MAYOR OF LONDON

London Wildlife Trust

Urban Greening for Biodiversity Net Gain: A Design Guide

Contents

Introduction 1

Greener and Wilder 3

Living Landscapes 7

Design Opportunities 9

- A: Sites of Importance for Nature Conservation (SINCs) 11
- B: Public Realm 13
- C: Sustainable Drainage Systems (SuDS) 15
- D: Roofs and Podiums 17
- E: Facades 19

Introduction

To help meet the challenges of a growing city and the climate and ecological emergency, there must be a step change in how development relates to London's natural environment. As well as continuing to protect the most valuable green and wild places, new development proposals need also to strengthen London's green infrastructure and ecological networks.

The London Plan policies G5 Urban Greening and G6 Biodiversity and Access to Nature together require developments to make urban greening a fundamental element of design and to deliver net gains for biodiversity. In practice this means thinking about how buildings and landscape function as well as look, and ensuring a development leaves nature in a better state than before it happened.

This guide shows how this can be achieved through good design, whilst also creating engaging, healthy and resilient places, helping to reduce Londoners' exposure to air pollution and enabling the city to adapt to climate change. It introduces simple design considerations for different types of urban greening features which help to make space for nature in our built environments.

This document is relevant to anyone involved in the design of new developments. It should not be seen as a replacement for ecological or landscape advice, rather its aim is to inspire more projects to consider how they can adopt an interdisciplinary approach to make the city greener and wilder.

London Plan Polices

Policy G5 Urban Greening:
"Major development proposals should contribute to the greening of London by including urban greening as a fundamental element of site and building design, and by incorporating measures such as high-quality landscaping (including trees), green roofs, green walls and nature-based sustainable drainage."

Policy G6 Biodiversity and Access to Nature:
"Development proposals should manage impacts on biodiversity and aim to secure net biodiversity gain. This should be informed by the best available ecological information and addressed from the start of the development process."

Key terms used in this document:

Landscape: Refers to its broadest meaning and includes buildings, roads and open spaces.

Habitat mosaic: A patchwork of different types of vegetation, known to create high biodiversity.

London Priority Habitats: The London Environment Strategy identifies priority habitats that are of particular importance for biodiversity in London. These habitats are included in borough Biodiversity Action Plans (BAPs) or Nature Recovery Plans.

Bridget Joyce Square, Community Rain Park (SuDS), Robert Bray Associates. (Photo credit: Robert Bray Associates).

Greener and Wilder

Brown banded carder bee, a priority species for conservation, foraging on wildflowers at Barking Riverside, London. (Photo credit: Stuart Connop).

Urban greening with gains for biodiversity

London Plan Policy G5 requires the use of an Urban Greening Factor (UGF) tool to evaluate the amount and quality of urban greening provided by a development proposal. The UGF enables planning authorities and developers to have informed discussions about the appropriate level of green infrastructure that should be provided to deliver locally relevant outcomes, such as climate resilience or active travel, benchmarked against target scores for different types of development.

The UGF is calculated by assigning a score to all the surface cover types in a proposed development that is based on the ability of the surface cover to provide a variety of benefits, such as reducing storm water run-off.

Typically, the better-quality surface cover types that score highest in the UGF are also the ones which have the most potential to provide benefits for biodiversity. However, the UGF is not a tool to measure the biodiversity benefits of greening proposals, and not all urban greening may be inherently good for wildlife. Ecologically informed and inspired design is needed to ensure new urban greening provides functioning habitats where biodiversity can exist alongside development preferably by augmenting existing habitats nearby.

On the next page, Table 1 shows which UGF surface cover types have the greatest potential to be designed to achieve net gains for biodiversity. The Biodiversity Potential category describes the typical ecological value of the urban greening feature if it is designed with wildlife in mind. The actual biodiversity benefits achieved will depend on a range of factors including how well the design accommodates local biodiversity conservation priorities and responds to the local landscape, the quality of installation, and how it will be managed and used through the life of the development.

Table 1: Urban Greening Factor Design Considerations

Surface Cover Types	Factor	Biodiversity Potential	Design Considerations
Semi-natural vegetation (e.g. trees, woodland, species-rich grassland) maintained or established on site.	1	High to Very High	Larger schemes should create new areas of priority habitat that relate to the immediate area. Details about priority habitats are provided in the London Environment Strategy (external link).
Wetland or open water (semi-natural; not chlorinated) maintained or established on site.	1	High to Very High	Can form part of a wider SuDS scheme and create new areas of priority habitat. See Sustainable Drainage Systems.
Intensive green roof or vegetation over structure. Substrate minimum settled depth of 150mm.	0.8	Moderate to High	Provide for birds and their young by including native trees and shrubs and group to create dense cover. Avoid chemical treatments or removal of decaying matter. See Roofs and Podiums.
Standard trees planted in connected tree pits with a minimum soil volume equivalent to at least two thirds of the projected canopy area of the mature tree.	0.8	Low to Moderate	Choose species of known wildlife value. Avoid up-lighting and place new trees to enhance bat flight-lines. See Public Realm.
Extensive green roof with substrate of minimum settled depth of 80mm (or 60mm beneath vegetation blanket) – meets the requirements of GRO Code 2014.	0.7	Moderate to High	Create roofs that mimic flower-rich priority habitats. See Roofs and Podiums. Further details about green roofs are provided in the London Wildlife Trust guide "A buzz up top" (external link).
Flower-rich perennial planting.	0.7	Moderate	Choose species that are pollinator friendly. Maintenance needs to retain dead wood and leaf litter to keep habitat for other invertebrates and attract birds. See Public Realm.
Rain gardens and other vegetated sustainable drainage elements.	0.7	Moderate	Ecological design can create valuable habitat as a secondary benefit. See Sustainable Drainage Systems.

Table 1: Urban Greening Factor Design Considerations

Surface Cover Types	Factor	Biodiversity Potential	Design Considerations
Hedges (line of mature shrubs one or two shrubs wide).	0.6	Moderate	Hedges of native species are more beneficial for pollinators and other invertebrates, as well as providing shelter and foraging resources for birds. Create an ecotone with adjacent grassland or woody vegetation. See Public Realm.
Standard trees planted in pits with soil volumes less than two thirds of the projected canopy area of the mature tree.	0.6	Moderate to Low	Choose species of known wildlife value. Avoid up-lighting and place new trees to enhance bat flight-lines. See Public Realm.
Green wall –modular system or climbers rooted in soil.	0.6	Moderate to Low	Can provide nesting or roosting sites and pollinator-friendly planting in urban environments dominated by hard-surfaces. See Facades.
Ground cover planting.	0.5	Low	Choosing plant species and/or cultivars of known wildlife value can provide some seasonal biodiversity benefit.
Amenity grassland (species-poor, regularly mown lawn).	0.4	Low	Value for invertebrates can be increased by the addition of wildflowers tolerant of regular mowing in lawn turf.
Extensive green roof of sedum mat or other lightweight systems that do not meet GRO Code 2014.	0.3	Low	Sedums are of value to some pollinators when in flower. Benefit other invertebrates by incorporating log piles, soil mounds and plug plants See Roofs and Podiums.
Water features (chlorinated) or unplanted detention basins.	0.2	Low to Negligible	See Sustainable Drainage Systems for wildlife friendly alternative design options.
Permeable paving.	0.1	Negligible	Minimise where possible.
Sealed surfaces.	0	Negligible	Minimise where possible.

Living Landscapes

Understanding the landscape and ecological context of a development can open untapped opportunities for biodiversity. Berkeley Homes' regeneration of Woodberry Down benefits greatly from the adjacent Wetlands, and nature reserve opened by London Wildlife Trust, in partnership with Thames Water, Berkeley Homes and Hackney Council. (Photo credit: Berkeley Homes).

Principles

For landscape designs to translate into successful schemes for wildlife there are a number of key principles to remember:

- Think about green infrastructure at the earliest opportunity in the design process. Making space for nature is an opportunity to achieve a wide range of policy objectives rather than a design constraint.

- Set out a mosaic of interconnected habitats early in the master planning process. Habitats can be created at every level and surface incorporating shrubs, trees, grassland, and fresh-water. More actively used spaces, such as areas for food-growing or play, can be planned to contribute to the habitat network too.

- Carefully consider the local conditions such as wind, ground water, aspect, light, soil substrate and soil depth. Take into account that tall buildings and high-density development can create especially harsh micro-climatic conditions for plants and other wildlife.

- Select and locate designed plant communities for their optimum traits (e.g. drought tolerance or ability to thrive in low nutrient soils) in order to reduce the need for irrigation, energy input and intensive management to establish a functional and climate-resilient landscape.

- Take reference from natural systems in form and pattern when developing planting designs i.e. where plants exist as groups of compatible, adaptable species that interact with each other and the site. Plants should be seen as forming part of a habitat type rather than creating solely garden or ornamental features.

Practice

The planning process requires developments to deliver on a wide range of policy objectives. Integrating these effectively necessitates the bringing together of technical expertise from many professions and creative problem solving to ensure biodiversity net gains.

Ecological expertise should be within the design team from the start and used to inform design decisions. This should not focus only on conserving any valuable species and habitats already present, but also on how to integrate any new habitats created through urban greening into the local ecological network that has been set out by the local planning authority in its Local Nature Recovery Plan.

A key recommendation of this guide is for those people responsible for commissioning design teams (the lead consultant and the client) to bring together professionals that understand how their discipline not only interfaces with biodiversity but has a role in enhancing it. This will include engineers, architects, planners and landscape architects. There is also a role for marketing and sales personnel to better understand the added value of a nature-rich development for people's health and wellbeing.

The next sections set out the design opportunities in relation to particular urban typologies and green infrastructure features comprising:

A: Sites of Importance for Nature Conservation (SINCs)
B: Public Realm
C: Sustainable Drainage Systems (SuDS)
D: Roofs and Podiums
E: Facades

Design Opportunities

A: Sites of Importance for Nature Conservation (SINCs)

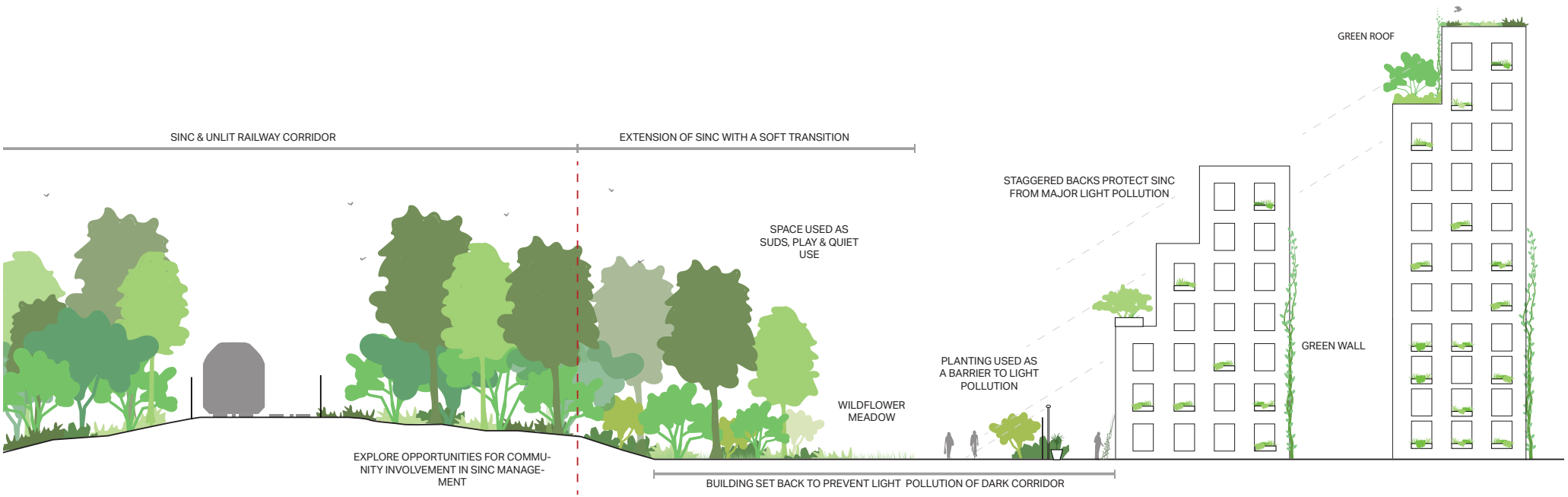
Through good design it is possible to protect and enhance London's priority habitats.

There are over 1600 Sites of Importance for Nature Conservation (SINCs) across London. Burgess Park in Southwark supports important habitats including neutral grassland and broadleaved woodland. (Photo credit: Mathew Frith/ London Wildlife Trust).

Sites of Importance for Nature Conservation (SINCs) are London's most important places for wildlife. The London Plan requires that they are identified and protected by London boroughs. They represent the core network from which to enhance the city's ecology. Development close to SINCs must respond to their ecological character and valuable features. The creation of ecological-rich development, adding further life and diversity, helps to connect, strengthen and expand this network to underpin nature's recovery.

Design solutions should be informed by the advice of an ecologist and go further than protecting the SINC. Ecologically inspired urban greening should be used to complement the SINC's important and distinctive habitats and species, extending and connecting wildlife habitat into the development.

Try to	Avoid
• Enhance condition of SINCs through appropriate management. • Inform design from the vegetation, features and management of the SINC. • Secure plant material of local provenance, including from adjacent SINCs if possible. • Create complementary habitat within the development. • Design out adverse impacts, for example obtrusive lighting or noise disturbance.	• Building up to the SINC boundary – provide a buffer zone, ideally of semi-natural habitat. • Surface water runoff directly into SINC unless ecological appropriate to do so (see SuDS). • Introducing invasive plant species.



Design Opportunities

B: Public Realm

A green infrastructure approach requires a re-imagining of the public realm to consider how these places can make London greener, healthier and more resilient. Creative design solutions can allow even the more formal aspects of public space to be stitched into the wider ecological network of the city.

Sunken rain gardens planted with small trees, shrubs and grasses provide structural diversity to an existing tree lined street in Portland, Oregon. (Photo credit: Dusty Gedge).

The main elements that need to be considered are:

- Can the public realm provide an ecological connection to nearby SINCs or priority habitats?
- What other urban greening objectives might provide opportunities to deliver habitat (e.g. providing shade with woodland creation and barriers to air pollution exposure with a species-rich hedgerow. See Using Green Infrastructure to Protect People from Air Pollution external link).
- Can the primary use of the street tailor the type and scale of features included (e.g. large trees on main streets or edible shrub planting for traffic-free streets)?
- Can biodiversity features be designed into typical public-realm furniture (e.g. bollards and fences).
- Which animals live in the immediate area and would benefit from more or better managed habitat?

Try to	Avoid
• Link green spaces at multiple levels e.g. street planting, podium gardens and green roofs. • Create soft transitions with green walls and a variety of management treatments. • Create connected tree pits using cell systems with shrubs under tree canopies to create structure. • Select plants that root at different depths to limit competition between species.	• Using large amounts of sealed surfaces. • Specifying the predominance of ornamental evergreen species of shrubs and cover planting. • Designing large areas of single species ground-cover. • Plants that require regular irrigation with mains water. • Introducing large quantities of nutrient-rich top soil.

Design Opportunities

C: Sustainable Drainage Systems (SuDS)

Development should manage the drainage of rain water as close to source as possible, prioritising green over grey techniques. Ecologically informed design of SuDS increases the benefits of this approach and can be applied at any scale from small swales and rain gardens through to large wetlands.

A series of shallow ponds provide an attractive setting to new housing, whilst providing new wetland habitats next to the River Lee, East Village, Stratford.

The main elements that need to be considered are:

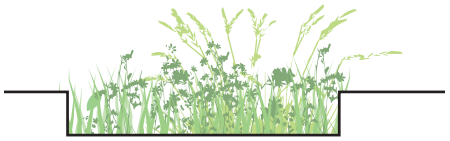
- Adapt the SuDS hierarchy, where appropriate, to allow for creation of permanent or ephemeral wetland habitats;
- Arrange SuDS as a system, making use of the landscape as much as possible before discharging off-site; and
- Emulate locally relevant priority habitat/s rather than focusing solely on garden plants.

Try to	Avoid
• Add at least one shallow side to swales, ditches and ponds for plants and to allow newts, frogs and other wildlife easy access. • Grade inclines to be no more than 1:5 (12%) and preferably less than 1:20 (3%). • Direct water through pollution and sediment traps before they reach play areas or ponds. • Add dead-wood, stones, trees, shrubs and tussock grasses. • Use tall vegetation, swales, buffer strips and ditches as natural barriers to access and to de-mark walking routes.	• Fountains and ornamental ponds, that use chlorinated, potable water and/or a UV filter as they limit use by wildlife. • Lighting vegetation or water, which can reduce value to bats and insects. • One large SuDS feature (located in a corner) rather than several smaller features located strategically across the development site. • Mulches and timber features that may float when the SuDS feature fills with water.

A creative, nature-inspired play-space combines a dry swale with log bridges and wildflower planting in Kidbrooke Village, Royal Borough of Greenwich.

Vegetated rain-gardens form part of new road improvements in White Hart Lane, Tottenham. (Photo credit: Robert Bray Associates).

Examples of habitat options for SuDS



Neutral wet grassland rain garden

Willow scrub rain garden

Open mosaic rain garden

Vegetated wet swale with sloping sides

Design Opportunities

D: Roofs and Podiums

Rooftop habitats provide an opportunity to create habitats that can become part of an ecologically-rich landscape. Bespoke designs which reflect local biodiversity priorities and reflect priority habitat in composition and structure will deliver positive gains for wildlife.

Alternate bands of crushed ceramic and pulverised brick substrates sown with wildflower seeds create a valuable habitat mosaic. Biosolar roof, Stratford. (Photo credit: Stuart Connop).

The main elements that need to be considered are:

- Aspect, available sunlight and exposure;
- Habitat/s vs maximum loads of structure; and
- Use, management and maintenance.

Any roof type can be designed to have biodiversity value

Roof Type	Notes	Substrate Depth	Reference Priority Habitat
Extensive green roof	Tolerant of windswept, exposed locations on the tallest buildings. Low maintenance.	80mm - 150mm	• Open mosaic • Alpine
Semi-intensive green roof	Suited to where deep soils are limited due to building structure. Opportunity to create flower-rich, prairie-like habitats with a rich species mosaic.	80mm - 250mm	• Meadow • Low scrub • Open mosaic
Intensive green roof	Better suited to sheltered or shaded locations. Deep soils and trees put heavier loads onto building structure. Opportunity to create the widest variety of habitats.	200mm - 950mm	• Wood/scrub • Orchard • Meadow
Blue roofs	Stores more water then other green roofs. If the outlet pipe is raised above soil level ephemeral wetlands may form. Potential to provide significant benefit to people and wildlife.	80mm - 150mm	• Open mosaic • Wetland
Sedum blanket roofs	Suitable for light-weight roofs. Lowest benefit for people and wildlife. Low maintenance.	60mm - 80mm	• Alpine

A sterile water feature is enhanced for wildlife by adding a pebble beach and planting with native wetland species. The Barbican, City of London.

The intensive green roof on Berkeley Homes' Goodman's Field in Aldgate, demonstrates the beauty and interest in a more nature-based design. Native hedgerow planting, ephemeral pool, chalk, shingle and heathland planting provide a rich habitat mosaic within a small area. (Photo credit: Mathew Frith/ London Wildlife Trust).

Design Opportunities

E: Facades

These recently developed features are now increasingly being installed in cities to provide amenity or address local environmental problems. Through simple design choices it is possible to achieve biodiversity benefits as well.

Species such as hops vines have vigorous growth enabling them to grow in excess of 20 metres from the ground as here in Basel, Switzerland. (Photo credit: Dusty Gedge).

The main elements that need to be considered are:

- Source of water for irrigation;
- Reference habitat/s and focal species; and
- Management.

Any wall can be designed to have biodiversity value

Typology	Description	Notes
Modular green wall	System built structures with plants in pockets, troughs (soil based) or rooted in fabric (hydroponic).	Irrigation is typically needed and can be expensive. Can be costly to maintain. Some designs can provide nesting opportunities for birds.
Traditional, climbing green wall	Climbing plants rooted in the ground and provided with support (e.g. trellis, steel cables etc.).	Irrigation not usually needed. Less able to provide nesting habitat until mature or well established.
Balcony planters	Planting space integrated into balcony architecture.	Less irrigation needed, so easier to maintain. Can be subject to windburn.
Window boxes	Often temporary planters installed by resident.	Regular watering needed due to desiccation and windburn.
Nest boxes	A range of bird and bat nest boxes can be intergrated into facades and green walls.	Some species are territorial and will not use boxes close together. Aspect and height also matters.

The Athenaeum Hotel near Green Park, Mayfair, has a large and diverse living wall designed by Patrick Blanc in 2003. Its features include shrubs, climbers, grasses and mosses.

Many vertical surfaces can be greened, such as fences, low walls, pillars, parapets, and railings, as here near Moorgate, City of London.

Try to	Avoid
• Use rainwater and/or grey water to irrigate the wall. • Add native grasses and herbs that provide homes as well as food for butterflies and moths. • Think about natural vertical habitats and mimic plant groupings and structure into wall design. • Provide artificial nesting and roosting sites for bats, birds and solitary bees. • Encourage residents' participation by providing balcony planters and window boxes on residential or office schemes.	• Lighting green walls, which will deter nocturnal wildlife such as moths and bats. • Use of combustible materials. • Only using non-native plant species that are not able to provide homes or food for the early life-stages of most invertebrate species.

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