



# Earl's Court and West Kensington Opportunity Area - Ecological Aspirations

September 2010

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## Site Description

The development site spans two boroughs, Royal Borough of Kensington and Chelsea and the London Borough of Hammersmith and Fulham. Both Boroughs are densely populated and openspace limited. Nevertheless there are 12 Sites of Nature Conservation Importance with 1km of the development zone (Map 1). Following are the site descriptions of these Local Sites.

### Holland Park (M131)

Holland Park comprises one of the larger areas of semi-natural habitat within central London and is important for its populations of mammals (including bats), birds and breeding amphibians. The site includes large areas of woodland, an uncommon habitat in inner London.

Holland Park contains a complex mosaic of habitats that have in recent years been managed with ecology in mind. There is an Ecology Centre within the park which oversees environmental education and provides a base for ecological management of the park.

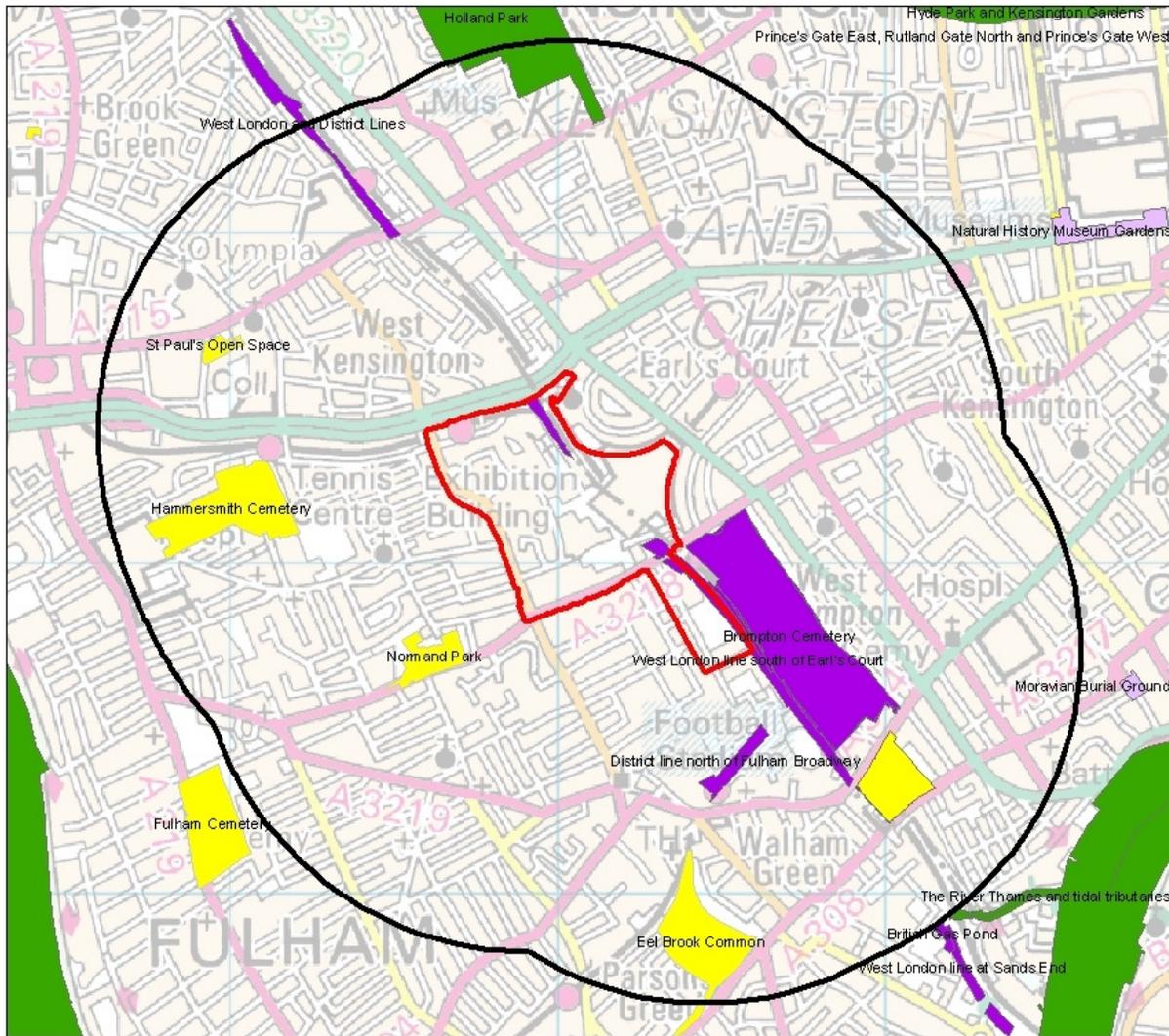
Holland Park's current habitats originate from the creation of a woodland park on open pasture in the 18<sup>th</sup> and 19<sup>th</sup> centuries. Following a long period of neglect, the park was acquired by London County Council in the 1950's and later transferred to Royal Borough of Kensington and Chelsea, who introduced more ecologically based management in the 1980's.

The current woodland habitats comprise a number of enclosures of varying character. During a period of neglect much the woodland park succeeded to an elm/sycamore dominated woodland. Dutch elm and sooty bark disease greatly reduced both species possibly creating a more open, ecologically interesting woodland structure. Elsewhere there are areas dominated by beech (*Fagus sylvatica*) or Turkey (*Quercus cerris*) and pedunculate oak (*Q robur*). The shrub layer generally comprises suckering elm, young sycamore and holly (*Ilex aquifolium*). The holly can become very dense in places and the shrub layer is shading out all ground-flora in a number of enclosures. Further commonly found species included bramble, elder and dog rose (*Rosa canina*). The ground-flora is very variable, depending on level of disturbance and level of shade cast by canopy and/or shrub layer. Widespread species include bluebell (*Hyacinthoides non-scripta*), nettle, ivy (*Hedera helix*), wood avens (*Geum urbanum*), red campion (*Silene dioica*), lords and ladies (*Arum maculatum*). More localised species include male fern and probably introduced foxglove (*Digitalis purpurea*), lily of the valley (*Convallaria majalis*) and sowbread (*Cyclamen hederifolium*). The woodland park reportedly supports an excellent assemblage of over 300 species of fungi.

Around the remains of Holland House, there are formal gardens with planted shrubbery and amenity lawns and further expanses of amenity grassland towards the south of the site and near the site entrances.

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Revision 1 . . .

The current survey recorded 12 bird species, a variety of invertebrates (field grasshoppers, speckled wood, small white, common darter and blue tailed damselfly). The Borough Bird Survey 2001 recorded 34 species, 27 breeding or possibly breeding. This included species uncommon in central London such as



Map 1

**Earls Court Development Site  
Sites of Nature Conservation  
Importance  
(Local Sites)**

**Legend**

- Development Site
- 1 km Buffer
- Metropolitan status
- Borough I status
- Borough II status
- Local status



THE ROYAL BOROUGH OF  
**KENSINGTON  
AND CHELSEA**

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N  
1:16,000

Ref: EC  
Author: S. Laing  
Date: 22/06/2010  
Scale: Draft

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sparrowhawk, great spotted woodpecker and tawny owl. The Park also supports large numbers of breeding blue tits, great tits and wrens as well as smaller numbers of song and mistle thrush, blackcap, chiffchaff, goldcrest, long tailed tit and coal tit.

The Borough Bat survey indicated that Holland Park is an extremely important site for bats with brown long eared bats and pipistrelles seen feeding in the park. The Borough Mammal survey 1997 highlights that a number of mammals are present within the park, including hedgehogs (indicated by droppings), domestic rabbits, foxes (the Fox Survey estimates four resident families), grey squirrel and wood mice. Additionally, there have been reports of brown rat and a feral ferret.

### **West London and District Line (BI 2)**

Undisturbed vegetation, dense in places providing a semi natural refuge in built up area. The site forms an important wildlife corridor joining the Grand Union Canal.

The West London and District Line runs north-south along the Borough boundary with Hammersmith and Fulham with much of the trackside area actually falling within the neighbouring borough. The part of the site within Hammersmith and Fulham has been designated as a site of Borough Grade I importance. The majority of the trackside areas comprise a complex of abandoned sidings overgrown with roughland and patches of semi-improved neutral grassland with a ruderal/ephemeral community nearer the track bed. Some areas of roughland have progressed to semi-mature sycamore woodland. There is a large area of semi improved neutral grassland to the south of Cromwell Road. The value of an extensive area of roughland, tall herb and sycamore woodland to the west of West Brompton Station is enhanced by adjoining habitat, including wetland areas in Hammersmith and Fulham.

The Borough Fox Survey indicated that the area is suitable for foxes providing undisturbed breeding habitat and a corridor to feeding areas including the adjacent Brompton Cemetery. Although there are no other specific surveys cover the fauna of the site, the mixture of habitats including bramble and other berry species are likely to provide a good food source and protection for birds and small mammals. A recent survey in June 2010 by LBHF biodiversity officers found a dominance of the native *Leucanthemum vulgare* that can support many nectar feeding insects.

### **Brompton Cemetery (BI 3)**

The site includes moderately diverse grassland containing at least three London notable species and which supports a diverse invertebrate assemblage.

A large cemetery established in 1840 on pasture along the Borough's western boundary. The majority of the site comprises semi-improved neutral grassland dominated by false oat with much red fescue, Yorkshire fog and rough meadow grass. Herbs include lady's bedstraw, birds foot trefoil, meadow vetchling, black knapweed, smooth tare, broadleaved everlasting pea and ox-eye daisy. The London notables grey sedge, sheep's fescue (*Festuca ovina*) and dark mullien (*Verbascum nigrum*) are also present. Patches of acid grassland contain red fescue, sheep's sorrel, mouse eared hawkweed and the aforementioned sheep's fescue. Associated invertebrates included field grasshoppers, small white, meadow brown, cinnabar moth caterpillars and red tailed bumblebee. Within the grassland are many

vegetated tombstones and the wall separating Brompton Cemetery from the West London and District Railway supports male and harts tongue fern. There are many fine mature trees including, false acacia, evergreen oak, Turkey oak, weeping ash, Scott's pine, horse chestnut, London plane, common lime and yew.

Mammal surveys report the presence of a number of species and emphasise the value of the site for bat. Seven feeding pipistrelles were noted with higher counts expected with more intensive survey. The Fox Survey indicated a resident population of two or three families and additional feeding visitors. The 1997 Mammal Survey also recorded 2 house mice, 2 wood mice and 20+ grey squirrels.

### **Kings College (L8)**

The site has been converted into apartments and houses. There are some communal areas for the residents although it is not known whether the planting scheme is of benefit to wildlife. To the east of the site, a permissive path will be opened up creating a shortcut between Kings Road and Fulham Road. This path will retain a thin strip of the current vegetation where it exists and new planting elsewhere. There is also a body of standing water on the site which has value in terms of biodiversity.

### **The River Thames and tidal tributaries (M031)**

This SMI has been designated primarily for its brackish and freshwater flora, wildfowl, waders, fish and invertebrates and for its strategic importance as a natural landscape feature.

The course of the Thames within Kensington and Chelsea and LBHF forms part of one of London's richest wildlife habitats supporting diverse assemblages of birds, fish and invertebrates. The RBKC bird survey carried out in 2001 reported 28 species present along the Thames, 18 of which were breeding or probably breeding. This list includes common tern, greylag goose, pintail, tufted duck, dunnock and probably inner London's largest colony of house martins (that nest in the streets immediately north of Chelsea Creek).

The stretch of the Thames from the mouth of Chelsea Creek to Kensington Borough Wharf includes areas of extensive inter-tidal mud, while mud and shingle are exposed at low tide between Kensington Borough Wharf and Battersea Bridge where there is also a small sand beach. These features and the muddy channel of Chelsea Creek are particularly valuable for birds, with large numbers of black-headed gull, grey wagtail, heron and mallard reported in the current survey.

The LBHF portion of the Thames covers around 2,300 hectares, by far the largest site important for nature conservation (SINC) in LBHF. The 2009 LBHF bird watch by residents and professionals found around 35 species of bird using the Thames, and 155 native plant species growing in along or within 3 metres of the Thames.

### **St Paul's Open Space (H&FL08)**

St Paul's Green on Hammersmith Road, near Hammersmith bus station, was once part of the grounds of St Paul's Boys School. It was developed for public use after the school moved to Barnes in the 1968.

It is a most attractive site, with fine mature plane trees shading almost all of the garden by mid-summer. Hedges and shrubbery around the sides provide some cover for birds. Here tangles of bramble (*Rubus fruticosus* agg.), elder (*Sambucus nigra*) and roses (*Rosa* spp.) are allowed to grow up into thickets, and creepers such as ivy (*Hedera helix*) and Russian vine (*Fallopia baldschuanica*) scramble over the walls, creating further nesting opportunities for small birds. Like many sites with a long history as a garden, the grass here has a fair variety of wild flowers, especially in the walled section where the grass management is more relaxed. As well as masses of daisies (*Bellis perennis*), bulbous and meadow buttercups (*Ranunculus bulbosus* and *R. acris*), selfheal (*Prunella vulgaris*), garden bluebells (*Hyacinthoides hispanica*) and dove's-foot crane's-bill (*Geranium molle*) can all be found here, plus swine cress (*Coronopus didymus*) growing alongside paths.

The most noteworthy species are, *Silene dioica*, *Galium mollugo*, *Galium verum*, *Hypericum hirsutum*, *Hypericum perforatum*, *Quercus robur* and *Viburnum opulus*. Those which are rare in London are: *Aquilegia vulgaris*, *Allium ursinum*, and on the London BAP waiting list are: *Geranium pratense*, and *Hyacinthoides non-scripta*. In March 2010, 98 native plant species were recorded on this site.

### **Hammersmith Cemetery (H&FL09)**

This burial ground, opened in 1868, offers a peaceful retreat from the noise and traffic of Fulham Palace Road, and a real sense of countryside in town. Although part of the site houses some relatively recent burials, with well-tended plots in traditional style, other parts are managed on more natural lines. Here some of the graves have been cleared aside, leaving a wide expanse of open grassland. As the mowing regime has been relaxed, wild flowers have returned, with species such as bulbous buttercup (*Ranunculus bulbosus*), creeping jenny (*Lysimachia nummularia*), common mouse-ear (*Cerastium fontanum*), hedgerow crane's-bill (*Geranium pyrenaicum*), parsley piert (*Aphanes arvensis*) and oxeye daisy (*Leucanthemum vulgare*), plus selfheal (*Prunella vulgaris*), ground ivy (*Glechoma hederacea*) and dog violet (*Viola riviniana*) in the shade. Some of the sandy soil in the individual grave plots is particularly herb-rich. Several species of stonecrop (*Sedum* spp.) serve as a good nectar source for bees. Lower plants such as mosses, lichens and liverworts cling to the stonework. Ferns, including the locally uncommon broad buckler-fern (*Dryopteris dilatata*), grow in shady spots by the walls.

Species of plant found on this site by LBHF biodiversity officers that are of greatest London significance found on the London BAP waiting list are: *Daphne mezereum*, *Hyacinthoides non-scripta*, *Rosa pimpinellifolia*, *Clinopodium ascendens*, *Thalictrum flavum*, *Viola canina*, *Convallaria majalis*, *Geranium pratense* and *Sedum telephium*. Of national rarity which grows on this site is *Salvia pratensis*. In total 188 vascular plant species were recorded on this site in 2010.

A good range of birds can be found here, for example great spotted woodpecker, jay, greenfinch and robin as well as the now ubiquitous (in west London) rose-ringed parakeet.

### **Normand Park (H&FL11)**

This small park, in a densely built-up part of Fulham, was developed on a bombed site from the Second World War. It has an emphasis on active recreation,

appropriate to its location beside the health club, with a playground, tennis courts and Bowling Green. The main features of significance for wildlife are the mature trees, for example ash, beech, silver birch and white willow, and an unusual 'living fossil', the maidenhair or ginkgo tree (*Ginkgo biloba*). This attractive tree, which hales from China, is the sole survivor of a family of trees that were common across much of the world 200 million years ago, before our present day coniferous and deciduous trees had evolved. The botanical survey of 2010 by LBHF biodiversity officers found 175 native species of plant of which *Geranium pratense*, *Viola canina*, *Clinopodium ascendens* and *Dipsacus pilosus* are on the London BAP waiting list.

There are large areas of the park (more than 20%) of the area which is managed as long acid grassland.

The park attracts a fair variety of common birds, such as goldfinch, robin, blue tit and great tit. Perhaps more notable at the present time, you may still find a few house sparrows. The park will soon be undergoing a major regeneration thanks to a £2 million regeneration scheme sponsored by the council and the North Fulham New Deal for Communities (NDC).

### **Eel Brook Common (H&FL13)**

Up till the 19th century this was a traditional piece of common land, and used for grazing. Today it is an important open space for public recreation, with something of the character of a village green. The fine old London plane trees (*Platanus x hispanica*), which are mainly towards the edges, lend the site an historic feel. More recent tree planting by the council has focused on native species, which should bring greater wildlife value in the longer term. However, most of the site is taken up by a large expanse of short mown grass. This is clearly a popular area for an informal kick-about as well as for social activities. There is a popular children's playground.

To the south of the main common, a chain of small green spaces continues alongside the Kings Road. These have rather more extensive tree cover, including some fine old Huntingdon elms (*Ulmus x vegeta*); this is one of the few varieties of elm to survive the Dutch elm disease in the 1970s, which devastated most of the UK's elm trees. In 2010 the botanical survey for this site found just 40 native species of plant on the site.

### **British Gas Pond (H&FBI05)**

This pond, the only remnant of a short canal which once linked Fulham Gas Works to Chelsea Creek, is probably the best in Hammersmith & Fulham from a botanical point of view. Three sides of the pond have excellent marginal vegetation, including great reedmace (*Typha latifolia*), gypsywort (*Lycopus europaeus*), brooklime (*Veronica beccabunga*), common water-plantain (*Alisma plantago-aquatica*), amphibious bistort (*Persicaria amphibia*), trifid bur-marigold (*Bidens tripartita*), bittersweet (*Solanum dulcamara*), water mint (*Metha aquatica*) and pale galingale (*Cyperus eragrostis*). The pond is probably not so valuable for amphibians or invertebrates due to a large population of carp. There is a small patch of willow (*Salix* spp.) scrub at the southern end.

The fourth side of the pond is a high brick wall, on which grows fern-grass (*Catapodium rigidum*), which is scarce in London.

There is no public access, but the pond is viewable for travellers on the West London railway. The site was ecologically and botanically surveyed by LBHF biodiversity officers in October 2009. In 2009 no fish were seen to present, and there had been no local sighting of amphibians. The site had been allowed to grow over significantly with *Buddleja davidii*, this was clearly rapidly changing the nature of the habitat from grassland to scrubland.

### **District line north of Fulham Broadway (H&FBI07G)**

The network of railway lines which criss-crosses Hammersmith & Fulham provides some of the borough's most important wildlife habitats. Railsides tend to be undisturbed, with only infrequent management and no public access. Railside land thus provides excellent habitat for plants and animals, corridors for the spread of wildlife and, often, a pleasant and deceptively rural outlook for train travellers.

The District line emerges from a tunnel just north of Fulham Broadway station, and runs in a shallow cutting cloaked in dense scrub, mostly of ornamental species planted as part of the station landscaping. Cotoneaster (*Cotoneaster* sp.) and firethorn (*Pyracantha coccinea*) provide abundant berries for birds in autumn.

There is no access, but the railsides provide a pleasant view for train travellers.

### **West London line south of Earl's Court (H&FBI07F)**

The network of railway lines which criss-crosses Hammersmith & Fulham provides some of the Borough's most important wildlife habitats. Railsides tend to be undisturbed, with only infrequent management and no public access. Railside land thus provides excellent habitat for plants and animals, corridors for the spread of wildlife and, often, a pleasant and deceptively rural outlook for train travellers.

The West London Line runs in a shallow cutting along the borough boundary with Kensington & Chelsea, beside Brompton Cemetery. The Kensington & Chelsea side of the cutting is described as West London Line in Brompton. Part of the cutting is shared with the District line. A variety of habitats can be seen along the railsides, including scrub of goat willow (*Salix caprea*), hybrid poplars (*Populus spp.*) and butterfly-bush (*Buddleja davidii*), developing sycamore (*Acer pseudoplatanus*) woodland, tall herbaceous communities and grassland. The LBHF side by the station has a deep cutting where the former Counter's Creek ran. Some of the grassland has a calcareous influence, supporting plants such as salad burnet (*Sanguisorba minor*), wall lettuce (*Mycelis muralis*) and blue fleabane (*Erigeron acer*), which are scarce in London and known nowhere else in the borough. A natural pond fed through water coming from out of the exposed river gravels sitting on clay has allowed for a luxuriant growth of great reedmace (*Typha latifolia*) with smaller amounts of water plantain (*Alisma plantago-aquatica*) and floating sweet-grass (*Glyceria fluitans*). Also found in this area are *Ranunculus lingua* and *Scrophularia auriculata*. There have also been sightings of *Bufo bufo* (the common toad). The area may well be suited to protected species such as Great Crested Newts and bats roosting in the trees or under the old arches. Significant piles of dead wood from large logs may be ideal habitat for *Lucanus cervuus* (the stag beetle).

A small nature area immediately adjacent the West London Line 'up' platform is managed by the Local Agenda 21 Forum in partnership with the railway company and an interpretation sign is attached to the railings separating the platform and nature area. The area has been botanically surveyed by LBHF biodiversity officers

on 09/06/2010, the results can be found in the appendices. On one day a total of 99 native vascular plants were identified.

### **Protected species records**

Data held by the regional records centre has shown that four protected amphibian species, 30 bird species, one fish species, 16 flowering plant species, 25 invertebrate species and six mammal species have been recorded within 1km of the development site, See Appendix 1 for species list and protected status. More protected species may exist in the area (as suitable habitat certainly exists for them) but be unknown of at the time of this document.

### **Existing open space and biodiversity value<sup>1</sup>**

Domestic gardens and other managed open spaces have the potential to play a crucial role in supporting urban biodiversity. In the UK, residential zones can account for more than 60% of urban land area. Consequently, private gardens may represent a significant proportion of greenspace in a city. From work in Leicester, and elsewhere, it has been estimated that gardens typically constitute about a quarter of urban land areas.

Urban gardens will never act as substitutes for many semi-natural habitats, however, neither are they 'wildlife deserts'. Gardens can offer a rich variety of resources, such as a broad range of microclimates, plant species, and vegetation structures. They can also provide habitats, such as ponds, that may be increasingly rare elsewhere. Furthermore, gardens are not inhabited only by common species. The juniper pug is an example of a scarce moth whose natural food plant is rare, but which successfully exploits ornamental junipers in domestic gardens. Likewise, the stag beetle lives in tree stumps and logs in its larval stage, but these are a rather scarce resource in many areas. Their presence in gardens supports stag beetle populations in south east England.

### **Development Site and existing green space**

The proposed development site area has been assessed using spatial data from GIS mapping(GIS Aerial photos 2007, LBHF). The site has been split into areas and sections to help assess the quantity of greenspaces and tree cover combined on the existing site. Each section has been measured on GIS counting up the separate square metres of tree canopy and green space combined. The data for each section was then collated give total square metreage for each section., see Table 1.

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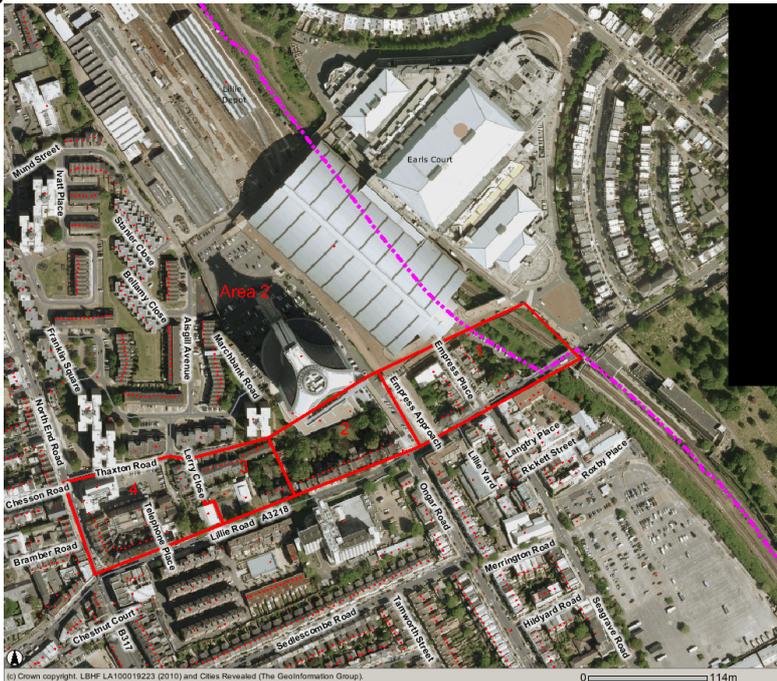
<sup>1</sup> University of Sheffield <http://www.bugs.group.shef.ac.uk/BUGS1/backgrnd.html> 23/09/10

**Table 1: Square metrage of greenspace per areas and sections on the proposed site as identified from GIS.**

| Area | Section | Area Of Space Per Sq Metres | Area of Green Space Per Sq Metres | Percentage % Of Green Space Per Sq Metre |
|------|---------|-----------------------------|-----------------------------------|--|
| 1    | 1       | 10,571.23                   | 1,521.38                          | 14.39%                                   |
|      | 2       | 12,060.84                   | 2,073.48                          | 17.19%                                   |
|      | 3       | 9,675.01                    | 377.23                            | 3.90%                                    |
|      | 4       | 10,379.67                   | 3377.40                           | 32.54%                                   |
| 2    | 1       | 12,283.03                   | 2,167.62                          | 17.64%                                   |
|      | 2       | 8,036.37                    | 2,816.08                          | 35.04%                                   |
|      | 3       | 4,655.47                    | 623.25                            | 13.38%                                   |
|      | 4       | 10,254.29                   | 452.11                            | 4.40%                                    |
| 3    | 1       | 40,925.79                   | 4,680.20                          | 11.4%                                    |
|      | 2       | 44,300.68                   | 3,144.92                          | 7.1%                                     |
|      | 3       | 35,079.09                   | 6,737.92                          | 19.2%                                    |
|      | 4       | 39,008.11                   | 1,534.98                          | 3.9%                                     |
| 4    | 1       | 7,688.57                    | 2,418.01                          | 31.4%                                    |
|      | 2       | 9,117.91                    | 4,220.63                          | 46.3%                                    |
|      | 3       | 27,944.84                   | 3,375.59                          | 12.1%                                    |
|      | 4       | 28,756.32                   | 3,017.56                          | 10.5%                                    |



**Figure 1: Area 1, Proposed development area south of Lillie Road, eastwards up to the boundary of the existing railway, part including SINC West London line south of Earl's Court (H&FB107F)**



**Figure 2: Area 2, Proposed development area north of Lillie Road, northwards to Thaxton Road and eastwards to include part of SINC West London line south of Earl's Court (H&FB107F)**



**Figure 3: Area 3, Proposed development area east of North End Road and South of West Cromwell Road, eastward, up to but excluding the Lillie bridge rail depot. Including private land, the majority of West Kensington estate, Gibbs Green Estate, Gibbs Green school,**

**London Underground Facilities on Beaumont avenue and part including SINC site West London and District Line (BI 2).**



**Figure 4: Area 4, Proposed development area, north to south including the district line and eastwards including the Earls court exhibition centre (excluding Earls Court 2). Eastwards to the rear of Philbeach Gardens, and extending to Warwick Road at the eastern entrance of the Earls Court Exhibition Centre. Part including SINC site West London and District Line (BI 2).**

### **Flooding and Lost Rivers**

The proposed development area is a flood risk area<sup>2</sup>, and therefore any increase in surface water runoff need to be carefully mitigated.

Counter's Creek, one of London's historic 'Lost Rivers', is the main sewer for the area (Map 2). It is a combined sewer, carrying both rainwater and sewage, and it simply cannot cope with the demands of modern-day London<sup>3</sup>. Counter's Creek, named after a medieval bridge over Kensington High Street, ran for four miles in an almost straight line from Kensal Green to the Thames at Chelsea. It may have been a relatively insignificant stream in its day, but its course has left a lasting legacy across West London. The river's first transformation was from natural stream to artificial channel. In 1827, the speculative Kensington Canal was built along the alignment of Counter's Creek between Kensington High Street and Battersea Reach. The canal rapidly proved highly unprofitable and so was sold off to a railway

<sup>2</sup> Environment Agency <http://www.environment-agency.gov.uk/default.aspx> 23/09/10

<sup>3</sup> Thames Water News release 8/3/10

<http://www.thameswater.co.uk/cps/rde/xchg/corp/hs.xsl/10072.htm>

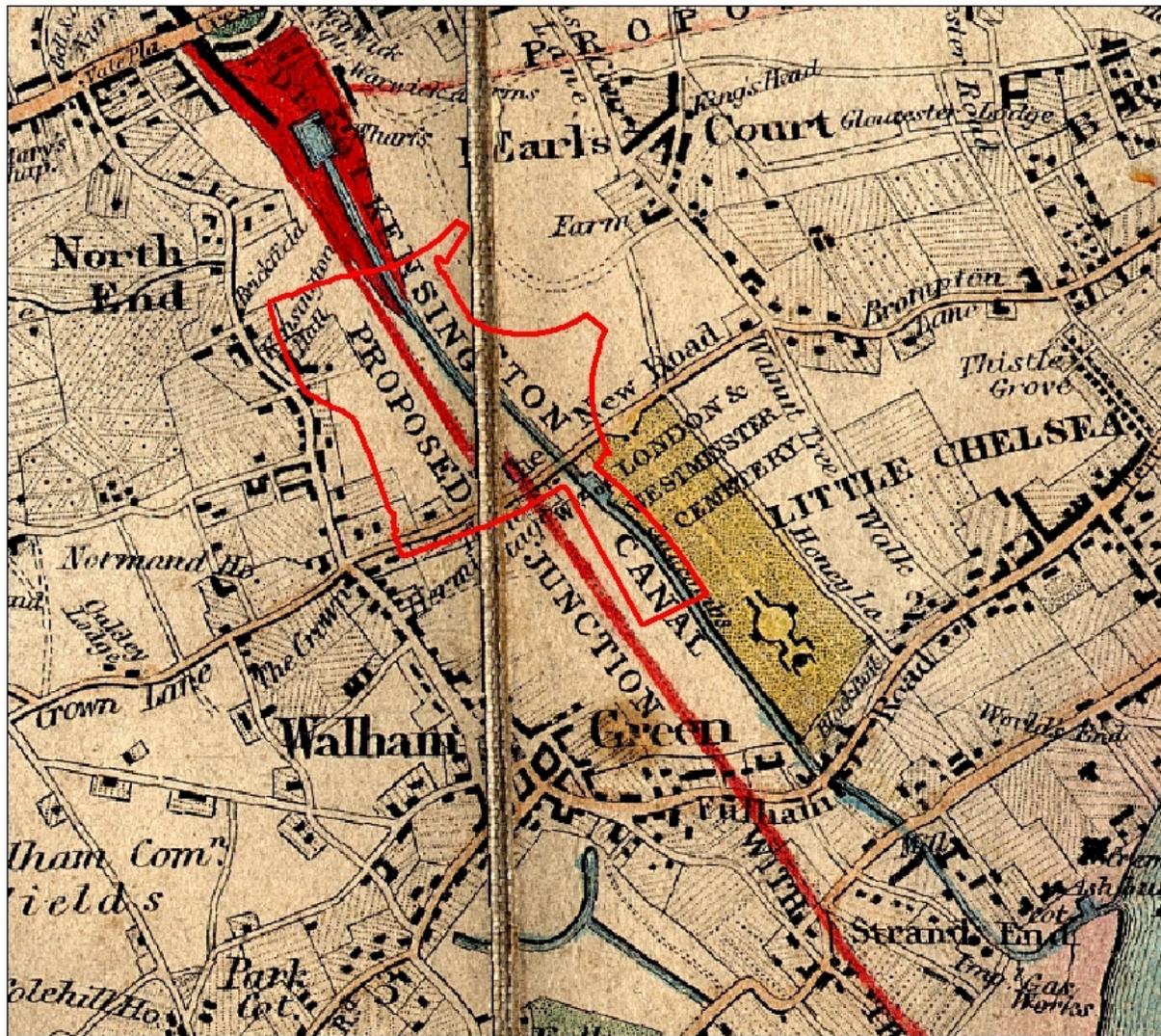
company, who built an equally unprofitable line up the valley to link Kensington Docks with Willesden <sup>4</sup>.

Therefore, in terms of the sites biodiversity based heritage value there is a need for [the historical presence of wetland areas to be considered](#). Creating wetland or soak away areas that could help with Sustainable Drainage Systems (SUDS). The creation of wet areas could help to mitigate flooding in the area and compliment and link the parcels of land West London line south of Earl's Court (H&FB107F), British Gas Pond (H&FBI05) The River Thames and tidal tributaries (M031).

**Deleted:** the presence of Counters Creek to be considered within the development site.

---

<sup>4</sup> [http://Indn.blogspot.com/2010\\_03\\_01\\_Indn\\_archive.html](http://Indn.blogspot.com/2010_03_01_Indn_archive.html)



Map 2

Earls Court Development Site  
1841 Map  
(Kensington Canal)

Legend

 Development Site



THE ROYAL BOROUGH OF  
KENSINGTON  
AND CHELSEA

Ecology Site to be  
The Royal Borough of Kensington and Chelsea  
Holland Park  
020 7938 8185  
cask@rbkc.gov.uk

N  
1:12,000

Ref: EC  
Author: G. Loring  
Date: 22/09/2010  
Scale: Draft

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## **Policy and Legislative Context**

### **European biodiversity policy**

In 1992, the then European Community adopted Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive. This is an important piece of international wildlife legislation, intended to provide member states of the European Union (EU) with a mechanism to meet their obligations under the 1979 Bern Convention and to complement the provisions of the 1979 Birds Directive. The main aim of the Habitats Directive is:

"...to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the Treaty applies" (Article 2)

The EU adopted the 6th Environmental Action Programme Environment 2010: Our Future, Our Choice in 2002. It provides the environmental component of the Community's forthcoming strategy for sustainable development. The new programme identifies four priority areas: Climate Change; Nature and Biodiversity; Environment and Health; Natural Resources and Waste.

### **National biodiversity policy**

The Convention on Biological Diversity is dedicated to promoting sustainable development and recognises that conserving biological diversity is about people's needs as well as plants, animals, micro-organisms and ecosystems; 150 governments at the 1992 Rio Earth Summit signed the convention.

The objectives of the convention are the conservation of biodiversity, sustainable use and equitable sharing of the benefits. The convention commits signatories to action, and is implemented in the UK Biodiversity Action Plan (BAP).

The UK Biodiversity Action Plan represents a new approach to nature conservation. Key achievements include developing costed, quantifiable targets for actions, establishing effective systems for handling data, promoting public awareness and broadening public involvement, and monitoring progress and broadening the biodiversity constituency.

UK Biodiversity priorities that are addressed through this local plan are:

- To increase the overall populations and natural ranges of native species and the quality and range of wildlife habitats and ecosystems.
- To enhance species, habitats, natural and managed ecosystems those are characteristic of local areas.
- To enhance the biodiversity of natural and semi-natural habitats where this has been lost over recent decades.

### **England's Biodiversity Strategy**

The Department for the Environment, Food and Rural Affairs (DEFRA) produced a biodiversity strategy for England (Working with the grain of nature, 2002) which provides a useful framework for urban areas. The Strategy developed eight

indicators to monitor. Some of these are relevant to the Royal Borough of Kensington and Chelsea and can be monitored as part of this action plan:

- Populations of wild birds
- Biological quality of rivers
- Progress with local biodiversity action plans
- Public attitudes to biodiversity

### **Legislation**

Section 40 of the Natural Environment and Rural Communities Act (2006) states that 'Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity'. Section 40(3) also states that 'conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat'.

Protected Species is a species which receives protection under domestic or European Legislation – the protection could be partial (prohibiting sale, for example) or full, in which case the disturbance, killing or injuring of just one of the species could constitute an offence. Following are the key acts and regulations:

- The Wildlife and Countryside Act 1981 (as amended)
- The Countryside and Rights of Way Act 2000
- The Conservation of Habitats and Species Regulations 2010
- The Protection of Badgers Act 1992

Natural England recommends that, where there is a reasonable likelihood of a protected species being affected by a development, surveys are provided prior to determination of the application. This is in accordance with Paragraphs 98 and 99 of ODPM Circular 06/2005 which advise that surveys should only be conditioned under exceptional circumstances. The presence of protected species is a material consideration when a local authority is considering a planning application that could affect a protected species. If surveys are not carried out before planning permission is granted there is a risk that not all material considerations will have been addressed.

### **Planning policy**

The Government guidance contained within Planning Policy Statement 9: Biodiversity & Geological Conservation (PPS9) also makes it clear that developments should build in features beneficial to wildlife or geological features as part of the overall design. Natural England recommends that Local Planning Authorities maximise the opportunities for enhancements associated with all developments. The enhancements should be proportionate to the scale of the development proposed and could range from the installation of nest boxes or bat bricks in a small scale development through to the creation of areas of semi-natural habitat for larger scale applications. Some examples of this are creating new areas of wetland and the incorporation of ecological corridors that can also be used as pedestrian or cycle routes.

## Regional Context

### London Biodiversity Partnership

The London Biodiversity Partnership (LBP) is a partnership of public, private and voluntary sector organisations as well as individuals. It was established in 1996 in response to the UK BAP and has produced London's BAP. The Partnership aims to protect and enhance the capital's habitats and species for future generations to benefit from and enjoy.

London's BAP consists of the 28 action plans: 14 habitats and 11 species. As well as its action plan species, London contains a number of nationally rare UK BAP priority species are identified; however, the London's BAP states that:

- All of our habitat action plans are designed to support these species.
- This list is constantly being reviewed and updated.
- Planning decisions must consider these species.
- 

The London BAP contains the following targets (Table 1) to improve the condition and increase the extent of a selected number of habitats found in the capital by 2015. These targets were adopted in 2007, have been incorporated into the Further Alterations to the London Plan (FALP), and constitute London's contribution towards the England Biodiversity Targets.

Table 2: London Biodiversity Partnership habitat targets 2015.

| Habitat Type                         | Target to Improve Condition by 2015 | Target to Increase Extent by 2015                          |
|--------------------------------------|-------------------------------------|--|
| Coastal and Floodplain Grazing Marsh | 30 hectares                         | 10 hectares  |
| Chalk Grassland                      | N/A                                 | 25 hectares  |
| Acid Grassland                       | 5 hectares                          | 20 hectares  |
| Heathland                            | N/A                                 | 30 hectares  |
| Reedbeds                             | N/A                                 | 10 hectares  |
| Open Landscapes with Ancient Trees   | 2 hectares                          | 20 hectares  |
| Woodland                             | N/A                                 | 20 hectares (of which 5 hectares is wet woodland)          |
| Meadows and Pastures                 | 5 hectares                          | 20 hectares  |
| Tidal Thames                         | N/A                                 | 1 new salt marsh or mudflat                                |
| Rivers and Streams                   | 15 kilometres                       | N/A  |
| Standing Waters                      | N/A                                 | Create 33 new ponds per year and 5 new larger water bodies |

LBP partner organisations are working to secure delivery of these important targets for London to which this Local Biodiversity Action Plan will contribute. Any habitat creation in Kensington & Chelsea should contribute towards these targets.

### London Biodiversity Strategy

As required by the Greater London Authority Act, the Mayor of London produced a biodiversity strategy for the capital in 2002 that requires the London Boroughs to

assist with implementation and encourages them to formulate their own action plans (Mayor of London, 2002). The document details the Mayor's vision for protecting and conserving London's natural open spaces. It seeks to ensure that there is no overall loss of wildlife habitats in London and that more open space is created and made accessible, so that all Londoners are within 1km walking distance of a quality natural space (Mayor of London, 2002).

### **Mayors New London Plan**

The principles of green infrastructure are supported policy 5.10 of the Mayors New London Plan, in which it states the Mayor will promote and support urban greening, such as new planting in the public realm (including streets, squares and plazas) and green infrastructure, to contribute to the adaptation to, and mitigation of, the effects of climate change making green infrastructure relevant in densely urban area.

## **Local policies**

### **RBKC Core Strategy**

Biodiversity policies associated with Biodiversity are contained within the 'Respecting the Environmental Limits' Chapter. The following policies are set out to protect the existing biodiversity in the borough and create opportunities to attract biodiversity into the Borough.

Policy CE4: The Council will enhance and improve the biodiversity value of the Borough. To deliver this the Council will:

- a) Protect Sites of Nature Conservation Importance, or provide significantly improved habitats in accordance with the national, regional and local Biodiversity Action Plans;
- b) Protect Green Corridors and require that development proposals create opportunities to extend or link Green Corridors;
- c) Require a site specific Ecological Impact Assessment for all major developments in or adjacent to Sites of Nature Conservation Importance or Green Corridors;
- d) Require major development proposals to create opportunities for attracting biodiversity and habitat creation, through measures such as green corridors, nest boxes, swift bricks, green / brown roofs, water course enhancements and planting for habitat creation, having regard to the national, regional and local Biodiversity Action Plan.

### **LBHF Core Strategy**

Biodiversity policies associated with development and biodiversity and the environment include:

UDP Part 2 - Chapter 4: Environment - Policy G3 (Restatement of Part 1 Policy G3: Environment)

The council will seek to conserve, protect and enhance the quality, character and identity of the borough's built and open environment; and to address wider environmental issues such as the sustainability of development and growth, global warming, and resource and energy conservation, as far as possible through local land-use and transportation planning in the following ways:

- (a) Preserving and enhancing buildings and areas of special character;

**EN2-7, EN31, Site 36**

(b) Requiring new development to create a safe and secure environment, be of a high standard of design that will contribute to enhancing the townscape of the locality, be compatible with the scale and character of the surroundings, and respect important local and long-distance views;  
**EN8-15, EN21, EN31**

(c) Protecting Metropolitan Open Land and other open space, and seeking additional open space provision, especially in areas of deficiency;  
**EN22-24, Site 32, Site 36, Site 22A**

(d) Recognising and protecting the natural environment and biodiversity of the borough by protecting, managing, and seeking to enhance nature conservation areas and green corridors linking with other boroughs, and developing new nature conservation areas where possible and securing the protection and enhancement of features of nature conservation interest in connection with development proposals;  
**EN25-30, EN40, Site 22, Site 36**

(e) Making the environment safer and more accessible for all;  
**EN10, EN20A-21**

(f) Seeking a reduction in pollution and waste, including carbon dioxide emissions and other pollution from road traffic and other forms of transport. It will seek to ensure that the collection and disposal of waste is carried out so as to minimise the traffic and environmental impact, both within the borough and elsewhere;

#### **RBKC Local Biodiversity Action Plan: 2010/11 - 2014/15**

The broad aims and objectives of this Biodiversity Action Plan are:

- To audit and monitor the ecological status of habitats and species, by carrying out focused biodiversity surveys and monitoring key indicators for species and habitats.
- To raise awareness of the importance of biodiversity, by creating opportunities for local residents and visitors to enjoy and learn about the natural environment and to understand the biodiversity of the borough.
- To protect and enhance the borough's biodiversity resource, by improving the quality of the local environment through practical management, habitat creation and protection of important wildlife sites.

Action plans for the following are specified with the RBKC LBAP:

- Surveys and Management
- Environmental Education and Awareness
- Green Corridors
- Parks, Gardens, City Squares School Grounds and Churchyards and Cemeteries
- Woodland
- Grassland
- Wildlife Hedges
- Tidal Thames
- Freshwater Habitats
- Mammals
- Birds

- Invertebrates
- Vegetation / Fungi

### **LBHF Draft Local Biodiversity Action Plan**

The broad aims and objectives of this Biodiversity Action Plan and its' partnership are through 'no net loss' and 'creation and enhancement':

- To monitor and evaluate, enhance and create all identified habitats contributing to biodiversity, with priority given to those identified in the habitat action plans (HAPs)
- To monitor and evaluate and encourage all species identified in the species action plans (SAPs)
- To promote and protect all species protected by statute as national and international law and applies.
- To promote awareness, participation and management of biodiversity, through education, environmental enhancement, habitat creation, restoration and management where ever possible.
- To monitor at least twice annually the SINC's (35) within the borough where accessible, and to work with the land owners to proactively manage for biodiversity 'no net loss' .
- The HAPs and SAPs are:

#### *Habitat*

Gardens and allotments  
 Standing water bodies (lakes and ponds)  
 Grand Union Canal  
 'Greening' the Built Environment  
 Trees, woodland and scrub  
 Railway land and corridors  
 River Thames and it's foreshore

#### *Species*

Black Redstart  
 House sparrow

- The BAP will be linked in priority and targets for HAPs and SAPs as identified in the UK BAP, London BAP

## Biodiversity Strategy for the Development Site

The two core requirements relating to the development site are:

1. To audit and monitor the ecological status of habitats and species.
2. To protect and enhance the biodiversity resource, by improving the quality of the local environment through the protection of important wildlife sites, the creation and enhancement of habitats, and the incorporation of green infrastructure through innovative design.

These core requirements can be delivered by applying the following guiding principles.

### Guiding principles for the Earls Court Development Area

- 1) No net loss of open space, including natural and semi-natural.
- 2) No net loss of tree cover, (see Appendix 2 for evidence base for planting more trees)
- 3) No loss of Sites of Nature Conservation Importance or Local Sites (map 1)
- 4) Retention, protection and enhancement of all existing UK BAP priority<sup>5</sup> habitats and species (Appendix 1).
- 5) Net sustainable native biodiversity gain
- 6) Habitat creation should be focussed on acid grassland, woodland and freshwater habitats as per the London BAP.
- 7) Connectivity across the site through the development of '*green ribbon*' corridors following the *green infrastructure* (Green Grid) principals (Map 3) to be an integral part of the development proposals. With particular focus in maintaining and enhancing linkage from West Brompton Cemetery through to Talgarth Road and the railside environment.

---

<sup>5</sup> UK Biodiversity Action Plan species and habitats: <http://www.ukbap.org.uk/newprioritylist.aspx>, London Biodiversity Action Plan species: <http://www.lbp.org.uk/londonap.html>, Local Biodiversity Action Plan Species and species / habitats protected under statutory legislation.





Map 3

Earls Court Development Site  
Green Infrastructure

Legend

- Development Site
- Park
- Green Ribbon / Infrastructure
- Biodiversity Zones



THE ROYAL BOROUGH OF  
KENSINGTON  
AND CHELSEA

Ecology Services  
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Ref: EC  
Author: S. Laing  
Date: 22/06/2010  
Status: Draft

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### Green design and infrastructure

- 8) Living roofs and other green design features required on all buildings within the 'Biodiversity Zone' (map 3). Living roofs should be a substrate based roof planted for biodiversity (see appendix 3 for examples), other green features should be an integral part of the building's design. Living roofs and other green design are desired on the remainder of the site. London biodiversity action plan (LBAP) habitat action plan priority habitats (HAP) should be chosen for all green roofs. The Living roofs should be substrate based roof planted with native species to enhance and compliment existing biodiversity.
- 9) Building design should also incorporate nesting features (e.g. bird<sup>6</sup> and bat<sup>7</sup> boxes) into the structure of all buildings. Thus maximising roosting and nesting potential of the buildings.
- 10) The development proposals should be based on the incorporation of Green Infrastructure to enhance ecological value of the site, deliver climate change mitigation and green transport.
- 11) Consideration be given the creation of wet areas to mitigate flooding in the area and compliment and link the parcels of land West London line south of Earl's Court (H&FB107F), British Gas Pond (H&FB105) The River Thames and tidal tributaries (M031).

Deleted: Green

Deleted: Green

Deleted: Green

Deleted: green

Deleted: to opening up 'lost rivers'.

### Shadow Free Zone

- 12) No new shade impact to be allowed on the 'biodiversity zone' or over existing Local Sites (Sites of Nature Conservation Importance), as identified in the 'shadow free zone' (4). Shade would impact on species composition and vegetation growth of the Local Sites.

### Lighting

- 13) Lighting must be low level, LED lighting. Light spillage and pollution should be mitigated across the development.

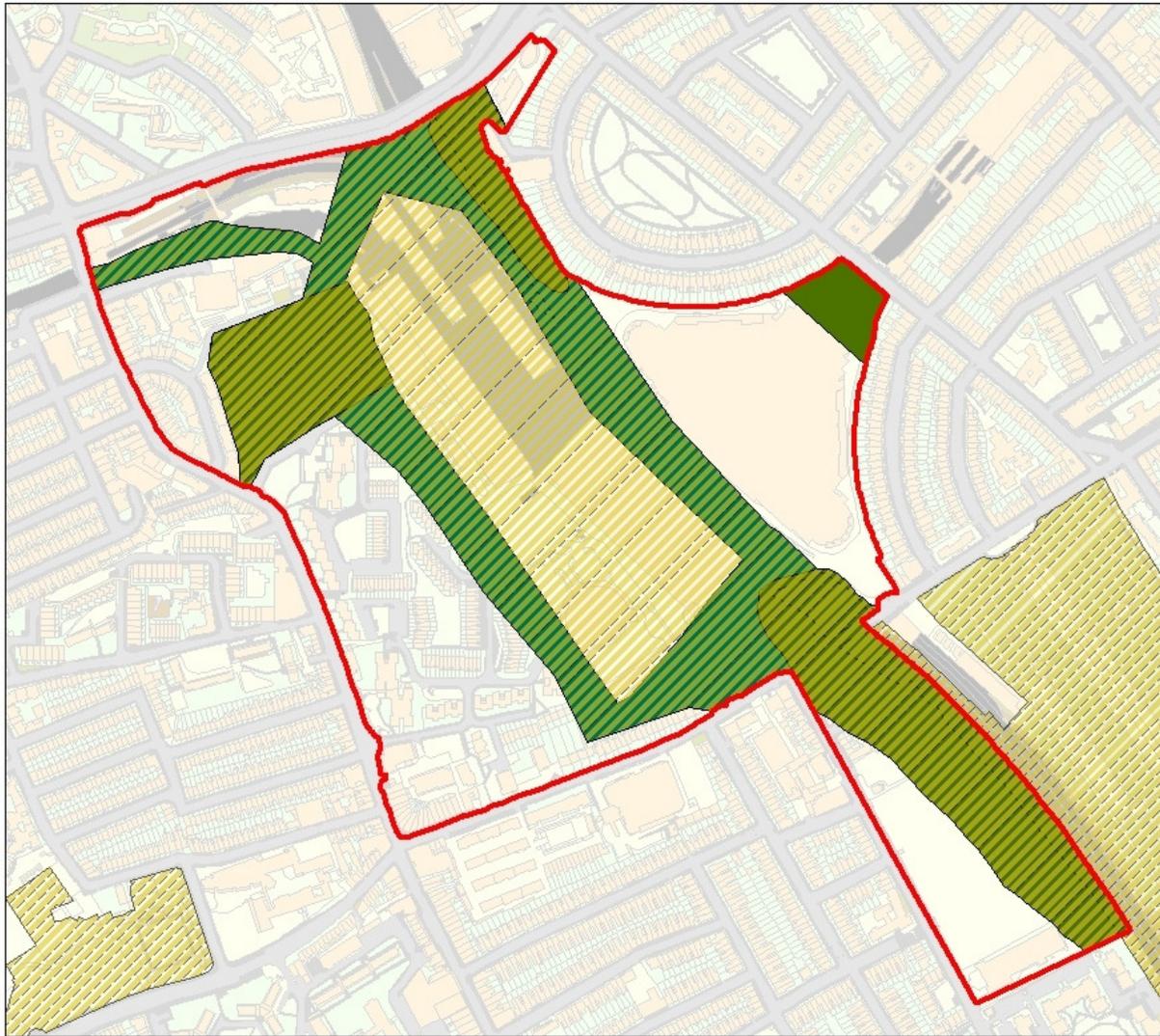
### Survey and management

- 14) Full ecological, environment impact assessments and protected species surveys of the development zone to be carried out
- 15) Ecological management plans in perpetuity need to be produced for all priority habitats.

<sup>6</sup> e.g. [http://www.londons-swifts.org.uk/swift\\_bricks.htm](http://www.londons-swifts.org.uk/swift_bricks.htm) but not restricted to this species

<sup>7</sup> e.g. <http://www.ibstock.com/pdfs/ideas-into-action/ideas-into-action-bats.pdf> but not restricted to this design.

|



Map 4

**Earls Court Development Site  
Shadow Free Zone**

**Legend**

-  Development Site
-  Shadow free zone
-  Park
-  Green Ribbon / Infrastructure



THE ROYAL BOROUGH OF  
**KENSINGTON  
AND CHELSEA**

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## Additional Guidance

### Biodiversity Corridors and Earls Court and West Kensington Development site

Green corridors or wildlife corridors allow plants and animals to move between habitats and therefore increase their foraging and breeding areas. Corridors also enable species to colonise new areas, or bring much-needed new blood into small populations that are in danger through inbreeding as a result of being restricted to a fragmented and therefore isolated habitat<sup>8</sup>.

Green corridors are near continuous areas of open space serving as conduits for wildlife. These corridors link more isolated habitats and provide a strategic open space framework. Figure 5 summarises how habitats can be connected:

Due to the nature of the urban environment connectivity between habitats can be achieved through a combination of maintaining smaller habitat fragments between larger sites and by maintaining continuous green corridors.

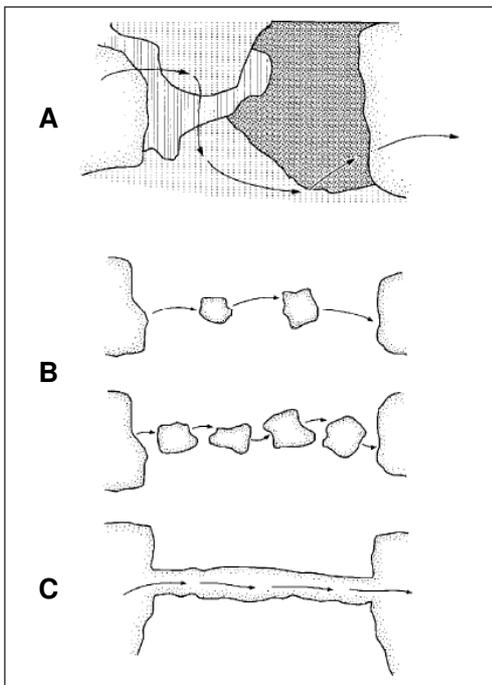


Figure 5: Landscape connectivity may be achieved in two main ways: by managing the entire landscape mosaic to facilitate movement (A); or by maintaining specific habitats that assists the movement of biodiversity through an inhospitable environment (B), or by green corridors that provide a continuous connection between habitats (C) Figure adapted from Bennett, 2003<sup>9</sup>.

<sup>8</sup> Bonner, J. (1994). Wildlife's road to nowhere?: Corridors connecting fragmented islands of natural habitat are all the rage. John Bonner asks whether they are routes to survival for threatened species or expensive dead ends. *New Scientist*. 1939, pp 30.

<sup>9</sup> Bennett, A.F. (2003). *Linkages in the Landscape: The Role of Corridors and Connectivity in Wildlife Conservation*. IUCN, Gland, Switzerland and Cambridge, UK.

### **Current Status**

Railway and canal land provides excellent corridors for wildlife within the Boroughs. These habitats have been protected as Sites of Nature Conservation Importance (SNCI) but remain under threat from development.

The railway land areas consist of vegetation, old structures such as bridges and buildings. The vegetated areas are often broken up by areas of hard standing. These areas are often relatively undisturbed due to the security associated with rail side environment and the infrequent management of these areas. The Hammersmith and City and British Rail Western Region Land extend east to west across the north of the borough, and the Metropolitan line, West London, Hammersmith and Fulham and the District run north to south along the western boundary of the Borough.

Both the Thames and the Grand Union Canal are designated as Sites of Metropolitan Importance, which reflects their strategic nature. They are both important wildlife corridors that permit wildlife to move and colonise more widely through the city. The Grand Union Canal (Paddington Arm) extends across the north of the borough. In addition to the canal and rail side corridors, small habitat fragments located between larger sites also serve as wildlife corridors. For example, Kensington Memorial Gardens, Carmelite Monastery and Ladbroke Grove Garden Complex serve as habitats which link larger sites such as Hyde Park, Holland Park and Wormwood Scrubs and the Thames. It is therefore important that these cross city links are enhanced where they have become fragments. Connectivity through continuous habitats is especially important for less mobile species such as epigaic invertebrates and plants.

### **Specific Factors Affecting Green Corridors**

- Development pressure: loss of habitat through unsympathetic development
- Degradation caused by heavy public use.
- Lack of appropriate management leading to dominance by vigorous invasive species

### **Green Infrastructure and Earls Court Development site**

The green ribbon corridor would ensure relevant green infrastructure in densely urban area will provide a strategic network of multifunctional green space which would provide the following services:

- Climate change adaption
  - o Reduction in heat and flooding effects
  - o Reduction in surface water flooding through the attenuation of stormwater using green space (SUDS see appendix 5)
- Ecological functionality
  - o Connectivity between habitats
  - o Priority habitat creation
- Cycle paths, walkways

These benefits can be summarised and quantified using the Green Infrastructure Tool Kit. See appendix 4 for summary.

Examples of green infrastructure include

- The [Portland Stormwater](#) Management scheme

- [The High Line](#), New York: An interesting concept for the site, when looking at delivering open space and green infrastructure (plus biodiversity) in the development area; in particular the areas surrounding the exhibition centre where the rail track is paved over.
- [Sutcliffe Park Project](#) - The Quaggy River flood alleviation scheme
- Erith Marshes and Beledere Links (an example of the establishment of Green Infrastructure where there no Local Authority land ownership.
- [The Greenway](#), Olympic site
- [Parkland Walk](#), Haringey



The High Line, New York

- 1) It is recommended that SUDS be used as part of a multifunctional green infrastructure approach to water management, openspace planning and ecological enhancement given the historical context and flooding problems associated with the development zone.

## Appendix 1 - Protected species recorded within 1km of the development site<sup>10</sup>

| Group                              | Scientific name             | Common name                     | Protected status   |
|------------------------------------|-----------------------------|---------------------------------|--|
| amphibian                          | <i>Bufo bufo</i>            | Common Toad                     | BAP Priority London; BAP Priority National; W&CA Act Sch5 Sec 9.5a; W&CA Act Sch5 Sec 9.5b<br>W&CA Sch5 Sec 9.5a; W&CA Sch5 Sec 9.5b; BAP Priority National; NERC S41; BAP Priority London |
|                                    | <i>Lissotriton vulgaris</i> | Smooth Newt                     | W&CA Act Sch5 Sec 9.5a; W&CA Act Sch5 Sec 9.5b   |
|                                    | <i>Rana temporaria</i>      | Common Frog                     | W&CA Act Sch5 Sec 9.5a; W&CA Act Sch5 Sec 9.5b<br>W&CA Sch5 Sec 9.5a; W&CA Sch5 Sec 9.5b<br>W&CA Sch5 Sec 9.5b; W&CA Sch5 Sec 9.5a   |
|                                    | <i>Triturus vulgaris</i>    | Smooth Newt                     | W&CA Sch5 Sec 9.5a; W&CA Sch5 Sec 9.5b<br>W&CA Sch5 Sec 9.5b; W&CA Sch5 Sec 9.5a   |
| bird                               | <i>Alauda arvensis</i>      | Skylark                         | BAP Priority National; NERC S41; BAP Priority London   |
|                                    | <i>Alcedo atthis</i>        | Kingfisher                      | W&CA Sch 1 Part 1; Birds Dir Anx 1   |
|                                    | <i>Anas acuta</i>           | Pintail                         | W&CA Sch 1 Part 2  |
|                                    | <i>Anas querquedula</i>     | Garganey                        | W&CA Sch 1 Part 1  |
|                                    | <i>Anser anser</i>          | Greylag Goose                   | W&CA Sch 1 Part 2  |
|                                    | <i>Anthus trivialis</i>     | Tree Pipit                      | BAP Priority National; NERC S41; BAP Priority London   |
|                                    | <i>Aythya marila</i>        | Scaup                           | W&CA Sch 1 Part 1; BAP Priority National; NERC S41   |
|                                    | <i>Bucephala clangula</i>   | Goldeneye                       | W&CA Sch 1 Part 2  |
|                                    | <i>Carduelis cannabina</i>  | Linnet                          | BAP Priority National; NERC S41; BAP Priority London   |
|                                    | <i>Cuculus canorus</i>      | Cuckoo                          | BAP Priority National; NERC S41; BAP Priority London   |
| <i>Cygnus columbianus bewickii</i> | Cygnus columbianus bewickii | BAP Priority National; NERC S41 |  |

<sup>10</sup> Data source Greenspace Information for Greater London (GiGL) <http://www.gigl.org.uk/> 04/06/10

| Group                                 | Scientific name             | Common name                 | Protected status   |
|---------------------------------------|-----------------------------|-----------------------------|--|
|                                       | <i>Cygnus cygnus</i>        | Whooper Swan                | W&CA Sch 1 Part 1; Birds Dir Anx 1   |
|                                       | <i>Falco peregrinus</i>     | Peregrine                   | W&CA Sch 1 Part 1; Birds Dir Anx 1; BAP Priority London  |
|                                       | <i>Falco subbuteo</i>       | Hobby                       | W&CA Sch 1 Part 1  |
|                                       | <i>Larus argentatus</i>     | Herring Gull                | BAP Priority London  |
|                                       | <i>Larus melanocephalus</i> | Mediterranean Gull          | Birds Dir Anx 1; W&CA Sch 1 Part 1   |
|                                       | <i>Motacilla flava</i>      | Yellow Wagtail              | BAP Priority London  |
|                                       | <i>Muscicapa striata</i>    | Spotted Flycatcher          | BAP Priority National; NERC S41; BAP Priority London   |
|                                       | <i>Passer domesticus</i>    | House Sparrow               | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London |
|                                       | <i>Phoenicurus ochruros</i> | Black Redstart              | W&CA Sch 1 Part 1; BAP Priority London   |
|                                       | <i>Prunella modularis</i>   | Dunnock / Hedge Accentor    | BAP Priority National; NERC S41; BAP Priority London<br>BAP Priority London                        |
|                                       | <i>Pyrrhula pyrrhula</i>    | Bullfinch                   | BAP Priority National; NERC S41; BAP Priority London   |
|                                       | <i>Riparia riparia</i>      | Sand Martin                 | BAP Priority London  |
|                                       | <i>Sterna hirundo</i>       | Common Tern                 | Birds Dir Anx 1  |
|                                       | <i>Sturnus vulgaris</i>     | Common Starling<br>Starling | BAP Priority London<br>BAP Priority National; NERC S41; BAP Priority London                        |
|                                       | <i>Tringa ochropus</i>      | Green Sandpiper             | W&CA Sch 1 Part 1  |
|                                       | <i>Turdus iliacus</i>       | Redwing                     | W&CA Sch 1 Part 1  |
|                                       | <i>Turdus philomelos</i>    | Song Thrush                 | BAP Priority London<br>BAP Priority National; NERC S41; BAP Priority London                        |
|                                       | <i>Turdus pilaris</i>       | Fieldfare                   | W&CA Sch 1 Part 1  |
|                                       | <i>Vanellus vanellus</i>    | Lapwing                     | BAP Priority National; NERC S41; BAP Priority London   |
| <b>bony fish<br/>(Actinopterygii)</b> | <i>Anguilla anguilla</i>    | Eel                         | BAP Priority National; NERC S41; BAP Priority London   |

| Group                        | Scientific name                  | Common name             | Protected status  |
|------------------------------|----------------------------------|-------------------------|---|
| flowering plant              | <i>Bupleurum rotundifolium</i>   | Thorow-Wax              | BAP Priority National<br>BAP Priority National; NERC S41  |
|                              | <i>Centaurea calcitrapa</i>      | Red Star-Thistle        | BAP Priority National; NERC S41   |
|                              | <i>Centaurea cyanus</i>          | Cornflower              | BAP Priority National<br>BAP Priority National; NERC S41  |
|                              | <i>Chamaemelum nobile</i>        | Chamomile               | BAP Priority National; NERC S41; BAP Priority London  |
|                              | <i>Chenopodium vulvaria</i>      | Stinking Goosefoot      | W&CA Sch 8; BAP Priority National; NERC S41   |
|                              | <i>Corrigiola litoralis</i>      | Strapwort               | W&CA Sch 8; BAP Priority National; NERC S41   |
|                              | <i>Cuscuta epithymum</i>         | Dodder                  | BAP Priority London   |
|                              | <i>Galium parisiense</i>         | Wall Bedstraw           | BAP Priority London   |
|                              | <i>Hyacinthoides non-scripta</i> | Bluebell                | W&CA Sch 8  |
|                              | <i>Illecebrum verticillatum</i>  | Coral-necklace          | BAP Priority National   |
|                              | <i>Muscari neglectum</i>         | Grape-hyacinth          | BAP Priority National<br>BAP Priority National; NERC S41  |
|                              | <i>Populus nigra betulifolia</i> | Black Poplar            | BAP Priority London   |
|                              | <i>Scleranthus annuus</i>        | Annual Knawel           | BAP Priority National; NERC S41; BAP Priority London  |
|                              | <i>Silene gallica</i>            | Small-Flowered Catchfly | BAP Priority National; NERC S41   |
|                              | <i>Stellaria palustris</i>       | Marsh Stitchwort        | BAP Priority National; NERC S41   |
|                              | <i>Viscum album</i>              | Mistletoe               | BAP Priority London   |
| fungus                       | <i>Hericium cirrhatum</i>        | Hericium cirrhatum      | BAP Priority London   |
| insect - beetle (Coleoptera) | <i>Lucanus cervus</i>            | Stag Beetle             | BAP Priority London; BAP Priority National; Hab&Spp Dir Anx 2; W&CA Act Sch5 Sec 9.5a; W&CA Act Sch5 Sec 9.5b |

| Group                 | Scientific name               | Common name             | Protected status   |
|-----------------------|-------------------------------|-------------------------|--|
| insect - butterfly    | <i>Coenonympha pamphilus</i>  | Small Heath             | BAP Priority National; NERC S41; BAP Priority London   |
|                       | <i>Lasiommata megera</i>      | Wall                    | BAP Priority National; NERC S41; BAP Priority London   |
|                       | <i>Satyrrium w-album</i>      | White Letter Hairstreak | BAP Priority National; NERC S41; BAP Priority London   |
| insect hymenopteran - | <i>Formica rufa</i>           | Southern wood ant       | BAP Priority London  |
| insect - moth         | <i>Acronicta psi</i>          | Grey Dagger             | BAP Priority National; NERC S41; BAP Priority London   |
|                       | <i>Acronicta rumicis</i>      | Knot Grass              | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                       | <i>Agrochola litura</i>       | Brown-Spot Pinion       | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                       | <i>Agrochola lychnidis</i>    | Beaded Chestnut         | BAP Priority London; BAP Priority National   |
|                       | <i>Amphipoea oculea</i>       | Ear Moth                | BAP Priority National; NERC S41; BAP Priority London<br>BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London |
|                       | <i>Amphipyra tragopoginis</i> | Mouse Moth              | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                       | <i>Apamea remissa</i>         | Dusky Brocade           | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                       | <i>Atethmia centrigo</i>      | Centre-Barred Sallow    | BAP Priority National; NERC S41; BAP Priority London   |
|                       | <i>Brachylomia viminalis</i>  | Minor Shoulder-Knot     | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                       | <i>Diarsia rubi</i>           | Small Square-spot       | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |

| Group                     | Scientific name                | Common name                        | Protected status   |
|---------------------------|--------------------------------|------------------------------------|--|
|                           | <i>Drepana binaria</i>         | Oak Hook-Tip                       | BAP Priority London  |
|                           | <i>Eugnorisma glareosa</i>     | Autumnal Rustic                    | BAP Priority London; BAP Priority National   |
|                           | <i>Euxoa nigricans</i>         | Garden Dart                        | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                           | <i>Lycia hirtaria</i>          | Brindled Beauty                    | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                           | <i>Melanchra persicariae</i>   | Dot Moth                           | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                           | <i>Mythimna comma</i>          | Shoulder-Striped Wainscot          | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                           | <i>Scopula marginepunctata</i> | Mullein Wave                       | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                           | <i>Spilosoma lubricipeda</i>   | White Ermine                       | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                           | <i>Tyria jacobaeae</i>         | Cinnabar                           | BAP Priority London; BAP Priority National<br>BAP Priority National; NERC S41; BAP Priority London   |
|                           | <i>Watsonalla binaria</i>      | Oak Hook-Tip                       | BAP Priority London; BAP Priority National   |
| <b>terrestrial mammal</b> | <i>Erinaceus europaeus</i>     | Hedgehog<br>West European Hedgehog | BAP Priority National; NERC S41; BAP Priority London<br>BAP Priority London; BAP Priority National   |
|                           | <i>Nyctalus leisleri</i>       | Leisler's Bat                      | Cons Regs 1994 Sch2; W&CA Sch 5 Sec 9.1; W&CA Sch 5 Sec 9.2; W&CA Sch5 Sec 9.5a; W&CA Sch5 Sec 9.4a; W&CA Sch5 Sec 9.5b; W&CA Sch5 Sec 9.4b; W&CA Sch 5 Sec 9.1; Hab&Spp Directive Anx 2np; BAP Priority London                                  |
|                           | <i>Nyctalus noctula</i>        | Noctule                            | Cons Regs 1994 Sch2; W&CA Sch 5 Sec 9.1; W&CA Sch 5 Sec 9.2; W&CA Sch5 Sec 9.5a; W&CA Sch5 Sec 9.4a; W&CA Sch5 Sec 9.5b; W&CA Sch5 Sec 9.4b; W&CA Sch 5 Sec 9.1; Hab&Spp Directive Anx 2np; BAP Priority National; NERC S41; BAP Priority London |

| Group | Scientific name                        | Common name          | Protected status   |
|-------|--|----------------------|--|
|       | <i>Pipistrellus pipistrellus</i>       | Common Pipistrelle   | BAP Priority London; Cons Regs 1994 Sch2; Hab&Spp Dir Anx 4; W&CA Act Sch5 Sec 9.4a; W&CA Act Sch5 Sec 9.4b; W&CA Act Sch5 Sec 9.5a; W&CA Act Sch5 Sec 9.5b; W&CA Sch 5 Sec 9.1  |
|       | <i>Pipistrellus pipistrellus 45kHz</i> | 45 Khz Pipistrelle   | Cons Regs 1994 Sch2; W&CA Sch 5 Sec 9.1; W&CA Sch 5 Sec 9.2; W&CA Sch5 Sec 9.5a; W&CA Sch5 Sec 9.4a; W&CA Sch5 Sec 9.5b; W&CA Sch5 Sec 9.4b; W&CA Sch 5 Sec 9.1; Hab&Spp Directive Anx 2np; BAP Priority London                                  |
|       | <i>Pipistrellus pipistrellus 55kHz</i> | 55 Khz Pipistrelle   | Cons Regs 1994 Sch2; W&CA Sch 5 Sec 9.1; W&CA Sch 5 Sec 9.2; W&CA Sch5 Sec 9.5a; W&CA Sch5 Sec 9.4a; W&CA Sch5 Sec 9.5b; W&CA Sch5 Sec 9.4b; W&CA Sch 5 Sec 9.1; Hab&Spp Directive Anx 2np; BAP Priority National; NERC S41; BAP Priority London |
|       | <i>Pipistrellus pygmaeus</i>           | Soprano Pipistrelle  | BAP Priority London; BAP Priority National; Cons Regs 1994 Sch2; Hab&Spp Dir Anx 4; W&CA Act Sch5 Sec 9.4a; W&CA Act Sch5 Sec 9.4b; W&CA Act Sch5 Sec 9.5a; W&CA Act Sch5 Sec 9.5b; W&CA Sch 5 Sec 9.1   |
|       | <i>Plecotus auritus</i>                | Brown Long-Eared Bat | Cons Regs 1994 Sch2; W&CA Sch 5 Sec 9.1; W&CA Sch 5 Sec 9.2; W&CA Sch5 Sec 9.5a; W&CA Sch5 Sec 9.4a; W&CA Sch5 Sec 9.5b; W&CA Sch5 Sec 9.4b; W&CA Sch 5 Sec 9.1; Hab&Spp Directive Anx 2np; BAP Priority National; NERC S41; BAP Priority London |



### **Reduction of Heat Stress**

1. London experienced a 15% , 23% and 42% increase in deaths in the hot summers of 1976, 1995 and 2003 respectively. There were an excess of 2139 people (a 16% increase) who died in England and Wales and 35,000 in Europe as a result of the 2003 heat wave. However the elderly were most vulnerable with a 59% increase in deaths in those over the age of 75yrs in London.<sup>11</sup>
2. London temperatures can be as much as 10°C higher than the surrounding areas. Other cities also have urban heat islands related to their size (Reading 4.4°C and Sheffield 7°C)<sup>12</sup>
3. Heat waves and air pollution are more likely to occur in geographically expanding or sprawling cities where vegetation is replaced with surface retaining heat.<sup>13</sup>
4. Using the high emissions scenario for Manchester, an extra 10% green cover is projected to keep maximum surface temperatures in high density residential areas and town centres 1°C above current temperatures (1961-1990 average) over the next 70 years. If there is no change to green space then temperatures will increase by 3.7°C. In contrast if there is 10% less green cover then urban temperatures would increase by about 8.2°C.<sup>14</sup>
5. Trees planted on a street canyon in Munich reduced mean radiant temperatures and extreme heat stress by 40%<sup>15</sup>
6. Green spaces of 30Ha reduced air temperature in the immediate vicinity of between 150 and 600m and for spaces of 212Ha up to 900m.<sup>16</sup>
7. Vulnerable groups
  - People with concurrent illness that limits their mobility
  - Medication that interferes with their thermoregulation<sup>17</sup>
  - Low fitness. A study looking at a response to hot temperatures found that fitness was more important than age itself in maintaining a stable body temperature. So older people maintaining fitness through regular exercise will make them much more resilient to higher temperatures.<sup>18</sup>
  - Elderly particularly in residential care homes.<sup>19 20</sup>

<sup>11</sup> Euro Surveillance 2005 Jul;10(7):168-71.

<sup>12</sup> Wienert (2001) Untersuchungen zur Breiten und Klimazonenabhängigkeit der urbanen Wärmeinsel: Eine städtische Analyse. Universität Essen)

<sup>13</sup> Patz JA Kovats RS Hotspots in climate change and human health. BMJ.202 325 (7372): 1094-1098

<sup>14</sup> Gill S, Handley J, Ennos R, Pauleit S (2007) Adapting cities for climate change: the role of the green infrastructure.

<sup>15</sup> Mayer H (1996) Human-Biometeorologische Probleme des Stadtklimas. Geowissenschaften 14(6):233-239.

<sup>16</sup> Kuttler W (1988) Spatial and temporal structures of the Urban climate - a survey. In:Grefen K, Lobel J,Environmental meteorology. Dordrecht, Kluwer:305-333

<sup>17</sup> Haventh G 2001a)Temperature regulation and technology. Gerontechnology, 1:41-49.

<sup>18</sup> Haventh G, Luuikholt VGM, Vrijkotte TGM (1995) The relative influence of body characteristics on humid heat stress response. European J Applied Physiology, 70:270-279.)

<sup>19</sup> Pajares Oritz MS et al (1997) Mortalidad diaria en la Comunidad de Madrid Durante el periodo 1986-1991 para el grupo de edad de 45 a 64 años : su relación con la temperature del aire. Revista Española de Salud Pública 71(2):149-160.

- Obesity. Up to temperatures of 37°C obese people have to overcome the insulation effects of adipose tissue and so divert blood to the skin putting considerable load onto their heart.<sup>21</sup>

### **Trees as a carbon sink.**

- 1.3 million trees (one for each NHS employee) would absorb 689,000 tonnes of CO<sub>2</sub> each year.<sup>26</sup>
- The charity Trees for Cities has worked out a formula of 2.67 trees planted for every tonne of CO<sub>2</sub> generated (using this formula 1.3 million trees would absorb 487,000 tonnes)<sup>22</sup>
- The net present value of carbon storage of woodlands has been estimated for different English Regions, this varies from £601 million in the North West to £2,684 million in the South East for broadleaved woodlands.<sup>23</sup>

### **Increasing Physical Activity**

- Trees in particular provide additional motivation to walk compared to routes that have no trees<sup>24</sup>
- Senior citizens live longer with more space to walk and with nearby parks and tree lined streets near to where they live.<sup>25</sup>
- Being within access to green space can increase levels of physical activity<sup>26</sup>

### **Improving mental health, wellbeing and sense of community**

- For every 10% increase in green space there was a reduction in health complaints equivalent to a reduction of five years of age.<sup>27</sup>
- Several studies have been carried out in Chicago that compared identical tower blocks with very poor Afro-American tenants. New tenants were allocated randomly from a waiting list to the next vacant flat so they had no choice of flat. Some flats still had grass and trees surrounding them (Figure 1) whereas in others these had been removed (Figure 2)

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<sup>20</sup> Kovats RS Johnson H, Griffiths C England during the 2003 heatwave by place of death Health Statistics Quarterly 29 Spring 2006

<sup>21</sup> Haventh G, Luukholt VGM, Vrijkotte TGM (1995) The relative influence of body characteristics on humid heat stress response. European J Applied Physiology, 70:270-279.

<sup>22</sup> [www.treesforcities.org](http://www.treesforcities.org)

<sup>23</sup> Social and Economic Benefits of the Natural Environment: Review of Evidence, GHK Consulting, 2006

<sup>24</sup> Bird W, Adams F, Sonning Common Health Walks: a 4 year review. Walking the 21<sup>st</sup> century Perth 2001

<sup>25</sup> Tanaka A, Takano T, Nakamura K, et al. Health levels influence by urban residential conditions in a megacity — Tokyo. Urban Stud 1996; **33**: 879–945.

<sup>26</sup> Giles-Corti B, Donovan RJ. Relative influence of individual, social environmental, and physical environmental correlates of walking. Am J Public Health 2003; **93(9)**: 1583–1589.

<sup>27</sup> De Vries, S. Nature and health; the importance of green space in the urban living environment. Proceedings of the symposium 'Open space functions under urban pressure'. Ghent: 19–21 September 2001.



People living in those flats with an outlook onto trees and grass were associated with:

- Reduced stress in children <sup>28</sup>
- Increased concentration and self discipline in children <sup>29</sup>
- Reduced symptoms of ADHD in children <sup>30</sup>
- Increased the amount of play for local children. <sup>31</sup>
- Half the incidence of violent and property crimes and domestic violence. <sup>32</sup>  
<sup>33</sup>
- Increased strength of community <sup>34</sup>
- Increased ability for the poorest single parent mothers to cope with major life issues. <sup>35</sup>

#### **Reducing pollution**

- Each year 1.3 million trees remove 2535 tonnes of pollutants from the air (425 tonnes of ozone and 477 tonnes of particulate). <sup>36</sup>
- A study in the West Midlands has suggested that by doubling tree cover across the Region would reduce the concentration of fine PM<sub>10</sub> particles by 25%, preventing 140 air pollution related premature deaths in the Region every year <sup>37</sup>

<sup>28</sup> Wells NM, Evans GW; Nearby Nature; A buffer of life stress among Rural Children. Environment and Behaviour, vol.35, No 3 311-330 2003.

<sup>29</sup> Taylor AF, Kuo FE, Sullivan WC Views of nature and self-discipline: evidence from inner city children JEPV (2001) 21 Supp.

<sup>30</sup> Kuo,FE; Faber Taylor,A: A potential Natural Treatment for Attention-Deficit Hyperactivity disorder: Evidence from a national study American J Public Health 2004 94 9 p1580-1586.

<sup>31</sup> Sallis JF, Nadir PR, Broyles SL, et al. (1995) Correlates of physical activity at home in Mexican-American and Anglo-American preschool children. Health Psychology: **12**:390-8

<sup>32</sup> Kuo FE, Sullivan WC (2001) Aggression and Violence in the inner city: Effects of Environment via Mental Fatigue. Environment and Behaviour 33 No4 July 2001 543-571.

<sup>33</sup> Kuo F, Sullivan WC, (2001) Environment and Crime in the Inner City: Does Vegetation Reduce Crime. Environment and Behaviour **33** May 2001 343-367.

<sup>34</sup> Kuo FE, Sullivan WC, Coley RL, Brunson L,1998. Fertile Ground for Community: Inner-City Neighborhood Common Spaces American Journal of Community Psychology 26, 6, 1998.

<sup>35</sup> Kuo F (2001) Coping with Poverty: Impacts of environment and attention in the inner city. Environment and Behavior, Vol 33 No 1 January 2001

<sup>36</sup> McPherson EG, Simpson JR, Peper PJ Maco SE, Gardner SL, Cozard SK Xiao Q 2005. Midwest Community Tree Guide: Benefits, Costs and Strategic planting. US Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry.

<sup>37</sup> Stewart HE, Owen S, Donovan R, MacKenzie R, Hewitt N, 2002 Trees and sustainable Urban Air Quality: Using Trees to Improve Air Quality in Cities. Centre for Ecology and Hydrology University of Lancaster

### **Reduced Flooding**

- Each year 1.3 million trees would catch 7 billion tons of rainwater reducing the load on storm water drainage and reducing flooding and the major effect this has on mental health of flood victims.<sup>38</sup>

### **Reducing Noise**

- A belt of trees can reduce noise levels by as much as 6-8 decibels for every 30 metres width of woodland.<sup>39</sup>

### **Reducing exposure to harmful ultra violet radiation.**

- Sitting under a canopy of a broadleaf can reduce UVB radiation by a factor that is equivalent to a factor 10 sun cream. 60% of the UV radiation received from under a tree is from diffusion.<sup>40</sup>

### **Patient care**

- A landmark study measured the benefit to cholecystectomy patients of viewing trees compared to viewing a wall from their hospital window. This demonstrated that those patients viewing trees required weaker analgesia, made fewer complaints and were discharged home earlier.<sup>41</sup>
- Women with breast cancer were better able to concentrate on their treatment if they had regular contact with the natural environment.<sup>42</sup>
- Elderly residents who sat in a small garden for one hour significantly improved all measures of concentration compared to staying in their room.<sup>43</sup>

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<sup>38</sup> McPherson EG, Simpson JR, Peper PJ Maco SE, Gardner SL, Cozard SK Xiao Q 2005. Midwest Community Tree Guide: Benefits, Costs and Strategic planting. US Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry.

<sup>39</sup> Leonard RE and Parr SB, Trees as a sound barrier, Journal of Forestry, 1970).

<sup>40</sup> Grant R, Heisler G Gao W. Estimation of Pedestrian Level UV exposure under trees. Photochemical and Photobiology, April 2002

<sup>41</sup> Ulrich RS (1984) View through window may influence recovery from surgery Science Vol.224,pp.420-421

Cimprich B Development of an intervention to restore attention in cancer patients . Cancer Nursing 1993;16:83-92.

<sup>43</sup> Ottosson J and Grahn P (2005) A comparison of leisure time spent in a garden with leisure time spent indoors: On measures of restoration in residents in geriatric care. Landscape Research, 30 1 23-55 Jan 2005.

### **Appendix 3: Royal Borough of Kensington and Chelsea – Living Roof Advisory Note<sup>44</sup>**

The Royal Borough of Kensington and Chelsea Ecology Service promotes aggregate (substrate) based living roofs designed specifically for biodiversity. The Council's Core Strategy requires opportunities to be taken to enhance and attract biodiversity. Biodiversity living roofs are now very common in countries such as Germany and Switzerland, where they can be found on a variety of building types e.g. factories, schools, offices and houses. However, living roofs are not restricted to large buildings; there are many opportunities to create living roofs on a small scale, e.g. domestic houses, sheds, porches, balconies, garages and small extensions and litterbin sheds.

The Borough's Draft Local Biodiversity Action Plan aims to protect and enhance the borough's biodiversity resource, by improving the quality of the local environment through practical management, habitat creation and protection of important wildlife sites. Policy LR27 of the Council's UDP encourages the allocation of pockets of land for nature conservation and the planting of native species in landscaping on appropriate development sites. Core Strategy Policy CE4(d) requires development proposals to create opportunities where possible for attracting biodiversity and habitat creation, having regard to national, regional and Biodiversity Action Plans. Policy 5.10(C) of the London Plan Consultation Draft requires development proposals to integrate green infrastructure from the beginning of the design process to contribute to urban greening. The London Plan states that these elements could include tree planting, green roofs and walls, and soft landscaping. However, the Council will pay particular attention to the impact of green roofs or walls on the appearance and character of conservation areas and listed buildings.

The Mayor of London's Plan states that: 'The Mayor will and boroughs should expect major developments to incorporate living roofs and walls where feasible and reflect this principle in LDF policies. It is expected that this will include roof and wall planting that delivers as many of these objectives as possible:

- accessible roof space
- adapting to and mitigating climate change
- sustainable urban drainage
- enhancing biodiversity
- improved appearance

Boroughs should also encourage the use of living roofs in smaller developments and extensions where the opportunity arises.'

All planning applications are determined on their individual merits. If you are thinking of submitting a planning application that involves a living roof, you are strongly encouraged to seek pre-application advice from the Council's Development Control

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<sup>44</sup> This strategy is also approved of by the LBHF biodiversity officers and is recommend in the draft LBHF BAP

Service. As part of the pre-application and planning application stage, the Council's Ecology Service will be involved in determining the suitability of a living roof system.

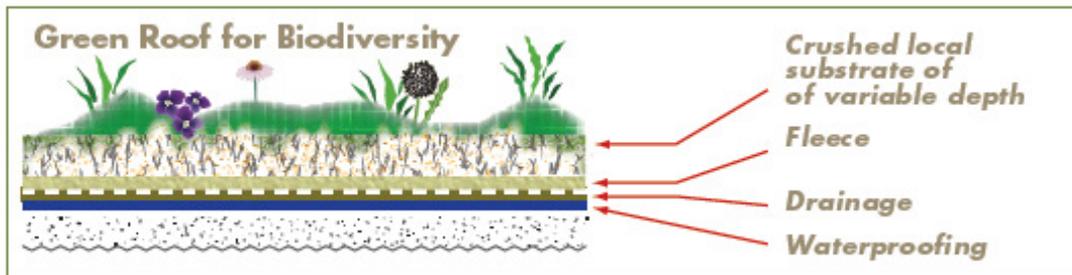
The Council's Ecology Service has a preference for substrate based roofs rather than mat based systems because substrate based roofs deliver significant multifunctional benefits (such as higher biodiversity and SUDS potential, plus higher thermal and acoustic insulation) as opposed to sedum mats. Substrate based living roofs raise the ecological potential over that of a sedum blanket, as they support a more complex plant and animal species community. They also minimise the risk of failure that can frequently occur with mat based systems in periods of drought.

This document is intended as an Advisory Note only and will not be used in determining a planning application.

The following notes provide detailed information on the following types of living roofs:

1. Extensive substrate based living roof system designed for biodiversity
2. Extensive low maintenance meadow living roof
3. Intensive roof garden
4. Extensive sedum mat based systems (Although not recommended)

**Extensive substrate based living roof system designed for biodiversity (Recommended)**



A substrate based green roof system designed for an inverted roof would be typically, 80-150mm of aggregate [80% crushed brick]; filter sheet; floradrain; [insulation]; root barrier and then a hydrotech membrane. Loading 120 -170kg/m<sup>2</sup>



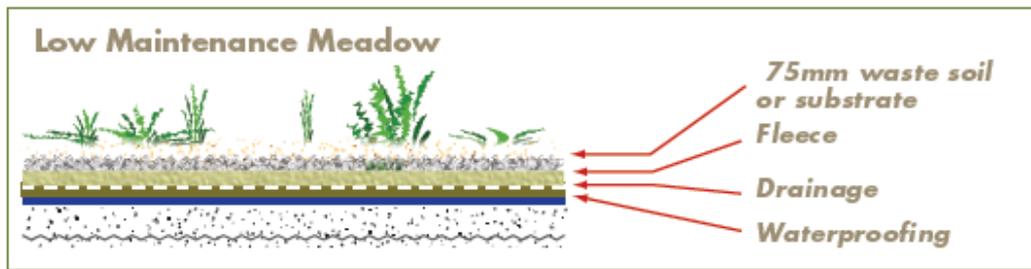
Biodiverse living roof

**Benefits:**

- Excellent for wildlife and biodiversity
  - Supports bird and insect species including London Biodiversity Action Plan species such as the Black redstart & House sparrows
  - It will help to remedy areas of deficiency by providing new habitat in areas which are currently lacking wildlife habitat
  - It will create new links in an intermittent network of habitats, thereby facilitating movement and dispersal of wildlife
  - Can alleviate urban air quality problems, filtering particulates and absorbing gaseous pollutants

- Excellent for thermal and acoustic insulation
  - Helps ameliorate the Urban Heat Island effect as roof vegetation absorbs sunlight and the transpiration process keeps the roof cool
  - Protects the roof from direct sunlight keeping the building cool in summer. The substrate also acts to provide added insulation in the winter. This reduces the overall energy requirements for heating the building in winter or cooling it in summer and helps to reduce CO<sub>2</sub> emissions. [Air conditioning units located on living roofs use less energy as they are draw in cooler air]
  - Prolongs the life of the water proof membrane. *"Perhaps the most important technical advantage of vegetation on the roof is protection from ultra-violet radiation. A notable example is the roof garden on the Kensington High Street building original occupied by Derry and Toms department store. Installed in 1938, the roof membrane materials were examined some 50 years later and it was found that the roof surface was in excellent condition. In contrast, the average flat roof has a life expectancy of 10 to 15 years"* [Mayor of London, Building Green: A guide to using plants on roofs, walls and pavements, May 2004].
  
- Excellent at reducing storm water runoff (SUDS)
  - Green roofs can form part of an effective sustainable drainage (SUDS) solution by reducing the amounts of storm water run-off and attenuating peak flow rates. Consequently this proven source control technique reduces the downstream need for expensive underground drainage infrastructure and also cuts the risk of localised flooding events. In the summer a green roof can typically retain between 70-80 per cent of rainfall runoff.
  
- Low maintenance
  - No need for irrigation or mowing

## Extensive low maintenance meadow living roof (Recommended)



A low maintenance meadow (living roof) with a minimum of 75mm of substrate will be suitable for sedum plugs, certain grasses and herb species. Loading for 80mm substrate 120kg/m<sup>2</sup>



Domestic meadow living roof

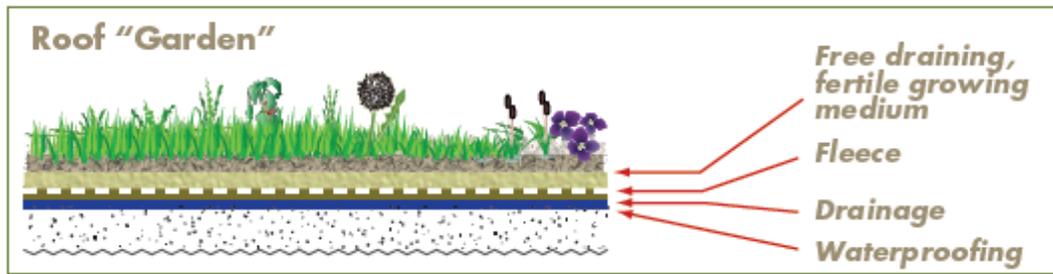
### Benefits:

- Good for wildlife and biodiversity
- Good for thermal and acoustic insulation
- Good at reducing storm water runoff (SUDS)
- Low maintenance

### Disadvantages:

- Can look scruffy through the winter
- As the substrate is thin the roof can brown off during the summer months

## Intensive roof garden (Recommended)



A intensive roof garden system designed for an inverted roof would use a similar build up to the extensive substrate based living roof system but would incorporate a more fertile and often thicker depth of substrate. Loading 200 – 500+ kg/m<sup>2</sup>.



Cannon Street Station

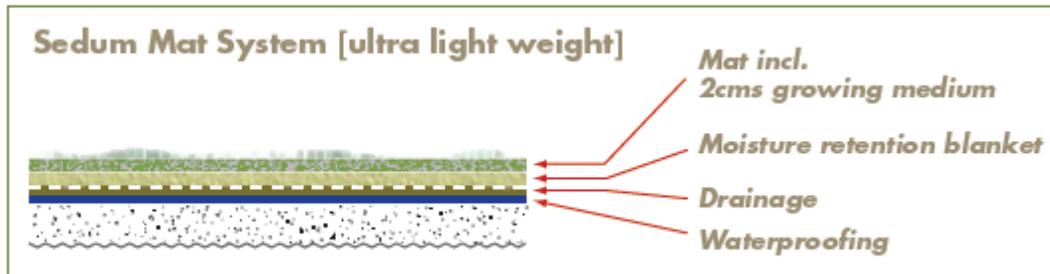
### Benefits:

- Potentially greater amenity benefits as this has a more traditional garden feel
- Moderate biodiversity benefits
- Excellent for thermal and acoustic insulation
- Excellent at reducing storm water runoff (SUDS)

### Disadvantages:

- Expensive
- Greater loading requirement
- High energy and water input
- Hand and perimeter fencing required for amenity use
- High maintenance, requiring regular maintenance and mowing

## Extensive sedum mat based systems (Not recommended)



This is the lightest living roof system and is often favoured by architects as building will not require extensive structural reinforcing and it can be bought and installed, 'off the shelf.' Loading 55 - 60kg/m<sup>2</sup>.



Extensive sedum mat living roof

### Benefits:

- Extremely light weight
- It is a clip on system and is therefore easy to install
- Low maintenance

### Disadvantages:

- Expensive (compared to an aggregate substrate based system)
- Performs poorly for biodiversity. Sedum mats are effectively a monoculture of alpine plants. Although they have value for nature conservation, this is limited
- They perform less well in terms of storm water amelioration and SUDS as they have less ability to store water

- Thermal and acoustic performance as limited as the substrate is very thin, thus reducing the thermal mass. Therefore, there is a higher total energy requirement to keep the building warm in winter and cool in summer
- Sedum mats will often suffer and may die in times of drought. Over a number of years issues may arise in terms of the 'look' if they perform poorly

## Planting

The Ecology Service recommended seed mixes for extensive substrate based living roof system designed for biodiversity.

To assuage many local botanists and nature conservations concerns re native providence and to restrict the use of plants to only those that area commonly found in the Greater London area a seed mix has been prepared for the stony meadows in the Olympic Park by Gary Grant of Ecoschemes LTD. Livingroofs.org has adapted this mix to exclude the grasses and to include only the herbs.

### London Living roof Mix

*Agrimonia eupatoria*  
*Hippocrepis comosa*  
*Anthyllis vulneraria*  
*Centaurea nigra*  
*Galium verum*  
*Hypericum perforatum*  
*Knautia arvensis*  
*Leucanthemum vulgare*  
*Lotus corniculatus*  
*Origanum vulgare*  
*Ranunculus bulbosus*  
*Sanguisorba minor*  
*Leontodon autumnalis*  
*Echium vulgare*  
*Leontodon hispidus*  
*Linaria vulgaris*  
*Malva moschata*  
*Plantago media*  
*Primula veris*  
*Prunella vulgaris*  
*Ranunculus acris*  
*Reseda lutea*  
*Silene vulgaris*  
*Sedum acre*  
*Sedum album*  
*Centranthus ruber*

Agrimony  
Horseshoe Vetch  
Kidney Vetch  
Common Knapweed  
Lady's Bedstraw  
Perforate St John's-wort  
Field Scabious  
Oxeye Daisy  
Bird's-foot-trefoil  
Wild Marjoram  
Bulbous Buttercup  
Salad Burnet  
Autumn Hawkbit  
Viper's-bugloss  
Rough Hawkbit  
Common Toadflax  
Musk-mallow  
Hoary Plantain  
Cowslip  
Selfheal  
Meadow Buttercup  
Wild Mignonette  
Bladder Campion  
Biting stonecrop  
White stonecrop  
Red Valerian

### Special Cornflower Mix

*Adonis annua*  
*Agrostemma githago*

Pheasant's-eye  
Corn Cockle

|                              |                      |
|------------------------------|----------------------|
| <i>Anagallis arvensis</i>    | Scarlet Pimpernel    |
| <i>Anthemis arvensis</i>     | Corn Chamomile       |
| <i>Centaurea cyanus</i>      | Cornflower           |
| <i>Chrysanthemum segetum</i> | Corn Marigold        |
| <i>Matricaria recutita</i>   | Scented Mayweed      |
| <i>Myosotis arvensis</i>     | Common Forget-me-not |
| <i>Papaver rhoeas</i>        | Common Poppy         |
| <i>Ranunculus arvensis</i>   | Corn Buttercup       |

As it is often difficult to get seed mixes sown at the appropriate time experience has shown that the inclusion of an element of cornflower provide instant colour and character of the green roofs. Therefore it is proposed that 20% of any mix is of a special cornflower mix.

### Indicative Structural Loading for various Types of Roof

| Roof type   | Loading                    |
|---|----------------------------|
| Gravel surface  | 90-150 kg/m <sup>2</sup>   |
| Paving slabs  | 160-220 kg/m <sup>2</sup>  |
| Vehicle surface   | From 550 kg/m <sup>2</sup> |
| Extensive living roof (sedum mat only)                    | 55-60 kg/m <sup>2</sup>    |
| Extensive living roof (sedum/wildflower + 40mm substrate) | 90-95 kg/m <sup>2</sup>    |
| Extensive living roof (substrate based: biodiversity)     | 80-160 kg/m <sup>2</sup>   |
| Intensive living roof                                     | 200-500 kg/m <sup>2</sup>  |

Living Roofs and Walls (technical report): Supporting London Plan Policy [Mayor of London, Feb 2008]

### Additional guidance and information:

- Living Roofs and Walls, Technical Report: Supporting London Plan Policy [Greater London Authority, February 2008]
- Building Green, A guide to using plants on roofs, walls and pavements [Greater London Authority, May 2004]

Please also refer to [www.greenroofs.com](http://www.greenroofs.com) and/or [www.livingroofs.org](http://www.livingroofs.org) as excellent sources of information.

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## Appendix 4 Green Infrastructure summary

### *The Green Infrastructure Valuation Toolbox*

The Green Infrastructure Valuation Toolbox that was developed over the past two years by a consortium led by the Northern Way, five Regional Development Agencies (including the London Development Agency, ONE North East, Yorkshire Forward, Northwest Development Agency and Advantage West Midlands) as well as Defra, Natural England, and CABI. The Toolbox provides a simple framework to identify and value the functional benefits of individual green infrastructure investments and existing green assets. It takes into account the wide spectrum of environmental, social and economic returns green investments have the potential to generate and helps articulate their value in qualitative, quantitative and when possible monetised terms. The toolbox will be officially launched in the autumn 2010 and is recommended for use in this project as a method of developing the business case for the green infrastructure of this development area.

| The 11/12 Benefit Groups |                           | GI Function  | GI benefit   | Benefit Type                 |
|--------------------------|---------------------------|--|--|------------------------------|
| BENEFIT GROUP 1          | CLIMATE CHANGE ADAPTATION | GI can offer shelter from wind   | Saving in energy / cost for reductions in loss of commercial / public building / residential heating                               | COST REDUCTION               |
|                          |                           |  | Saving in carbon emissions from energy savings associated with above.  | DIRECT                       |
|                          |                           |  | Avoided damage from wind and storm   | RISK MANAGEMENT / MITIGATION |
|                          |                           | GI reduces the Urban Heat Island effect  | City liveability - Estimate of avoided loss of GVA from maintaining city centre temperatures and hence city centre competitiveness | INDIRECT                     |
|                          |                           | GI provides shading from the sun and a cooling effect, through evapo-transpiration | Saving in energy / cost for reductions in use of building air conditioning   | COST REDUCTION               |
|                          |                           |  | Saving in carbon emissions from energy savings associated with above   | DIRECT                       |
|                          | CLIMATE CHANGE MITIGATION | GI can store and sequester carbon  | Market value of carbon stored and sequestered in woodland and forests  | DIRECT                       |

| The 11/12 Benefit Groups |                                      | GI Function  | GI benefit  | Benefit Type                 |
|--------------------------|--------------------------------------|--|---|------------------------------|
|                          |                                      |  | Market value of carbon stored and sequestered in other land use types   | DIRECT                       |
| BENEFIT GROUP 2          | WATER MANAGEMENT & FLOOD ALLEVIATION | GI provides shading from the sun and a cooling effect, through evapo-transpiration   | Avoided energy costs and carbon emissions from reduced water treatment  | COST REDUCTION               |
|                          |                                      |  | Avoided cost of water treatment - residential and commercial surface water drainage - savings to home owners and businesses   | COST REDUCTION               |
|                          |                                      |  | SUDS - avoided costs of traditional drainage infrastructure / engineering   | COST REDUCTION               |
| BENEFIT GROUP 3          | QUALITY OF PLACE                     | GI improves neighbourhood environment, creates a sense of community, and offers opportunities for communities to come together | Landscape / amenity of land uses (application of average values for given land use typology)  | INDIRECT                     |
|                          |                                      |  | Estimate of the willingness to pay for a view of urban green space, characterised by a mixture of woodland interspersed with open space   | INDIRECT                     |
|                          |                                      |  | Community capacity / cohesion   | INDIRECT                     |
| BENEFIT GROUP 4          | HEALTH AND WELLBEING                 | GI provides opportunities for exercise   | Direct savings to the National Health Service from improved health of the local population / reduced obesity levels from increased levels of physical activity (per Quality Adjusted Life Year) | COST REDUCTION               |
|                          |                                      |  | Calculation of reduction in mortality rates from take-up of moderate physical exercise through walking or cycling   | RISK MANAGEMENT / MITIGATION |
|                          |                                      | GI can help reduce stress levels and improve mental health   | Direct savings to the National Health Service from improved health of the local population from reduction in mental health disorders  | COST REDUCTION               |
|                          |                                      | GI can speed patient recovery times  | Direct savings to the National Health Service from reduced in-patient stays   | COST REDUCTION               |
|                          |                                      | GI can contribute to improved air quality, filtering, trapping and locking-in airborne particulates                            | Calculation of reduction in mortality rates from illnesses associated with particulates in the air  | RISK MANAGEMENT / MITIGATION |

| The 11/12 Benefit Groups |                          | GI Function   | GI benefit  | Benefit Type   |
|--------------------------|--------------------------|---|---|----------------|
|                          |                          |   | Calculation of savings from other pollution control measures taken to prevent sulphur dioxide, carbon monoxide, PM10 emissions                              | COST REDUCTION |
| BENEFIT GROUP 5          | LAND AND PROPERTY VALUES | GI increases demand for residential and commercial property nearby  | Residential land and property uplift within 450 metres of park / open space   | INDIRECT       |
|                          |                          |   | Commercial land and property uplift - requires bespoke willingness to pay surveys with prospective investors / developers, purchasers, tenants or occupiers | INDIRECT       |
| BENEFIT GROUP 6          | INVESTMENT               | GI can help improve the image of an area, so improving an area's chances of securing inward investment.<br><br>Evidence of increase in inward investment at employment sites incorporating significant GI | Estimate of the level of private sector investment levered - bespoke site appraisal, adjusted for attribution of relative importance of GI                  | INDIRECT       |
|                          |                          |   | Estimation of site employment capacity and employment based GVA assessment, adjusted for attribution of relative importance of GI                           | INDIRECT       |
|                          |                          |   | Image / perceptions of an area impacting on private sector investment / location decision-making  | INDIRECT       |
| BENEFIT GROUP 7          | LABOUR PRODUCTIVITY      | GI can reduce days lost at work through supporting health and wellbeing   | Reduction in working days lost and estimate of GVA benefit  | INDIRECT       |
|                          |                          | Access to greenspace at work can make people more productive.   | Increase in labour productivity - % increase in GVA   | INDIRECT       |
|                          |                          | GI can help improve environment helping to attract and retain high quality staff  | Cost saving to business for employee turnover/recruitment costs - % increase in GVA   | COST REDUCTION |
| BENEFIT GROUP 8          | TOURISM IMPACTS          | GI can offer natural tourism assets (and heritage and cultural assets)  | Increased visitor numbers bring additional expenditure, supporting local employment: Gross Value Added  | DIRECT         |
|                          |                          |   | Tourism expenditure   | DIRECT         |
|                          |                          |   | Jobs supported  | DIRECT         |
|                          |                          |   | Gross Value Added   | DIRECT         |

| <b>The 11/12 Benefit Groups</b> |                         | <b>GI Function</b>   | <b>GI benefit</b>  | <b>Benefit Type</b> |
|---------------------------------|-------------------------|--|--|---------------------|
| BENEFIT GROUP 9                 | RECREATION & LEISURE    | GI provides opportunities for recreation                         | Recreational value / use of the GI asset by the local population | DIRECT              |
| BENEFIT GROUP 10                | BIODIVERSITY            | GI can provide, protect and enhance natural habitats.            | WTP for protection or enhancement of biodiversity                | INDIRECT            |
| BENEFIT GROUP 11                | LAND MANAGEMENT         | GI can provide food, timber and industrial crops (e.g. biofuels) | Market value of products   | DIRECT              |
|                                 |                         | Direct management of GI assets                                   | Employment supported   | DIRECT              |
| BENEFIT GROUP 12                | CONNECTIVITY / MOBILITY |  |  |                     |



## Appendix 5 Sustainable Drainage Systems (SUDS)<sup>45</sup>

SUDS solutions are most cost effective when designed to work with the natural drainage pattern of your site. For example, you can design them to:

- use existing ditches or natural depressions for swales and ponds, or
- form part of hard and soft landscaped areas.

The Government's planning policy on development in the floodplain highlights the important role that SUDS can play and introduces a general expectation for their use at all sites. Surface water disposal is a material planning consideration. Local authorities increasingly expect developers to submit proposals that incorporate the SUDS approach.

Ponds and green spaces provide habitats for wildlife to flourish, reduce pollution and provide areas for people to enjoy, adding value to your site. Even in the most constrained site you can use green roofs to:

- reduce surface water run-off, or
- collect rainwater for flushing toilets or watering gardens.

### **Maintaining drainage systems**

In the early stages of your site design, consider how the drainage system will be adopted and maintained in the future. It is likely that these decisions will influence the design, just as much as the technical considerations.

### **Harmful effects of traditional drainage**

Traditional drainage is designed to move rainwater as rapidly as possible from the point at which it has fallen to a discharge point, either a watercourse or soak away.

This approach has a number of harmful effects:

- Run-off from hard paving and roofing can increase the risk of flooding downstream, as well as causing sudden rises in water levels and flow rates in watercourses.
- Surface water run-off can contain contaminants such as oil, organic matter and toxic metals. Although often at low levels, cumulatively they can result in poor water quality in rivers and groundwater, affecting biodiversity, amenity value and potential water abstraction. After heavy rain, the first flush is often highly polluting.
- By diverting rainfall to piped systems, water is stopped from soaking into the ground, depleting ground water and reducing flows in watercourses in dry weather.

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<sup>45</sup> Environment Agency <http://www.environment-agency.gov.uk/business/sectors/36998.aspx> 29/09/10