BOW COMMON GASWORKS

ECOLOGY STRATEGY
JULY 2020
The design of Bow Common Gasworks takes an ecology led approach to enhance and join up the ecological network of the area. This strategy documents the initiatives to ensure Bow Common Gasworks vastly improves upon the current condition, increases the provision for wildlife, and enhances the connection between ecological sites through wider environment improvements. Bow Common Gasworks sets out a sustainable and managed approach to ecology that ensures a thriving and connected wildlife population.

At a glance, Bow Common Gasworks proposes a net biodiversity gain of 60%, a high urban greening factor of 0.4 or above, significant contributions to the council’s Biodiversity Action Plan, and developer enhancement objectives including the introduction of habitats specially designed to meet the needs of the council’s Biodiversity Action Plan listed species. Spatially, new habitat creation will be formed at ground levels, including up to 10,700 sqm of species rich grassland with calcareous species, and living roofs. In addition to new habitats, a cross phase strategy is provided to expand existing habitat species populations into new calcareous grassland habitats.

In due course, a detailed Landscape Maintenance and Management Plan will reflect the detailed ecology provisions brought forward in the Reserved Matters Applications. This document will highlight the vegetation and habitat types, giving specific direction to their needs. As a start, three key vegetation and habitat types have been identified in this strategy and objectives outlined.

The structure of this strategy includes the following chapters:

- Ecology Led Approach
- Contributing Towards the Objectives of the Local Biodiversity Action Plan (2019-2024)
- Biodiversity Net Gain
- New Habitat Creation at Bow Common Gasworks
- Management and Maintenance Approach
- Briefing Note on Small Blue Butterfly
AN ECOLOGY LED APPROACH
Existing Green Grid Network

Proposed Green Grid Extensions

Bow Common Gasworks Site Boundary

Ecologically driven public open space
Strategic connections
Bow Common Gasworks Site Boundary

EXISTING GREEN GRID NETWORK

PROPOSED GREEN GRID EXTENSIONS

BOW COMMON GASWORKS SITE BOUNDARY

TOWER HAMLETS GREEN GRID STRATEGY (2017)
“The essence of what needs to be done to enhance the resilience and coherence of England’s ecological network can be summarised in four words: more, bigger, better and joined. There are five key approaches which encompass these, and also take account of the land around the ecological network. We need to: (i) Improve the quality of current sites by better habitat management. (ii) Increase the size of current wildlife sites. (iii) Enhance connections between, or join up, sites, either through physical corridors, or through ‘stepping stones’. (iv) Create new sites. (v) Reduce the pressures on wildlife by improving the wider environment, including through buffering wildlife sites.”

“Overall, bigger is better, and creating new wildlife habitat will move the network in the right direction.”

“...in areas which only have small and isolated sites, it will be better to invest in the restoration and creation of new wildlife habitat.”

“In general, the first priority is to enhance the quality of remaining wildlife habitat. Increasing connectivity helps, but first there needs to be high quality sites with thriving wildlife populations to connect.”

## THE LOCAL BIODIVERSITY ACTION PLAN (2019-24) BOW COMMON GASWORKS CONTRIBUTION TO HABITAT TARGETS

<table>
<thead>
<tr>
<th>PRIORITY HABITATS</th>
<th>LBAP TARGET</th>
<th>BOW COMMON CONTRIBUTION TO LBAP TARGETS</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>DETAIL APPLICATION</td>
</tr>
<tr>
<td>Flower Rich Grassland</td>
<td>1 hectare</td>
<td>163 sqm</td>
</tr>
<tr>
<td>Open Mosaic Habitats</td>
<td>3 hectares</td>
<td>1160 sqm</td>
</tr>
<tr>
<td>Native Broadleaved Woodland</td>
<td>no specific quantum of new habitat</td>
<td>476 sqm</td>
</tr>
<tr>
<td></td>
<td>3 species of native tree per site</td>
<td>5 species of native tree listed in <em>Landscape Strategy</em>, including Black Poplar (detail planting plans to follow at later stages)</td>
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<tr>
<td>Orchards</td>
<td>0.5 hectare</td>
<td>-</td>
</tr>
<tr>
<td>Mixed Native Hedgerows</td>
<td>500m</td>
<td>&gt;30m</td>
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<tr>
<td>Rivers</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Standing Water (canals &amp; docks)</td>
<td>1km of emergent and marginal vegetation</td>
<td>-</td>
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<tr>
<td>Ponds</td>
<td>5 ponds</td>
<td>0 ponds</td>
</tr>
<tr>
<td>Reedbeds</td>
<td>500m²</td>
<td>-</td>
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</tbody>
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“Tower Hamlets is a densely built-up borough, and over one third of its area is occupied by buildings, streets and car parks. The built environment can be surprisingly rich in wildlife. Buildings provide roosts for bats, and nest sites for birds which more traditionally nest on cliffs. These include the spectacular peregrine falcon and the rare black redstart...

We can enhance the built environment for wildlife in many ways. Green roofs are the easiest place to replace our disappearing brownfield (open mosaic) habitats. Buildings can be enhanced for bats and birds by providing custom-designed nesting and roosting sites, either built into the fabric of new buildings or retrofitted to existing ones. Climbers and other forms of green walls can provide nectar for bees and nesting sites for our declining house sparrows. And streets can be greened with trees, hedges and planters full of nectar-rich flowers.”


"Almost 40% of the area of Tower Hamlets is occupied by gardens and the landscaped areas around housing estates, schools, businesses and other premises. By far the majority of this is housing amenity land. In the last few years, social housing providers and residents in Tower Hamlets have created some excellent wildlife habitats, such as meadows, copses, hedges, orchards and nectar-rich community and communal gardens, around housing estates..."

Since the beginning of the design process, Bow Common Gasworks has sought to meet the objectives of the *Tower Hamlets Biodiversity Action Plan* (in particular, those set out in the *Built Environment* and the *Gardens & Grounds Action Plans*), by contributing to the priorities, targets, and to help meet the needs of the relevant LBAP species. This will be achieved by:

- creating wildlife habitats such as meadows, open mosaic habitat, small areas of woodland, a pond and mixed hedges, as an integral part of the surrounding green infrastructure;

- planting of native trees, common or alder buckthorns and other food plants for butterfly larvae, and nectar-rich flowers to provide food for wild bees and other insects;

- provision for bat boxes, nest boxes for birds, bumblebee boxes, loggeries and insect hotels;

- ensuring that lighting of (during construction and operation) does not adversely impact on foraging bats or their prey.

The following species, listed in the BAP, will have specific measures undertaken to meet their needs;

**Bats**
- Some potential for bat boxes, extending foraging habitat, sensitive lighting to be installed where possible

**Black redstart**
- Rooftop habitat provision

**House martin, House Sparrow, Swifts**
- Potential for specific nestbox provisions

**Peregrine falcon**
- Rooftop nesting provision on highest blocks

**Brimstone butterfly**
- Habitat provision, through planting of Buckthorn

**Streaked bombardier beetle**
- Potential for habitat provision on site

**Black poplar**
- Specific planting of this native tree, with care taken that there is no confusion with hybrids or the Lombardy Poplar

**Jersey cudweed**
- To be featured in planting plans for rooftops and other suitable habitats

**Wild bees (all species of bumblebees and solitary bees)**
- Habitat provision across site
- Specific bee species to consider in detailed design and with regards to management and maintenance include the Brown Banded Carder Bee, Clover Blunt Horn Bee, Red Girdled Mining Bee and the Large Scabious Mining Bee

The following species have also been identified through the design and consultation process and are being considered within the landscape proposals:

**Small Blue Butterfly**
- A cross phase strategy will be employed to expand habitats of existing populations to future calcareous grassland habitats created at Bow Common Gasworks

- Kidney Vetch (*Anthyllis vulneraria*) is the Small Blue Butterfly’s sole food plant and will be planted across the site

**Toadflax Brocade**
Toadflax Brocade thrives on green roofs, especially where *Linaria purpurea* is planted - which will be included in planting plans both on green roofs and at ground.
BIODIVERSITY NET GAIN
In 2016, The Berkeley Group became the first major house builder in the UK to commit to biodiversity net gain on all their developments and have developed a guide called 'The Nine Concepts: Nature and Beauty'.

This guide has helped Berkeley Group to ensure that nature is in a better condition after the development than it was before, and is part of the St William and Berkeley Group’s strategic plan called ‘Our Vision’.

London Wildlife Trust has helped to develop and assess this particular design proposal and concluded that it produces a 60% biodiversity net gain, which is significantly above the HM Government’s draft target recommendation of 10% net gain.

Another helpful tool to ensure developments result in a greener city is the GLA’s Urban Greening Factor that is a part of the emerging Draft New London Plan. The Mayor recommends a target score of 0.4 or 40% of residential development consists of green infrastructure. Both the Detail and Outline Applications for Bow Common Gasworks exceed a score of 0.5 or 50%.

Refer to appendix A for further information.

"It is great to be working with such an influential yet progressive placemaker as St William. They are constantly striving to ensure that nature is at the heart of their developments and that both people and wildlife have a home. I look forward to the day when all developers not only think but act this way”

David Mooney, Director of Development
London Wildlife Trust
Current illustrative plans reach an urban greening factor score of 0.5. This is above the rarely achieved recommendation of 0.4. Where some areas may come down during detailed design due to unforeseen constraints, vertical greening will increase. Due to the difficulty in measuring vertical greening in an outline application, this has not been factored in. Vertical greening is featured in the detailed application and forms a key part of the architectural materiality at Bow Common Gasworks.
NEW HABITAT CREATION
AT BOW COMMON GASWORKS
HABITATS

Open Mosaic (Calcareous Grassland)
Flower Rich Grassland (in base rich substrate)
Broadleaved Woodland (Urban Forest)
Pond

Area: 1160 sqm
Area: 163 sqm
Area: 476 sqm
Area: 0 sqm

DETAILED APPLICATION (phase 1)
LBAP Priority Habitats

OUTLINE APPLICATION (phase 2+)
LBAP Priority Habitats

Phase 1 boundary
Mixed Hedgerow
Area: 768 sqm
Rain Garden, SUDs
Area: 283 sqm
Flower Rich Perennial Planting
Area: 1400 sqm

Vegetation Types with Significant Ecosystem Services

Open Mosaic (Calcareous Grassland)
Flower Rich Grassland
Broadleaved Woodland (Urban Forest)
Pond

Area: 7680 sqm
Area: 2437 sqm
Area: 1385 sqm
Area: 421 sqm

Mixed Hedgerow
Area: 2790 sqm

Rain Garden, SUDs
Area: 905 sqm
Flower Rich Perennial Planting
Area: 2088 sqm

Keyplan
Scale Bar

General Notes

No implied licence exists. This drawing should not be used to calculate areas for the purposes of valuation. Do not scale this drawing. All dimensions to be checked on site by the contractor and such dimensions to be their responsibility.

All work must comply with relevant British Standards and Building Regulations requirements. Drawing errors and omissions to be reported to the architect.

Revision Drawing Number

Drawn by

Date

Scale at A1

Project Number Status

Drawing Title

Client

0337-SEW-ZZ-ZZ-SK-100021

0337

Information

0337

Bow Common Gas Works

St. William
Areas seeing over 8 hours of direct sunlight at summer solstice

Areas seeing less than 8 hours of direct sunlight at summer solstice
Areas seeing over 8 hours of direct sunlight on March 21st

Areas seeing less than 8 hours of direct sunlight on March 21st
Modular green roof cassette systems can be used to encourage the migration of species to green roof habitats that would otherwise not be able to. Further, they provide a ‘meanwhile’ form of habitat creation that fills in the gaps that would usually occur during the construction phase of a development.

Using a similar approach, cassettes could be filled with a low nutrient, base rich green roof substrate and seeded (potentially with seed harvested from Scrapyard Meadows, Mile End Park or another local source of wildflowers).

The new habitat and vegetation could be grown, established and maintained on a suitable ‘nursery’ site at Bow Common Gasworks, before being transferred to rooftops at an appropriate time of year. The best location for this is the final delivery phase, as it will be:

- the last location to be developed;
- set away from public and construction access points;
- a sunny south facing aspect;
- in the most protected corner of the site.

Such an approach using a cassette system would be part of a wider green roof design that incorporates more traditional methods and a variety of substrate depths (using guidance from Buglife, Creating Green Roofs for Invertebrates: A Best Practice Guide.).
Location of green roof ‘nursery’ in full sun and away from potential disturbance. The area shown in yellow is approximately 1100m², which is equal to the total area of green roof in phase 1.

Cassettes are filled with an extensive green roof substrate and seeded with a suitable mix of species (potentially harvested from a nearby source such as Scrapyard Meadows).

This is to commence the autumn before phase 1 construction begins.

The cassettes are then to be installed on roofs at the appropriate time of year.
PHASE 1
Green roof cassettes that were seeded prior to the construction of phase 1 are installed.

PHASE 5 PLOT
New green roof cassettes replace the ones that have been relocated to Phase 1 rooftops. The same process of seeding, maintenance and relocation is repeated.

After the completion of phase 1, the cassette system would not be intended to fill all living roofs. It would be one part of a wider mosaic of habitat creation using more traditional methods. This would ensure a better variety of calcareous grassland habitat (degrees of openness, variety of substrate depths etc...). The amount of cassettes used in subsequent phases will be subject to the development of a more in depth strategy.
New green roof cassettes replace the ones that have been relocated to Phase 2 green roofs. The same process is repeated.

The nursery location remains unaffected by continued construction.
Green roof cassettes that were seeded prior to the construction of phase 3 are installed. Which roofs receive the cassettes are subject to the development of a more in-depth strategy.

New green roof cassettes replace the ones that have been relocated to Phase 3 green roofs. The same process is repeated.

The nursery location remains unaffected by continued construction.
HABITAT CREATION STRATEGY  COLONISATION OF EXISTING SPECIES

PHASE 1

PHASE 2

PHASE 3

PHASE 4

PHASE 5 CONSTRUCTION

Green roof cassettes that were seeded prior to the construction of phase 4 are installed. Which roofs receive the cassettes are subject to the development of a more in depth strategy.

No green roof cassettes are used during phase 5 construction.

No green roof cassettes are used during phase 5 construction.
Living roofs in phase 5 are seeded and planted using more conventional methods.
It is the intention to bring the park forward as quickly as possible. The diagram above illustrates the current phasing strategy considering all construction, access and remediation constraints. This is subject to change if areas of the park are able to be completed sooner.
MANAGEMENT AND MAINTENANCE APPROACH
The establishment and future success of the landscape is largely dependent on the standard and frequency of the maintenance and management it receives.

Key objectives for maintenance and management include:

- To facilitate an efficient and sustainable landscape management and maintenance regime that evolves through the lifetime of the development;
- To ensure that the landscape develops in a manner commensurate with the original design intentions;
- To provide a safe, high quality external environment for all users;
- To positively welcome people into the Common, physically and socially, whilst balancing the desire to provide a haven for wildlife;
- To ensure the successful establishment and continued growth through to maturity of the trees and other planting identified in the Landscape Proposals;
- To contribute to the value of the surrounding green infrastructure, and to help provide links with the wider green grid;
- To enhance the ecology of the site and improve local biodiversity wherever possible;
- And to learn from the excellent and sustainable precedent set by the Tower Hamlets Cemetery Park’s management and maintenance.

As the design of Bow Common Gasworks progresses, a detailed Landscape Maintenance and Management Plan should be produced and updated with each new phase.

For this, the site should be divided into vegetation types and habitat areas, based largely on the priority habitats found in the Local Biodiversity Action Plan, and the categories that comprise the New London Plan’s Urban Greening Factor (Policy G5), and then further influenced by the site’s specific character areas. This will ensure that areas are given the specific direction they need (for example, spaces that may be categorised as both a swale and a broadleaved woodland).

The following pages begin to develop a strategy for three of these key vegetation types and habitat areas. They are given a brief description, along with any associated influences and constraints. Specific objectives have been assigned, shaped by the overall site objectives. This methodology should be continued and progressed at later stages to form part of a detailed Landscape Maintenance and Management Plan.
OPEN CALCAREOUS GRASSLAND

Description:

This is designed to directly complement the area of open chalk grassland on the neighbouring Scrapyard Meadows. To maximise the colonisation from Scrapyard Meadows to the newly created habitat at Bow Common Gasworks, locally sourced seed could be utilised. Additionally, a feasibility study is being undertaken to establish green roof cassettes at ground level, along the eastern boundary of the site, during the construction phases to enhance the existing calcareous grasslands found within the area. These green roof cassettes could potentially be transferred to the final green roof habitats once appropriately established.

The design, construction and management of these biodiverse green roofs will follow guidance from Buglife, Creating Green Roofs for Invertebrates: A Best Practice Guide.

This habitat type will be found on living roofs across the site. Varying depths of base rich, low nutrient substrate will produce a mosaic of habitat features (size and cover of vegetation, areas of bare ground, features that will collect pools of rainwater, etc.). The vegetation will be made up of mainly stress and drought tolerant perennials and annuals. Although dwarfed by the harsh conditions, these communities of plants are highly floral and diverse.

Biodiversity Aims:

• To extend and enhance the habitat and biodiversity found in Scrapyard Meadows.

• To increase the numbers of, and support breeding populations of rare and priority species of birds and invertebrates that are currently found at Scrapyard Meadows, such as the Small Blue Butterfly (Cupido minimus).

• To establish and maintain species-rich swards of differing structure and openness to support inveterbrate larvae and flowers that attract pollinators at different times of the year.

• To contribute, over the lifetime of the development, to the local biodiversity action plan’s targets of Open Mosaic Habitat and support the associated bird and invertebrate species that depend on it.

Visual Aims:

• Although it is assumed that most of the living roofs across the site will not be open to residents, they will still provide visual amenity to neighbouring balconies and windows. It is therefore still an objective to provide colour and interest throughout the year.
FLOWER RICH GRASSLAND ON BASE RICH SUBSTRATE

Description:

Flower rich grassland is a visually exciting, meadow-like vegetation type. This will be found in the central common, as generous margins to the mown lawn, with paths meandering through, and at the north west entrance to the site where it will form a visual and ecological connection to the Cemetery Park and the Ackroyd Green Link.

Taller vegetation with fewer gaps means it is better suited to publicly accessible areas, when compared to Open Grassland that may be perceived by the general public as messy or unmaintained. Therefore, it is important that this vegetation type flowers for as long as possible, with bulbs in early winter and spring, and features plants that provide autumn and winter interest with late flowers, attractive seed heads and architectural structure. To maximise these qualities, a native seed mix will be augmented, sparingly, with robust non-native ornamental species.

Short lived ornamental species (such as Gaura lindheimeii) can be used as a ‘filler’, to create first year impact, filling gaps that will later be taken by species slower to mature.

Biodiversity Aims:

• To establish and maintain a robust, species rich sward of forbs and grasses that support invertebrates and pollinators for as much of the year as possible.

• To use a mosaic cutting regime that will create more diversity of species, structure and habitat.

• To contribute, over the lifetime of the development, to the local biodiversity action plan’s targets for Flower Rich Grassland habitat and support the associated bird, mammal and invertebrate species that depend on it.

Visual Aims:

• To provide colour, excitement and the therapeutic atmosphere of meadow vegetation, in key public spaces.

• To create natural ecotones between areas of mown lawn and tree cover, tying different character areas together.

• To balance habitat creation with year round interest and visual appeal.
BROADLEAVED WOODLAND GROVES

Description:

Groups of trees will create small pockets of broadleaved woodland with a predominantly herbaceous understorey, that blends into areas of flower rich grassland. Trees will be chosen based on their form, robustness (tolerance of drought, flooding, heat, pollution and diseases) and contribution to ecosystem services. They will be comprised of a mix of native and non-native trees to increase biodiversity and resilience to climate change. The understorey will be created initially with a native seed mix, augmented with some non-native, ornamental species. It is the intention that these designs evolve with a selective weeding approach to maintenance. Varying microclimates of light, moisture and nutrients will determine what species persist and which do not. This more sustainable approach also allows the vegetation to blend with areas of flower rich grassland. The selective weeding approach should be informed by an appropriate monitoring process.

Amongst planting, wood and stone will be used for both natural play features and as habitat creation.

Biodiversity Aims:

• To plant trees of varying maturity for greater long term spatial diversity.

• To plant a range of native and non-native trees that will stand up to the unpredictable nature of our changing climate, while providing maximum ecosystem services

• To plant a minimum of 5 native species, particularly those that support high numbers of invertebrates and lichens such as Oak, Willow and Birch.

• To establish and maintain a robust, species rich understorey of forbs and grasses that support invertebrates and pollinators throughout the year.

Visual Aims:

• To create visual interest, structure and frame the key journeys through the site

• To create seasonal and horticultural interest with a variety of flowers, fruits and foliage without them feeling out of place in their context.

Amongst planting, wood and stone will be used for both natural play features and as habitat creation.
CALCAREOUS GRASSLAND  
SUB DIVISIONS OF A KEY VEGETATION TYPE AT BOW COMMON GASWORKS

Open Calcareous Grassland

Flower Rich Calcareous Grassland

Flower Rich Perennial Planting
(in base rich substrate)

managed more for wildlife

managed more for visual amenity

can be challenging for some in a public space

visually exciting in a public space

relatively low maintenance

relatively high maintenance

higher percentage of native species

higher percentage of non-native species

lower number of overall species

higher number of overall species

significant ecosystem services &
benefits to local ecology and biodiversity

highly robust & resilient to a changing climate

highly robust & resilient to a changing climate
ECOLOGICALLY INFORMED MAINTENANCE

The long term success of the public realm at Bow Common Gasworks is dependent on a knowledgeable and passionate maintenance team. With naturalistic planting and ecosystem services at the heart of this landscape led design, it is vital that those responsible for the management and maintenance are suitably trained and have an ecological understanding of plants as well as a horticultural one.

COLLABORATION

There are many lessons that can be learned from the work being carried out at the Tower Hamlets Cemetery Park and on the Ackroyd Green Link. The approach being taken at these neighbouring sites should be integrated with Bow Common Gasworks to a degree that allows an extended area of biodiverse green space, but managed with the residents and the wider community in mind. The London Wildlife Trust have been consulted throughout the design process and may be another party that can help to inform the implementation of management and maintenance.

An ongoing quality control system is another tool that should be implemented. This could be achieved through an annual monitoring process to review and discuss all aspects of the management and maintenance plan. This review may be attended by, for example, a senior member of the maintenance team, a representative of the Friends of Tower Hamlets Cemetery Park, a member of the London Wildlife Trust and a member of the design team.

By continually reviewing and updating plans, the landscape can be managed more efficiently, and for the benefit of the users, the local ecology and the wider green infrastructure.

The following checklist is an example of items to be addressed by a board or committee on updates or improvements to the existing management and maintenance plan:

- Access and safety for all users and stakeholders
- Emergency access and protocol
- Grounds maintenance staff provisions such as training, security, equipment
- Health & Safety risk assessment
- Community engagement (such as bulb or tree planting days)
- General maintenance of hard and soft landscape
- Biodiversity and ecological value

GREEN FLAG AWARD

One way to measure the success of the management and maintenance is to attain Green Flag Award status, the national benchmark for parks and green space management. Tower Hamlets Cemetery Park achieved this status in 2019 and previous years. To attain Green Flag Award status a set of overriding principles must be met, including safety, security, litter management, sustainability, marketing, engagement with local people, biodiversity, and site heritage. The detailed Landscape Management and Maintenance Plans that are to be developed will be written with these benchmarks in mind and with aspirations of applying for the award.
BRIEFING NOTE ON SMALL BLUE BUTTERFLY (CUPIDO MINIMUMS) + SHADING IMPACTS

PREPARED BY TEC
Briefing note on Small Blue butterfly *Cupido minimus* & Shading impacts

**SMALL BLUE *CUPIDO MINIMUS* (LEPIDOPTERA: LYCAENIDAE) ECOLOGY**

Adults have a single brood (univoltine) annually and fly between late May–early July. Eggs are laid on the developing flowers (Langmaid et al., 1989; of kidney vetch *Anthyllis vulneraria*, the sole host plant. Larvae hatch in approximately 10 days, and feed within the flowers until fully grown, usually by late July, and then either leave the hostplant to overwinter in moss or a soil crevice, pupating in spring, or, more rarely, pupate immediately to emerge in August (Porter, 1997) as a second brood.

**REVIEW OF BUTTERFLY TRANSECT DATA FROM TERRY LYLE – THE FRIENDS OF TOWER HAMLETS CEMETERY (FOTH/C) PARK.**

The data received from FOTH/C Park transects indicates that small blue was not recorded in 2017, but has been recorded in 2018 (1 individual, 27/05/2018) and in 2019 (3 individuals, recorded 27/05/2019, 03/06/2019 and 17/06/2019) with a maximum number at any time of one individual. The flight period indicates a single brood with no second August brood recorded.

Numbers of small blue recorded on site are low, and it is important to note that (UKBMS, 2020) ‘The identification of population extinction and foundation can rarely be certain however. In particular, the absence of a species from a site can not be proven by the absence of records and the presence of records does not prove the existence of a breeding population, as butterflies may fly through areas in which they do not breed. In spite of these difficulties, definitions have been adopted to identify extinction and colonisations of populations from butterfly monitoring data. We assume that there was a breeding population at a site if a species was seen in four successive flight-periods and assume that there was no breeding population if it was not seen in four successive flight-periods. Population extinction was therefore assumed if ‘presence’ was followed by ‘absence’ at some later period; population foundation or colonisation was assumed when the converse occurred. Thus, a run of data of eight flight periods (note: 4 years for a bivoltine species; 8 years for a univoltine species) was required for either extinction or foundation to be identified’.

The small blue is generally regarded as a univoltine species (Porter, 1997; Langmaid et al., 1989), and so far there is no record to confirm the status of small blue at Tower Hamlets Cemetery (THC).

Other species which have been well recorded at THC include spiders (Araneae) and solitary bees (Hymenoptera: Aculeata). A common feature for both groups is their excellent dispersal ability, which has resulted in successful colonisation of the relatively isolated THC area following its development of suitable on-site habitat.

**EFFECTS OF SHADING ON INVERTEBRATES AND BUTTERFLIES, WITH REFERENCE TO SMALL BLUE BUTTERFLY**

Effects of shading on invertebrates are difficult to quantify, but in general for butterflies can be grouped into four main effects (Sparks et al., 1996):

- Reduction of direct sunlight for adult butterflies;  
- Reduction of nectar sources for adult butterflies;  
- Reduction in the quality of larval food plants; and  
- Reduction in quantity of larval food plants.

Evidence of specific shading effects have been poorly recorded in scientific literature on invertebrates, with some of the few examples investigating the effects of shading on butterfly populations within woodland rides (Warren, 1985; Greatorex-Davies et al., 1993; Sparks et al., 1996). These studies noted in general a greater range of species in the least shaded woodland rides (which included common blue *Polyommatus icarus* and brown argus *Aricia agestis* as the only open grassland blue butterfly (family Lycaenidae) species present), as well as a preference for woodland rides with abundant larval hostplants and nectar sources (Warren, 1985). It should be noted in the study by Sparks et al. (1996) that specific shading impacts on Lycaenidae species were not considered significant.

Additional factors of importance to butterfly populations in woodland include irradiance (amount of light present) and ride orientation, which was considered more important in the months of March and April, when the larvae of many species of butterfly begin to feed after hibernation, and east-west orientation rides were considered more valuable for butterflies as the sunlight was at maximum throughout the summer (Warren, 1985). Direct sunlight may be important at this stage for larval development (Greatorex-Davies et al., 1993). This does not however apply to small blue butterflies, as caterpillars pulate immediately following hibernation (Porter, 1997).

The basis of Ellenberg indicator values (Hill et al., 1999) for plants is the actual ecological niche they occupy. Hill et al. (1999) state that ‘plants have a certain range of tolerance of temperature, light, soil pH’ etc. ‘If we wish to make inference about the ecological conditions pertaining at a site, much useful information can be obtained from the flora’. Sparks et al. (1996) suggested that Ellenberg L values (for Light tolerance) are a useful surrogate for hostplants of butterflies and their resistance to shading, as many of the hostplants of butterflies have Ellenberg L values of 6 or greater, i.e. toward the well-illuminated end of the range. (Sparks et al., 1996). Ellenberg L values are on a scale of 1-9 where heaviest shade tolerant species are at 1 (Hill et al., 1999).

The Ellenberg L value for kidney vetch *Anthyllis vulneraria* (the specific larval hostplant of the small blue butterfly) is given by Hill et al. (1999) as 8, defined as a ‘Light-loving plant rarely found where relative illumination in summer is less than 40% (Cardamine hirsuta, Orchis morio, Thymus polytrichus, Vaccinium oxyccoccus)’, however note that kidney vetch does not score 9 (defined by Hill et al., 1999 as a ‘Plant in full light, found mostly in full sun’), as it is able to tolerate some degree of shading.

However, shading impacts also need to be considered in the context of other factors such plant species richness (diversity), which is also an important factor in retaining diversity in other taxa, such as butterflies (Sparks et al., 1996). In addition, specific growth form of the hostplants will determine if they are used as egg-laying sites (e.g. Warren, 1985).
ADDITIONAL HABITAT PROVISION

The provision of ‘meanwhile’ habitats (ideally ‘brownfield’ habitats) during construction will provide additional habitat suitable for colonisation by many of the more mobile species of invertebrate already present at THC, and ensure resilience of local faunas throughout the construction period, as the newly colonised habitat areas will augment populations of invertebrates present at THC. Inclusion of specific plant species (including, but not restricted to, kidney vetch) would aim to augment local plant populations for some of the scarcer invertebrate species recorded at THC.

REFERENCES


