



Land at Oak Road Wrexham Industrial Estate

Outline Habitat Management Plan

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CONTENTS

1	Introduction.....	3
1.1	Background.....	3
1.2	Rationale.....	3
1.3	Site Description	5
1.3.1	Overview	5
1.3.2	Habitats	6
1.3.3	Habitat Evaluation	6
1.4	Fauna	7
1.4.1	Invertebrates	8
1.4.2	Great Crested Newt	9
1.4.3	Birds.....	10
1.4.4	Bats.....	10
1.4.5	Badgers.....	10
1.4.6	Otters.....	10
1.4.7	Reptiles.....	10
2	Outline Habitat Management Plan	11
2.1	Overview	11
2.1.1	Development Proposals.....	11
2.1.2	Mitigation Plan Aims	11
2.1.3	Management Plan Delivery	12
2.2	Proposals	12
2.2.1	Overview	12
2.2.2	Proposed Ecology Zone	13
2.2.3	Initial Habitat Preparation/ Habitat Creation	14
2.2.4	Grassland and Scrub Mosaic Management.....	14
2.2.5	Woodland Habitat Management	17
2.2.6	Riparian Corridor Habitat	18
2.2.7	Pond Creation	18
2.2.8	Outline SUDS Proposals, Proposed Maintenance and Easements within Ecology Zone.....	19
2.2.9	Invasive Species Management.....	21

2.2.10	Wildlife Corridors	22
2.2.11	Site Clearance	23
2.3	Species Specific Recommendations.....	24
2.3.1	Reptiles.....	24
2.3.2	Breeding Birds	24
2.3.3	Bats.....	25
2.3.4	Bat and Bird Boxes.....	25
2.3.5	Otter.....	25
2.3.6	Great Crested Newt	26
2.3.7	Invertebrates.....	26
2.4	Wardening, Monitoring and Reporting	29
3	Appendix.....	32

1 Introduction

1.1 Background

Kingdom Ecology have produced an Outline Habitat Management Plan to support the proposed development of approximately 5.5ha of land at located on Oak Road, Wrexham Industrial Estate LL13 9PW (Ordnance Survey Grid SJ 386 494). Figure 1 in the Appendix shows the site layout.

This document identifies areas of land that will be subject to long term management to promote their biodiversity value and provides outline prescriptions for management of this habitat.

The outline recommendations within this document would be used to inform the preparation of detailed management plans, prescriptions and method statements to support any future development of the site.

This document has been produced by Richard Roe (BSc MSC MCIEEM CEnv) of Kingdom Ecology from Andy Jukes (BSc, MCIEM, FRES) of Conops Entomology. Andy has specifically assisted with habitat management and monitoring prescriptions for invertebrates at the site

Richard has over 19 years' experience as a professional Ecological Consultant.

Andy has over 20 years' experience working with invertebrates and is a Fellow of the Royal Entomological Society. Andy is also a former lecturer at the University of Staffordshire teaching Invertebrate Taxonomy to both undergraduate and postgraduate students.

1.2 Rationale

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 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 1999. 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 as outlined in this document 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.

Through appropriate 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.

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'.

1.3 Site Description

1.3.1 Overview

Ecological Surveys of the Oaks Site have been undertaken in 2016, 2017 and 2019 and have comprised of habitat and botanical surveys plus further specific bat, badger, reptile, great crested newt, breeding bird and invertebrate surveys.

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. CADW, the Welsh Government's Historic Environment Service, has identified the remnant buildings of the ordnance factory as being of heritage significance and it is proposed that this part of the site would be protected as a Scheduled Ancient Monument.

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.

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

1.3.2 Habitats

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 2016-2019 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.

1.3.3 Habitat 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'¹

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.

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.

1.4 Fauna

The Ecological Assessment has found the site to be of ecological importance supporting a great crested newt pond, valuable botanical and invertebrate communities plus locally important breeding bird and bat assemblages.

¹ Wales Biodiversity Partnership (2008) Guidelines for the Selection of Local Sites in Wales, <http://www.biodiversitywales.org.uk/>

A summary of the survey findings in relation to protected/notable species is provided below.

1.4.1 Invertebrates

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

A survey was undertaken in 2016 by Andy Jukes of Conops Entomology Ltd., 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.

No other species of importance were record 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 (2016²) page 7-9 for more details on the assemblages present on the site and their relative value.

1.4.2 Great Crested Newt

The Site supports a great crested newt breeding pond and high-quality terrestrial habitat. The Site may form an important part of the wider Wrexham Industrial Estate GCN metapopulation and provides a potential habitat corridor between isolated GCN populations at HMP

² Jukes, A (2016) *Land off Oak Road, Wrexham. An Invertebrate Assessment*. Unpublished report for Kingdom Ecology.

Berywn to the west of the site and around Bryn Lane to the north of the site.

1.4.3 Birds

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.

1.4.4 Bats

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.

1.4.5 Badgers

Low levels of badger activity. Badger subsidiary/main sett located near southern boundary of the site.

1.4.6 Otters

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.

1.4.7 Reptiles

Common species likely to be present in low numbers.

2 Outline Habitat Management Plan

2.1 Overview

2.1.1 Development Proposals

Development proposals are to construct industrial units at the site with associated areas of hardstanding. The proposed development will cover an area of approximately 5.48ha 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.

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

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

2.1.2 Mitigation Plan Aims

An outline mitigation plan for management of the Ecology Zone has been designed around the following key principles and aims:-

- Where possible, retain large blocks of interlinked habitat as opposed to isolated pockets of habitat;
- Maximise the biodiversity value of retained habitats at the site;
- Promote botanical interest within retained grassland, scrub and woodland habitats;
- Include suitable habitat for notable invertebrate species;
- Include wildlife pond habitat;
- Provide species specific enhancements for bats, birds and otters
- Maintain wildlife corridors through the site;
- Ensure the long-term viability of the proposed mitigation area by appropriate, long-term management and long-term protection of the site;
- Allow for a flexible and iterative process with regards to the management of the habitats through an annual review of the habitats present and the management plan to allow biodiversity opportunities to be explored and promoted.

2.1.3 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

2.2 Proposals

2.2.1 Overview

A detailed habitat management plan would be developed for the proposed Ecology Zone and these habitats would 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 would also seek to enhance habitats within the woodland blocks at the site.

Habitat management would extend into the proposed heritage area of the site but would comprise of low impact works to avoid impacts on the Scheduled Ancient Monument. Management in this area would comprise of grassland and scrub management with no ponds or other excavations carried out.

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 1 in the Appendix. This plan shows the broad extent of the three proposed habitat types.

2.2.2 Proposed Ecology Zone

Some of 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'.

The Ecology Zone will comprise of areas of retained and managed habitat within the eastern third of the site (around the existing great crested newt pond and heritage assets); 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 within the identified breeding pond (no development will take place within 100m 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 16.72ha and will be linked to further areas of habitat of nature conservation value located along the River Clywedog.

2.2.3 Initial Habitat Preparation/ Habitat Creation

Proposals within the Ecology Zone will include:-

- Creation of south facing butterfly banks/mounds and butterfly scrapes (minimum 5 x butterfly mounds each being 10m in length)
- Management of existing areas of grasslands to retain areas of short turf and bare ground and also areas of taller grassland
- Management of areas of scrub and woodland habitat
- Creation of Wildlife Ponds (minimum x 7)
- Installation of bat and bird boxes
- Construction of artificial otter holts

It is recommended that an Ecological Clerk of Works (EcOW) is appointed to produce detailed Design and Method Statements for the initial habitat creation works and to oversee and advise on sensitive stages of the initial ground works.

It is advised that the mitigation areas are prepared in advance of the wider site clearance as this will allow opportunities to identify and translocate flower-rich grassland turves into the mitigation areas from the proposed development area.

2.2.4 Grassland and Scrub Mosaic Management.

Areas of grassland and scrub mosaic would be managed within habitats to the east and west of the main development area (See Figure 1 in the Appendix).

The habitat management plan would 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 a combination of large open areas of grassland habitat plus through the creation of a series of mown paths and tracks through the existing scrub habitats including within the Scheduled Ancient Monument area. The tracks would include larger glade areas 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 would 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 can be left in the ground and allowed to rot away as opposed to being grubbed out. However, where there is a high density of stumps some may be removed through grubbing to prevent nutrient release into the surrounding substrates.

Where substrate beneath recently established scrub is unsuitable for species-rich grassland establishment, these will be scraped and removed until suitable substrates are exposed.

The large open Ecology Area proposed at the west of the site would require extensive scrub removal to provide unshaded, open, grassland habitats. These are required to provide well-functioning open mosaics for the key invertebrate assemblages. In order to provide this area of open habitat it is recommended that wholesale clearance of scrub is undertaken at the outset.

This is a dramatic but efficient method of clearance, done in a single operation over the duration of a single winter period. The benefit of this operation done during a single event is that the resulting open ground can then be brought on-line as optimal habitat within a short period of time, benefiting the key fauna, principally S42 butterflies.

There are however negative impacts associated with this approach. The primary concern is that there would be no option to monitor the on-going effects of scrub clearance on existing habitats or desirable flora establishment. Also, a single operation aesthetically may not be welcomed locally and a more piecemeal, and cautious approach may be more acceptable.

The Option of a phased clearance is considered less desirable, as depending upon the phasing, this may take five or more years before the clearance is completed. There is then a period of desirable habitat development. The process therefore may have a much longer timeframe than wholesale clearance.

In long standing scrub areas, it is likely that the underlying soils will have been altered considerably through nutrient enrichment from fallen leaves and would not lend themselves as suitable locations for grassland expansion. 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 2.2.5).

The scrub clearance would seek to retain some areas of hawthorn scrub and bramble scrub as a varied and sinuous fringe to promote complexity and microclimatic conditions.

Grasslands will be created to produce a mosaic of different open habitat types from short sward flower-rich grassland and bare ground to coarser tall grassland complimented by bramble and hawthorn scrub.

Scrub clearance would 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.

Once habitats have established, the management plan would seek to encourage a diverse range of habitat types. 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 would be applied to the mitigation grasslands.

Mowing regimes would 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 would be carried out twice a year in early April and in September/October and would 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 (minimum size 2x2m) created periodically to provide suitable butterfly breeding habitat.

In total, the proposed Ecology Zone grassland habitat will be approximately 3.15ha. Of which 40% of this resource will be managed as short sward grassland and bare ground (open mosaics). 40% will be maintained as tall sward flowery grassland and the remaining 20% is proposed to be managed on long rotation tussocky grassland. All of these habitats will form a complex matrix and will not be isolated from one another.

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. All cutting will have ecological continuity and considerations at its fore, including ensuring that trefoil-rich verges are not mown at a height that would sever their flowering potential.

Grassland mowing would 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 would 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 would 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.

2.2.5 Woodland Habitat Management

The existing 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 oak 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 at the southern end of the site. The ride should be approximately 8-10m wide.

The ride would 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 would be retained within the woodland to provide additional habitat for invertebrates.

2.2.6 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 2.2.4.

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 2.2.8).

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 2.2.5.

2.2.7 Pond Creation

It is recommended that wildlife ponds are created at the site (minimum 7 additional specific wildlife ponds). Ponds would 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. Two SuDS ponds are proposed for the site which would be fed with water runoff from the development site by vegetated swales.

The SuDS ponds would 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 would be considered in order to help maximize the nature conservation of SuDS ponds.

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

The proposed wildlife and SuDS ponds would 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 would have an irregular shape to increase the length of pond margin habitat.

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

If ground conditions dictate, the wildlife ponds would be lined with either butyl pond lining or clay and be overlaid with a subsoil substrate. Ponds would be planted up with appropriate marginal vegetation (to be determined by an ecologist). Marginal planting would 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 (See Section 2.2.8 below). The ponds would be managed to retain at least 30% open water. Further detail on maintenance of the SUDS proposals is provided below along with proposed easement routes to allow management of the SUDS Infrastructure.

Any invasive aquatic plant species would 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 would be carried out by a long-armed excavator. This would be carried out from as few entry points as possible 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.

2.2.8 Outline SUDS Proposals, Proposed Maintenance and Easements within Ecology Zone

The proposed development would use a Sustainable Urban Drainage System (SUDS) to capture, store and treat surface water from the site. This would comprise of two large SUDS ponds with outfalls into Redwither Brook as shown on the attached Drainage Strategy Plan these would be fed by vegetated swales. These would all be located within the proposed Ecology Zone.

Maintenance access will come down to what is practical with the ponds and swales only requiring limited maintenance. In order to manage and maintain the SUDS infrastructure, appropriate easements and access routes would be required. The SUDS infrastructure and easement routes would remain under the ownership of the development site freeholder.

Land within the easements will still be managed for its nature conservation benefit as these areas will only need to be accessed irregularly. Therefore, management of these areas as wildflower grassland or short sward grassland would be appropriate.

The extent of proposed easements and an estimate of management requirements within the Ecology Zone is provided below and shown on the Outline Proposed Drainage Strategy Figure provided in the Appendix.

Swales

These will need access for regular grass cutting (once every 1-2 years) and occasional silt removal (once every 3-5 years). Grass cutting would be done manually with a trimmer and with a mid-sized tractor with a mowing attachment on an arm. This would need an easement route of approximately 3m width from the bank of the swale. The easement would be located only on one side of each swale as the mowing arm will be able to cut both sides. Sediment removal would be expected to be infrequent, particularly once overall site construction is finished, and would be completed by a mid-sized excavator to remove accumulated sediment in the swale and dumper to remove. The 3m easement route would also be appropriate for sediment removal works.

Ponds

These will need regular (once every 1-2 years) access for grass cutting/vegetation clearance around the edges - This would need an easement route of approximately 3m width from the bank of the pond. The degree of cutting will depend on how the banks are planted up. If they are grass, then probably an annual cut but if trees/shrubs it would likely be less frequent.

Access will also be needed for very occasional clearance of silts and sediment from the pond. The pond design will include a sediment forebay which will capture the bulk of the sediment. Clearance would be by a long-armed excavator and a silt bucket plus a dumper to take the material away. This will be infrequent (perhaps every 3-5 years) once the site is established depending on the sediment load from the site. It may need to be more frequent during the construction phase(s) when most sediment is generated.

The sediment forebay will capture most of the material but it may occasionally be necessary to clear other parts of the pond to remove sediment or excess plant growth.

In order to carry out sediment removal a 4m wide route would be required all the way round each pond.

Flow controls

These will need access for annual maintenance/inspection. The flow controls are at the ponds so the same route provided for cutting/clearing the ponds would give access.

Pipes

Access would only normally be required to the manholes for inspection or to allow clearance of a blockage. The pipe runs would not need access unless the pipe needed to be dug up and replaced. The piped sections in the Ecology Zone are from the flows controls to the watercourse so the access provided to the flow controls and the watercourses would suffice for maintenance.

Watercourses (Redwither Brook and the River Clywedog)

The watercourse will need access for maintenance. These are Main Rivers managed by Natural Resources Wales. Their requirement is for a notification or permit application for works within 8m of the river bank and that is normally their requirement for an access strip. This is covered by NRW legal powers and therefore does not need to be considered with regards to easements.

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

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

Control measures for Himalayan balsam would 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 would be carried out May-July to be the most effective. Cutting would be carried out at ground level and below the first node to achieve the best results.
- Cut Himalayan balsam and contaminated soils would be removed from site to licensed landfill as controlled waste or dealt with on-site in appropriate waste management areas.

2.2.10 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 existing great crested newt breeding pond at the northern edge of the site providing a link close to another breeding pond on the opposite side of Oak Road.

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

2.2.11 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. 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 a breeding pond and approximately 4.7ha of land located between 250-500m from the pond. No land will be developed within 150m of the breeding pond.

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 would 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 would 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 trees to be felled with regards to their suitability to support bat roosts.

With regards to the buildings present, potential bat roosting features are offered within exposed superficial crevices 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.

2.3 Species Specific Recommendations

2.3.1 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.

2.3.2 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 (see 2.3.4). This would include the incorporation of 3 x barn owl boxes onto retained oak trees at the site. The barn owl boxes would ideally be located within some of the retained munitions buildings but this is likely to conflict with heritage interests 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.

2.3.3 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 to possibly be on account of limited bat roosting opportunities in the locality.

It is therefore recommended that new roosting provision for bats is created. This would comprise of a bat box scheme with bat boxes fitted to retained mature trees (see 2.3.4).

Further bat summer and winter roosting habitat would also ideally be provided within some of the retained munitions buildings but this is likely to conflict with heritage interests at the site.

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.

2.3.4 Bat and Bird Boxes

A bat and bird box scheme would be implemented at the site.

It is recommended that the following models and numbers of bat and bird boxes are installed on mature trees at the site:-

- 12 x Schwegler 1B Bird boxes with 32mm entrances
- 6 x Schwegler 1B Bird boxes with 26mm entrances
- 12 x Schwegler 1FS Bat boxes
- 6 Schwegler 2FN Bat boxes
- 4 x Schwegler 2FN Bat boxes

Bat boxes would be positioned to face in a more-or-less southerly direction; would be located at a minimum height of 4m and would be located so that flight lines to the bat box are not obstructed by vegetation.

Bird boxes would be located at a minimum height of 3m and would be positioned in a sheltered location.

2.3.5 Otter

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

2.3.6 Great Crested Newt

As described in section 2.2.10, The site development will need to be completed under a European Protected Species License.

As described in Section 2.2.9, 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 2.2.7).

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 existing ponds become unsuitable.

With regards to the final design of the proposed new industrial units and access roads, site design will 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.

2.3.7 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.

2.4 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.

3 Appendix

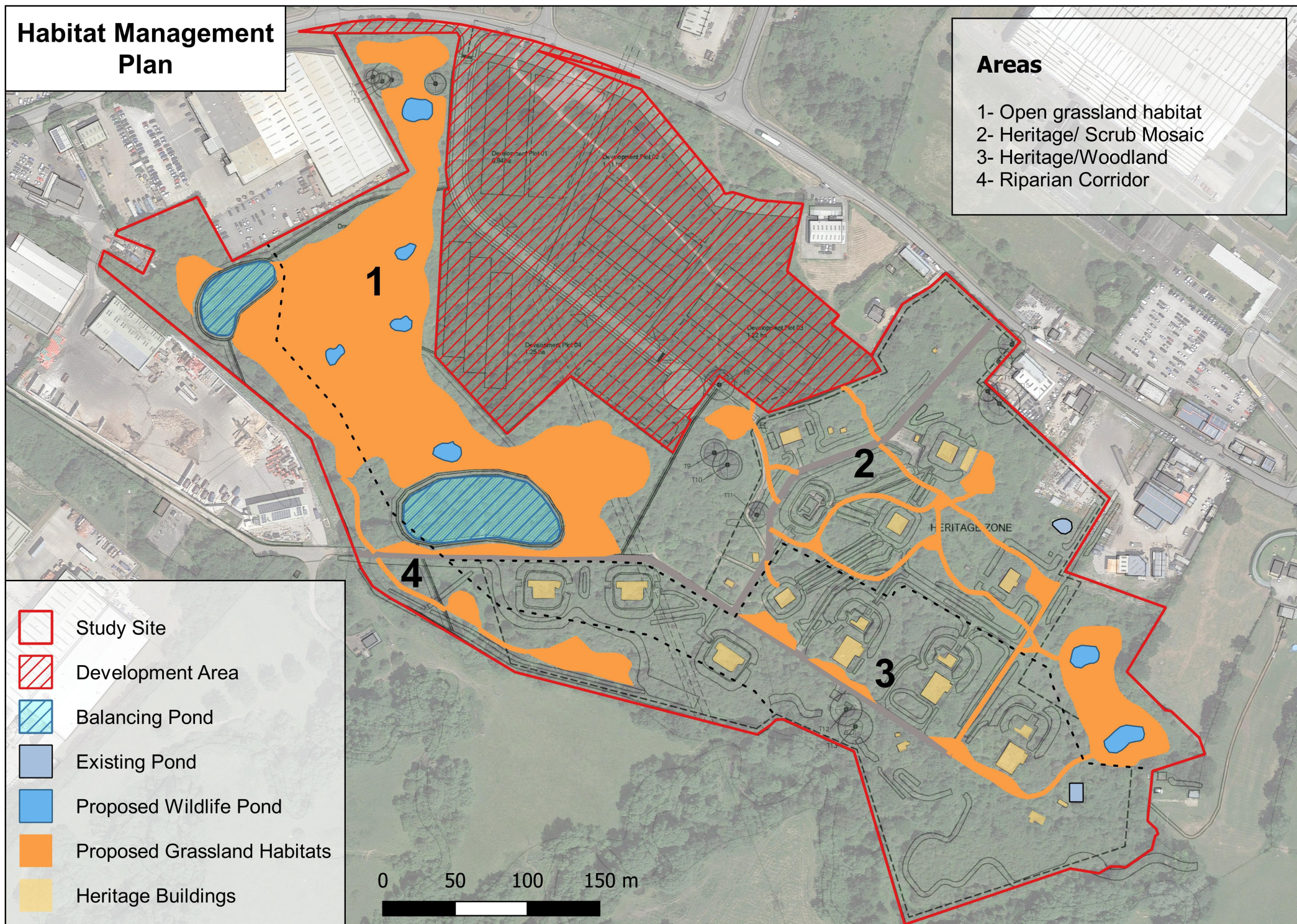
Habitat Management Plan

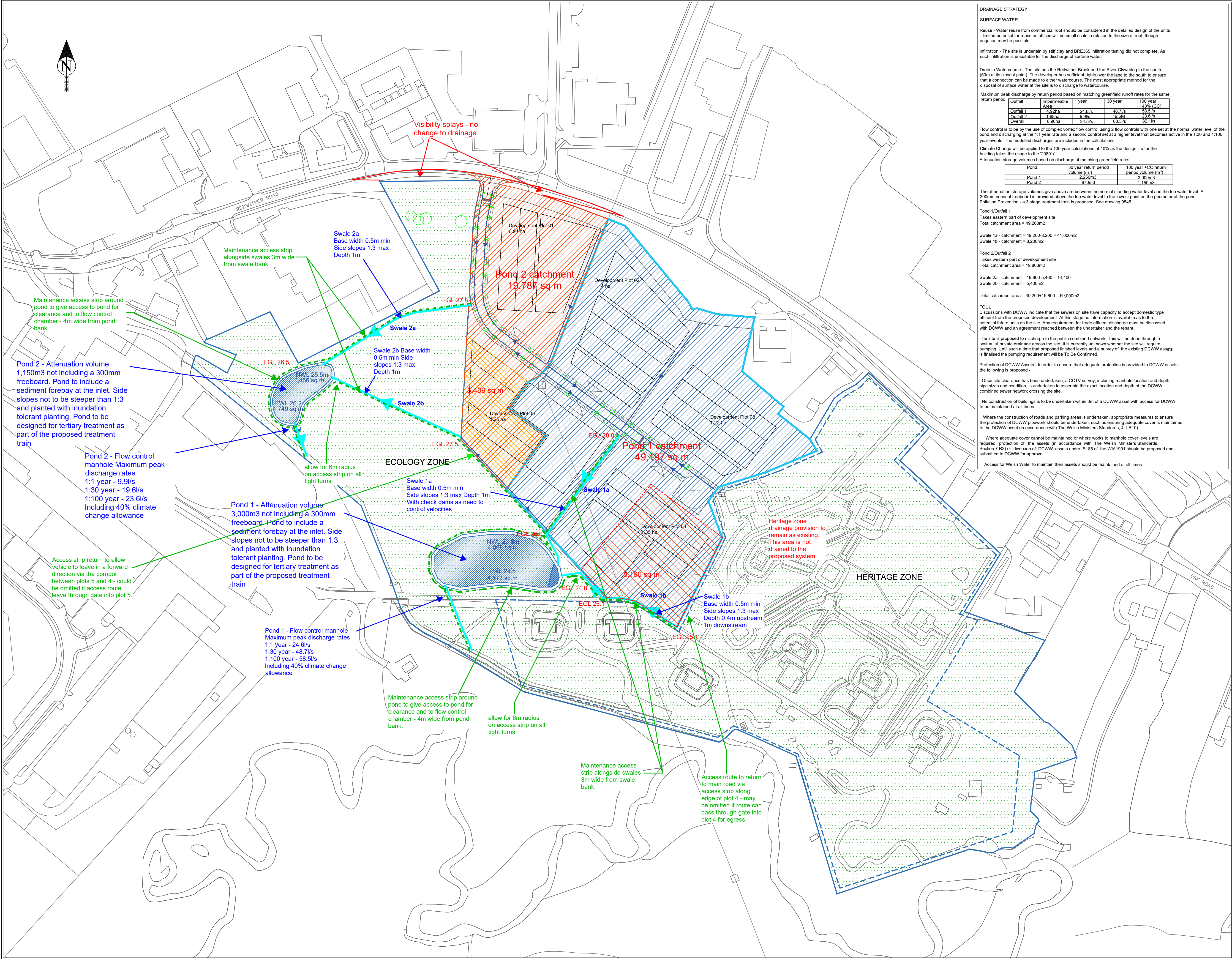
Areas

- 1- Open grassland habitat
- 2- Heritage/ Scrub Mosaic
- 3- Heritage/Woodland
- 4- Riparian Corridor

- Study Site
- Development Area
- Balancing Pond
- Existing Pond
- Proposed Wildlife Pond
- Proposed Grassland Habitats
- Heritage Buildings

0 50 100 150 m





DRAINAGE STRATEGY

SURFACE WATER

Reuse - Water reuse from commercial roof should be considered in the detailed design of the units
- limited potential for reuse as offices will be small scale in relation to the size of roof, though irrigation may be possible.

Infiltration - The site is underlain by stiff clay and BRE365 infiltration testing did not complete. As such infiltration is unsuitable for the discharge of surface water.

Drain to Watercourse - The site has the Redwither Brook and the River Clywedog to the south (50m at its closest point). The developer has sufficient rights over this land to the south to ensure that a connection can be made to either watercourse. The most appropriate method for the disposal of surface water at the site is to discharge to watercourse.

Maximum peak discharge by return period based on matching greenfield runoff rates for the same return period

Outfall	Impermeable Area	1 year	30 year	100 year
Outfall 1	4.92ha	24.6l/s	48.7l/s	+40% (CC) 68.5l/s
Outfall 2	1.98ha	9.9l/s	19.6l/s	23.6l/s
Overall	6.90ha	34.5l/s	68.3l/s	92.1l/s

Flow control is to be by the use of complex vortex flow control using 2 flow controls with one set at the normal water level of the pond and discharging at the 1:1 year rate and a second control set at a higher level that becomes active in the 1:30 and 1:100 year events. The modelled discharges are included in the calculations

Climate Change will be applied to the 100 year calculations at 40% as the design life for the building takes the usage to the '2080's'

Attenuation storage volumes based on discharge at matching greenfield rates

Pond	30 year return period volume (m ³)	100 year +CC return period volume (m ³)
Pond 1	2,250m ³	3,000m ³
Pond 2	870m ³	1,150m ³

The attenuation storage volumes give above are between the normal standing water level and the top water level. A 300mm nominal freeboard is provided above the top water level to the lowest point on the perimeter of the pond.

Pollution Prevention - a 3 stage treatment train is proposed. See drawing 0545.

Pond 1/Outfall 1
Takes eastern part of development site
Total catchment area = 49,200m²

Swale 1a - catchment = 49,200-8,200 = 41,000m²
Swale 1b - catchment = 8,200m²

Pond 2/Outfall 2
Takes western part of development site
Total catchment area = 19,800m²

Swale 2a - catchment = 19,800-5,400 = 14,400
Swale 2b - catchment = 5,400m²

Total catchment area = 49,200+19,800 = 69,000m²

FOUL

Discussions with DCWW indicate that the sewers on site have capacity to accept domestic type effluent from the proposed development. At this stage no information is available as to the potential future units on the site. Any requirement for trade effluent discharge must be discussed with DCWW and an agreement reached between the undertaker and the tenant.

The site is proposed to discharge to the public combined network. This will be done through a system of private drainage across the site. It is currently unknown whether the site will require pumping. Until such a time that proposed finished levels and a survey of the existing DCWW assets is finalised the pumping requirement will be To Be Confirmed.

Protection of DCWW Assets - in order to ensure that adequate protection is provided to DCWW assets the following is proposed -

- Once site clearance has been undertaken, a CCTV survey, including manhole location and depth, pipe sizes and condition, is undertaken to ascertain the exact location and depth of the DCWW combined sewer network crossing the site.
- No construction of buildings is to be undertaken within 3m of a DCWW asset with access for DCWW to be maintained at all times.
- Where the construction of roads and parking areas is undertaken, appropriate measures to ensure the protection of DCWW pipework should be undertaken, such as ensuring adequate cover is maintained to the DCWW asset (in accordance with The Welsh Ministers Standards, 4.1 R10).
- Where adequate cover cannot be maintained or where works to manhole cover levels are required, protection of the assets (in accordance with The Welsh Ministers Standards, Section 7 R3) or diversion of DCWW assets under S185 of the WIA1991 should be proposed and submitted to DCWW for approval.
- Access for Welsh Water to maintain their assets should be maintained at all times.

- Notes**
1. Do not scale from drawing. Not issued for construction
 2. Location and exact alignment of drainage and water strategy requirements requires confirmation on site.
 3. Surface water sewer and drainage locations are indicative only and not to be used for construction
 4. Topographic site levels have been utilised for development of this be subject to change based on development finishing and layout amendments.

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

Site

**The Oaks
Wrexham**

Title

Proposed Drainage Strategy

Scale	1:1,500	@ A1	
Drawing No.	TOW-TCL-HDG-XX-DR-D-0510		
Rev	Date	Description	
A	04/20	New Layout & Drainage Amendments	
B	10/20	Maintenance Access Routes Added	
File	TOW-TCL-HDG-XX-DR-D-0510 RevB.dwg		
Date	04/20	Engineer	TCL
Drawn	PP GH	Checked	DRAFT