fluctuating water level provides dynamic habitats that include diverse margins. It is this character that should be replicated where possible.
- 6.10 The pools should vary from shallow ephemeral ones to those that contain water for longer periods. The margin should be as varied as possible, with considerable shallows that have the ability to draw down. Photograph 1 below shows a good-quality pond with a highly variable margin and depths that encourage a range of flora and a corresponding invertebrate fauna.



Photograph 1

Deadwood

- 6.11 To cater for deadwood-nesting bees and wasps, dry, desiccated wood in sunny and sheltered situations is required. The deadwood should be of large volume and at least partly stripped of bark to desiccate quickly. The size of material is important, as large volume pieces rot down slowly, providing long-term value. Timber with a diameter greater than 30 cm is therefore advised. This should be close to scrub or trees, which offer foraging for the nesting species and provide added shelter to the deadwood feature. Several of these deadwood features should be situated around the mitigation site.

Ruderal areas

- 6.12 Although not thought of as high-value habitats, ruderal areas are important features to a well-functioning invertebrate site, as they offer a huge amount of pollen and nectar to pollinators. Small patches of ruderals can be allowed to develop in any unused space for mitigation or around the development, but ideally close to the principal invertebrate features being retained or created.

Woodland and trees

- 6.13 The woodland is largely of a poor character due to the domination of hawthorn and off-road activity. To increase the value of the mature trees, they should be haloed in order to enable light to reach the trees and encourage their retention for the future. This will also enable the corresponding fauna to flourish.
- 6.14 Haloing involves the felling and pruning back of surrounding low-value trees and scrub so that they do not shade out and stunt the development of the older, slow-growing oak trees.
- 6.15 The hawthorn scrub is of some value, as it provides spring blossom and structure; however, it should be managed to reduce its impact on other valuable resources such as the trees and also open short sward areas.

Juxtapositions and interfaces

- 6.16 To increase the complexity of the mitigation and therefore provide a wide range of niches for high-fidelity invertebrates, features such as the flower-rich invertebrate banks, patchy scrub fringe, flowery grassland and bare ground should all be in close proximity to one another wherever possible. An intricate mosaic of habitats and juxtapositions will generate many opportunities for invertebrates and in turn elevate the biodiversity value of the landholding.

7 References

- Alexander, K.N.A. (2014)** *A review of the beetles of Great Britain: The soldier beetles and their allies. Species Status No. 16.* Natural England Commissioning Reports, Number 134.
- Alexander, K.N.A. and Denton, J.S. (2014)** *A review of the beetles of Great Britain: The darkling beetles and their allies. Species Status No. 18.* Natural England Commissioning Reports, Number 148.
- Anon (2008)** *Acalypterate keys.* Unpublished test keys. Dipterists Forum.
- Ball, S. (2005)** *Hoverfly Recording Scheme.* www.hoverfly.org.uk
- Bantock, T. (2016)** *A review of the Hemiptera of Great Britain: The shield bugs and their allies. Species Status No. 26.* Natural England Commissioning Reports, Number 190.
- d'Annis Fonseca, E.C.M. (1978)** *Diptera Orthorrhapha Brachyycera – dolichopodidae.* Royal Entomological Society of London.
- Drake, C.M. et al. (2007)** *NERR005. Surveying terrestrial and freshwater invertebrates for conservation evaluation.* Natural England.
- Falk, S. (2015)** *Field guide to the bees of Great Britain and Ireland.* British Wildlife Publishing.
- Hubble, D.S. (2014)** *A review of the scarce and threatened beetles of Great Britain: The leaf beetles and their allies. Species Status No. 19.* Natural England Commissioning Reports, Number 161.
- Lott, D et al. (2007)** *ISIS. Invertebrate Species–habitat Information System, 2010 build.* Natural England.
- Plant, C. (2009)** *Invertebrates and ecological assessment.*
http://www.cieem.net/data/files/Resource_Library/Technical_Guidance_Series/SoSM/Colin_Plant_-_Invertebrates.pdf
- Richards, O.W. (1980)** *Scolioidea, Vespoidea and Sphecoidea. Hymenoptera, aculeata.* Royal Entomological Society.
- Shirt, D.B. (1987)** *British Red Data Books: 2. Insects.* Nature Conservancy Council Peterborough.
- Stubbs, A.E. (2002)** *British Hoverflies.* British Entomological and Natural History Society.
- Stubbs, A.E. and Drake, M. (2001)** *British Soldierflies and their allies.* British Entomological and Natural History Society.
- Sutton, P. (2015)** *A review of the Orthoptera (grasshoppers and crickets) of Great Britain: Species Status No. 21.* Natural England Commissioning Reports, Number 187.
- Telfer, M.G. (2016)** *A review of the beetles of Great Britain: Ground beetles (Carabidae): Species Status No. 25.* Natural England Commissioning Reports, Number 189.

8 Appendices

Appendix I: Red Data Book definitions

Appendix II: Criteria for defining invertebrate sites of significance. Taken from Plant (2009)

Appendix III: Survey results

Appendix IV: ISIS description

Appendix I: Red Data Book definitions

Red Data Book category 1 (RDB 1) – Endangered

Species that are known or believed to occur as only a single population within one 10 km square of the National Grid.

Red Data Book category 2 (RDB 2) – Vulnerable

Species declining throughout their range or in vulnerable habitats.

Red Data Book category 3 (RDB 3) – Rare

Species that are estimated to exist in only 15 or fewer post-1970 10 km squares. This criterion may be relaxed where populations are likely to exist in over 15 10 km squares but occupy small areas of especially vulnerable habitat.

Nationally Notable (Scarce) category A (NS A) – Notable A

Taxa that do not fall within the RDB category but that are nonetheless uncommon in Great Britain and thought to occur in 30 or fewer 10 km squares of the National Grid or, for less well recorded groups, between 8 and 20 vice counties.

Nationally Notable (Scarce) category B (NS B) – Notable B

Taxa that do not fall within the RDB category but that are nonetheless uncommon in Great Britain and thought to occur in 31–100 10 km squares of the National Grid or, for less well recorded groups, between 8 and 20 vice counties.

Nationally Notable (Scarce) (N) – Notable

Species that are estimated to occur within the range of 16 to 100 10 km squares. The subdividing of this category into Notable A and Notable B has not been attempted for many species in this part of the review.

Appendix II: Criteria for defining invertebrate sites of significance. Taken from Plant (2009)

Importance	Description	Minimum qualifying criteria
International (high) importance	European important site (i.e. SAC)	Internationally important invertebrate populations present or containing RDB 1 (Endangered) species or containing any species protected under European legislation or containing habitats that are threatened or rare at the European level (including, but not exclusively so, habitats listed on the EU Habitats Directive).
National (high) importance	UK important site (SSSI)	Achieving SSSI invertebrate criteria (NCC, 1989) or containing RDB 2 (Vulnerable) or containing viable populations of RDB 3 (Rare) species or containing viable populations of any species protected under UK legislation or containing habitats that are threatened or rare nationally (Great Britain).
Regional (medium) importance (for border sites, both regions must be taken into account)	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in south-east England	Habitat that is scarce or threatened in the region or that has, or is reasonably expected to have, the presence of an assemblage of invertebrates including at least 10 Nationally Notable species or at least 10 species listed as Regionally Notable for the English Nature region in question in the Recorder database or elsewhere or a combination of these categories amounting to 10 species in total.
County (medium) importance (for border sites, both counties must be taken into account)	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the county in question	Habitat that is scarce or threatened in the county and/or that contains, or is reasonably expected to contain, an assemblage of invertebrates that includes viable populations of at least five Nationally Notable species or viable populations of at least five species regarded as Regionally Scarce by the county records centres and/or field club.
District (low) importance	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the administrative district	A rather vague definition of habitats falling below county significance level, but which may be of greater significance than merely Local. They include sites for which Nationally Notable species in the range from one to four examples are reasonably expected but not yet necessarily recorded and where this omission is considered likely to be partly due to under-recording.
Local (low) importance	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the affected and neighbouring parishes (except Scotland, where the local area may best be defined as being within a radius of 5 km)	Habitats or species unique or of some other significance within the local area.
Importance within the context of the site only (low importance)	—	Although almost no area is completely without significance, these are the areas with nothing more than expected 'background' populations of common species and the occasional Nationally Local species.

Appendix III: Survey results

Only species with a national status have been annotated. All others are common or local species.

Taxon	Vernacular	Date	Status
<i>Aglais io</i>	Peacock	09-May-16	
<i>Aglais urticae</i>	Small tortoiseshell	28-May-16	
<i>Agriotes sputator</i>	A click beetle	09-May-16	
<i>Anaspis frontalis</i>	A beetle	05-Jul-16	
<i>Andrena chrysosceles</i>	A mining bee	09-May-16	
<i>Andrena wilkella</i>	A mining bee	18-Jun-16	
<i>Anthocharis cardamines</i>	Orange-tip	09-May-16	
<i>Anthonomus rubi</i>	Strawberry blossom weevil	05-Jul-16	
<i>Aphantopus hyperantus</i>	Ringlet	18-Jun-16	
<i>Argyra leucocephala</i>	A dolyfly	09-May-16	
<i>Athous haemorrhoidalis</i>	A click beetle	18-Jun-16	
<i>Autographa gamma</i>	Silver Y	18-Jun-16	
<i>Barypeithes pellucidus</i>	A weevil	28-May-16	
<i>Bembecia ichneumoniformis</i>	Six-belted clearwing	05-Jul-16	
<i>Beris chalybata</i>	A soldierfly	28-May-16	
<i>Bombus hortorum</i>	Small garden bumble bee	05-Jul-16	
<i>Bombus hypnorum</i>	A bumblebee	28-May-16	
<i>Bombus lapidarius</i>	Large red tailed bumble bee	28-May-16	
<i>Bombus lucorum sens. str.</i>	White-tailed bumble bee	05-Jul-16	
<i>Bombus pascuorum</i>	Common carder bee	09-May-16	
<i>Bombus terrestris</i>	Buff-tailed bumble bee	09-May-16	
<i>Bombus vestalis</i>	A bumblebee	05-Jul-16	
<i>Bombylius major</i>	A beefly	09-May-16	
<i>Brachypterus urticae</i>	Nettle pollen beetle	28-May-16	
<i>Calliopum aeneum</i>	A fly	10-Aug-16	
<i>Calobata petronella</i>	A stilt-legged fly	18-Jun-16	
<i>Calopteryx splendens</i>	Banded demoiselle	28-May-16	
<i>Calopteryx virgo</i>	Beautiful demoiselle	18-Jun-16	
<i>Calvia quattuordecimguttata</i>	Cream-spot ladybird	28-May-16	
<i>Cantharis livida</i>	A soldier beetle	28-May-16	
<i>Cantharis rustica</i>	A soldier beetle	28-May-16	
<i>Ceratopion onopordi</i>	A weevil	18-Jun-16	
<i>Cercopis vulnerata</i>	A leafhopper	28-May-16	
<i>Chaetorellia jaceae</i>	A fruitfly	28-May-16	
<i>Cheilosia albitarsis sens. str.</i>	A hoverfly	09-May-16	
<i>Cheilosia lasiopa</i>	A hoverfly	09-May-16	
<i>Cheilosia pagana</i>	A hoverfly	09-May-16	
<i>Cheilosia variabilis</i>	A hoverfly	28-May-16	
<i>Chloromyia formosa</i>	A soldierfly	18-Jun-16	

<i>Chorisops tibialis</i>	A soldierfly	18-Jun-16	
<i>Chrysogaster solstitialis</i>	A hoverfly	18-Jun-16	
<i>Chrysopilus asiliformis</i>	A snipefly	18-Jun-16	
<i>Chrysotoxum arcuatum</i>	A hoverfly	18-Jun-16	
<i>Chrysotoxum bicinctum</i>	A hoverfly	18-Jun-16	
<i>Chrysotoxum festivum</i>	A hoverfly	18-Jun-16	
<i>Chrysotus gramineus</i>	A dolyfly	05-Jul-16	
<i>Closterotomus fulvomaculatus</i>	A true bug	18-Jun-16	
<i>Closterotomus norwegicus</i>	A true bug	18-Jun-16	
<i>Coccinella septempunctata</i>	7-spot ladybird	28-May-16	
<i>Coenonympha pamphilus</i>	Small heath	28-May-16	S42
<i>Crossocerus cetratus</i>	A digger wasp	18-Jun-16	
<i>Dicyphus globulifer</i>	A true bug	28-May-16	
<i>Dolichopus festivus</i>	A dolyfly	05-Jul-16	
<i>Dolichopus griseipennis</i>	A dolyfly	05-Jul-16	
<i>Dolichopus plumipes</i>	A dolyfly	05-Jul-16	
<i>Dolichopus trivialis</i>	A dolyfly	28-May-16	
<i>Dolichopus unguatus</i>	A dolyfly	18-Jun-16	
<i>Dolichopus wahlbergi</i>	A dolyfly	18-Jun-16	
<i>Empis livida</i>	A dancefly	18-Jun-16	
<i>Empis nuntia</i>	A dancefly	28-May-16	
<i>Empis planetica</i>	A dancefly	18-Jun-16	
<i>Empis tessellata</i>	A dancefly	09-May-16	
<i>Empis trigramma</i>	A dancefly	09-May-16	
<i>Epistrophe eligans</i>	A hoverfly	09-May-16	
<i>Episyrphus balteatus</i>	A hoverfly	18-Jun-16	
<i>Eristalis arbustorum</i>	A hoverfly	05-Jul-16	
<i>Eristalis horticola</i>	A hoverfly	10-Aug-16	
<i>Eristalis interruptus</i>	A hoverfly	10-Aug-16	
<i>Eristalis intricaria</i>	A hoverfly	09-May-16	
<i>Eristalis pertinax</i>	A hoverfly	09-May-16	
<i>Eristalis tenax</i>	A hoverfly	09-May-16	
<i>Erynnis tages</i>	Dingy skipper	28-May-16	S42
<i>Eupeodes corollae</i>	A hoverfly	18-Jun-16	
<i>Gastrophysa viridula</i>	Green dock beetle	10-Aug-16	
<i>Gerris gibbifer</i>	A pond skater	10-Aug-16	
<i>Grypocoris stysi</i>	A true bug	05-Jul-16	
<i>Gymnomerus laevipes</i>	A mason wasp	18-Jun-16	
<i>Haematopota pluvialis</i>	A horsefly	18-Jun-16	
<i>Halictus rubicundus</i>	A mining bee	28-May-16	
<i>Harpocera thoracica</i>	A true bug	09-May-16	
<i>Helophilus pendulus</i>	A hoverfly	28-May-16	
<i>Helophorus grandis</i>	A water beetle	09-May-16	
<i>Herina lugubris</i>	A fruitfly	10-Aug-16	

<i>Heterocordylus tibialis</i>	A true bug	05-Jul-16	
<i>Hilara anglodanica</i>	A hybotid fly	18-Jun-16	
<i>Hybos grossipes</i>	A hybotid fly	10-Aug-16	
<i>Hydrellia thoracica</i>	A shorefly	09-May-16	
<i>Hydromya dorsalis</i>	A snail-killing fly	05-Jul-16	
<i>Kleidocerys resedae</i>	A true bug	28-May-16	
<i>Lasioglossum albipes</i>	A mining bee	28-May-16	
<i>Leiosoma deflexum</i>	A weevil	28-May-16	
<i>Leptogaster cylindrica</i>	A robberfly	18-Jun-16	
<i>Leptopterna dolabrata</i>	A true bug	18-Jun-16	
<i>Leucozona lucorum</i>	A hoverfly	09-May-16	
<i>Limnia unguicornis</i>	A snail-killing fly	28-May-16	
<i>Limonia nigropunctata</i>	A crane fly	28-May-16	
<i>Limonia nubeculosa</i>	A crane fly	10-Aug-16	
<i>Liocoris tripustulatus</i>	A true bug	10-Aug-16	
<i>Lonchoptera lutea</i>	A pointed-winged fly	28-May-16	
<i>Lygocoris pabulinus</i>	A true bug	10-Aug-16	
<i>Malachius bipustulatus</i>	Malachite beetle	28-May-16	
<i>Maniola jurtina</i>	Meadow brown	18-Jun-16	
<i>Meconema thalassinum</i>	Oak bush cricket	28-May-16	
<i>Megachile willughbiella</i>	Willughby's leaf-cutter bee	18-Jun-16	
<i>Meiosimyza rorida</i>	A fly	28-May-16	
<i>Melanostoma mellinum</i>	A hoverfly	28-May-16	
<i>Melanotus castanipes</i>	A weevil	28-May-16	
<i>Meligethes atratus</i>	A pollen beetle	10-Aug-16	
<i>Mesembrina meridiana</i>	A fly	09-May-16	
<i>Microcara testacea</i>	A beetle	28-May-16	
<i>Microchrysa polita</i>	A soldierfly	28-May-16	
<i>Minettia flaviventris</i>	A fly	18-Jun-16	
<i>Miris striatus</i>	A true bug	28-May-16	
<i>Nedyus quadrimaculatus</i>	Small nettle weevil	18-Jun-16	
<i>Neoascia podagrica</i>	A hoverfly	28-May-16	
<i>Nephrotoma quadrifaria</i>	A crane fly	28-May-16	
<i>Neria cibaria</i>	A stilt-legged fly	28-May-16	
<i>Nomada fabriciana</i>	A cuckoo bee	28-May-16	
<i>Nomada flava</i>	A cuckoo bee	09-May-16	
<i>Ochlodes sylvanus</i>	Large skipper	16-Jun-16	
<i>Ocydromia glabricula</i>	A hybotid fly	18-Jun-16	
<i>Oedemera nobilis</i>	Swollen-thighed beetle	28-May-16	
<i>Oncotylus viridiflavus</i>	A true bug	10-Aug-16	
<i>Osmia caerulea</i>	A mason bee	28-May-16	
<i>Osmia rufa</i>	Red mason bee	09-May-16	
<i>Oxystoma subulatum</i>	A weevil	10-Aug-16	
<i>Palloptera umbellatarum</i>	A picture-winged fly	18-Jun-16	

<i>Pararge aegeria</i>	Speckled wood	09-May-16	
<i>Parhelophilus versicolor</i>	A hoverfly	18-Jun-16	
<i>Parydra coarctata</i>	A shorefly	10-Aug-16	
<i>Perapion hydrolapathi</i>	A weevil	28-May-16	
<i>Pherbellia dubia</i>	A snail-killing fly	18-Jun-16	
<i>Phyllobius pomaceus</i>	A weevil	05-Jul-16	
<i>Phytocoris longipennis</i>	A true bug	10-Aug-16	
<i>Pieris brassicae</i>	Large white	09-May-16	
<i>Pieris napi</i>	Green-veined white	09-May-16	
<i>Pipizella viduata</i>	A hoverfly	18-Jun-16	
<i>Plagiognathus arbustorum</i>	A true bug	18-Jun-16	
<i>Plagiognathus chrysanthemi</i>	A true bug	05-Jul-16	
<i>Platycheirus albimanus</i>	A hoverfly	28-May-16	
<i>Platycheirus clypeatus</i>	A hoverfly	09-May-16	
<i>Platycheirus manicatus</i>	A hoverfly	09-May-16	
<i>Platycheirus rosarum</i>	A hoverfly	16-Jun-16	
<i>Platycheirus rosarum</i>	A hoverfly	10-Aug-16	
<i>Poecilobothrus nobilitatus</i>	A dolyfly	05-Jul-16	
<i>Polydrusus pterygomalis</i>	A weevil	28-May-16	
<i>Polyommatus icarus</i>	Common blue	28-May-16	
<i>Portevinia maculata</i>	A hoverfly	09-May-16	
<i>Propylea quattuordecimpunctata</i>	14-spot ladybird	10-Aug-16	
<i>Psylliodes napi</i>	A leaf beetle	28-May-16	
<i>Psyllobora vigintiduopunctata</i>	22-spot ladybird	10-Aug-16	
<i>Pyrghus malvae</i>	Grizzled skipper	09-May-16	S42
<i>Pyrochroa serraticornis</i>	Common cardinal beetle	09-May-16	
<i>Pyronia tithonus</i>	Gatekeeper	10-Aug-16	
<i>Pyrrhosoma nymphula</i>	Large red damselfly	09-May-16	
<i>Rhagio scolopaceus</i>	A snipefly	28-May-16	
<i>Rhagonycha fulva</i>	A soldier beetle	05-Jul-16	
<i>Rhagonycha limbata</i>	A soldier beetle	28-May-16	
<i>Rhamphomyia crassirostris</i>	A dancefly	09-May-16	
<i>Rhaphium caliginosum</i>	A dolyfly	05-Jul-16	
<i>Rhingia campestris</i>	A hoverfly	09-May-16	
<i>Rhinoncus pericarpus</i>	A weevil	28-May-16	
<i>Riponnensia splendens</i>	A hoverfly	10-Aug-16	
<i>Rivellia syngenesiae</i>	A fruitfly	18-Jun-16	
<i>Scellus notatus</i>	A dolyfly	28-May-16	
<i>Scolopostethus thomsoni</i>	A true bug	18-Jun-16	
<i>Sicus ferrugineus</i>	A thick-headed fly	18-Jun-16	
<i>Sigara nigrolineata</i>	A boatman	10-Aug-16	
<i>Sitona cylindricollis</i>	A beetle	10-Aug-16	
<i>Sitona suturalis</i>	A beetle	28-May-16	

<i>Sphaerophoria scripta</i>	A hoverfly	05-Jul-16	
<i>Sphecodes monilicornis</i>	A cuckoo bee	09-May-16	
<i>Stenodema laevigata</i>	A true bug	10-Aug-16	
<i>Stenotus binotatus</i>	A true bug	05-Jul-16	
<i>Symmorphus gracilis</i>	A mason wasp	18-Jun-16	
<i>Syritta pipiens</i>	A hoverfly	28-May-16	
<i>Syrphus ribesii</i>	A hoverfly	09-May-16	
<i>Syrphus torvus</i>	A hoverfly	18-Jun-16	
<i>Systemus pallipes</i>	A dolyfly	09-May-16	
<i>Tachyporus solutus</i>	A beetle	09-Jun-16	
<i>Tephritis leontodontis</i>	A fruitfly	18-Jun-16	
<i>Terellia tussilaginis</i>	A fruitfly	18-Jun-16	
<i>Thymelicus sylvestris</i>	Small skipper	05-Jul-16	
<i>Tipula lunata</i>	A crane fly	28-May-16	
<i>Trypoxylon attenuatum</i>	Slender wood borer wasp	18-Jun-16	
<i>Urophora jaceana</i>	A fruitfly	05-Jul-16	
<i>Vanessa cardui</i>	Painted lady	10-Aug-16	
<i>Vespula germanica</i>	German wasp	28-May-16	
<i>Vespula vulgaris</i>	Common wasp	10-Aug-16	
<i>Volucella pellucens</i>	A hoverfly	18-Jun-16	
<i>Xylota segnis</i>	A hoverfly	09-May-16	
<i>Zygaena lonicerae</i>	Narrow-bordered five-spot burnet	05-Jul-16	

Appendix IV: ISIS description

ISIS (Invertebrate Species–habitat Information System) is a computer application that can be used to identify assemblages of importance when species lists are inputted into the computer software. This is particularly useful for identifying key areas of interest and importance and monitoring site changes as management alters habitat structure and species composition.

ISIS was developed by Natural England as a way of assessing sites for their invertebrate value. Although initially developed for assessing the condition of Sites of Special Scientific Interest (SSSI), it has been adopted for a wider use in habitat assessments. As it uses values (numbers) to score sites or features on a site, the computer application is very useful at providing baseline scores to sites and therefore a means of comparing a site either ‘intra’spectively (comparing an individual site against itself, normally how it changes with time or after management regime changes) or ‘inter’spectively (comparing one site against another or a suite of similar site/s).

ISIS provides scores for two types of ‘assemblage’ (an assemblage is a group of invertebrates that use a similar habitat or feature):

- Broad assemblage type (BAT) – often a landscape-scale habitat type that is affected by various environmental factors such as light/shade, hydrology and disturbance factors such as poaching, drainage, drought and water level fluctuation. This is a useful assemblage type, as it provides an overview of habitat quality and, by using it to monitor sites, can help highlight issues that may affect them over time such as over- and under-grazing, drainage and poaching.
- Specific assemblage type (SAT) – characterised by stenotopic species (those that can only withstand a narrow range of environmental conditions). SATs are therefore more tightly defined than BATs and sit within a parent BAT. More than one SAT can sit within a parent SAT.

Example:

BAT:

F2 – grassland and scrub matrix

SAT:

F211 – herb-rich dense sward

F212 – dense scrub

Invertebrate species that are associated with a specific assemblage are known as ‘fidelity species’ and these are the species that score highly and elevate an assemblage’s status in the ISIS analysis. The highest fidelity species tend to be those associated with SATs, as these are the most scarce and restricted assemblage types and, by association, the species using them tend to also be scarce and restricted in distribution.

The site quality score (SQS), also known as the ‘rarity score’, is a total score of all the species recorded at the site. Each national designation (Red Data Book, Nationally Scarce through to common species) receives a different level of score. The system is not reliant on exhaustive sampling of a site but is more useful for singular surveys or a limited range of closely related surveys.

Fowles *et al* (1999²) scoring for SQS is:

- 32 – RDB 1
- 32 – RDB 2
- 24 – RDB 3
- 16 – RDB ‘K’
- 16 – NS A
- 8 – NS B
- 4 – Regional NS/very local
- 2 – Local
- 1 – Common

These scores can be used as a baseline for the monitoring of sites post-mitigation if required. The higher the score, the ‘better’ the site.

Key to BAT and SAT output table	
BAT code	Invertebrate habitat code
BAT name	Invertebrate habitat name
Representation	% of species recorded associated with that BAT
Rarity score	Site quality score (SQS) – the combined score of all species recorded for that BAT BATs with no score are those that are below a threshold of 15 species present for that BAT
Condition	Used in SSSI condition assessment – not relevant
BAT species richness	Total number of species recorded associated with BAT
Index of ecological continuity (IEC)	Used for deadwood sites such as parklands

² Fowles, A.P., Alexander, K.N.A. and Key, R.R. (1999). The Saproxylous Quality Index: evaluating wooded habitats for conservation of deadwood Coleoptera. *The Coleopterist* 8:121-141.

BAT code	BAT name	Representation (1–100)	Rarity score	Condition	BAT species richness	IEC
F2	grassland & scrub matrix	42	136		56	
W3	permanent wet mire	18	167		24	
F1	unshaded early successional mosaic	10			13	
A1	arboreal canopy	7			9	
W2	mineral marsh & open water	3			4	
F3	shaded field & ground layer	2			2	
A2	wood decay	1			1	0

Example BAT ISIS results (ISIS, 2010)



Land at The Oaks, Oak Road, Wrexham Ind Est
Further GCN Assessment- GCN Dispersal Corridors

13th August 2020

Doc Ref: KE2020/0301

INTRODUCTION

Kingdom Ecology have completed a set of ecological assessments of approximately 7.6ha of land located on Oak Road, Wrexham Industrial Estate LL13 9PW (Ordnance Survey Grid SJ 386 494). Surveys were undertaken in 2016, 2017 and 2019.

As part of the assessments undertaken, the potential presence of great crested newt was considered. Findings of the assessment are provided in the original site assessment report (*'Land at Oak Road, Wrexham Industrial Estate- Ecological Assessment Report (Document Ref: KE1720.2) dated July 2019*). Surveys recorded great crested newt presence within one pond located at the northeast corner of the site.

The previous report considered the overall presence of great crested newt at the Oaks Site and within context of the nationally important great crested newt population contained within the wider environs of the Wrexham Industrial Estate.

This Ecology Addendum provides further information concerning potential dispersal routes for great crested newt between fragmented newt populations distributed around the wider Industrial Estate and passing through the Oaks. This has been undertaken by examining GCN records within the surrounding landscape, examining potential dispersal barriers and potential dispersal routes.

This addendum goes on to examine the impacts of development proposals and opportunities to enhance and strengthen dispersal corridors through the industrial estate.

This paper has been produced by Richard Roe (BSc, MSc, MIEEM, CEnv). Richard is a professional ecological consultant with over nineteen years' experience. Richard has extensive experience working with great crested newt in Wales and the wider UK and has held survey licenses since 2004.



Addendum

PREVIOUS SURVEY EVALUATIONS

The findings and evaluation of the 2019 report can be summarised as follows:-

'There are two permanent ponds present at the Oaks site. Great crested newt presence has been recorded in one of these ponds (Pond 4). It was not possible to safely complete a Population Size Class Assessment of this pond.

Nevertheless, it is understood that for developments within similar habitats at the Industrial Estate, there have been some inconsistencies between numbers of great crested newt recorded in ponds during survey and the ultimate numbers of great crested newt present within affected terrestrial habitats, with much larger numbers of great crested newt present than originally predicted.

Given the suitability of terrestrial habitats at the site, it is likely that the pond supports good numbers of great crested newt. It is likely that the greatest density of great crested newt are located within 100m of Pond 4.

Great crested newt are likely to be present within more distant habitats at the site albeit at lower densities.

In addition to supporting a great crested newt population in its own right, the Oaks site is located between good populations of great crested newt at the HMP Berwyn Prison Complex and further good populations located on Bryn Lane. There are some partial barriers to newt dispersal between all three of these sites but there is still the possibility of some movement between sites.

Consequently, given the oaks strategic location between these two newt populations, the presence of a breeding pond on the site itself and that the HMP Berwyn, Oaks and Bryn Lane newt populations are not entirely isolated from one another, the Oaks may form an important stepping stone providing a dispersal route between the three populations. The Oaks site may therefore represent a valuable feature within the overall Wrexham Industrial estate Great Crested Newt metapopulation.

A further assessment of the Oaks likely strategic importance has been undertaken by examining GCN records within the surrounding landscape, examining potential barriers and potential dispersal routes.



Addendum

STATUS OF GREAT CRESTED NEWT IN WREXHAM

Overview

Northeast Wales, including the County Borough of Wrexham and parts of neighbouring Flintshire, is one of the strongholds of the great crested newt within the UK (Jehle et al 2011¹). Due to the soil type, underlying geology and historical farming practices, lowland parts of Wrexham have a particularly high density of suitable ponds and the pondscape of northeast Wales has been identified as being of European importance. The high density of suitable ponds means that great crested newts are widespread across the county (Russell et al. 2017²).

Despite the prevalence of suitable ponds within the county, the decline of great crested newts within Wrexham has been acknowledged and a Great Crested Newt Species Biodiversity Action Plan was produced by Wrexham Borough Council in 2003 in order to maintain and enhance the status of the species within the county.

Great Crested Newt at the Industrial Estate

Wrexham Industrial Estate itself also supports important populations of great crested newt. Figure 2 in the Appendix shows historic pond records as provided by COFNOD for great crested newt in relation to the development site and the wider Industrial Estate.

This Figure shows a ring of occupied great crested newt ponds extending around the boundaries of the Industrial Estate with further populations located within the Industrial Estate itself including good populations around HMP Berwyn (to the southwest of the proposed development site); around Erlas Black Wood at the centre of the Industrial Estate and along Bryn Lane at the north of the Oaks site.

Habitats around each of these areas of high newt population have been recently enhanced through pond creation exercises and other habitat creation associated with the Village Bakery (creation of two new ponds at Erlas Black Wood in 2018 as part of wider measures to create a new nature reserve); creation of new ponds as part of the habitat mitigation area associated with the HMP Berwyn Site in 2016;

¹ Jehle R Thiesmeier B and Foster J. 2011. *The Crested Newt -A Dwindling Pond Dweller*. Laurenti-Verlag, Bielefeld, Germany

² Russell L, Starnes T and Wilkinson J (2017). *Spatial Action Plan for Great Crested Newts in Wrexham, A Manual for Achieving Favourable Conservation Status*. NRW Science Report Series. Report 77 pp 69, NRW, Bangor.



Addendum

plus creation of several ponds next to Bryn Lane as mitigation for development in 2008.

However, the Industrial Estate infrastructure of roads, industrial units and areas of hardstanding has resulted in some isolation and fragmentation of the pond clusters located within the industrial estate itself.

This means that the potential dispersal corridors that remain are of prime importance to the continuing function of the wider Wrexham Industrial Estate great crested newt metapopulation.

With regards to dispersal distances, great crested newt have been recorded travelling up to 1.3km in relatively unfragmented rural landscapes. However, such long-range migrations are typically rare with most studies indicating that shorter dispersal distances are more usual. Nevertheless, long-range dispersals are likely very important in maintaining local gene flow and allowing metapopulations to persist (Jehle et al 2011).

Potentially valuable wildlife corridors at the Industrial Estate are likely to include various blocks of broadleaved woodland and unimproved grassland habitats. Such habitats in proximity to the proposed development site include the oaks site itself and woodland habitats along River Clywedog.

The potential value and function of semi-natural habitats at the Industrial Estate acting as wildlife corridors has been recognised by Wrexham Borough Council who have provided a Green Network Plan for the Industrial Estate.

Previous GCN Modelling

A model of great crested newt habitat and likely presence has been developed by Amphibian and Reptile Conservation (ARC), in conjunction with Natural Resources Wales (NRW). This model has covered North East Wales including Wrexham.

To construct the model, Arnell & Wilkinson (2013³) gathered high resolution, recent great crested newt records and then used distribution modelling software, along with environmental layers to produce an estimated probability of presence output for great crested newts in North-East Wales at a 25m resolution across the study area.

³ A.P.Arnell & J.W.Wilkinson (2013) *Spatial Conservation Status Modelling of the Great Crested Newt in Anglesey and North-East Wales*. CCW Contract Science Report No. 1044



Addendum

The model has been used to create a number of maps and GIS layers to assist great crested newt conservation across Wrexham, including:

- Habitat Suitability: This maps the suitability of habitat for great crested newts across the county;
- Habitat Value: This maps the value of particular areas for great crested newts across Wrexham in a landscape context, based on the core habitat of the species within the county;
- Survey Target Areas: This maps priorities for great crested newt surveys, highlighting particular areas where knowledge is lacking; and
- Pond Creation Target Areas: This maps areas where the creation of new ponds would provide the most conservation benefit

The modelling data and maps are at a relatively coarse geographic resolution, but nevertheless, the Oaks Site and the surrounding areas of habitat are located within broad core habitat and pond creation target areas.

Wildlife Trusts Living Landscapes Project

The Wrexham Industrial Estate forms one of the Wildlife Trust's 'Living Landscapes Projects'. The Wildlife Trusts identify a living landscape as one that involves the creation of robust, resilient and connected landscapes on a large scale that are highly valued and accessible to people; full of wildlife and rich in opportunities for learning, health, well-being and economic development.

The Living Landscapes project identifies the Estate as being of importance for great crested newt but as also having a relatively low pond density. However, it confirms that there are three known great crested newt 'hot spots' located around the former firestone site (at the south of the estate and now the HMP Berwyn mitigation site), at the mitigation sites located along Bryn land (east of the site) and at Erlas Blackwood (at the centre of the site).

The Living Landscapes plan identifies a need to improve connectivity between these amphibian 'hotspots'. This includes a need to create new ponds between the identified areas.

FURTHER ASSESSMENT OF DISPERSAL ROUTES

Methodology

In order to predict potential great crested newt dispersal routes, a model has been produced using records of GCN obtained from COFNOD (See Figure 1). The model examines pond clusters and dispersal routes located at the southeast corner of the Industrial Estate and located within approximately 1km of the Oaks Study Site.



Addendum

The GCN data has been plotted on an aerial map of the Industrial Estate along with potential barriers to new dispersal. Barriers include buildings, extensive areas of hardstanding, roads and watercourses. Only GCN data recorded after 2000 has been used.

For each potential barrier, the resistance to great crested newt movement has been assessed based upon professional opinion, on-site knowledge and ground truthing of the features. Some barriers are considered likely to be more-or-less impervious to newt movements (buildings, the River Clywedog, extensive expanses of hardstanding); whilst other features have varying degrees of permeability (e.g. Roads with kerbs and gully pots, roads without kerbs, smaller watercourses etc).

In addition to confirmed great crested newt records, ponds without any survey data have also been plotted. These ponds lie principally to the east of the Industrial Estate. Although these ponds lack positive records of GCN, this is attributable to a lack of survey and so it is likely that a good proportion of these ponds support suitable GCN aquatic habitat and are likely to support GCN.

A buffer area of 250m has been plotted around each pond. These buffers indicate terrestrial habitats likely to support great crested newt. Where buffer areas intersect with neighbouring ponds these indicate areas where there is likely to be frequent movement of newts between ponds.

Groups of ponds have been identified as discreet Pond Clusters. These are numbered 1-6 on Figure 1.

By examining the distribution of ponds and pond clusters in relation to dispersal barriers, distance, and continuous areas of suitable GCN habitat, it has been possible to determine likely and/or potential dispersal newt corridors between the discrete pond clusters.

The Oaks Study Site along with the proposed development extent have been plotted over this Figure to show how the development could potentially impact upon the identified dispersal corridors.

This data is presented on Figure 1 in the Appendix and discussed below.

Analysis of Dispersal Routes and Pond clusters

Pond Cluster 1 comprises of two confirmed GCN ponds located either side of Oak Road. One pond is located within the Oaks Site the other within the grounds of an adjacent industrial estate.



Addendum

This cluster is relatively isolated from other pond clusters by both distance and by a series of barriers (see Figure 1) including Oak Road, areas of hardstanding and buildings located to the north of the cluster and by watercourses to the south (River Clywedog and Redwither Brook).

Oak Road itself is likely to act as a partial barrier to newt movements. The road is 8m in width and has a tarmacked pavement either side. The road is kerbed and has gully pots which would be likely to capture and trap some newts attempting to cross the road. However, there is likely to still be some movement of GCN across the road between the two ponds of Cluster 1.

There are also further areas of buildings and extensive hardstanding located directly between the two ponds, however there are some areas of semi-natural habitat with direct linkages to the two ponds and located opposite one another on either side of Oak Road where GCN may move between the two pond sites. This location is to the west of the two ponds. This potential crossing point is shown on Figure 1.

Redwither Brook is likely to present a partial barrier to movements between Ponds in Clusters 1 and 2 (Cluster 2 comprises of ponds located within the Ecology Mitigation Area of HMP Berwyn) with the two clusters further isolated from one another by distance. The brook is located within a trapezoidal, concrete channel and is relatively fast flowing. The closest ponds of Cluster 1 and Cluster 2 are located over 850m away from one another with no suitable ponds or GCN breeding habitat located within intervening habitat.

The River Clywedog is likely to act a barrier to movements between newts in Cluster 1 and Cluster 3 (Cluster 3 comprises of ponds located around the solar farm to the south of the River Clywedog).

The Industrial Estate buildings along Bryn Lane, Abbey Road South and Dunster Road along with their surrounding extensive hardstanding are likely to act as a more-or-less impermeable barrier between Cluster 1 and Pond Clusters 5 and 6 (ponds located either side of Bryn Lane).

It is possible that there may be an interchange of Newts between Pond Cluster 1 and Pond Cluster 4 with intervening habitats comprising of pasture and woodland/scrub habitats within the Oaks Site.

Movement between the two clusters would require GCN to cross Oak Road. However, to the east of the Industrial Estate, Oak Road is a much more permeable barrier to dispersal as the road is narrower (approximately 5.5m in width) and does not have kerbs or gully pots along its full length.



Addendum

The closest ponds of Cluster 1 and Cluster 4 are located approximately 600m away from one another with no suitable ponds or GCN breeding habitat located within intervening habitat.

Pond clusters 4, 5 and 6 are well connected to one another and there is likely to be frequent movement of newts between these ponds. If newts are moving between Cluster 1 and Clusters 2 and 4, this would represent a dispersal corridor linking all pond clusters north of the River Clywedog.

These potential dispersal routes, pond clusters and barriers to dispersal are shown on Figure 1.

Taken as a whole, and as indicated on Figure 1, there is potential broad GCN dispersal corridor between Clusters 1, 2, 4, 5 and 6 which runs along the Clywedog River corridor, passes into terrestrial habitats at the Oaks Site and extends to the east of the Industrial Estate, linking to GCN pond clusters located either side of Bryn Lane (Clusters 5 and 6).

Development Impacts and Mitigation Opportunities

As shown on Figure 1, the proposed development area is located within the north-western portion of the Oaks Site. This is located within a blind-ending area of habitat which is isolated to the north and west by surrounding buildings and development associated with the wider Industrial Estate.

As can be seen on Figure 1 the development area will not significantly impinge upon the potential GCN dispersal route along the Clywedog corridor and will still permit movement between the two ponds within Cluster 1 via the most likely existing dispersal route.

The majority of the development is located over 250m away from any GCN Ponds (approximately 1ha of the development land is located within 150m-250m of GCN ponds associated with Cluster 1) and so is away from the core areas of newt terrestrial habitat located around the ponds of Cluster 1, with approximately 5.9ha of land located between 250-500m from the pond. No land will be developed within 150m of the GCN ponds.

The mitigation measures which will form part of the development proposals will offer the opportunity to provide new pond habitat. Whilst the existing Oaks site offers extensive areas of suitable GCN terrestrial habitats, suitable aquatic breeding habitats at the site are limited. There are only two ponds present within the Oaks site: one comprises of a raised concrete tank and does not support GCN, the other is the confirmed GCN pond as described previously.



Addendum

It is likely that the absence of suitable aquatic habitats is a limiting factor on the overall viability of the Oaks site for GCN. The absence of multiple breeding habitats also leaves the GCN population susceptible to stochastic events which could destroy the only breeding pond at the site and so potentially wipe out the GCN population present.

Additional ponds at the site would create a more resilient population with GCN able to survive any periodic loss of individual ponds at the site.

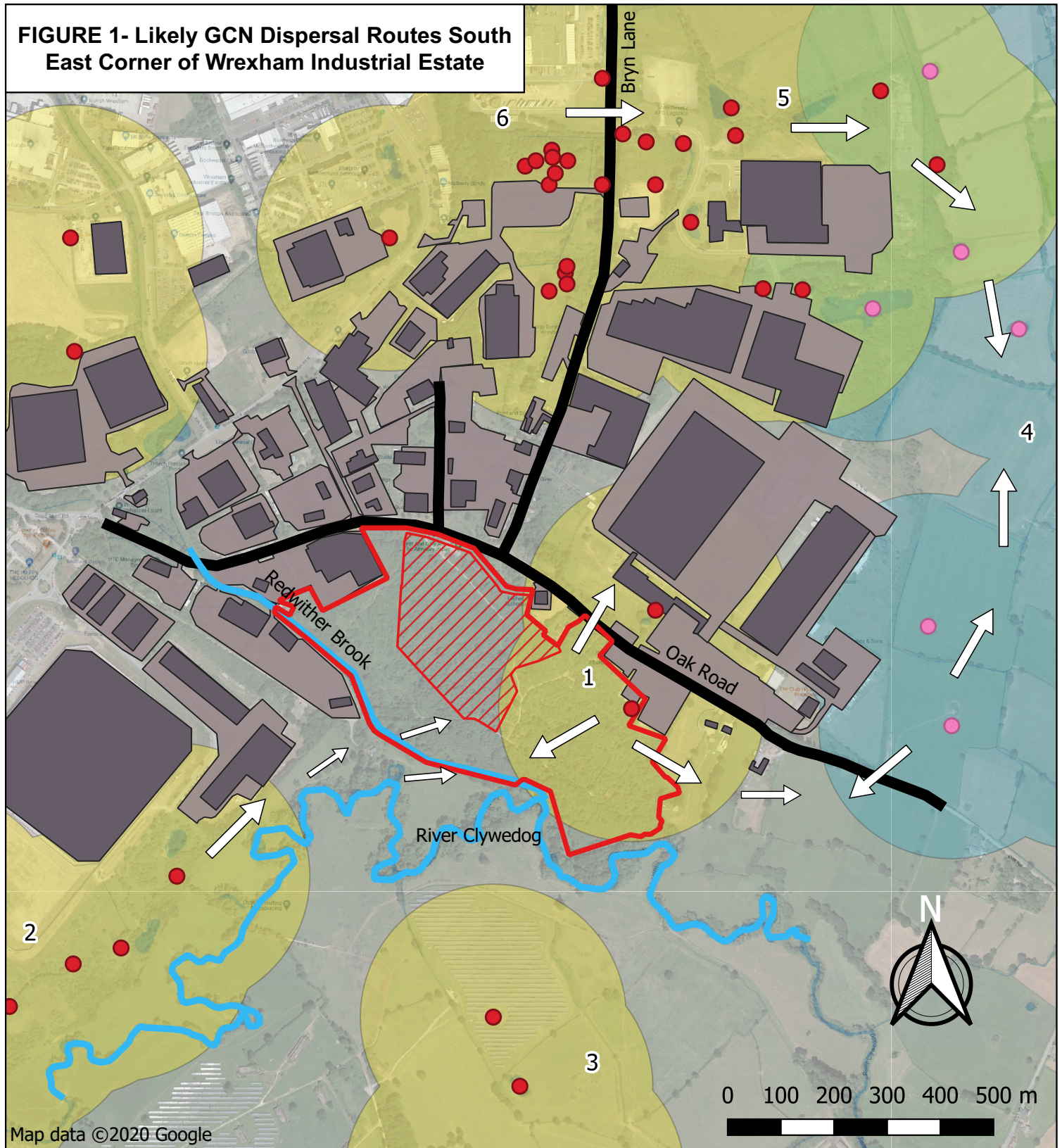
The mitigation ponds could also be strategically located to expand the range of the GCN population at the Oaks with ponds created closer to the southern and eastern boundaries of the site. Outline mitigation proposals with mitigation pond locations are shown in Figure 3 in the Appendix.

Clusters 2 and 4 are currently relatively isolated from Cluster 1 by distance. By expanding the network of ponds within Cluster 1 this would effectively move the edges of these neighbouring clusters closer to one another and so increase the chances of dispersing newts encountering ponds within a neighbouring pond cluster.

This can have the dual benefit of increasing genetic mixing between neighbouring clusters repressing any negative effects of inbreeding depression and can also provide recruitment and recolonisation of suitable habitats where these may have been affected by a localised extinction event.

As opposed to having a negative impact upon connectivity, the development with its associated opportunities to provide mitigation habitat (specifically new aquatic habitat), provides the opportunity to enhance connectivity and dispersal routes for GCN at the Wrexham Industrial Estate, thereby promoting the long-term persistence of the meta-population.

**FIGURE 1- Likely GCN Dispersal Routes South
East Corner of Wrexham Industrial Estate**



Oaks Study Site



Development Area



Existing Buildings



Existing Hardstanding



Watercourse



Pond Cluster



GCN Pond/Record



250m Buffer around GCN record



Ponds (no data)

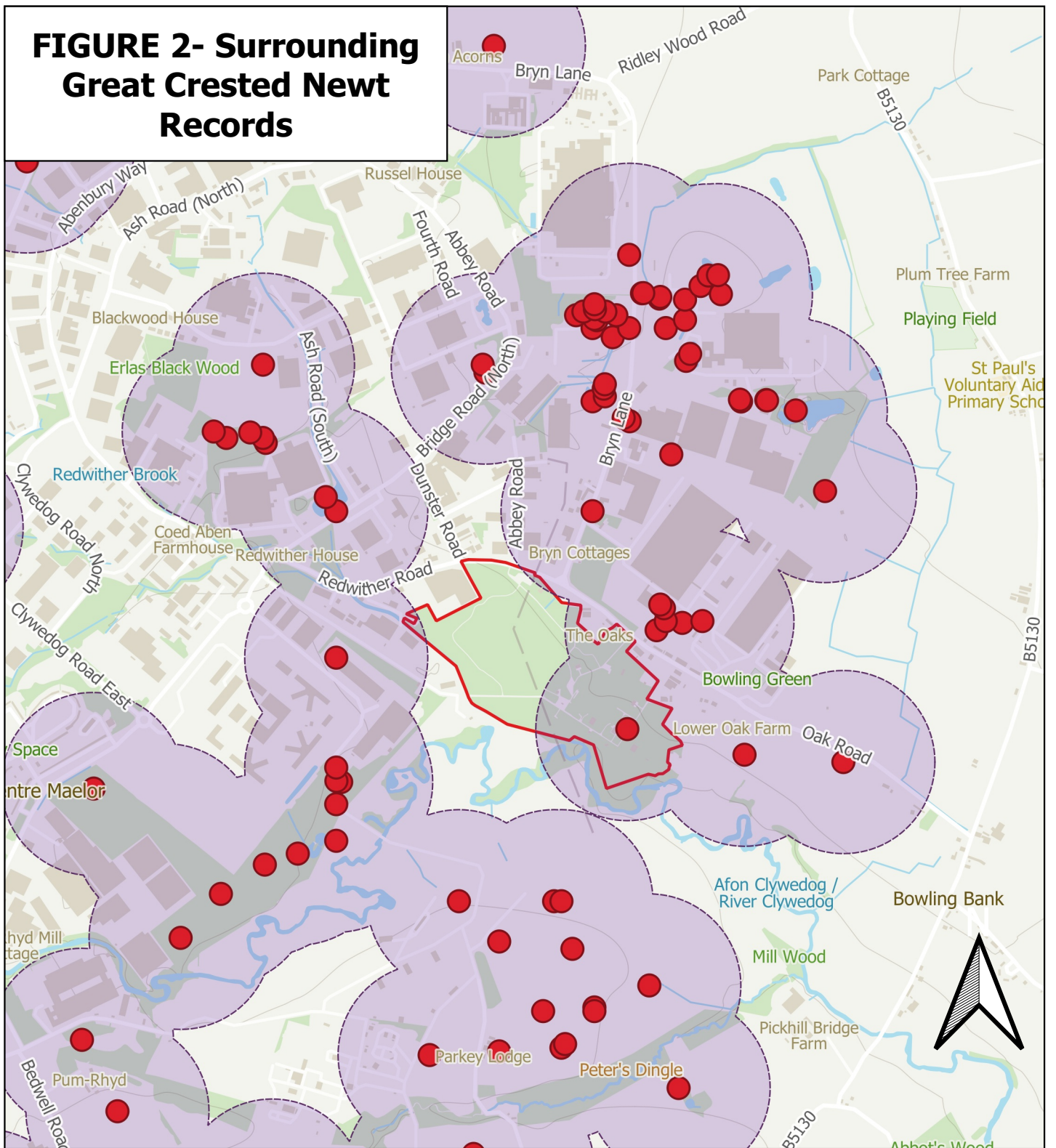


250m buffer around no data pond



Potential GCN dispersal route

FIGURE 2- Surrounding Great Crested Newt Records



KEY

- development boundary
- Great Crested Newt Pond
- 250m Buffer around Pond

0 250 500 750 1000 m

