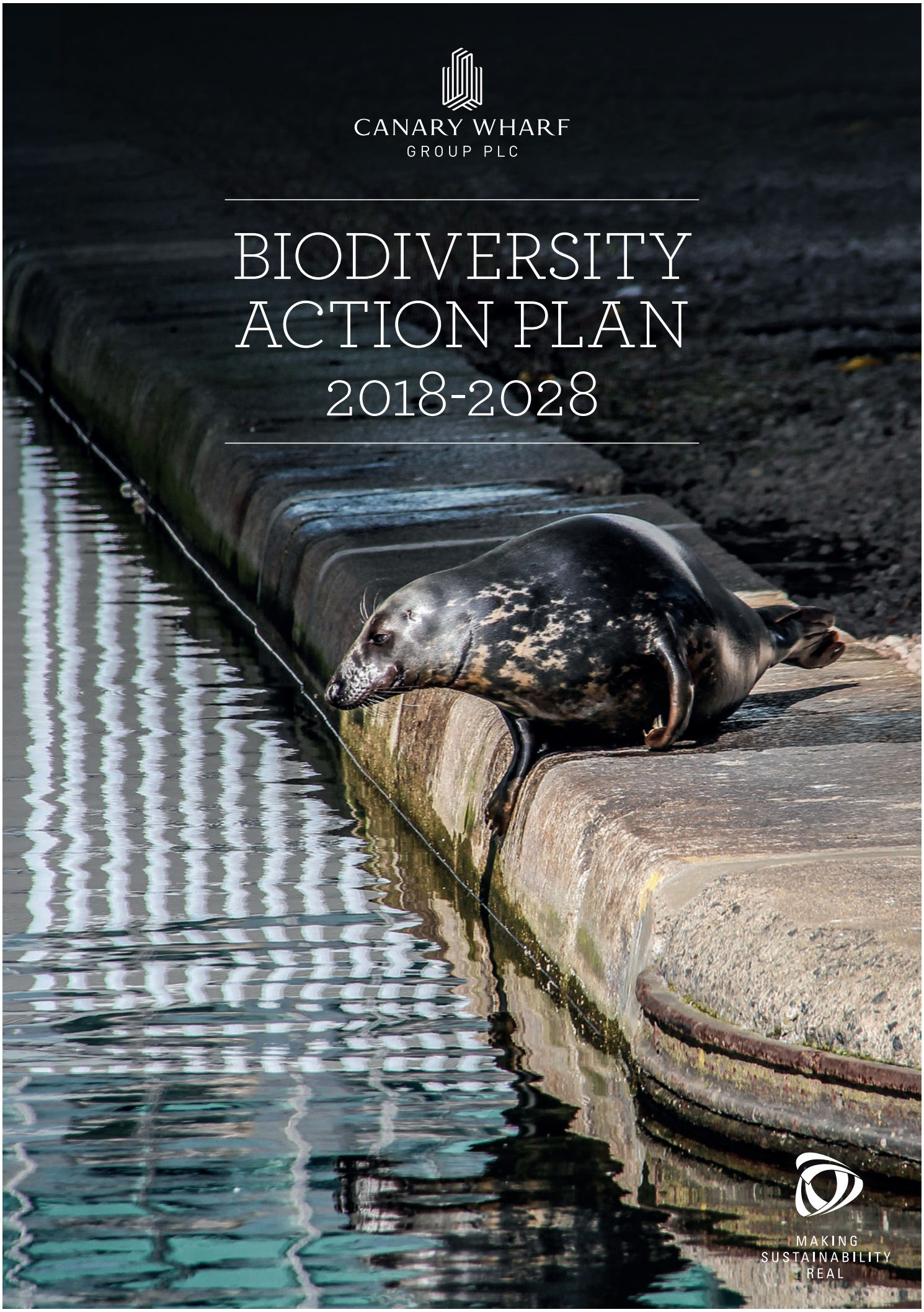
CANARY WHARF
GROUP PLC

BIODIVERSITY ACTION PLAN 2018-2028



MAKING
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“There is more to biodiversity in Canary Wharf than meets the eye. The Canary Wharf Estate is an integral part of the Thames Estuary and Canary Wharf Group works to promote an integrated green infrastructure that maximises the estuarine ecosystem services we are part of. Through time, our urban design has created a suitable living environment for native and threatened species of plants and animals and their establishment has taken place alongside the thriving commercial world of the Canary Wharf Estate.

Looking forward, we have updated our Biodiversity Action Plan (BAP) which aims to create a precise baseline and better our understanding of the present value of ecology on the Estate. By defining key habitats and species, we are ensuring that current and future developments integrate this knowledge into their design and maximise the links and corridors with the rest of Tower Hamlets. Undertaking an Ecosystem Service Valuation will also allow us to define the value of biodiversity assets which can then inform Estate-wide management and identify areas of ecological priority. Through our BAP, we are working to ensure that we create safe and healthy ecosystems and amenities that promote integrated, pleasant and liveable public spaces where biodiversity and leisure meet.”

Canary Wharf Group, March 2018.

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- Canary Wharf Group plc
- Greengage Environmental Ltd

The report has been produced with evidence and support from the following bodies:

- London Borough of Tower Hamlets
- Greenspace Information for Greater London

CONTENTS

1.0 EXECUTIVE SUMMARY

1.1 This document presents the Canary Wharf Biodiversity Roadmap 2018 -2028 (herein 'the Roadmap').

1.2 The Roadmap aims to:

- Define the existing ecological baseline of the Canary Wharf Estate (herein 'the Estate'), mapping features in an interactive GIS database;
- Undertake an Ecosystem Service Valuation exercise to clearly define the value of biodiversity assets, and identify management and habitat creation priorities;
- Contextualise these actions with respect to wider climate change adaptation actions;
- Define the key site wide objectives and key performance indicators (KPIs) against which management of existing assets and future developments will be measured;
- Create a Design Principles Framework (DFP) which sets standards for future development at the Estate; and
- Update the existing Canary Wharf Group Biodiversity Action Plan (CWG BAP)[1].

BASELINE ASSESSMENT

Biodiversity Appraisal

1.3 The ecological baseline was assessed through a detailed desk-based study and extended site survey.

1.4 Canary Wharf is inherently a brownfield site; 'natural' ecosystems will not have existed in this location since the draining of the Stepney Marshes in the 13th Century.

1.5 The location, scale and nature of ecological features across the Estate was assessed and mapped within an interactive online GIS database.

1.6 The assessment identified 4 Local Nature Reserves, 26 Sites of Importance for Nature Conservation and 170 Open Space Sites within a 2km radius of the Estate.

1.7 These designated sites and areas of open space have a total coverage of over 300 hectares (ha) with the River Thames corridor providing an additional 2090 ha; the Estate contains, and is connected to, vast areas of green and blue infrastructure.

1.8 Records for a number of protected, rare and notable species were identified within 1km of the Estate, including records for 5 bat species and all 7 Priority Bird Species in the Tower Hamlets BAP.

1.9 Within the 5ha Estate itself four urban parks, 13 buildings with living roofs, and over 650 trees were assessed and mapped, alongside:

- 8,000m^2 of living roof space
- 24,000m^2 of park/amenity space
- 348,000m^2 of open water habitat
- 2,000m^2 of tree cover

1.10 Additional ecological features such as bird boxes, bee hives and reed beds were identified.

1.11 Other interesting findings include the discovery of Jersey cudweed (*Gnaphalium luteoalbum*), a protected plant species listed on schedule 8 of the Wildlife and Countryside Act, 1981 (as amended), growing on the sedum roof on 15 Canada Square. This Tower Hamlets BAP species can be found in several locations through east London, and is abundant around the Milwall Docks ~200m south of the Estate.

Ecosystem Service Valuation

1.12 A review process was undertaken to identify the most appropriate ecosystem service valuation approach. This process identified two priority tools/methodologies that were suitable for application at Canary Wharf.

i-Tree Eco

1.13 All trees across the Estate were surveyed using a combination of i-Tree Eco and *BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations*[2] methodologies. The locations of trees were recorded using a GPS unit and mapped onto the GIS database.

1.14 The tree survey data was analysed using i-Tree Eco, an ecosystem valuation tool which assigns quantitative and monetary values for the ecosystem services urban trees provide. These services include air pollution removal, carbon storage and sequestration, oxygen production, avoided stormwater runoff and overall structural (replacement) value. Key results include:

- The tree population was found to include a mix of over 30 species, amounting to 4.3% tree cover in the Estate. This results in avoided run off or 198m^3 per year.
- The gross sequestration of Canary Wharf trees is about 11 tonnes of carbon per year with an associated annual value of £687.
- Trees also store carbon within their tissues which is released as trees decay and die. Trees in Canary Wharf are estimated to store 154 tonnes of carbon (£9,830).

- Trees in Canary Wharf are estimated to produce 29 tonnes of oxygen per year.
- The structural value of the trees in Canary Wharf was calculated at £658,000 – this is estimated to be the cost of having to replace a tree with a similar specimen.

Green Infrastructure Valuation Toolkit

1.15 Use of this toolkit is ongoing at the time of report production. Final results will be available in 2018.

Climate Change Resilience

1.16 Human caused climate change is happening and will have long term impacts upon the built environment. Adaptation to these future climatic conditions is important if the spaces we occupy are to remain useable and safe.

1.17 A review of the Urban Heat Island (UHI) effect on the Estate has been undertaken with the overall aim to ensure that any biodiversity enhancements incorporated within the wider design principles of this Roadmap take consideration of the climatic context of the Estate. A series of 'heat maps' has been produced which should be used by decision makers to ensure that planting should:

- Be appropriate to the level of direct and reflected light received (there is significant variation due to the presence of tall buildings in close proximity) and the ability for the species to flourish;
- Provide a service to the human use of particular locations, for example by providing sufficient shade at ground level for areas where people are likely to dwell and which are exposed to the most significant urban UHI;
- Provide a service to buildings where UHI effects cause excessive heat build-up, for example through insulation or shading properties; and
- Be appropriate to naturally dry or moist conditions caused by micro climatic conditions so as to minimise need for irrigation.

1.18 A questionnaire has also been circulated to entrants in the Canary Wharf Wildlife Photography Competition which aims to establish why people use the open spaces, what features they value, and what could improve the user experience of the parks and open spaces. The results of this survey will then be used to provide an additional layer of consideration for decision makers when implementing the biodiversity recommendations of the Roadmap.

1.19 A Health and Well Being Strategy is currently under production to accompany this document, reflecting broader H&WB targets for the Estate.

OBJECTIVES

1.20 Results of the baseline assessment were analysed to help define three key objectives for the Estate:

- **Objective 1** – Embed the biodiversity 'net gains' principle within management and planning decision-making across the Estate;
- **Objective 2** – Develop and apply actions for climate change resilience; and
- **Objective 3** – Improve ecosystem service value and in particular health, well-being and productivity of Estate users.

1.21 These form the principle tenets against which all recommended actions are designed.

ACTIONS

Biodiversity DFP

1.22 This Framework presents reasoned and evidence-based actions to be embedded within future development proposals at the Estate.

1.23 A stepwise process to achieve these actions is presented, measured against RIBA design stages.

1.24 A list of appropriate enhancements and target 'principles' are provided. These features and conservation principles should be factored into all new developments at the Estate.

1.25 A metric is provided to help ensure measurable net gains for biodiversity.

Biodiversity Action Plan

1.26 A BAP is presented to cover 2018 – 2028. This BAP includes an updated list of priority habitats and species, reflecting results of the baseline appraisal, alongside several key 'themes'.

1.27 Management actions are provided which reflect the targets of the three sitewide objectives.

2.0 AN INTRODUCTION TO THE ROADMAP

2.1 Biodiversity – literally the measure of all living things – forms the foundation of life on Earth; it is a priceless resource. Biodiversity forms the basis of many essential environmental processes, regulating our world and enriching our lives.

2.2 An ecosystem describes the biodiversity of an area in conjunction with its physical and chemical environment, such as a woodland, a coral reef, or a city. Ecosystems are subject to incalculably complex interactions, and the 'urban ecosystem' of London is no exception.

2.3 Global biodiversity is severely threatened by human activity. We are living in the Anthropocene, a new geological era defined by our actions and their impact upon the planet. It has therefore never been more important to consider our impact, and put in place appropriate measures to adapt to a changing climate.

2.4 Consideration of biodiversity in the urban environment has risen to the fore in recent years given increasing rates of urbanisation and greater understanding of climate change related threats such as air quality reduction, flood risk and urban heat island (UHI) effect intensification.

2.5 Biodiversity cannot be viewed as an afterthought; a perk that is nice to have but is superfluous to design and function. Biodiversity defines our inherent ability to survive. It is the driving force of our Natural Capital which underscores the entire foundation of Financial Capital. It helps regulate our climate, clean our water, grow our crops and support our cognitive development, benefitting our health, well-being and prosperity.

2.6 Canary Wharf Group are therefore committed to implementing their Biodiversity Roadmap scheme presented in this summary report document.

There is more to biodiversity in Canary Wharf than meets the eye. The Canary Wharf Estate is an integral part of the Thames Estuary and Canary Wharf Group works to promote integrated green infrastructure. Through time, our urban design has created a suitable living environment for native and threatened species of plants and animals and their establishment has taken place alongside the thriving commercial world of the Canary Wharf Estate.

Current and future developments have biodiversity as a priority and it is our goal to ensure that we create safe and healthy ecosystems and amenities within the Canary Wharf Estate that promote biodiversity and create pleasant and liveable public spaces where biodiversity and leisure meet.

THE ROADMAP

2.7 This document presents the results of the Canary Wharf Biodiversity Roadmap exercise undertaken by Greengage Environmental Ltd on behalf of Canary Wharf Group.

2.8 The aims of this exercise include:

- Define the existing ecological baseline of the Canary Wharf Estate (herein 'the Estate'), mapping features on an interactive GIS database;
- Define key actions for the management of existing biodiversity assets;
- Define key targets for creating and enhancing biodiversity for future development across the Estate;
- Undertake Ecosystem Service Valuation exercise to clearly define the value of biodiversity assets, and identify management and habitat creation priorities;
- Contextualise these actions with respect to wider climate change adaptation actions; and
- Build on the existing Canary Wharf Group Biodiversity Action Plan (CWG BAP) documents for the Estate and produce an updated CWG BAP 2018-2028.

2.9 The Roadmap framework can be found in Appendix 2. It is broken down into the following key headers:

- Assessment and Evaluation – the baseline assessment that will be used to inform the approach going forward will be undertaken during this stage. The GIS database will be created.
- Option Identification and Appraisal – priority areas of action will be defined during this stage. The baseline data will be built on and ecosystem service valuation assessments will be undertaken. Key stakeholders will be consulted during this stage. Key performance indicators will be defined and on-going actions will be formulated.
- Strategy Definition – this will build on the previous stage, adding more detail to the actions that come off the back of the ecosystem service valuation exercises. Specific multidisciplinary actions will be integrated with the biodiversity considerations.
- Management Strategy – this stage describes the on-going implementation of the strategy.
- Implementing the Strategy – the Biodiversity Action Plan report which describes the approach informed by the first three stages will be completed and implemented during this stage.

SITE HISTORY

2.10 The Estate sits on the former site of the West India Docks on the Isle of Dogs, in the east London Borough of Tower Hamlets.

2.11 The London Docklands formed an important role in the UK's industrialisation, with the Port of London operating as a key trading hub from as early as the 16th Century. Come the Industrial Revolution of the 19th Century, the Docks were rapidly expanding, with trade peaking in the mid-20th Century.

2.12 The docks could not compete with larger cargo ship sizes and emergent technologies of the 1970s however, and London's docks were all closed by 1981, leaving vast expanses of derelict industrial land.

2.13 The London Docklands Development Corporation (LDDC) led the regeneration of the area creating what is now a thriving financial hub in London's east-end.

2.14 The existing Estate comprises a grid network of roadways and skyscraper office blocks alongside street trees, bed planting and pocket parks, besides the open water of the River Thames and former dock basins. Green spaces across the Estate were primarily designed for their amenity use and aesthetic value, however many of the buildings support areas of living roof or other features designed specifically with biodiversity in mind.

2.15 Water is a key biodiversity feature at the site, with the North and South Docks still present, along with most of the Middle Dock (some of which was lost to the Jubilee Park development). The Estate is bound to the north by the West India Dock Basin beyond which extends the residential area of Poplar with the extensive Millwall Dock Basin to the south on the Isle of Dogs.

2.16 Canary Wharf is therefore inherently a brownfield site; 'natural' ecosystems will not have existed in this location since the draining of the Stepney Marshes in the 13th Century.

2.17 Defining what biodiversity *should* exist at a site such as this can therefore be a challenge, however the development of the Estate over the years has been informed by several key strategies, including the former CWG BAPs.

2.18 This document aims to build on these former plans, providing a robust framework for approach to Estate management and future development in context with wider ecosystem service provision and climate change adaptation considerations.

2.19 Canary Wharf's position within London's wider 'urban ecosystem' is also an important element to consider within this approach; understanding and being considerate of the interconnectedness of stepping stone habitats throughout the capital, and the importance of this mosaic of sites for the plants and animals that live there, is key in creating and implementing meaningful conservation actions.

KEY CONCEPTS AND TERMS

Ecosystem Services

2.20 Ecosystem services are the beneficial outcomes of functioning ecosystems – biological communities and their chemical and physical environments, such as rivers, wetlands, woodlands or coastlines – and can be divided into four key categories:

- Cultural: benefits for people's health, wellbeing and cognitive development as well as the aesthetic value of experiencing nature.
- Provisioning: products obtained from ecosystems, such as food, fuel, pharmaceuticals or fresh water.
- Supporting: key services such as photosynthesis, nutrient cycling and soil formation.
- Regulating: crucial processes such as carbon cycling, air quality control, water regulation, pollination, natural hazard reduction, pest regulation and, most importantly today, climate change regulation.

Green Infrastructure

2.21 Natural England describes Green Infrastructure (GI) as the:

'…strategically planned and delivered network comprising the broadest range of high quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering those ecological services and quality of life benefits required by the communities it serves and needed to underpin sustainability. Its design and management should also respect and enhance the character and distinctiveness of an area with regard to habitats and landscape types.

Green Infrastructure includes established green spaces and new sites and should thread through and surround the built environment and connect the urban area to its wider rural hinterland. Consequently, it needs to be delivered at all spatial scales from sub-regional to local neighbourhood levels, accommodating both accessible natural green spaces within local communities and often much larger sites in the urban fringe and wider countryside.'

2.22 The requirement of GI in new development is deeply embedded within London planning policy and best practice, however many areas are lacking in meaningful GI assets.

2.23 GI represents a key ally in urban climate change mitigation and adaptation. The network of multifunctional green spaces which traverse our urban jungles stand to reduce the impacts of urban heat island effect, surface water flooding, biodiversity loss and poor air quality, alongside a raft of other benefits.

2.24 It is well established that urban populations suffer from a disconnect with nature3 and its associated benefits with our health and well-being. A key objective is therefore to strengthen people's connection with, and appreciation of, the natural world. GI is an important tool in achieving this.

3.0 BASELINE ASSESSMENT

3.1 This phase of the Roadmap was designed to assess the Estate's overall 'ecological baseline', defining the existing biodiversity 'assets' and evaluating their status, condition and relative importance.

3.2 The assessment was split between a high level ecological appraisal of the site, where habitats and records of notable/protected species were identified and mapped, and a detailed arboricultural survey was undertaken.

BIODIVERSITY

Methodology

Desk top assessment

3.3 A key element of this data collection stage included a desktop review of available biological records for the site and surrounding area.

3.4 Biological records were sourced from Greenspace Information for Greater London (GiGL) and other open data sources such as the National Biodiversity Network (NBN).

3.5 Notable species reviewed for, as listed on the former CWG BAP, included:

- Ivy (Hedera helix);
- Hawthorn (Crataegus monogyna).
- Common Reed (Phragmites australis);
- Brown Banded Carder Bee (Bombus humilis);
- Stag Beetle (Lucanus cervus);
- Meadow Brown Butterfly (Maniola jurtina);
- Brimstone Butterfly (Gonepteryx rhamni);
- House Sparrow (Passer domesticus);
- Black Redstart (Phoenicurus ochuros);
- Peregrine Falcon (Falco peregrinus);
- Grey heron (Ardea cinerea);
- Sand martin (Riparia riparia);
- Swift (Apus apus);
- House Martin (Delichon urbicum);

- Water Vole (Arvicola amphibius);
- Kingfisher (Alcedo atthis);
- Bats;
- Hedgehog (Erinaceus europaeus);

3.6 Several former BAP species were discounted from the assessment based on local/regional absence and/or not being of relevance to current site conditions.

3.7 Records for designated sites for nature conservation were also reviewed.

3.8 Alongside this, available plans and reports were reviewed to identify the original design intention for features of ecological interest across the site.

3.9 All available planning reports for development plots were reviewed. The design intention was assessed against the 'as built' condition during the site survey stage.

3.10 An aerial assessment of drone images and satellite imagery was also undertaken to identify the potential location of ecological features such as living roofs.

3.11 Finally, planning reports for future development plots were reviewed to assess the likely near future scenario at site.

Site Surveys

3.12 The desk-based assessment was supplemented by a site wide ecological appraisal and ground truthing survey.

3.13 All key potential ecological features identified during the desk-based assessment were visited, including areas of living roof, parks, street trees and dock basins.

3.14 The scale and nature of each feature was assessed with attention paid to the condition of the feature against the design intention targets identified during the planning and design report review process.

3.15 The presence of, or value for, notable/protected species was also noted.

Results

Biodiversity Action Plan Review

3.16 UK Biodiversity Action Plans (BAPs) have been developed which set priorities for nationally important habitats and species. To support the BAPs, Species/Habitat Statements (otherwise known as Species/Habitat Action Plans – SAPs and HAPs) were produced that provide an overview of the status of the species and set out the broad policies that can be developed to conserve them. A list of priority species of conservation importance was also developed.

3.17 The UK BAP was succeeded in 2012 by the UK-Post 2012 Biodiversity Framework which informed the creation of the Biodiversity 2020 strategy; England's contribution towards the UK's commitments under the United Nations Convention of Biological Diversity.

3.18 Despite this, the UK BAP priority species list and conservation objectives still remain valid through integration with local BAPs (which remain valid), and in the form of the Habitats and Species of Principle Importance list (as required under section 41 of the Natural Environment and Rural Communities (NERC) Act).

3.19 Local Biodiversity Action Plans (LBAPs) ensure that national action plans (the UK BAP/Biodiversity 2020) are translated into effective action at the local level, and establish targets and actions for locally characteristic species and habitats.

3.20 The Estate is subject to the London and Tower Hamlets BAP.

3.21 Specific features of the London BAP4 that are relevant to this report include;

- House Sparrow SAP;
- Sand martin SAP:
- Bat SAP;
- Black redstart former SAP;
- Grey heron former SAP;
- Peregrine falcon former SAP;
- Parks and urban green spaces HAP;
- Reedbeds HAP;
- Tidal Thames HAP;
- Standing water HAP;
- Wasteland HAP; and
- A focus on the built environment.

3.22 Priority habitat and species listed in the Tower Hamlets BAP include:

- Standing water (canals and docks);
- Reedbeds;
- Bats;
- Peregrine;
- Black redstart;
- House martin;
- Sand martin;

- House sparrow;
- Swift;
- Stag beetle;
- Streaked bombardier beetle (*Brachinus sclopeta*);
- Jersey cudweed (*Gnaphalium luteoalbum*);
- Bumblebees (*Bombus* species); and
- Common Tern.

3.23 Action plans of relevance include:

- Built environment; and
- Rivers and standing water.

3.24 Actions within this Roadmap should accordingly give consideration to the potential impacts, or benefits that could be provided for these species and habitats, and should reflect actions described in the relevant actions plans which include:

- Built environment
  - To include biodiverse roofs which meet the definition of open mosaic habitats on all new development;
  - To include living walls with nectar-rich climbers in new development;
  - To provide planters with nectar-rich flowers in new development;
- Docks, reedbeds and standing water
  - To maintain the biodiversity value of canals by controlling invasive species;
  - To enhance docks by providing vegetation on walls and floating islands;
  - To increase the area of reed beds by planting new reed beds along rivers, canals and dock walls and on floating islands in the docks;
  - To fit vegetated gabion baskets to walls of rivers, canals or docks within or adjacent to development sites;
  - To install vegetated rafts in docks within or adjacent to development sites;
  - To install tern rafts in docks within or adjacent to development sites;
  - To eradicate invasive plants from water bodies within or adjacent to their development sites.

- Bats
  - To ensure potential impacts on bats are considered in the assessment of all planning applications;
  - To provide roost sites for bats, such as bat boxes or bat bricks, in new developments, housing estates, parks and schools in parts of the borough where bats are likely to use them;
  - To encourage nocturnal insects by planting night-scented plants in landscaping schemes in parts of the borough where bats are likely to forage.
- House sparrow, black redstart, peregrine, kingfisher, sand martin and swift
  - To ensure that the possible presence of black redstarts is considered in the assessment of planning applications;
  - To increase the availability of nest sites for by installing boxes/nest sites.
- Bumblebees
  - To increase the food resource for bumblebees and other pollinators by planting nectar-rich flowers in parks, gardens and the built environment, including growing ivy on suitable structures in sunny places;
  - To increase nesting sites for bumblebees by installing bee boxes or insect hotels in suitable places.
- Beetles
  - To increase the available habitat for stag beetles and other deadwood invertebrates by creating loggeries in parks, housing estates and community gardens;
  - To ensure that the redevelopment of sites which contain suitable habitat for the streaked bombardier beetle takes account of the possible presence of this rare species.
- Jersey cudweed
  - To ensure the known populations of Jersey Cudweed in the borough are protected or, where this is not possible, their loss is appropriately mitigated;
  - To ensure that development sites in Docklands with suitable habitat are surveyed for Jersey Cudweed so that it can be properly considered in assessing planning applications.

Biological Records

3.25 Consultation with Greenspace Information for Greater London (GiGL) provided a biological records search for an area of 2km radius from the centre of the Estate. Primarily, this highlighted statutory and non-statutory designated sites, and rare, notable and protected species records within the search area.

3.26 Designated sites identified as being most relevant to the Estate are predominantly aquatic; these include the River Thames and tidal tributaries Metropolitan Site of Importance for Nature Conservation (SINC) and Millwall and West India Docks Borough II SINC. Despite the presence of local designated sites, the Estate falls within an Area of Deficiency (AoD) which are defined as built-up areas more than one kilometre actual walking distance from an accessible Metropolitan or Borough site.

3.27 In total, 4 Local Nature Reserves (LNR) and 26 SINCs were identified within the search area. Table 3.1 below outlines a selection of those.

3.28 The species records include a wide range of important plants, invertebrates, and birds, however the majority of these are over 1km from the centre of the Estate and are not directly linked to habitats and features currently present. There are records for several urban adapted species including birds such as black redstart, swift and house sparrow, and bats such as noctule and pipistrelles which may occasionally forage over the Estate and adjacent open water.

Table 3.1 ***Designated Sites within 2km of Canary Wharf.***

Site Name and Designation	Location	Description
Mudchute Park Farm LNR	1.2km South	Mudchute is a 32-acre site with a working farm and stables and a wide range of habitats, from wetlands and woodlands to open meadows and field margins.
Lavender Pond LNR	1.2km West	Lavender Pond, is a local nature reserve based on a reservoir that was used to maintain water levels in the Surrey Docks. It has reed beds and islets, and a museum that serves as a teaching centre.
Ackroyd Drive LNR	1.9km North	The site has a varied network of paths across woodlands and wildflower meadows.

Tower Hamlets Cemetery Park LNR; SINC – Metropolitan	1.9km North	This Cemetery is a stronghold for four butterfly species in the East End – holly blue, brimstone, orange tip and speckled wood. Other features of interest include mature trees and three ponds which have been created.
London's Canals SINC – Metropolitan	1.5km Northwest	London's canals support a wide range of aquatic flora, amongst which are found a number of locally uncommon species.
River Thames and tidal tributaries SINC – Metropolitan	0.5km West	The River Thames and the tidal sections of creeks and rivers which flow into it comprise a number of valuable habitats not found elsewhere in London. The mud-flats, shingle beach, inter-tidal vegetation, islands and river channel itself support many species from freshwater, estuarine and marine communities which are rare in London.
Mile End Park SINC – Metropolitan	1.5km Northwest	A linear site adjacent to the Regents Canal, stretching from Victoria Park to St. Pauls Way. The site comprises linked areas of amenity and herb-rich grassland habitat, with numerous trees, discreet areas of woodland and scrub and formal planted beds of aromatic and nectar-rich herbs.
Russia Dock Woodland & Stave Hill Nature Park SINC – Borough Grade I	1.4km West	Russia Dock Woodland is a linear park created in 1980, with belts of mixed woodland and scrub, which contain a high diversity of mostly native species, areas of grassland which have been sown with wildflower mixes, and a linear water feature connecting a series of ponds and lakes. The adjacent Stave Hill Nature Park has been developed since 1987, and now contains an excellent range of habitats, including several types each of scrub, woodland and grassland, two ponds and a short section of chalk stream, as well as a butterfly garden.
Blackwall Basin	0.5km East	This large area of open water has hard surfaces around the perimeter, apart from a margin of grassland, scrub and tall herbs along the south a

SINC – Borough Grade I		side. Common terns nest on rafts in Blackwall Basin, and small numbers of tufted duck, great crested grebe, cormorant, coot and mallard are regularly present, with larger numbers of waterfowl in hard winters.
Millwall and West India Docks SINC – Borough Grade I	Adjacent to Site	These large areas of open water are surrounded by dense and high-rise development. The vertical concrete walls of the docks support a sparse flora where the old brick and stonework is still extant. Millwall Outer Dock supports the greatest number of colonising plant species on its sides, some associated with wetland habitats, others with terrestrial habitats.

3.29 Records of the following species were identified within 2km of the Estate and have been noted as being of relevance to this assessment:

- Birds
  - Black Redstart
  - Peregrine Falcon
  - Swift
  - House Sparrow
  - House Martin
  - Kingfisher
  - Grey Heron
- Bats
  - Common, Nathusius's and Soprano Pipistrelles (Pipistrellus pipistrells, P. nathusii and P. pygmaeus)
  - Noctule (Nyctalus noctula)
  - Leisler's (N. leisleri)
  - Daubenton's (Myotis daubentonii)
- Invertebrates
  - Brown Banded Carder Bee
  - Yellow Legged Mining Bee (Andrena flavipes)
  - Large Yellow Faced Bee (Hylaeus longiceps)

- Marbled White Butterfly (Melanargia galathea)
- Mullein Wave (Scopula marginepunctata)

- Mammals
  - Water Vole
  - Hedgehog
  - Grey seal (Halichoerus grypus)

3.30 The above species list reflects those ecological receptors that would be suitable to provide targeted enhancement features to encourage their dispersal onto the Estate. Some of these features have been built in to existing development plots such as living roofs, bird nest boxes and bee hotels. However, there are opportunities to provide further enhancements across both the existing landscaping and buildings and future development plots to maximise the biodiversity value in Canary Wharf.

Parks and Open Green Spaces

3.31 There are three 'typical' urban parks across the Estate, Jubilee Park, Canada Square Park and Westferry Circus, along with the Crossrail Place Roof Garden, a more unusual space located above the new Crossrail station and retail development. These parks are all effectively,
in engineering terms, intensive living roofs, given their position above the underground network of development beneath the street level of the Estate. However, they function as typical ground level urban parkland spaces and have therefore been classified as such in this assessment.

3.32 Biodiversity value is limited in Jubilee Park, Canada Square Park and Westferry Circus, with habitats comprising mostly non-native street trees amongst heavily managed amenity grassland space. Beech hedging and some areas of herbaceous and shrub planting can be found within the parks, however these habitats are largely considered of low ecological value.

3.33 Bird nest boxes are located throughout Jubilee Park however no evidence of use was noted.

3.34 Bed planting across the site contains a variety of herbaceous and shrub species, although the majority are of low ecological value.

3.35 Crossrail Gardens supports a diverse floral assemblage, however there are very few native species of noted value for wildlife. It is probable that honey bees find some value in the small number of nectar producing plants, however notable native pollinator species are not likely to derive high value.

Living Roofs

3.36 There are thirteen buildings across the Estate that support living roof spaces. Ten of these comprise sedum roofs with limited floral diversity and vegetative structure. Two substrate-based bio-diverse roofs were identified, on 1 Westferry Circus and 10 Cabot Square; the latter of which could not be directly accessed and was assessed from height. These were both in a poor condition. A single intensive living roof garden was identified on 20 Bank Street comprising raised beds of herbaceous and shrub planting; species here were all non-native however there were several species of potential value for pollinators and honey bees were noted as foraging across the roof space.

3.37 Jersey cudweed (Gnaphalium luteoalbum), a protected plant species listed on schedule 8 of the Wildlife and Countryside Act, 1981 (as amended), was noted on the sedum roof on 15 Canada Square. This species can be found in several locations through east London, and is abundant around the Milwall Docks ~200m south of the Estate. Its conservation significance has been called into question in recent years (it is considered likely to have been introduced to this region) and a Defra review of schedule 8 is outstanding, however this species is nonetheless still afforded legislation protection.

3.38 In total over 8000m^2 of living roof cover was identified.

3.39 The living roof on 1 Westferry Circus was used as a ‘biodiverse roof laboratory’, studied as part of a PhD thesis related to living roof biodiversity; this was monitored between 2002 and 2012, although the results of this monitoring have not been made available for this assessment.

Street Trees and Landscaping

3.40 A detailed assessment of the street trees was undertaken during the arboricultural survey, however notes were made during the ecological appraisal relating to the ecological value of the trees.

3.41 On the whole tree species across the site are non-natives and of limited ecological value; although the denser tree coverage and arboreal connectivity in the parks are likely to provide some value for common passerine bird species, including blackbird which has been recorded nesting. There are also several species which are noted as providing a food source for bees and other pollinators. These trees include bird cherry, tulip tree, sycamore, broad-leaved lime and horse chestnut, as listed in the Urban Bees ‘Trees for Bees’5 advice note.

Aquatic Habitats

3.42 Open water habitats are abundant across the Estate with large areas of open water in the North, South and Middle Docks, along with the surrounding West India Quay, Milwall and Blackwall Dock Basins, and surrounding Thames.

3.43 The docks are likely to provide habitat for a number of notable aquatic species; juvenile fish in particular are likely to benefit from the sheltered environment provided.

3.44 Floating islands ('floating reed bed') are present in the Middle Docks; this feature is in a poor condition with patchy vegetative coverage, and incursion by ruderal weed species. There is nonetheless evidence of nesting on the islands by common aquatic bird species such as mute swan, mallard and moorhen.

3.45 Aquatic invertebrate habitat is present throughout the basins mostly in the form of wood cladding around the basin edges; boring Mollusca and Polychaeta species are likely to benefit from these features.

3.46 Reedbeds installed adjacent to Crossrail seemingly provide valuable shelter and feeding for juvenile fish which have been observed in high numbers shoaling in this location.

3.47 A Grey seal (Halichoerus grypus) has been observed on several occasions in the dock basins surrounding the Estate; this species is listed as a priority marine species on the UK BAP.

Nesting Opportunities and Other Ecological Features

3.48 Standard bird nest boxes have been installed on trees across the Estate, including within Jubilee Park. Anecdotal evidence suggests these have historically been used by great tits – no other species have been recorded as nesting within these boxes.

3.49 Anecdotal evidence suggests that peregrine falcons have been noted at the site.

3.50 Swift boxes have been installed on 1 Canada Square Park, however these had not been visited at the time of writing to confirm continued presence and usage.

3.51 Bee hives were observed on the rooftop of 15 Canada Square Park alongside 'bee friendly' planting in some small raised beds.

Future Scenario Assessment

3.52 An assessment was also made of the proposed ecological mitigation, compensation and enhancement actions associated with upcoming development across the Estate. All planning documents relating to ecology for future development schemes (both consented and still within planning) were analysed. These future development plots were mapped and the features listed in the results table (see Appendix 1). The key future development plots assessed, along with their primary proposed ecological design features included:

- 1 Bank Street – proposals included the provision of 8 bird boxes (targeting house sparrow, black redstart and swift) and 2 bat boxes, a brown roof, alongside invertebrate features on the roof, wildlife friendly landscaping, street trees and an aquatic invertebrate wall;
- Wood Wharf – this project includes a wide range of ecological enhancements, including:
  - Biodiverse roofs;
  - Ecology islands and aquatic invertebrate walls (timber cladding);
  - Wildlife friendly aquatic vegetation;
  - Fish refuges;
  - Wildlife friendly landscaping; and
  - Bird boxes for black redstart, kingfisher, sand martin, swift, house sparrow and tern rafts.
- 10 Bank Street – proposals include provision of house sparrow boxes, an aquatic invertebrate wall and street trees.
- Newfoundland – this site included bird boxes, landscaping, a trellis system living wall and areas of biodiverse and wildflower living roof.

3.53 Key actions for these plots going forward will also be listed in the evidence review results table at Appendix 1; crucially, this will be an evolving document that changes to reflect progress at site.

GIS DATABASE

3.54 A database of all collected biodiversity information for Canary Wharf and its surroundings has been collated within a GIS format.

3.55 At this stage, all data included within the database has been obtained from the field, direct consultation or open sources.

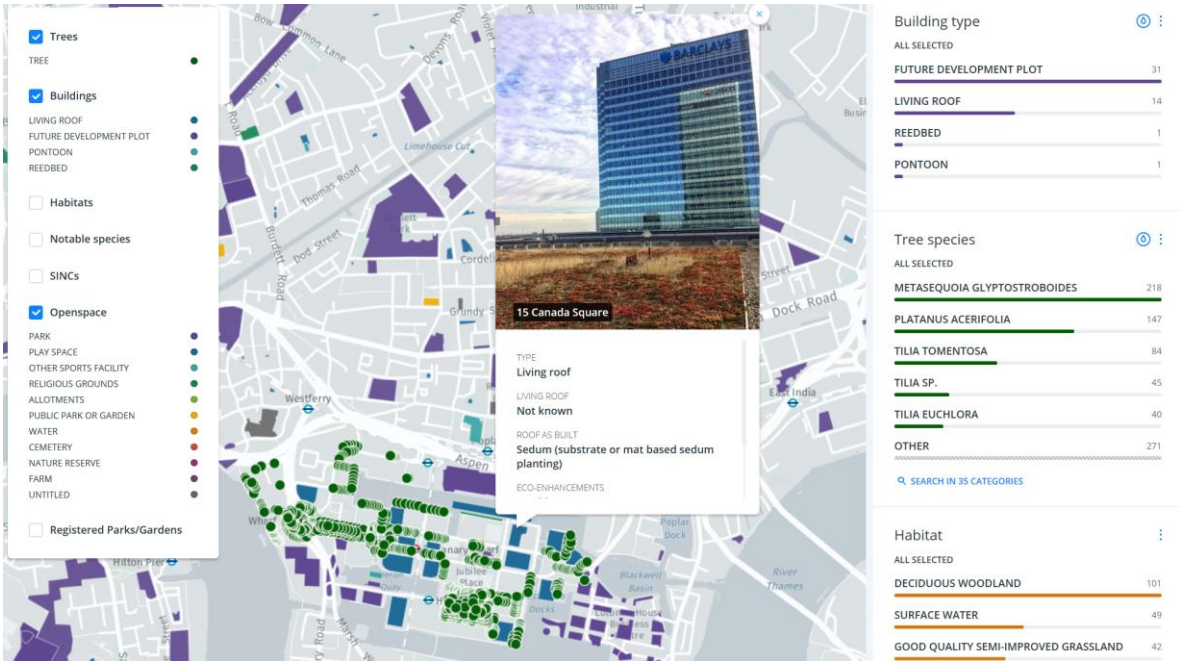
3.56 The interactive map currently holds the following information:

- Living roofs with detail on design intention, ‘as built’ condition, additional enhancement features and quality;
- Future development plots and design intention;
- Tree locations with information recorded during the arboricultural survey;
- Parks and open spaces; and
- Notable species records.

3.57 The interactive map has been developed to work as an iterative system, regularly updated with new data as it is collected or made available.

3.58 The full results of the desk-based assessment and site survey can be found at Appendix 1 of this summary report. In turn, the results can be found on the online interactive GIS (Geographic Information System) database.

Figure 3.1 GIS database for Canary Wharf Estate



ECOSYSTEM SERVICE VALUATION

3.59 Greengage undertook an exercise to identify the most appropriate ecosystem service valuation tools to assess the Canary Wharf site.

3.60 The selected methodologies will be applied to define and evaluate the quantitative and qualitative benefits of Canary Wharf's greenspace and ecological features. The outputs of the ecosystem valuation will not only explicitly demonstrate the intrinsic value of this natural capital as a baseline, but will also identify the most effective forms of investment in green infrastructure – be it street trees, accessible amenity space, or biodiverse roofs – informing future design interventions and management decisions, and ensuring these ecosystem services are delivered in the most effective way.

3.61 Some further context on the process of ecosystem service valuation is provided in the text below.

Comments on Ecosystem Service Valuation

3.62 Where possible, we have sought to characterise and evaluate the ecosystem service provision (ESV) of biodiversity features across the Estate.

3.63 These services are the manifestation of what is termed natural capital, the stock of renewable and non-renewable resources from which we derive value. Inherently, all financial capital relies on its natural cousin, with the flow of associated services literally providing us with the water we drink, the food we eat and the air we breathe.

3.64 Ecosystems should therefore not be regarded solely as wild spaces removed from our sheltered urban existence; they are vital to our ability to combat climate change and live sustainably. Understanding and appreciating their value for sites such as Canary Wharf is therefore crucial to inform practical, 'future proofed' policy production and application.

3.65 Valuation is a relatively novel concept however with most assessment tools in their infancy.

3.66 The idea of placing a value on nature, while useful, poses many risks, and paves the way for all natural capital decisions to be made from a purely financial perspective. An important consideration from the outset, therefore, is that ecosystem service valuation should not only dwell on financial output, but also on often unquantifiable elements such as aesthetic value. Implicitly, the valuation process runs the risk of making a trade-off between a development and ecosystem conservation, particularly where assessment may prioritise a course of action such as habitat destruction. It is therefore best handled with care.

3.67 There are several valuation tools and approaches however that present themselves as potentially valuable resources for defining ecosystem service provision across the Estate. These tools are discussed in the following section.

Ecosystem Service Valuation Tool Appraisal

3.68 In analysing the most appropriate assessment tool, several key criteria alongside optional but desirable features were considered:

- Geographical relevance (key);
- Appropriate scaling (key);
- Appropriate to habitat types present (key);
- Time efficient (key);
- Replicable and quantifiable approach (key);
- Level of data detail (key);
- Can be 'site based' (key);
- Inclusion of non-monetary elements (desirable);
- Precedent of use in London or the UK (desirable).

3.69 'Tools' can take the form of guidance documents, checklists, or quantitative models using GIS or online mapping platforms, which can perform a multitude of functions and provide a wide variety of outputs.

3.70 The key required outputs for the ESV at Canary Wharf include:

- Define financial benefit afforded by habitats/ecosystems across the Estate;
- Define health and well-being benefits;
- Define and inform future approach to new development and interventions to combat climate change impacts.

3.71 A selection of available valuation tools/methodologies are listed in the table below. This list is informed by available methods described on the Ecosystems Knowledge Network's Tool Assessor resource[6], Defra's guide to ecosystem service valuation[7], the Ecosystem Service Mapping Gateway website[8], National Ecosystem Approach Toolkit (NEAT)[9] and a literature review of optimal ecosystem service valuation toolkits for generalised use based on open source academic research[10] [11] (pure accounting tools such as Cost Benefit Analysis calculations and the Corporate Ecosystem Valuation Tool[12] have been ruled out from the outset due to their 'product focused' output, alongside several geographically discrete models and approaches):

Table 2.1 ***Available valuation tools / methodologies***

Tool/methodology	Comments
InVEST – Integrated Valuation of Ecosystem Services and Tradeoffs (www.naturalcapitalproject.org/invest/)	ArcGIS integrated tool. Free and open source model. Used for wide range of applications usually relating to service provision over large spatial scale. More applicable to non-urban environment. Complex and requires academic input.
i-Tree Eco (www.itreetools.org/eco/)	Software application that uses urban street tree data to extrapolate service provision value. Provides financial output. Has been used across London, excluding the Canary Wharf Estate. Applicable to 'site based' assessment. Targets trees which are primary green infrastructure feature at the site. Suitable spatial resolution. Appropriate outputs.
Land Utilisation and Capability Indicator (LUCI) (www.lucitools.org/)	ArcGIS integrated tool. Uses range of openly available environmental data to model service provision throughout a landscape; these data would generally not be applicable or available for Canary Wharf however. Not available for general use yet.

ARIES – Artificial Intelligence for Ecosystem Services (www.ariesonline.org)	Model run in dedicated software k.Lab. Awaiting development of online platform for wide public use. Most case studies focus on landscape scale modelling. Complex; needs new model for each case study. 'Modules' assessing individual services are largely not applicable to Canary Wharf focusing on large scale flows of ecosystem services such as sediment regulation. Not been readily used in UK.
Eco-SERV GIS (http://arcg.is/1HFLHHv)	GIS toolkit for mapping ecosystem services at a county or regional scale.
Co$ting Nature (www.policysupport.org/costingnature)	Web based tool for natural capital accounting. Allows for accounting of baseline provision and speculative provision following intervention; has a 1 hectare resolution however which is unlikely to factor in features of interest within the Estate.
Toolkit for Ecosystem Service Site-Based Assessment (TESSA) (http://tessa.tools/)	Allows non-specialists to carry out an ecosystem service assessment for a 'site-based' area. It was created to make ecosystem service assessment cheaper and less technically challenging. It aims to promote better land use planning decisions.
Natural Capital Planning Tool (NCPT)	Recently released – not assessed.
Value/Benefit Transfer Calculation	Practical implementation of Ecosystem Services Framework in decision-making; transfers value from existing site data from real world market derived scenarios and Total Economic Value (TEV) approach[13], where monetary value cannot be assigned from real-world data, to ecosystem service provision value. Heavily relies on level of subjective assessment however and is less structured than some other assessments, making comparative repeatability challenging.
Green Infrastructure Valuation Toolkit (2008)	Provides a set of calculator tools to assess the value of a green asset or a proposed green investment. Where possible, the benefits of green infrastructure

http://www.greeninfrastructurenw.co.uk/html/index.php?page=projects&GreenInfrastructureValuationToolkit=true	(GI) are given an economic value. Other quantitative contributions (e.g. number of jobs) and qualitative contributions (e.g. case studies or research) can also be provided to give a complete view of the value of an asset. Uses Excel spreadsheet calculator tool. Easily applied.

3.72 Of the above, the following assessment tools were identified as being appropriate for application at Canary Wharf:

- i-Tree Eco – reasons for suitability include:
  - Uses local meteorological and pollution data;
  - Can be implemented at a small-medium scale (full inventory) or large scale (random plot sample);
  - Ecosystem services valuation based on tree population which is an integral feature of the Estate's green infrastructure;
  - Data takes some time to collect however, analysis and results are instantaneous;
  - Standard methodologies are employed to ensure the results are replicable and comparable;
  - Provides monetary values for ecosystem services in addition to quantitative and qualitative information regarding the urban forest structure; and
  - Has been utilised on several city/town-wide projects in the UK.
- Green Infrastructure Valuation Toolkit:
  - Free and open source;
  - Uses excel;
  - Allows for standardised approach to measure 'before and after' scenarios based on proposed intervention or following actual action;
  - Measures wide range of interventions;
  - Is applicable at small scale; and
  - Applicable to the UK.

i-Tree

Introduction

3.73 The i-Tree Eco tool was initially developed to help managers and researchers quantify urban forest structure and functions based on standard inputs of field, meteorological, and pollution data. The model currently calculates the following parameters based on local measurements:

- Urban forest structure, including species composition, tree cover, tree density, tree health (crown dieback, tree damage), leaf area, leaf biomass, and information on shrubs and ground cover types;
- Hourly pollution removal by the urban forest for ozone, sulphur dioxide, nitrogen dioxide, carbon monoxide, and particulate matter (PM10);
- Effect of trees on building energy use and related reductions in carbon dioxide emissions;
- Total carbon stored and net carbon sequestered annually by trees; and
- Exotic species composition.

Methodology

3.74 Trees across the Estate were subject to a detailed full-inventory assessment using i-Tree Eco survey methodology to record information on tree size, condition and site context.

3.75 Specific information collected from the site for the Canary Wharf project is described in table 3.2 below.

Table 3.2 ***Canary Wharf i-Tree Eco variables and descriptions***

Tree variables and descriptions	
Tree ID	Unique tree number
Status	Indicates whether a tree was (P) planted or naturally regenerated (I) in the landscape.
DBH 1-6 (mm)	Diameter at breast height ('DBH') of each tree stem
Tree Height (m) o Total Height o Live top Height o Crown base	- Height to the top of the tree - Height to the live top of canopy - Height to the base of live crown

Crown width (m)	Recorded as two measurements (N-S & E-W)
Canopy o Canopy missing o Dieback o Impervious ground o Shrub cover o Crown light exposure	- Percentage of crown volume that is not occupied by leaves to nearest 5% - Percentage of crown dieback to nearest 5% - Percentage of impervious ground beneath canopy - Percentage of land beneath canopy drip line which is occupied by shrubs - Number of sides of the tree receiving sunlight ('CLE')
Tree site	Used to identify street trees

3.76 The information described in table 3.2 was collected for each tree within the Estate.

3.77 The locations of trees were recorded using a GPS unit (Garmin Oregon 650t) and mapped onto a GIS map using QGIS software. Due to the prevalence of tall buildings, the GPS accuracy was reduced. In these instances, the trees were manually repositioned to the correct locations using information recorded during the survey.

3.78 The full inventory tree survey data was analysed using i-Tree Eco, an ecosystem valuation tool that quantifies the ecosystem services urban trees provide. This tool has been utilised extensively in the United States and Canada (where it was developed) and has been implemented on several projects in the UK in recent years, the most significant of these being the London i-Tree Eco Project (2015)14.

3.79 The specific outputs from the Estate i-Tree Eco analysis are described below.

Results

Air Pollution Removal

3.80 Pollution removal by trees in Canary Wharf was estimated using field data and recent available pollution and weather data available. Pollution removal was greatest for nitrogen dioxide. It is estimated that trees remove 0.126 tonnes of air pollution (ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter less than 2.5 microns (PM2.5), and sulphur dioxide (SO_2)) per year with an associated value of £9,570.

Carbon Storage and Sequestration

3.81 Trees reduce the amount of carbon in the atmosphere by sequestering atmospheric carbon into new growth every year. The amount of carbon sequestered annually increases with the size and health of the trees. The gross sequestration of Canary Wharf trees is about 11 tonnes of carbon per year with an associated value of £687.

3.82 Trees also store carbon within their tissues which is released as trees decay and die. Trees in Canary Wharf are estimated to store 154 tonnes of carbon (£9,830). Of the species sampled, London plane stores and sequesters the most carbon (approximately 29.1% of the total carbon stored).

Oxygen Production

3.83 The annual oxygen production of a tree is directly linked to the amount of carbon sequestered by the tree, which is tied to the accumulation of tree biomass. Trees in Canary Wharf are estimated to produce 29 tonnes of oxygen per year. However, this tree benefit is relatively insignificant because of the large and relatively stable amount of oxygen in the atmosphere and extensive production by aquatic systems.

Avoided Runoff

3.84 Surface runoff can be detrimental in urban environments by causing localised flooding and contributing to pollution incidents of streams, rivers and other aquatic habitats. Trees and shrubs can intercept precipitation before it reaches the ground and minimise surface runoff. This is particularly beneficial in urban areas where the ground cover is predominantly hard and impervious.

3.85 The trees of Canary Wharf help to reduce runoff by an estimated 198 cubic meters a year with an associated value of £300. Avoided runoff is estimated based on local weather from the nearest weather station. In Canary Wharf, the total annual precipitation in 2013 was 31cm.

Structural Value

3.86 The structural value of the trees in Canary Wharf was calculated at £658,000 – this is estimated to be the cost of having to replace a tree with a similar specimen.

i-Tree Summary

3.87 The tree population was found to provide a mix of over 30 species, amounting to 4.3% tree cover in the Estate. A summary of the ecosystem services the trees in Canary Wharf provide are listed below:

- Air pollution removal: £9,570/year
- Carbon storage: 154 tonnes (total), (£9,830)
- Carbon sequestration: 11 tonnes/year (£687/year)

- Oxygen production: 29 tonnes/year
- Avoided runoff: 198m^3/year (£301/year)
- Structural value: £658,000

GI Valuation Toolkit

3.88 Use of this toolkit is ongoing at the time of report production. Final results will be available in 2018.

Climate Change Resilience

3.89 There is near universal scientific agreement now that human caused climate change is happening and will have long term impacts upon the built environment. The UK Climate Impact Programme produces climate change projections for the UK and is underpinned by a unique methodology developed by the Met Office. The key climate projections over the next 50+ years for the UK are:

- Summers will become hotter and drier;
- Winters will become milder and wetter;
- Soils will become drier on average;
- Snowfall and the number of very cold days will decrease;
- Sea levels will rise; and
- Storms, heavy and extreme rainfall, and extreme winds will become more frequent.

3.90 Adaptation to these future climatic conditions is important if the spaces we occupy are to remain useable and safe. Adaptation also can give rise to opportunities such as securing the long-term sustainability of investment decisions, reducing risks to business continuity and creating more attractive environments for employees and visitors to the Estate.

3.91 Whilst there are several climate change adaptation functions that the proposed biodiversity enhancements for Canary Wharf may have, for the purposes of this exercise, we have focussed on the appropriateness of planting for particular urban heat island conditions. The overall aim is to ensure that any biodiversity enhancements incorporated within the wider design principles of this Roadmap take consideration of the climatic context of the Estate. Specifically, planting should:

- Be appropriate to the level of direct and reflected light received (there is significant variation due to the presence of tall buildings in close proximity) and the ability for the species to flourish;
- Provide a service to the human use of particular locations, for example by providing sufficient shade at ground level for areas where people are likely to dwell and which are exposed to the most significant UHI;

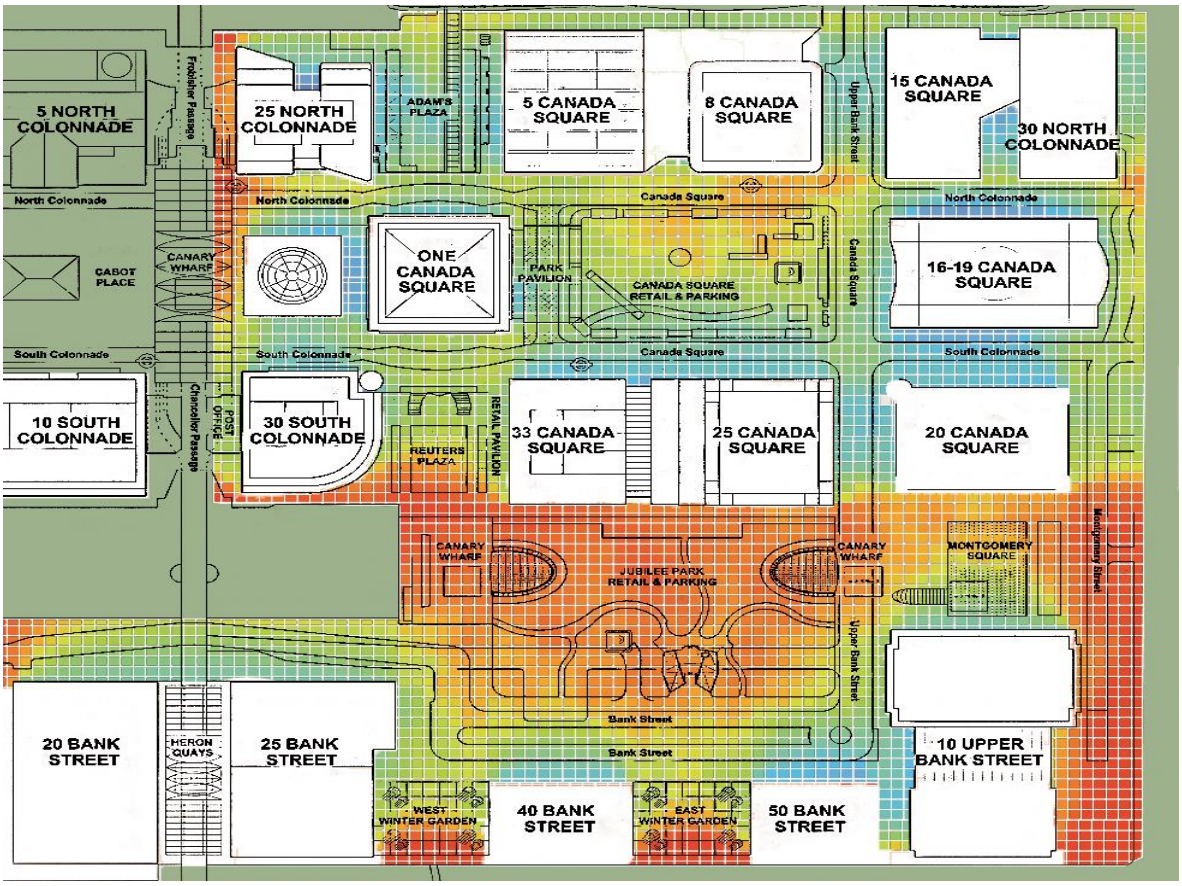
- Provide a service to buildings where UHI effects cause excessive heat build-up, for example through insulation or shading properties; and
- Be appropriate to naturally dry or moist conditions caused by micro climatic conditions so as to minimise need for irrigation.

Modelling

3.92 A 3D model of the Estate was used to analyse the current and future UHI environment for the spaces at ground level and for the roof areas of key buildings. IES software processed weather data specific to London, considering direct sunlight, reflected sunlight and diffuse radiation. This data was then presented on a plan of the Estate showing a grid of the 'UHI' for different locations (represented through different coloured squares). The output is a map of the Estate that allows the reader to understand where the likely hottest and coolest locations are both at ground level and on roofs (see Figure 3.2).

3.93 The same modelling is then carried out for future climate scenarios by using CIBSE weather data through to future years of 2030, 2050 and 2080. This gives an accurate long-term view about the different climate conditions across the site and serves as a reference for decision makers considering the wider recommendations of the design principles. In areas where high heat stress is indicated, particular preference should be made towards drought tolerant species (please refer to appendix 5 for a list of example appropriate species). Appendix 6 presents the full outputs of the current and future urban heat island modelling.

Figure 3.2 UHI Model of Canary Wharf (current day)



Health, Well-Being and Usability Assessment

3.94 Another key interaction that should be considered when implementing the recommendations of the BAP is the way in which it complements or enhances the user experience of the Estate. Many of the open spaces are well utilised by visitors and employees of the various businesses in the vicinity. An exercise is currently underway to establish how occupiers and visitors currently interact with the public realm spaces, their perceptions towards biodiversity/green space, and how this affects their wellbeing.

3.95 A questionnaire has been circulated to entrants in the Canary Wharf Wildlife Photography Competition which aims to establish why people use the open spaces, what features they value, and what could improve the user experience of the parks and open spaces. The results of this survey will then be used to provide an additional layer of consideration for decision makers when implementing the recommendations of the Roadmap.

3.96 Key outputs from this exercise will be included in the Health and Well Being Strategy for the Estate, which is currently under production alongside this document.

4.0 BIODIVERSITY OBJECTIVES AND KEY PERFORMANCE INDICATORS

4.1 The baseline assessment has identified the following key target habitats and species which are either known to currently be present, or have the potential to be present, following interventions and careful management across the Estate.

4.2 Fundamentally, objectives must be realistic about what species may stand to survive in the innately harsh conditions of a heavily urbanised environment such as Canary Wharf. Targets should also be 'future proofed' reflecting the likely unavoidable changes in urban habitats and species compositions. These objectives therefore differ in some ways from the targets of the 2008-2013 CWG BAP.

4.3 Key habitats and taxa/species considered in this document, as identified within the baseline appraisal process, include:

Habitats

- Aquatic habitats;
  - open water;
  - floating rafts;
  - reedbeds; and
  - basin walls/structures
- Shrub and herbaceous beds;
- Parkland;
- Street trees; and
- The built form – open mosaic habitats, living roofs, walls and artificial nesting habitat.

Taxa/species

- Plants;
  - Protected/notable plant species such as Jersey cudweed; and
  - Pollinator friendly species.
- Birds;
  - Black redstart;
  - Peregrine falcon;
  - Kingfisher;
  - Swift;
  - House sparrow;

  - Waterfowl; and
  - Common Tern.
- Invertebrates;
  - Solitary bees and bumblebees;
  - Lepidoptera; and
  - Coleoptera such as stag beetles.
- Mammals;
  - Common pipistrelle bat; and
  - Seals.
- Fish;
  - Juvenile Sea Bass (Dicentrarchus labrax);
  - Thin-Lipped Grey Mullet (Chelon labrosus);
  - Smelt (Osmerus eperlanus);
  - Flounder (Platichthys flesus);
  - Sprat (Sprattus sprattus);
  - Plaice (Pleuronectes platessa);
  - Bream (Sparus aurata and Spondyliosoma cantharu);
  - Perch (Perca fluviatilis);
  - Roach (Rutilus rutilus); and
  - Rudd (Scardinius erythrophthalm*us*).

4.4 Alongside these habitats and species, the following ‘benefit themes’ are also considered as key target areas for the Estate:

- Ecosystem service provision;
- Ecological connectivity through green linkages and sensitive lighting;
- Management, maintenance and monitoring;
- Air and water quality and pollution control;
- Health and well-being;
- Public participation and connection with nature; and
- Climate change adaptation such as UHI effect and flood risk alleviation.

4.5 Accordingly, the following objectives and associated key performance indicators should be factored into future and current development plans and management of existing assets at the Estate.

4.6 The new Biodiversity Action Plan also reflects these objectives (see Chapter 6).

Objective 1 – Embed the biodiversity 'net gains' principle within management and planning decision-making across the Estate:

- **Achieve measurable net gains**
- **Improve living roof conditions**
- **Improve faunal diversity**
- **Define clear biodiversity enhancement and management targets for new developments within a Biodiversity design principles Framework**
- **Improve street tree condition and longevity**

Improve pollinator value in landscaping

KPIs – Biodiversity.

Success should be measured through application of biodiversity metrics which compare conditions before and after for the respective intervention, be it a management action or development project. An appropriate metric (see Appendix 4 for metric options) should be applied until a more reliable, cross industry metric becomes available. KPIs include:

- Measure of floral diversity to be taken from living roof spaces.
- Measures of invertebrate, avian and bat diversity can be taken, forming useful proxy measures for ecosystem health.
- Improvement in i-Tree output (such as measure of carbon sequestration rates/storage capacity) and qualitative judgement on overall resilience of street tree network during bi-annual tree status check by an experienced arboriculturalist and environmental consultant.
- Measurable increase in pollinator friendly planting area will act as proxy for measure of landscape value.

Objective 2 – Develop and apply actions for climate change resilience

- **Integrate biodiversity within climate change adaptation and resilience measures**
- **Seek to improve local air quality**
- **Reduce the urban heat island effect**
- **Increase storm water retention capacity**
- **Introduce drought tolerant planting where appropriate**

KPIs – Modelling Results and direct observations, including:

- Measure climate change modelling results based on proposed interventions, before vs after interventions, to include:
  - Measure of actual air quality (targeted decrease in PM2.5, PM10, NO_2, SO_2 and O_3 in µg/m^3), UHI (targeted decrease in UHI modelling polygons at risk locations) and surface water flooding (targeted decrease in risk level shown in predicted models) before vs after interventions – qualitative and quantitative

Objective 3 – Improve ecosystem service value and in particular health, well-being and productivity of Estate users

- **Improve public engagement with nature**
- **Increase awareness of the importance of biodiversity**
- **Integrate biophilia that has positive impact on human health within internal and external design**
- **Increase the number of Attract more occupiers, visitors and users**
- **Work with partners to identify opportunities to expand the Roadmap**
- **Share data and lessons learnt**
- **Improve education and awareness**

KPIs – ESV output and Public Questionnaire Response, including:

- Comparison between direct quantitative and qualitative ESV analysis for existing conditions vs conditions when targeted interventions have been applied.
- Questionnaire results to compare public perceptions under current conditions and after public awareness campaign/education events and nature improvement works.

5.0 BIODIVERSITY DESIGN PRINCIPLES FRAMEWORK

5.1 This chapter presents the ideal planning scenario with respect to ecology that should be adopted by new developments brought forward at the Canary Wharf Estate.

5.2 This sets the Framework for streamlining the design, planning and build process.

5.3 The legislation, policy and best practice basis for this Framework is provided in Appendix 3. The key tenet of this strategy is to achieve measurable net gains in biodiversity, reflecting site wide nature conservation targets, as defined by the baseline appraisal and ecosystem service valuation exercise described in chapters 2-4 of this report.

5.4 This therefore represents an evidence-based framework that embeds emerging and progressive principles within the planning approach for the Estate.

5.5 Figure 5.1 below shows the stages that should be followed by ecologists during typical planning scenarios. The approach should be cyclical and evidence based with approach informed by the success or failures of past schemes.

Figure 5.1 Ideal Ecological Planning Scenario

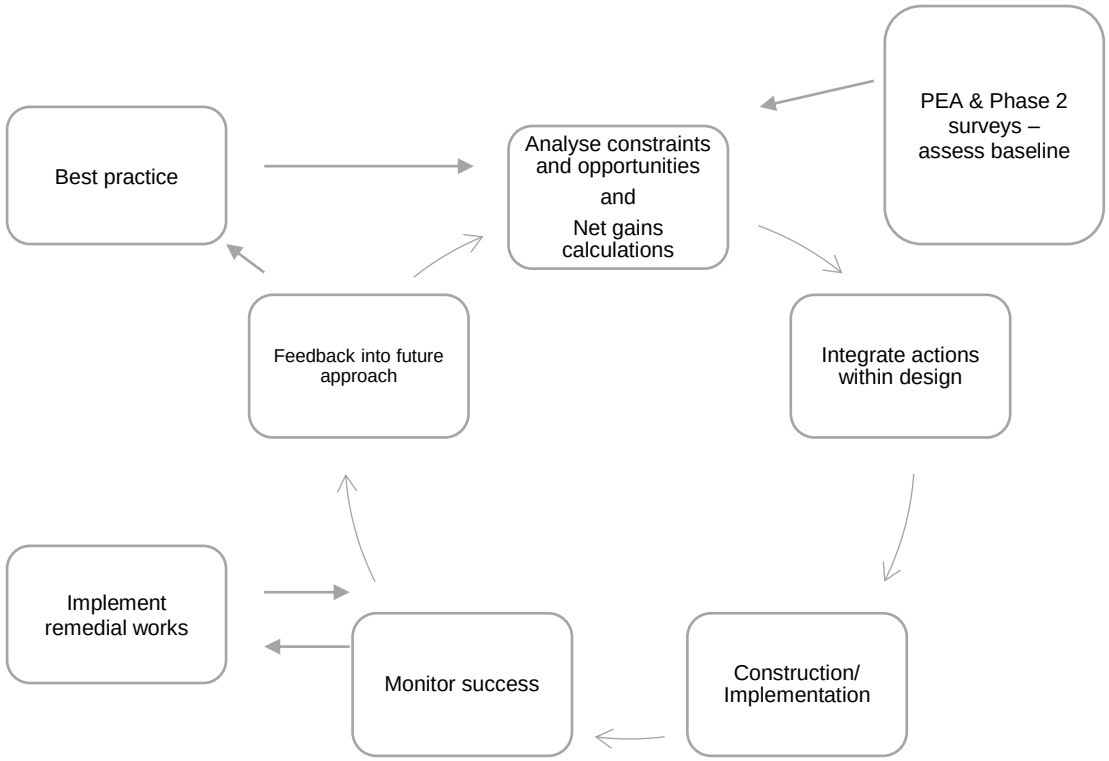


Table 5.1 *Key Actions in relation to RIBA Stage – this table should form a guide for Project Executive and design teams*

RIBA Stage	Action
0 Strategic Definition	• Project Manager (PM) to review current iteration of BAP and Biodiversity Design Principles Framework (BDPF).
1 Preparation and Brief	• PM and design team to consult with project ecologist. • Provide copy of BAP and BDPF to ecologist. • Ecologist should provide comments on likely constraints and appropriate actions which should be factored into design and approach. • PEA and other appropriate baseline assessments required to inform planning application can be undertaken. • Ecological design should form part of Initial Project Brief. • Seasonal time constraints related to ecological surveys should be considered.
2 Concept Design	• PEA and other appropriate baseline assessments required to inform planning application should be undertaken by this stage at the latest. • Ecologist to identify potential impacts and ensure that appropriate mitigation, compensation and enhancement actions, in accordance with legislation and relevant planning policy, best practice (see Appendix 3) and BDFP, are integrated within design and approach. • Ecologist to consult local authority/statutory bodies where appropriate. • If subject to BREEAM, WELL, Code for Sustainable Homes or other environmental assessment criteria, ensures that baseline assessment is compliant, having been undertaken/signed off by Suitably Qualified Ecologist as per BRE definition. • Subject to the creation of new and improved methodologies, an appropriate metric should be applied to measure the baseline and proposed biodiversity value of the site. Proposals should result in net gains in biodiversity as defined by this metric (see Appendix 4 for commentary on how to apply this).

3 Developed Design	• Final planning reports provided by ecologist. • Outputs to be rechecked against BDFP by project manager upon review.
4 Technical Design	• Ecologist to provide further detail relating to any relevant planning conditions/s106 commitments • Ecological Management Plans (EMP) to be produced based on finalised proposals which include actions relating to maintenance and monitoring of ecological enhancements
5 Construction	• Ecologist to oversee key stages of construction in Ecological Clerk of Works (ECoW) role if required within site specific EMP/CEMP • Construction of key enhancement elements should be overseen by ECoW such as living roof installation
6 Handover and Close Out	• Ecologist to undertake Post Construction Review (PCR) to sign off compliance with legislative, planning and BREEAM (if appropriate) commitments. • Implement appropriate remedial actions identified by PCR. • Maintenance, Management and Monitoring to commence as per details within site specific EMP • Handover of actions by ECoW to those responsible for day-to-day management
7 In Use	• On-going Maintenance, Management and Monitoring where appropriate.

Table 5.2 *Key Enhancement Features and Principles to be factored into all new development proposals – this table should be reviewed by design teams and project ecologists to ensure that proposals incorporate appropriate enhancements that reflect the evidence-based biodiversity objectives for the Estate. This table does not include mitigation actions that may be appropriate to be factored into the planning process.*

Feature/Principle	Target Species/ Habitat/Theme	Comments
Features		
Living Roofs (biodiverse extensive)	Invertebrates, birds, bats, floral diversity, open mosaic habitats	Living roofs should be provided on all new buildings where technically achievable. Substrate based systems should be used on all new developments, with 80-150mm depth, plug planted and seeded with appropriate wildflower, sedum and grass mixes. All biodiverse roofs should have depth variation with features such as pebble swirls, sandy piles, log piles, buried logs and rope coils. Roof should provide exposed perches for black redstart and areas where water can pool for birds to drink. Sedum roofs should be avoided. If loading constraint prohibits deep biodiverse substrate then wildflower/sedum blanket should be used with ~80mm of biodiverse roof substrate.
Living Roofs (intensive)	Invertebrates, birds, bats, floral diversity	Intensive roofs should as standard contain at least 10 species of known value for UK pollinator species. These can be selected from the RHS Perfect for Pollinators List[15]. Species that are scented, colourful or used for culinary purposes should be provided to encourage people to interact with planting. Drought tolerant species that respond well to exposed conditions should be chosen given the likelihood of more extreme conditions at roof level.

Aquatic habitats (floating nest platforms)	Invertebrates, fish, birds, aquatic habitats	Developments that take place adjacent to open water should provide new bird nesting platforms where possible. These floating platforms should be anchored and away from disturbance by humans.
Aquatic habitats (reed beds)	Invertebrates, fish, birds, aquatic habitats	Any development that has an opportunity to provide new reedbed habitats should integrate these within landscaping plans. Reedbeds should be planted at a density of 4 plants/m^2 with optimal water depths of 5cm.
Landscaping (planting scheme)	Invertebrates, birds, bats, floral diversity, open mosaic habitats	Landscaped areas should as standard contain at least 10 species of known value for UK pollinator species. These can be selected from the RHS Perfect for Pollinators List. Species that are scented, colourful or used for culinary purposes should be provided to encourage people to interact with planting. Peat free composts should be used, and pesticide and herbicide use should be discouraged. Planting should be drought tolerant and reflect climate change risk modelling where appropriate. Planting (including internal planting) should be chosen for potential to improve Estate user's health and well-being, based on WELL Biophilia criteria.
Landscaping (vertical greening)	Invertebrates, birds, bats, floral diversity	Vertical greening should take the form of climbers/trellis systems or modular systems. Modular systems can be costly and require high water use. Climber/trellis systems can be cheaper however may take time to establish. Either system should use native species where possible that are of value for pollinators or herbivorous insect. Where possible these features should be installed to provide functional

		gains such as noise attenuation or air quality improvement. Planting should be drought tolerant and reflect climate change risk modelling where appropriate. Planting (including internal planting) should be chosen for potential to improve Estate user's health and well-being, based on WELL Biophilia criteria.
Landscaping (amenity space and parkland)	Invertebrates, birds, bats, floral diversity, open mosaic habitats	Areas of amenity space should provide species rich grassland high in native herb species. Management should leave fringes where flowers and grasses are allowed to grow taller, creating structural habitat diversity. Shrub and tree species amongst parkland should be chosen for their longevity, resilience to extreme weather conditions and value for birds and invertebrates, e.g. berry producing shrubs such as blackthorn and hawthorn. Planting should be drought tolerant and reflect climate change risk modelling where appropriate. Planting (including internal planting) should be chosen for potential to improve Estate user's health and well-being, based on WELL Biophilia criteria.
Street Trees	Invertebrates, birds, bats	Street tree planting should be provided where possible on all new development projects. Species should be chosen for their climate change resilience and nature conservation value. A range of species should be provided. Where possible specimens of the same species should be selected from different providers to improve genetic diversity, and therefore resilience to pest and disease.

Invertebrate Features(terrestrial)	Invertebrates, birds, bats, open mosaic habitats	Features should target key invertebrate receptor species including: • Stag beetles – buried loggeries should be provided in shaded spots. • Log piles and 'insect hotels' should be provided as standard on all new development schemes where areas of landscaping are provided, and on living roofs • Sandy piles should be provided amongst landscaping to provide opportunities for ground nesting species such as *Adrena* spp. solitary bees. Pesticide/herbicide use should be avoided. Untreated deciduous native tree species should be used – wood can be sourced from any arboricultural works that take place across the Estate.
Invertebrate Features (aquatic)	Invertebrates, birds, fish, aquatic habitats	Timber, brushes and rope should be provided in subtidal habitats to provide niches for epifaunal and infaunal invertebrates, and algae. Untreated hardwood should be used.
Bird Nest Boxes (passerines and hirundine)	Birds	Boxes for swifts, house sparrows, and black redstart should be provided where appropriate on all new developments; in particular where living roofs and biodiverse landscaping features are provided. Swift boxes should be located on east facing elevations outside of direct sunshine, at least 5m from the ground and away from obstructions and climbing plants. Access holes should be 65mm (w) x 33mm (h). House sparrow boxes should be provided as terraces with three nest holes. 32mm diameter holes should be provided on east facing elevations at 2-5m height. Black redstart boxes should be provided on biodiverse roofs. These should be open fronted,

		75mm high at the front entrance. These should be in sheltered locations on the roofs. Where appropriate, schemes could seek to incorporate a sand martin nesting wall. This should provide between 11-100 holes in a vertical wall with surrounding soft material for further excavation, north facing looking over open water. Generalist bird boxes should be provided for a range of passerine species inbuilt into new buildings or provided on existing or new tree planting. These should provide for a range of species with different nest box needs with a range of 30mm and 45mm entrance hole boxes and some open fronted boxes. Boxes for house sparrows and swifts should be integral to the built form
Bird Nest Boxes (peregrines)	Birds	Peregrine boxes should be provided on all new buildings over 20m tall if appropriate and away from disturbance. Boxes should be open fronted with a raised edge along its open front. The base should have a covering of gravel or pea shingle. Boxes should be 600mm (w) x 900mm (h) x 450mm (d)
Bat Boxes	Bats	Boxes should be placed on south or west facing elevations at 2-5m height away from direct illumination. Boxes should be integral to the built form.
Fish Habitat	Fish, invertebrates, aquatic habitats	Brushes associated with the aquatic invertebrate features will provide niches for fish to lay their eggs. Enhancements should follow guidance provided in the Conservation of Tidal Thames Fish through the Planning Process document produced by the Zoological Society of London (ZSL)[16]. Fish terraces, overhanging habitats such as jetties and novel structures that encourage aggregation of spawning fish should be provided.

Principles		
Survey Best Practice and Mitigation Hierarchy	All	All new developments should follow key guidance relating to ecological surveying (as per guidance provided by the Chartered Institute of Ecology and Environmental Management[17] and within the British Standard for Biodiversity 42020: 2013[18]) and should follow the mitigation hierarchy at paragraph 118 of the National Planning Policy Framework[19].
Biodiversity Net Gains	All	Every new development should result in measurable net gains in biodiversity using appropriate metric presented at Appendix 4.
Connectivity (green links)	Invertebrates, birds, bats, floral diversity, all habitats	New proposals should factor in the presence of existing blue and green links, augmenting links or creating new ones through landscape design.
Connectivity (lighting)	Bats, invertebrates	New lighting should be considerate of potential wildlife corridors on and around the site. New lighting should be in accordance with the Bat Conservation Trust and Institute of Lighting Engineers Bats and Lighting[20] document, with directional, shielded, low UV LED lights used throughout any new lighting strategies. No uncontrolled light spill should occur.. Lighting of open water environments should be avoided.
Flood Risk (surface)	Floral diversity	Where appropriate SuDS or planting that would stand to alleviate surface water flooding/rainwater flow rates should be provided at street level. Systems should follow guidance provided by the RSPB on biodiversity and SuDS[21].
UHI Effect	Floral diversity	Planting should be located in strategic locations where appropriate to reflect predicted trends in warming, providing shelter and evapotranspiration cooling effects. Planting in areas known to suffer from more extreme temperatures should be reflective, with resilient species chosen.

Management and Maintenance	All	All new developments should provide an Ecological Management Plan which describes the mitigation/compensation actions, enhancements provided, and quantifies the biodiversity net gains achieved. Management, maintenance and monitoring actions should be defined in accordance with British Standard for Biodiversity 42020: 2013. Actions should be iterative, informed by monitoring results. Results should be fed back into future versions of this framework to improve approach, reflecting the evidence-based action theme. No herbicides or pesticides shall be used. In particular glyphosates and neonicotinoid containing products will be strictly avoided.
Air Quality	Floral diversity	Planting should be considerate of air quality risk hotspots; where possible species should be chosen to improve pollutant deposition, with location informed by greatest improvement to dispersal.
Water Quality	Floral diversity	Planting should be provided to reduce run off of grey water into open basins. Basins should also include aquatic vegetation such as reedbeds which help filter water and sediment, improving water quality.
Drought Resistance	Floral diversity	Planting should be drought resilient, in particular where climate change risk modelling identifies heighted UHI risk.
Health and Well being	Floral diversity	Planting should reflect Biophilia criteria under WELL, in particular when designing planting schemes for internal areas.
Invasive Species Management (terrestrial)	All	Care should be taken within procurement and construction to avoid introduction of invasive species and management plans should factor in consideration of invasive species. The current list of Species of Concern by the London Invasive

		Species Initiative (LISI) alongside species listed on the Wildlife and Countryside Act (1981) as amended should be reviewed. Key terrestrial Schedule 9 and LISI plant and animal species of relevance at Canary Wharf include (but are not limited to): • Asian hornet; • Oak processionary moth; • Japanese knotweed; • Rhododendron; • Pale galingale; • Cherry laurel; • Snowberry; • Cotoneaster species; and • Giant hogweed. GB Non-Native Species Secretariat species ID sheets on respective species should be provided to construction teams and Estate management teams
Invasive Species Management (aquatic)	All	Care should be taken within procurement and construction to avoid introduction of invasive species and management plans should factor in consideration of invasive species. The current list of Species of Concern by the London Invasive Species Initiative (LISI) alongside species listed on the Water Framework Directive UK TAG alien species and Wildlife and Countryside Act (1981) as amended should be reviewed. Key aquatic Schedule 9 and LISI plant species include (but are not limited to):

		• Floating water pennywort; • Himalayan balsam and other balsam species; • Parrots feather; and • Water hyacinth. Animal species include: • Terrapin; • Non-native crayfish species; • Goldfish; • Killer shrimp; • Chinese mitten crab; • American mink; and • Zebra mussel. GB Non-Native Species Secretariat species ID sheets on respective species should be provided to construction teams and Estate management teams.

6.0 BIODIVERSITY ACTION PLAN 2018 – 2028

6.1 This BAP reflects the three primary Estate conservation objectives described in Chapter 4:

- Embed the biodiversity 'net gains' principle within management and planning decision-making across the Estate;
- Develop and apply actions for climate change resilience; and
- Improve ecosystem service value and in particular health, well-being and productivity of Estate users.

6.2 Chapter 5 presents these objectives in terms of new development projects, where this BAP specifically addresses management of the existing and future biodiversity assets in the Estate.

6.3 A common thread throughout these objectives is for the application of multifunctional interventions that help reconnect people and nature, providing holistic ecosystem service benefits.

6.4 On that basis this BAP defines specific Species and Habitat Action Plans (SAPs and HAPs) alongside action plans built around key 'Themes'. These individual action plans are designed to inform management of existing and future ecological receptors at the site.

6.5 The wider context relating to BAPs, planning policy and legislation can be found at Appendix 3.

6.6 Table 6.1 below list the priority receptors for the Estate and describes their BAP status at a national, regional and local level. Key Themes are also listed. Discussion on the status of each of these receptors can be found in Chapter 3.

Table 6.1 ***BAP priority receptors***

Receptor	UK priority	London Priority	Tower Hamlets Priority
Species			
Black Redstart		X	X
Peregrine Falcon		X	X
Swift			X
House Sparrow	X	X	X

House Martin			X
Kingfisher			X
Common Tern			X
Waterfowl			
Bats	SOME SPECIES	X	X
Bees	SOME SPECIES	SOME SPECIES	SOME SPECIES
Lepidoptera	SOME SPECIES	SOME SPECIES	SOME SPECIES
Coleoptera	SOME SPECIES	SOME SPECIES	SOME SPECIES
Grey seal	X	X	
Fish	SOME SPECIES	SOME SPECIES	SOME SPECIES
Habitats			
Living Roofs and the Built Form		X	X
Shrub and Herbaceous Planting			
Parkland			
Street Trees			
Aquatic Habitats		X	X
Themes			
Biodiversity Net Gain	n/a	n/a	n/a
Ecosystem Service Provision	n/a	n/a	n/a

Climate Change Resilience	n/a	n/a	n/a
Health and Well-Being	n/a	n/a	n/a
Outward Communication and Education	n/a	n/a	n/a

6.7 The actions set out in the tables below expand the overall Estate objectives for each respective receptor, providing focused actions alongside key timeframes.

6.8 Many costs are project and action specific and would require costing exercises at the time of implementation. Where possible, predicted costs have been indicated.

6.9 In addition, roles and responsibilities are listed. Broadly speaking it is the responsibility of Estate management to implement the plan, but many of the specialised actions will require external technical input. Where this is the case the specialist has been listed alongside Estate management, whose responsibility it is to instruct said technical assessments as and when appropriate. Please note that responsibility may be subject to change as the BAP evolves.

6.10 A key enabling action of the BAP will be to hold an inaugural BAP Working Group Meeting in spring/summer 2018; initial responsibilities and actions will be assigned during this meeting.

Table 6.2 *Actions for respective receptors*

BIRDS

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
BD1	Install 100 new bird nest boxes for house sparrow, swifts, house martin and other passerines across the Estate targeting priority species. This should include at least 2 peregrine boxes. Black redstart boxes should be provided on every living roofs. At least 3 sites should be targeted for kingfisher. See Table 5.2 for box specifications.	2018	Estate Management, Ecologist	£2,000 - £3,000, Staff time	Provide nesting habitat for priority species which is currently limited.
BD2	Maintain boxes – bi-annual checks	Bi-annual	Estate Management	Staff time	Reduces risk of pests and nest abandonment. Allows for data to collected on usage.
BD3	Restore existing nesting islands	2018/2019	Estate Management	Costing exercise to be carried out	Some existing floating rafts are in poor condition.
BD4	Maintain islands – remove weeds and reseed where necessary	Annual	Estate Management	Staff time, costing exercise to be carried out for remedial works	Existing floating raft is in poor condition.
BD5	Monitor bird diversity at site	Bi-annual	Ecologist	£2,500 per survey	Allows for measure of success against Roadmap objectives
BD6	Reinstate swift call system	2018 onward	Estate Management, Ecologist	<£200	Encourages young swifts to move to site upon their migration in the spring.

BATS

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
BT1	Install 50 new bat boxes in tree across site. Boxes should be unlit areas following specifications in Table 5.2.	2018	Estate Management	£2,500, Staff time	Provide roosting habitat, which is currently limited
BT2	Maintain and check boxes for use.	Bi-annual	Estate Management, Licenced Ecologist	Staff time, cost for ecologist check to be included within monitoring surveys (BT4)	Allows for data to collected on usage. Must be done by licenced bat ecologist.
BT3	Where possible replace lighting with low UV component bulbs (e.g. LED) and introduce bat friendly lighting regime where lights are directional and shielded. Key features such as the open basins, Thames foreshore and areas of parkland should be unlit where safe and practical.	2018-2028	Estate Management	Costing exercise to be carried out	Reduces disturbance to commuting and foraging bats through reducing direct disturbance impacts, and impacts upon invertebrate distribution. Encourages roosting in darker areas.
BT4	Monitor bat diversity at site	Bi-annual	Ecologist	£2,500 per survey	Allows for measure of success against Roadmap objectives

INVERTEBRATES

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
IV1	Increase the availability of deadwood habitat in the parkland areas and on living roofs	2018 onward	Estate Management	Free (if wood from on site arboricultural works is retained), staff time cost for installation	Encourages BAP priority species such as the saproxlic stag beetle. Provides habitat variation
IV2	Increase pollinator friendly planting amongst street level herbaceous and shrub beds	2018 onward	Estate Management	Costing exercise to be carried out for sourcing of plants, staff time cost for installation	Encourages BAP priority species such as solitary bees and bumblebees
IV3	To provide loose sandy piles in sunny locations near to pollinator friendly planting.	2018	Estate Management	<£50, Staff Time	Encourages BAP priority species such as solitary bees and bumblebees
IV4	Monitor invertebrate biodiversity at site	2018 onward	Estate Management, Ecologist	~£2,500 per survey period	Allows for measure of success against Roadmap objectives

FISH, OTHER AQUATIC SPECIES AND AQUATIC HABITATS

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
F1	Install features that benefit spawning and juvenile fish such as ‘brushes’ or vegetated gabion baskets. A feature should be provided in every basin. Reduce overshadowing	2018	Estate Management	Costing exercise to be carried out, staff time	Provides locations for shelter and egg laying. Encourages fish abundance and diversity reflecting BAP priority species and themes. Reduction in overshadowing improves algal growth with provides food for fish

F2	Review pollution control protocols for the dock basins	2018	Estate Management	Staff time	Reduces impacts upon fish and aquatic invertebrates
F3	Install features for aquatic invertebrates such as hanging ropes and wooden boards on basin walls	2018 onward	Estate Management	Costing exercise to be carried out	Provides location for algal food growth and habitat for infaunal species
F4	Create and keep on show in management office data sheets on high risk aquatic invasive species. This sheet should include data on species identification and how to manage should they be encountered	2018	Estate Management	Staff time	Increases ability to identify and respond to any unforeseen non-native invasive species that may enter the docks
F5	Identify locations for, and install, enhanced aquatic vegetation such as reedbeds or floating vegetated rafts	2018 onward	Estate Management	Staff time	Provides opportunity to increase the cover of BAP priority habitat

LIVING ROOFS AND THE BUILT FORM

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
LR1	To retrofit substrate based biodiverse living roofs to flat roofed buildings with suitable loading capacity	2018 onward	Estate Management, Ecologist (to advise)	Costing exercise to be carried out	Existing living roofs are generally low in biodiversity and in poor condition. This would improve Estate and Borough priority habitat
LR2	To improve the status of existing living roofs through introduction of invertebrate friendly features such as log piles, sandy piles, rope coils, stone circles and water trays	2018 onward	Estate Management, Ecologist (to advise)	~£1,000	Existing living roofs are generally low in biodiversity and in poor condition. this would improve an Estate and Borough priority habitat

LR3	Monitor living roof status and floral diversity	Bi-annual	Ecologist	£1,750 per survey	Allows for measure of success against Roadmap objectives

PARKLAND

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
PK1	Manage parklands sensitively to wildlife. Install areas of meadow grassland and undertake reduced mowing in some areas to allow flowering	2018 onward	Estate Management	Costing exercise to be carried out	Reduced mowing regimes allow grass and flowers to grow and set seed, providing resources for invertebrates, birds and bats later into the season. New areas of wildflower meadow would replace existing amenity grassland which is of negligible ecological value
PK2	Discourage use of pesticides, herbicides and fungicides across the Estate. In particular no glyphosate or neonicotinoids derivatives will be used	2018 onward	Estate Management	Staff time	Reduces impact upon invertebrates and bioaccumulation risks for the water basins
PK3	Avoid lighting in parkland, and in particular, up lighting of trees	2018 onward	Estate Management	Staff time	Reduces impact upon invertebrates and bats; priority species groups

STREET TREES

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
ST1	Bi-annual tree survey to identify tree health and update iTree assessment	2019 onward	Arboriculturalist, Estate Management	£2,000/survey	Allows for measure of success against Roadmap objectives

ST2	Replace old trees with more appropriate species (ideally native) in suitable tree pit sizes, using a range of species that provide climate resilience	2018 onward	Estate Management	Costing exercise to be carried out	Allows for improved climate change resilience and biodiversity benefits
PK3	Avoid lighting in parkland, and in particular, up lighting of trees	2018 onward	Estate Management	Staff time	Reduces impact upon invertebrates and bats; priority species groups

SHRUBS AND HERBACEOUS PLANTING

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
L1	New planting should provide known benefit for wildlife, reflecting targets of the three objectives	2018 onward	Estate Management, Ecologist (to advise where appropriate)	Costing exercise to be carried out, staff time	Allows for improved climate change resilience and biodiversity benefits
L2	Increased ‘sense’ planting, such as nicely scented or colourful planting should be encouraged. Edible planting could also be provided	2018 onward	Estate Management	Costing exercise to be carried out, staff time	Improves human interaction with nature
L3	Procure plants from no pesticide and peat free sources	2018 onward	Estate Management	Staff time	Reduces off site external footprint of new planting

BIODIVERSITY NET GAIN

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
NG1	Apply the net gains principle to Estate management and planning. All non-development related projects should have biodiversity in mind and should result in net gains	2018 onward	Estate Management, Ecologist (to advise where appropriate)	Staff time, ecologist fees on project basis	Reflects key Roadmap objective

ECOSYSTEM SERVICE PROVISION

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
ES1	Undertake updated ecosystem service valuation exercises following interventions such as new street tree planting	2018 onward	Ecologist, Estate Management	£2,500	Allows for measure of success against Roadmap objectives
ES2	Identify opportunities to increase service provision	2018 onward	Estate Management	Staff Time	Implementing the other actions in the BAP will inherently stand to improve service provision

CLIMATE CHANGE RESILIENCE

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
CC1	Plant drought tolerant species in at risk area identified in the climate change modelling	2018 onward	Design Team (if project related), Estate Management	Costing exercise to be carried out, staff time	Allows for improved climate change resilience and biodiversity benefits
CC2	Plant rain gardens and new beds that will reduce storm water build and	2018 onward	Estate Management	Costing exercise to be carried out, staff time	Allows for improved climate change resilience and biodiversity benefits

	increase surface water flood storage capacity				
CC3	Undertake on-going modelling and data collection on climate change to identify risk areas and measure efficacy of interventions	2018 onward	Environmental Consultant, Estate Management	£5,000	Allows for measure of success against Roadmap objectives

HEALTH AND WELL-BEING

Ref	Action	Date	Responsibility	Cost	Reasoning/Comments
HWB1	Encourage exercise in green space at the Estate	2018 onward	Estate Management, CSR teams		
	Staff time	Reflects targets for improved interaction with nature at the Estate and provides direct health benefits			
HWB2	Undertake continued questionnaires relating to people's experience of green space across the Estate	2018 onward	Estate Management	Staff time	Allows for measure of success against Roadmap objectives
HWB3	Introduce trial air quality planting zones	2018 onward	Estate Management	Costing exercise to be carried out, staff time	Test potential direct health benefits of planting interventions
HWB4	Introduce planting of known benefit for people's health and well-being (reflect	2018 onward	Estate Management	Costing exercise to be carried out on project	Reflects targets for improved interaction with nature at the Estate and

	WELL Biophilia criteria)			specific basis, staff time	provides direct health benefits

COMMUNICATION AND EDUCATION

Ref	Action	Date	Responsibility	Cost	Reasoning/ Comments
C1	Create Biodiversity Action Plan Group. To include those with responsibility for the BAP and relevant stakeholders. The group should meet annually to discuss progress and actions. Updates to BAP should be included where appropriate				
An inaugural meeting should be held upon completion of this BAP					
External stakeholders should be consulted at this stage	Annual	BAP Stakeholder Group	Staff time	To help secure implementation of the plan and encourage engagement by stakeholders	
C2	Create outdoor displays about the biodiversity of the Estate	2018 onward	Marketing and CSR Teams, Estate Management	~£500, Staff time	To improve public perception of biodiversity at Canary Wharf
C3	Run workshops and presentation about the biodiversity of the Estate	2018 onward	BAP Group, Estate Management, Ecologist	Staff time	To improve public perception of biodiversity at Canary Wharf

C4	Create volunteering opportunities to help with nature conservation activities at the Estate	2018 onward	CSR Team, Estate Management	Staff time, Volunteer time	Provide opportunities for public involvement and engagement
C5	Run a ‘bat walk’	2018 onward	CSR Team, Estate Management. Ecologist	Staff time, Volunteer time	Provide opportunities for public involvement and engagement
C6	Engage with local schools to identify educational opportunities associated with the biodiversity of the Estate	2018 onward	CSR Team, Estate Management	Staff time, Volunteer time	Provide opportunities for public involvement and engagement
C7	Share and update the interactive green infrastructure map on the Canary Wharf Group website	2018 onward	Marketing Team, Estate Management	Staff time	Provide opportunities for public involvement and engagement
C8	Run competitions to increase engagement with nature such as wildlife photography competition	2018 onward	Estate Management	Staff time, Prize costs	Provide opportunities for public involvement and engagement
C9	Update Canary Wharf website to include updated information on Estate biodiversity	2018 onward	Marketing Team, Estate Management	Staff time	Provide opportunities for public involvement and engagement

7.0 SUMMARY

7.1 This document presents the Canary Wharf Biodiversity Roadmap 2018-2028.

7.2 Results from an ecological appraisal of the Estate are presented, alongside the outputs of climate change resilience modelling and Ecosystem Service Valuation tools, iTree and the Green Infrastructure Valuation Toolkit. These baseline results have helped identify opportunity and risk areas at the Estate in relation to biodiversity and climate change.

7.3 An interactive online map has been produced which presents the results of the baseline survey.

7.4 Actions for future interventions and management are based around three key objectives which encourage a multidisciplinary approach:

- Embed the biodiversity 'net gains' principle within management and planning decision-making across the Estate;
- Develop and apply actions for climate change resilience; and
- Improve ecosystem service value and in particular health, well-being and productivity of Estate users.

7.5 Actions relating to future development at the Estate are provided within the DFP, alongside an updated BAP which relates to management of existing and future assets.

7.6 The DFP provides a step-by-step approach to encourage integration of ecology into design and approach for future development schemes at site.

7.7 Particular focus is provided in the BAP on ways to encourage engagement with nature at the Estate, benefitting users' health and well-being, whilst resulting in quantifiable net gains for biodiversity and other climate change risk factors.

7.8 This Roadmap document represents an evidence based holistic strategy for management of biodiversity across the Canary Wharf Estate over the next 10 years, reflecting key climate change and development pressure risks.

APPENDIX 1: BASELINE ECOLOGY SURVEY RESULTS TABLE

CWG evidence review and GIS data V02 Dec-16 Morgan Taylor

Building	Living roof target	Living roof	Condition (Good/Bad)	Other ecological enhancements	Action	Notes	Evidence file reference
15 Canada Square	Not known	Sedum	G	Bee hives	revisit in spring	Jersey cudweed (sch 8 protected plant species)	
1 Churchill Place	Not known	TBC	TBC		n/a		
5 Churchill Place	Not known	TBC	TBC		n/a		
16-19 Canada Square	Not known	Sedum	G	None	None	Assessed from 1 Canada Square window	
Cabot Place	Not known	Sedum	G	None	None	Assessed from 1 Canada Square window	
20 Cabot Square	Not known	Sedum	G	None	None	Assessed from 1 Canada Square window	
30 Colonade South	Not known	Sedum	G	None	None	Assessed from 1 Canada Square window	
25/30 Churchill Place	Sedum	Sedum	G	Wildlife friendly landscaping	Continue management of roof; potential to improve value for invertebrates	Landscaping to be reviewed against proposals; 2011 BREEAM report missing; bird boxes recommended in original 2006 BREEAM report	
10 Upper Bank Street	Not known	TBC	TBC	n/a	n/a		
20 Bank Street	Not known	Intensive	G	none	install invertebrate features		
1 Westferry Circus	Biodiverse	Biodiverse	P	Landscaping; vertical greening; aquatic invertebrate wall; nest boxes	Re-seed and plug plant biodiverse roof; manage buddleja and canadian fleabane; improve invertebrate features	Green walls, native planting and nest boxes for birds discussed in ES but not observed at site	PA_07_00935_A1-ENV_STA _VOL_1_-_NON-TECH_ SUMMARY-684585
Crossrail	Intensive	Intensive	G	Designs including bird and bat boxes - these wee not located however during walkover	Install boxes where appropriate		RT-MME-105418
10 Cabot Square	Not known	Biodiverse	P	Not known	Improve roof conditions	Assessed from 1 Canada Square window	

1 Canada Place	None	None	n/a	Swift boxes and anecdotal suggestions of a peregrine box (not confirmed)	to confirm box presence, location and status		
Green Space							
Jubilee Park	n/a	n/a	G	Bird boxes; landscaping; trees		General arrangement compliant with plans	
Canada Square	n/a	n/a	G				
Westferry Circus	n/a	n/a	G				
Street trees	n/a	n/a	G				
Middle dock pontoons/tern rafts	n/a	n/a	P		Planting to be improved; nuisance/weed species removed		
Crossrail reedbeds	n/a	n/a	G				
Under construction/Future development							
1 Bank Street	Biodiverse; sedum	TBC					
Wood Wharf Phase 1	Biodiverse; sedum; wildflower	TBC					
10 Bank Street	Sedum	TBC					
Newfoundland	Biodiverse						
BAP Actions							

Key

Biodiverse	Substrate based wildflower roof
Sedum	Substrate or mat based sedum planting
Wildflower mat	Wildflower mat
Intensive	Planters/intensive roof garden landscaping
HS	House sparrow
BR	Black redstart
S	Swift
sm	Sand martin
kf	kingfisher
g	Good - no gaps in planting, appears compliant with target, some minor management actions may be appropriate
m	Moderate - some gaps in planting, some weed species, some management actions/interventions appropriate
p	Poor - major interventions required

APPENDIX 2: BIODIVERSITY ROADMAP APPROACH

BIODIVERSITY ROADMAP 2016/2017– *CANARY WHARF GROUP*

Biodiversity in Canary Wharf comprises more than what meets the eye. The Canary Wharf Estate is an integral part of the Thames Estuary and Canary Wharf Group works to promote an integrated green infrastructure. Through time, our urban design has created a suitable living environment for native and threatened species of plants and animals and their establishment has taken place alongside the thriving commercial world of the Canary Wharf Estate. Current and future development have biodiversity has a priority and it is our goal to ensure that we create safe and healthy ecosystems and amenities within the Canary Wharf Estate that promote biodiversity and create pleasant and liveable public spaces where biodiversity and leisure meet.

OUR ROADMAP FOR CANARY WHARF'S BAP

Stages	1. Assessment and evaluation	2. Option identification and appraisal	3. Strategy definition	5. Management strategy	6. Implementing the strategy
Dates	*August-November*	*July-September (3 months)*	*October – December (3 months)*	*3 Years*	*2018-2028*
Overall biodiversity objectives	**To assess and collate information about the ecology of the estate** **To gain an understanding of the ecological value, risks and potential for enhancement**	**To identify options for protecting, mitigating, compensating, offsetting and/or enhancing** **To evaluate options and formulate recommendations**	**To propose and quantify the value of recommendations for protecting, mitigating, compensating, offsetting, and/or enhancing**	**To create an effective Biodiversity Management Plan**	**To implement the strategy in line with the aims of the Biodiversity Action Plan**
Detailed biodiversity objectives	- Appoint Ecology Team - Define and close project budget - Undertake Ecology survey in the Estate - Set up of a GIS Database 'Canary Wharf Biodiversity Database' to hold biodiversity information in a spatial format. - Define key habitats - Understand state of current features vs. what was designed and predicted	Define priority areas of action: - Ecosystem valuation - Adaptation to climate change - Events and usability - Educational purpose - Risk and mitigation measures - Net ecology enhancement With key stakeholders, identify the options for protecting, mitigating, compensating, offsetting and/or enhancing biodiversity in Canary Wharf. Define KPIs	Define short, medium and long-term recommendations and associated measures: - Protection needs. - Mitigation and compensation. - Enhancement opportunities. - Ecological benefits. - Socio-economic benefits - Connectivity and habitat creation. - Maintenance and management options Assess opportunities of integration through other project assets/activities such as: - Water quality measures. - Surface water run off management.	Capture management activities and functions that impact on the priority areas defined in Option Identification and Appraisal stage (2). Create a biodiversity management plan that includes the following: - Green and brown roofs management strategy - Landscaped areas management strategy - Estate Protection plan for key habitats as defined in Assessment and Evaluation Stage (1). - Biodiversity management principles to inform design briefs	- Allocation of roles and responsibilities. - Ensuring that the strategy continues to align with existing activities and processes. - Putting procedures in place to promote effective implementation, e.g. site inductions. - Procedures for monitoring, measuring and reporting. - Procedures for reviewing and updating the strategy. - Procedures for effective handover at all stages of the project where responsibility is transferred.

			- Flood risk management. - Landscaping. - Heat Island Effect - Noise control measures. - Climate change mitigation.	- Clarity on the role of biodiversity in health & wellbeing Continue to grow the Canary Wharf Wildlife Photography Competition and promote within the local communities.	
Actions to implement	**Biodiversity Survey** **Stakeholders Mapping**	**Site Visit** **Workshop** **Biodiversity Forum**	**Strategic Framework Report**	**Workshop** **Biodiversity Management Plan**	**Biodiversity Action Plan Report**
Outward communication				**Drop-in Exhibitions** **Photo Competition** **Newsletter**	**Event with Community** **Photo Competition** **Website**

KEY BIODIVERSITY ISSUES FOR CANARY WHARF GROUP:

- ✓ Water space reduction and compensation measures
- ✓ Nesting opportunities
- ✓ Pollinators/bugs habitats
- ✓ Green roofs design opportunities (new roofs can include topography, lighter substrates)
- ✓ Adaptation to climate change
- ✓ Education and recreation

APPENDIX 3: RELEVANT LEGISLATION & PLANNING POLICY

Legislation

Current key legislation relating to ecology includes the Wildlife and Countryside Act 1981 (as amended)

[22] The Conservation of Habitats and Species Regulations 2010 ('Habitats & Species Regulations')[23], The Countryside and Rights of Way Act 2000 (CRoW Act)[24], and The Natural Environment and Rural Communities Act, 2006[25].

The Conservation of Habitats and Species Regulations 2010

The Habitats & Species Regulations replace The Conservation (Natural Habitats, etc.) Regulations 1994 (as amended)[26], and transpose Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna and Flora ('EU Habitats Directive')[27], and Council Directive 79/409/EEC on the Conservation of Wild Birds ('Birds Directive')[28] into UK law (in conjunction with the Wildlife and Countryside Act).

Regulation 41 of the Habitats & Species Regulations makes it an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2 (European protected species of animals), or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4 (European protected species of plant). Development that would contravene the protection afforded to European protected species requires a derogation (in the form of a licence) from the provisions of the Habitats Directive.

Regulation 61(1) states: 'A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which —

(a) is likely to have a significant effect on a European site or a European offshore marine site (either alone or in combination with other plans or projects); and

(b) is not directly connected with or necessary to the management of that site; must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.'

Wildlife and Countryside Act 1981 (as amended)

The Wildlife and Countryside Act 1981 (as amended) is the principal mechanism for the legislative protection of wildlife in Great Britain. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats[29] (the 'Bern Convention') and the Birds Directive and EU Habitats Directive are implemented in Great Britain.

The Countryside and Rights of Way Act 2000

The Wildlife and Countryside Act has been updated by the CRoW Act. The CRoW Act amends the law relating to nature conservation and protection of wildlife. In relation to threatened species it strengthens the legal protection and adds the word 'reckless' to the offences of damaging, disturbing, or obstructing access to any structure or place a protected species uses for shelter or protection, and disturbing any protected species whilst it is occupying a structure or place it uses for shelter or protection.

The Natural Environment and Rural Communities Act 2006

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. Biodiversity Action Plans provide a framework for prioritising conservation actions for biodiversity.

Section 41 of the Natural Environment and Rural Communities Act requires the Secretary of State to publish a list of species of flora and fauna and habitats considered to be of principal importance for the purpose of conserving biodiversity. The list, a result of the most comprehensive analysis ever undertaken in the UK, currently contains 1,149 species, including for example, hedgehog (*Erinaceus europaeus*), and 65 habitats that were listed as priorities for conservation action under the now defunct UK Biodiversity Action Plan[30] (UK BAP). Despite the devolution of the UK BAP and succession of the UK Post-2010 Biodiversity Framework[31] (and Biodiversity 2020 strategy[32] in England), as a response to the Convention on Biological Diversity's (CBD's) Strategic Plan for Biodiversity 2011-2020[33] and EU Biodiversity Strategy (EUBS)[34], this list (now referred to as the list of Species and Habitats of Principal Importance in England) will be used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under section 41 of the Natural Environment and Rural Communities Act 2006 'to have regard' to the conservation of biodiversity in England, when carrying out their normal functions.

Biodiversity Action Plans

Non-statutory Biodiversity Action Plans (BAPs) have been prepared on a local and regional scale throughout the UK over the past 15 years. Such plans provide a mechanism for implementing the government’s broad strategy for conserving and enhancing the most endangered (‘priority’) habitats and species in the UK for the next 20 years. As described above the UK BAP was succeeded in England by Biodiversity 2020 although the list of priority habitats and species remains valid as the list of *Species of Principal Importance for Nature Conservation*.

Regional and local BAPs are still valid however and continue to be updated and produced.

Detail on the relevant BAPs for this site are provided in the main text of this report.

Planning Policy

National Planning Policy Framework (NPPF)

Guidance on nature conservation within planning is issued by the Government within the National Planning Policy Framework[35]. This Framework document acts as guidance for local planning authorities on the content of their Local Plans, but is also a material consideration in determining planning applications.

The NPPF has replaced, among other planning guidance documents, Planning Policy Statement 9: Biological and Geological Conservation[36]. However, the accompaniment to PPS9, government circular 06/05: Biodiversity and Geological Conservation - Statutory Obligations and Their Impact within the Planning System[37], remains valid. The prevention of harm to biodiversity through prudent planning decisions is the key principle in the NPPF when considering planning and the natural environment; set out in section 11.

Within the NPPF the Government's vision for conserving and enhancing biological diversity in England within the planning system is set out. The Governments objectives for planning from an ecological perspective are, among others, to recognise the wider benefits of ecosystem services, minimise the impacts on biodiversity and provide net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, which will include the establishment of coherent ecological networks that are more resilient to current and future pressures.

Of particular note to ecological impact assessment is paragraph 152 of the Plan-Making Section which states:

"Local planning authorities should seek opportunities to achieve each of the economic, social and environmental dimensions of sustainable development, and net gains across all three. Significant adverse impacts on any of these dimensions should be avoided and, wherever possible, alternative options which reduce or eliminate such impacts should be pursued. Where adverse impacts are unavoidable, measures to mitigate the impact should be considered. Where adequate mitigation measures are not possible, compensatory measures may be appropriate".

As a result of the NPPF any species or habitats of principal importance found on the application site, in addition to statutorily protected species, are of material consideration in the planning process.

Regional Planning Policy: The London Plan Spatial Development Strategy for Greater London

The London Plan is comprised of separate chapters relating to a number of areas, including London's Places, People, Economy and Transport. The following policies have been identified within the London Plan, which relate specifically to ecology and this development.

Policy 2.18 Green Infrastructure

‘Policy 2.18 aims to protect, promote, expand and manage the extent and quality of, and access to, London’s network of open and green spaces’.

Policy 5.10 Urban Greening

This policy encourages the ‘greening of London’s buildings and spaces and specifically those in central London by including a target for increasing the area of green space (including green roofs etc.) within the Central Activities Zone’.

Policy 5.11 Green Roofs and Development Site Environs

Policy 5.11 specifically supports the inclusion of planting within developments and encourages boroughs to support the inclusion of green roofs.

Policy 5.13 Sustainable Drainage

‘Policy 5.13 promotes the inclusion of sustainable urban drainage systems in developments and sets out a drainage hierarchy that developers should follow when designing their schemes’.

Policy 7.19 Biodiversity and Access to Nature

‘The Mayor will work with all the relevant partners to ensure a proactive approach to the protection, enhancement, creation, promotion and management of biodiversity in support of the Mayors Biodiversity Strategy.’

Supplementary Planning Guidance (SPG): Sustainable Design and Construction 2014

As part of the London Plan 2011 implementation framework, the SPG, relating to sustainable design and construction, was released in April 2014 for consultation which includes the following sections detailing Mayoral priorities in relation to biodiversity of relevance to this development.

Nature conservation and biodiversity

The Mayor’s priorities include ensuring ‘developers make a contribution to biodiversity on their development site’.

Overheating

Where priorities include the inclusions of ‘measures, in the design of schemes, in line with the cooling hierarchy set out in London Plan policy 5.9 to prevent overheating over the scheme’s lifetime’

Urban greening

A Priority is for developers to ‘integrate green infrastructure into development schemes, including by creating links with wider green infrastructure network’.

Use less energy

'The design of developments should prioritise passive measures' which can include 'green roofs, green walls and other green infrastructure which can keep buildings warm or cool and improve biodiversity and contribute to sustainable urban drainage'.

Green Infrastructure and Open Environments: The All London Green Grid (ALGG) SPG

This document presents the concept of the ALGG, providing further guidance on London Plan policy, encouraging new development to feed into and augment existing green/blue infrastructure. Specifically, the SPG:

1) Provides guidance on the implementation of all the relevant policies in the London Plan to local neighbourhoods, boroughs, developers and other delivery partners;
2) Sets out a vision and spatial framework for London-wide green infrastructure;
3) Promotes partnership working across the 11 Green Grid Areas within London and beyond via the Green Arc Partnerships;
4) Identifies strategic green infrastructure opportunities.

Emerging policy: the draft London Environment Plan 2017

Current going through public consultation this emerging policy document describes the objectives and policies which will inform the approach taken in 2019's new London Plan with respect to the environment. Key policies in this draft document include a need to achieve net gains in biodiversity, and a requirement to provide new multifunctional green infrastructure features on new development schemes.

Tower Hamlets Core Strategy and Management Development Documents [38]

Both of these documents contain policies seeking to protect and enhance biodiversity, including:

SP04 CREATING A BLUE AND GREEN GRID

1. Deliver a network of open spaces, by:

Protecting

a. Protecting and safeguarding all existing open space such that there is no net loss.

Creating

b. Maximising opportunities for new publicly accessible open space, of a range of sizes, particularly in the following locations:

Poplar Riverside

Bethnal Green

Fish Island

Bromley-by-Bow

Aldgate

Spitalfields and Shoreditch

c. *Assisting in the delivery of new strategic publicly accessible open spaces, including the Lea River Park, FAT Walk and the Olympic Park, to significantly address deficiencies in open space in the eastern part of the borough.*

Enhancing

d. *Improving the quality, usability and accessibility of existing publicly accessible open spaces across the borough and to neighbouring boroughs.*

Connecting

e. *Promoting publicly accessible open spaces as multi-functional spaces that cater for a range of activities, lifestyles, ages and needs.*

f. *Improving access to the strategically important publicly accessible open spaces, which currently include Metropolitan Open Land (East India Dock Basin and Brunswick Wharf, Island Gardens, Lee Valley Regional Park, Meath Gardens, Mile End Park, Mudchute Park and Millwall Park, Tower Hamlets Cemetery, Victoria Park) as well as the Olympic Park, Lea River Park and the FAT Walk.*

g. *Creating new green corridors and enhancing existing ones to connect publicly accessible open spaces to main destination points, such as town centres, schools, health facilities, other publicly accessible open spaces, and also to, and along, waterspaces.*

2. *Promote and support new development that provides green roofs, green terraces and other measures to green the built environment.*

3. *Protect and enhance biodiversity value through:*

   a. *The design of open space and buildings.*

   b. *Ensuring development protects and enhances areas of biodiversity value in order to achieve a net gain in biodiversity.*

4. *Work with British Waterways and the Port of London Authority to deliver a network of high quality, usable and accessible waterspaces, through:*

Identifying opportunities for new water spaces, particularly in Poplar Riverside.

a. *Protecting and safeguarding all existing water spaces from inappropriate development.*

b. *Improving the quality, usability, accessibility of the environment of water spaces including the immediate area and water quality.*

c. *Working with relevant agencies and others to protect and enhance the aesthetic, ecological and biodiversity values of the borough's waterspaces.*

d. *Improving accessibility to and along waterspaces to maximise usability and promote these places for cultural, recreational and leisure activities.*

e. *Ensuring that new development responds positively and sensitively to the setting of waterspaces while respecting and animating waterspaces to improve usability and safety.*

f. *Using waterspaces for movement, including passenger and freight transport.*

g. *Ensuring residential and commercial moorings are in locations that do not negatively impact on waterspaces or navigation.*

5. *Reduce the risk and impact of flooding through:*

a. *Using the Sequential Test to assess and determine the suitability of land for development based on flood risk.*

b. *All new development that has to be located in a high risk flood zone must demonstrate that it is safe and passes the Exceptions Test (in accordance with PPS25).*
Ensuring that all new development across the borough does not increase the risk and impact of flooding.

c. *Ensuring the application of flood-resilient design of all new developments in areas of Flood Risk 2 and 3a.*

d. *Protecting and where possible increasing the capacity of existing and new waterspaces to retain water.*

e. *All new developments must aim to increase the amount of permeable surfaces, including SUDS, to improve drainage and reduce surface water run-off.'*

f. *Seeking to maintain existing flood defences to the appropriate standards and, in the case of riverside development, improve the standard, lifetime and access to such defences.*

g. *Ensuring effective emergency-planning practices are in place.*

h. *Working closely with the Environment Agency to keep up-to-date information about flood risk in the borough.*

DM11 LIVING BUILDINGS AND BIODIVERSITY

1. *Development will be required to provide elements of a 'living building'.*

2. *Existing elements of biodiversity value should be protected or replaced within the development and additional habitat provision made to increase biodiversity value.*

3. *Developments which will cause damage to a Site of Importance for Nature Conservation, or significantly harm the population or conservation status of a protected or priority species*, will not be supported unless the social or economic benefits of the development clearly outweigh the loss of biodiversity.*

4. *Major development will need to submit an Ecology Assessment demonstrating biodiversity enhancement in accordance with the Council's Local Biodiversity Action Plan.*

**supporting paragraph 11.4 states "priority species are those identified in the UK, London, or Tower Hamlets Biodiversity Action Plans"*

Tower Hamlets Green Grid Strategy [39]

This strategy seeks to:

Describe the Green Grid concept and its potential benefits in coming years;

Understand how the Green Grid concept can help realise and aims and objectives of 'One Tower Hamlets', the 'Tower Hamlets Core Strategy' and the 'Tower Hamlets Healthy Borough' pilot programme;

Propose a strategy for stimulating and responding to the demand for investment in the Green Grid in the coming years

This strategy maps the existing green grid and identifies opportunities to feed into this, augmented connections for nature and people.

APPENDIX 4: NET GAINS METRICS

In an effort to quantify the impact of future proposals upon biodiversity at the Canary Wharf Estate available metrics should be trialled until an accepted industry wide net gain calculation approach is made available. Metrics should include an adapted version of Defra's Biodiversity Offsetting metric calculation and the Green Space Factor.

Both of these tools are described below.

Defra's Offsetting Tool

This metric was created in 2011 and applied across six trial projects before going through a public consultation process. No further comment has been received from Defra on the application of this metric since publication of the 2013 draft green paper, and many limitations were raised during the consultation process that followed. Nonetheless, an adapted version of this metric represents a potentially useful framework against which to measure net changes in biodiversity in a development context at Canary Wharf.

Whilst this calculation is designed for ex situ mitigation at an 'offset' site when in situ habitat is lost, the principals in play are the same and it provides an accurate means of directly quantifying the projected change in biodiversity value; measured in 'habitat units'.

Standard guidance is not offered by Defra on the distinctness or quality bands (two of the three factors that go towards the metric calculation) that many habitat types on urban sites may fall into, and a level of subjective judgement is therefore still required by the ecological consultant. Given the finite number of habitats that are likely to exist at the Estate in the near future it is possible to provide defined distinctiveness ratings for all possible habitat types, with condition judgement made by an ecologist. An altered calculation that factors in a single multiplier to account for implementation risk should also be used, on the basis that fixed multiplier values can be provided relating to respective habitat types. Habitat units should be calculated before development and compared with proposed habitat unit post development during design stage to assess predicted biodiversity change. This can then be reappraised at the post construction review stage to help identify successes and failing, informing any appropriate remedial actions. Habitat units should be higher following development.

The net change and habitat unit calculations are as follows:

NET CHANGE = HABITAT UNITS FOLLOWING DEVELOPMENT - HABITAT UNITS BEFORE DEVELOPMENT

HABITAT UNIT = DISTINCTIVENESS BAND X HABITAT CONDITION X HABITAT AREA IN HECTARES X RISK MULTIPLIER

Distinctiveness Band

Habitat Type Band	Habitat Distinctiveness	Points	Broad Habitat Covered
High	High	6	BAP priority habitats, and all habitats listed in table 5.2 e.g. dock basins, bio-diverse roofs (i.e. wasteland habitats), reedbeds
Medium	Medium	4	Semi-natural, e.g. street trees, raised bed planters, parkland
Low	Low	2	Heavily disturbed, poor quality, e.g. amenity grassland, hardstanding, buildings with no ecological features

Importantly, in an Estate specific use the distinctiveness will be a relative measure in the context of Canary Wharf alone; in this context, habitats such as living roofs, which in another context may not reach the maximum level of distinctiveness, are extremely important.

Habitat Condition

Condition	Points
Good	3
Moderate	2
Poor	1

This should be based on professional judgement by the assessing ecologist.

Multiplier

Delivery Difficulty	Risk Multiplier
Hard	0.6
Moderate	0.8
Easy	1.0

This multiplier should be judged by a professional ecologist who has experience in application of the prescribed intervention being assessed. If the approach is untested, or well known to be challenging to successfully implement, then the delivery difficulty should be judged as hard, e.g. creating aquatic habitat enhancements for spawning fish. If the feature being measured is common, but requires skill and attention to implement, and will take time to reach a level of maturity where it is ecologically function, then the difficulty should be judged as moderate, e.g. species rich biodiverse roofs. If the feature is very common on development schemes and is easy to achieve, then the easy multiplier should be used, e.g. an area of amenity grassland.

This metric should be applied alongside other appropriate ecological assessments and should not form the only form of ecological impact assessment that new development plots are subject to; the presence of protected species is not directly factored into this metric for example.

Worked example

A new development is proposed for a 1ha plot of land on the Estate that currently contains 0.25 ha of amenity grassland, 0.1 ha of raised bed, 0.15ha of open mosaic habitat with 0.5ha of hardstanding. Proposals seek to include 0,4 ha of living roof, 0.1 ha of raised bed planting and 0.5 ha of building/hardstanding cover.

Habitat Type	Area	Distinctiveness	Condition	Difficulty multiplier	Multiplied
Pre- development					
Amenity grassland	0.25	2	3	n/a	1.5
Raised beds	0.1	4	2	n/a	0.8
Open mosaic habitat	0.15	6	3	n/a	2.7
Hardstanding	0.5	2	2	n/a	2
Total					7
Post-development					
Building and hardstanding	0.5	2	3	1	3
Biodiverse roof	0.4	6	3	0.8	5.76
Planting beds with street trees	0.1	4	3	1	1.2
Total					9.96

The overall change in total habitat units in this instance is therefore 9.96 – 7 = 2.96; a net gain in biodiversity.

Green Space Factor and Green Points System

An alternative metric that should be trialled at the Canary Wharf Estate is the green space factor and green points system. An initiative from the Green and Blue Space Adaptation for Urban Areas and Eco Towns (GRaBS) project, this tool was trialled in the city of Malmö, Sweden. The green space factor was designed for measuring required areas of green space on new developments, on a plot-wise basis. A key driver of the tool is to reduce non-permeable surface cover. The area defined as contributing to ecosystem function, i.e. through provision of target habitat space or reduction of surface water flood risk, is termed the ecological effective area. Different surface types (i.e. hard standing, grassland, open water) are assigned different factors, which are then multiplied by the area coverage of said surface type.

The total sum of all area/factor scores (i.e. the ecological effective area) weighted against the total red line area of the development plot provides the green space factor (GSF). A minimum GSF value can be set which all new developments must achieve. Alternatively, this factor can be compared against pre and post development scenarios to measure net gains (this was seemingly not the original intention of the tool however).

$$GSF = \frac{(area\ A\ x\ factor\ A) + (area\ B\ x\ factor\ B) + (area\ C\ x\ factor\ C) + etc.)}{total\ development\ area}$$

The benefit of this metric is the ability to measure multifunctionality. Whereas the Defra metric focuses on biodiversity, this metric allows for benefits of wider ecosystem service provision at a site level.

Surface Type	Factor value
Vegetation on ground	1
Vegetation on trellis or façade	0.7
Biodiverse roof	0.7
Green roof	0.6
Vegetation on beams, soil depth between	
200 millimeters and 800 millimeters	0.7
Vegetation on beams, soil depth more than	
800 millimeters	0.9
Water surfaces	1
Collection and retention of stormwater	0.2
Draining of sealed surfaces to surrounding	
vegetation	0.2

Sealed areas	0
Paved areas with joints	0.2
Areas covered with gravel or sand	0.4
Tree, stem girth 16-20 centimeters	

Factor values are defined in the guidance document produced by GRaBS. These are roughly consistent with habitat types found across the Estate.

A constraint of this approach is the tendency to only reward green infrastructure features that benefit surface flood risk, missing measurement of green space quality, e.g. an area of amenity grassland would be awarded the same measure as an area of wildflower meadow. In addition, the factor multipliers are seemingly arbitrarily determined. The GSF would also be constrained when land reclamation works take place in the docks; in a dockland environment the drainage focus is not as relevant given the rapidity that water re-enters the basins following rainfall, irrespective of surface permeability.

To address these shortcomings, a Green Points system was accordingly developed. Under the Swedish trial this points system does not feed into the GSF calculation, but forms a checklist of appropriate ecological enhancement actions, 10 of which must be chosen for integration within each new development.

An amended points list to reflect UK conservation targets and site specific conditions should be applied in this instance, reflecting enhancement actions described in table 5.2. Design compliance with these points should be judged by an ecologist or local planning authority.

All new developments under this trialled approach must include at least 5 key actions and at least 5 additional actions (chosen from a selection of other enhancement actions in 5.2) alongside achievement of a net gain in green space factor value.

The five key actions should be included within every development should include:

- An area of biodiverse living roof
- Bird and bat boxes
- Wildlife friendly landscaping that includes at least 10 species of value for pollinators and new street tree planting where possible
- Provision of invertebrate friendly enhancements
- Implementation of an ecological management and maintenance plan
- Where the development has influence of dock basins at least two of the aquatic enhancement actions should also be integrated within design and approach

Worked example

A new development is proposed for a 1ha plot of land on the Estate that currently contains 0.25 ha of amenity grassland, 0.1 ha of raised bed, 0.15ha of open mosaic habitat with 0.5ha of hardstanding. Proposals seek to include 0,4 ha of living roof, 0.1 ha of bed planting with 2 new street trees and 0.5 ha of building/hardstanding cover.

Baseline GSF therefore equals:

GSF = ((0.25 x 1) + (0.1 x 1) + (0.15 x 0.2) + (0.5 x 0))/1 = 0.38

Post construction GSF:

GSF = ((0.4 x 0.6) + (0.1 x 2) + (0.5 x 0))/1 = 0.44

This scenario results in a net gain in GSF of 0.06. This clearly shows the flaws of such a system however, as the post construction scenario may support greater biodiversity. When applying the amended Green Space Factor and Green Points approach the development would also need to commit to the 5 key enhancement actions and choose from at least 5 of the other actions described in the design principles Framework table.

APPENDIX 5 EXAMPLE SPECIES LISTS

BIODIVERSE/DROUGHT TOLERANT LANDSCAPING

1.1 Climate change is likely to result in greater drought risk and UHI effect in urban environments.

Species Name	Latin Name	Benefit	Conditions
Herbaceous planting for ground level or green walls			
Mullein species	Verbascum spp.	Attracts pollinators	Grows in full sun, in poor, well-drained soil.
Thyme species	*Thymus spp.*	Highly aromatic, attracts pollinators	Grows in well-drained alkaline and neutral soils. Grows in full sun and exposed areas
Lesser calamint	*Calamintha nepeta*	Attracts pollinators	Grows in well-drained soil in full sun
Scabious spp.	*Scabiosa spp.*	Attracts pollinators	Grows in well-drained fertile soil, in full sun
Red valerian (white variety)	*Centranthus ruber*	Attracts pollinators	Grows in well-drained soil, preferably chalky or stony, in full sun and exposed areas
Mountain rock cress	*Arabis alpina*	Attracts pollinators	Tolerates hot, dry conditions and poor, infertile soils.
Sage	*Salvia sp.*	Attracts pollinators	Grows in light, moderately fertile, well-drained soil. Requires sheltered spot, in full sun.
Korean mint	*Agastache rugosa*	Attracts pollinators	Grows in full sun, tolerates exposed locations.
Crane's-bill	*Geranium sp.*	Attracts pollinators	Grows in moderately fertile soils, can grow in any level of shade.
Thrift	*Armeria maritima*	Attracts pollinators	Grows in well-drained soils, in full sun and exposed locations.
Blanketflower	*Gaillardia x grandiflora*	Attracts bees, butterflies and soldier beetles	Grows in moderately fertile, well-drained soils in full sun
Yarrow	*Achillea sp.*	Attracts bees, butterflies, wasps, ladybirds and hoverflies	Grows in open, sunny positions in moist but well-drained soils.
Everlasting pea	*Lathyrus latifolius*	Pollinated by bumblebees, would suit a green wall	Can be grown as a climber or allowed to scramble over ground. Tolerates full sun and exposed locations.

1.2 Planting schemes in at risk locations, as identified by the climate change risk modelling, should therefore integrate climate resilient species that provide wildlife benefits whilst being tolerant to extreme conditions and low maintenance regimes.

Species Name	Latin Name	Benefit	Conditions
Shrub planting			
Firethorn	*Pyracantha sp.*	Attracts pollinators and birds	Grows in full sun or partial shade. Pollution tolerant
Rosemary	*Rosmarinus officinalis*	Attracts bees	Prefers poor, well-drained soils in full sun
Russian sage	*Perovskia atriplicifolia*	Attracts bees, butterflies and hoverflies	Grows in well-drained, poor to moderately fertile soil in full sun.
Viburnum	*Viburnum sp.*	Attracts pollinators and birds	Grows in most moderately fertile, well-drained soils
Oleaster	*Eleagnus sp.*	Attracts pollinators	Grows in well-drained soils in full sun or partial shade
Shrubby cinquefoil	*Potentilla fruticosa*	Attracts pollinators	Grows well in most soils but prefers partial shade and moister soils
Coral Sun	*Koelreuteria paniculata*	Good specimen tree, attracts pollinators	Grows in well-drained soils in full sun

BIODIVERSE/AIR QUALITY LANDSCAPING

1.3 The following tables provide recommendations for floral species to include within landscaping across the estate. The species have been selected for any combination of the following characteristics:

- Native and prominent in southeast region;
- Known wildlife benefits including pollinator resource, shelter, nesting habitat etc.;
- Air quality benefits;
- Drought resistant; and
- Resilient in harsh conditions.

1.4 Some recommended species are non-native/ornamental but their associated benefits for biodiversity and air quality are worth deviating from this standard prerequisite, particularly in the desire to create resilient habitats more typical of drier, hotter and harsher conditions.

1.5 The species have been taken from various studies, reports and websites, most prevalently the list of *Plants that capture and mitigate particulate air pollution* (City in Bloom,2017) which comprises species that were assessed in an Imperial College London study[xl].

Species Name	Latin Name	Benefit	Conditions
Herbaceous planting for ground level or green walls			
Shrubby bindweed	*Convolvulus cneorum*	Leaf surface is covered in a high density of fine silver hairs. Attractive to pollinators when flowering in the spring.	Grows in well-drained soil or low to moderate fertility, in a sheltered spot with full sun.
Perennial wallflower	*Erysimum bicolor*	Leaf surface has a high density of short hairs. Good for bees, butterflies, moths and other pollinators.	Grows in full-sun – partial shade. Grows well in most soil types but should be well drained. Light/sandy, clay/heavy/moist and chalky/alkaline.
Wild geranium	*Geranium maulatum*	Leaves are broad and palmate with fine hairs. Attracts pollinators.	Grows in full-sun – partial shade. Well-drained but moist soil of most types.
Boxwood hebe	*Hebe odora*	Very small leaves perfect for trapping particulates. Attracts honeybees.	Tolerates most conditions.

Shrubby bindweed	*Convolvulus cneorum*	Leaf surface is covered in a high density of fine silver hairs. Attractive to pollinators when flowering in the spring.	Grows in well-drained soil or low to moderate fertility, in a sheltered spot with full sun.
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Wild geranium	*Geranium maulatum*	Leaves are broad and palmate with fine hairs. Attracts pollinators.	Grows in full-sun – partial shade. Well-drained but moist soil of most types.
Hebe 'Mrs Winder'	*Hebe 'Mrs Winder'*	Attracts pollinators.	Tolerates most conditions. Full-sun – partial shade.
Common ivy	*Hedera helix*	Good food source for bees late in the season and berries for birds.	Grows in moist but well-drained soil. Most types suitable. Can grow in full shade – full sun.
Hairy alum root	*Heuchera villosa*	More or less evergreen, clump-forming perennial with rounded, shallowly palmately lobed leaves. Attractive to bees.	Full-sun – partial shade. Sand and loam soils, most but well-drained.
Hairy alum roof	*Heuchera 'Regina'*	As above.	Drought and shade tolerant. Grows in full-sun.
Common lavender	*Lavendula angustifolia*	Attracts Goldfinch, Honey bee, Red mason bee and Small white. Rough surface on leaves.	Full sun. Hardy.
Lambs ear	*Stachys byzantina*	Long, dense, silver, silky-lanate hairs on leaf surface. Attracts pollinators.	Grows in full sun. Well drained soil.
Lady's mantle	*Alchemilla mollis*	Herbaceous perennial forming a clump of softly hairy, light green leaves with scalloped and toothed edges. Attracts bees and other pollinators, birds and beneficial insects.	Grows in full-sun – partial shade/ Moist but well drained soils of most types.
Sweet box	*Sarcocca confusa*	Compact evergreen shrub. Attracts pollinators.	Tolerant of urban pollution, shade and drought. Moist but well drained soils in full or partial shade.
Hart's tongue fern	*Asplenium scolopendrium*	Regularly used for improving indoor air quality. Now common in green walls.	Grows well in humus-rich, moist but well-drained soil. Tolerant of dry shade but should be watered well in first season and mulch. Hardy.
Elephant's ears	*Bergenia*	Attracts pollinators. Regularly used in green walls.	Grows in full sun to partial shade. Very hardy (H7) and can tolerate most soils.
Phlebodium blue star fern	*Phlebodium aurium*	Air purifying. Used in green wall systems.	Tolerates partial shade.

Species Name	Latin Name	Wildlife Benefit and UTAQS
Trees and shrubs		
Alder	*Alnus glutinosa*	Food plant for the caterpillars of several moths including the alder kitten, pebble hook-tip, the autumnal and the blue bordered carpet moth. Catkins provide an early source of nectar and pollen for bees, and the seeds are eaten by the siskin, redpoll and goldfinch. UTAQS = high
Beech	*Fagus sylvatica*	Important habitat for many butterflies, particularly in open glades and along woodland rides. Larval foodplant for the barred hook-tip, clay triple-lines and olive crescent. The seeds are eaten by mice, voles, squirrels and birds. UTAQS = not available but highly regarded as removing ozone and CO.
Bird cherry	*Prunus padus*	Early source of nectar and pollen for bees. The cherries are eaten by blackbird and song thrush, as well as mammals such as the badger, wood mouse, yellow necked mouse and dormouse. Larval foodplant of many species of moth, including the orchard ermine, brimstone and short cloaked moth. UTAQS = medium
Crab apple	*Malus sylvestris*	Foodplant for moths including the eyed hawk-moth, green pug, Chinese character and pale tussock. The flowers provide an important source of early pollen and nectar for insects, particularly bees, and the fruit is eaten by birds, including blackbirds, thrushes and crows. Mammals, including mice, voles, foxes and badgers also eat crab apple fruit. UTAQS = medium
Elder	*Sambucus edulis*	Nectar source for a variety of insects and the berries are eaten by birds and mammals. Small mammals such as dormice and bank voles eat both the berries and the flowers. Many moth caterpillars feed on elder foliage, including the white spotted pug, swallowtail, dot moth and buff ermine. UTAQS = medium
Elm, English	*Ulmus minor*	Larval foodplant for the peppered, light emerald and white spotted pinion moths. Caterpillars of the white letter hairstreak butterfly feed on elms. UTAQS = medium
Field maple	*Acer campestre*	Attractive to aphids and therefore their predators, including many species of ladybird, hoverfly and bird. Larval foodplant of sycamore moth, mocha, maple pug, small yellow wave, prominent and maple prominent. The flowers provide nectar and pollen for bees and birds, and small mammals eat the fruits. UTAQS = high
Hazel	*Corylus avellana*	Larval foodplant for large emerald, small white wave, barred umber and nut-tree tussock. In managed woodland where hazel is coppiced, the open wildflower-rich habitat supports many species of butterfly, particularly fritillaries. Coppiced hazel also provides shelter for ground-nesting birds such as the nightingale, nightjar, yellowhammer and willow warbler. Hazel nuts are also eaten by woodpeckers, nuthatches, tits, wood pigeons, jays and a number of small mammals. Hazel flowers provide early pollen as a food for bees. UTAQS = medium

Species Name	*Latin Name*	Wildlife Benefit and UTAQS
Holly	*Ilex aquifolium*	Dense cover and good nesting opportunities for birds, while its deep, dry leaf litter may be used by hedgehogs and small mammals for hibernation. Flowers provide nectar and pollen for bees. Larval foodplant for yellow barred brindle, double-striped pug and the holly tortrix moths and holly blue butterfly. UTAQS = not available
Hornbeam	*Carpinus betulus*	Shelter, roosting, nesting and foraging opportunities for birds and small mammals. Larval food plant for the nut tree tussock. Finches and tits and small mammals eat the seeds in autumn. UTAQS = not available
Large leaved lime	*Tilia platyphyllos*	Larval foodplant for lime hawk, peppered, vapourer, triangle and scarce hook-tip moths. Attractive to aphids, providing a source of food for their predators, including hoverflies, ladybirds and many species of bird (bees also drink the aphid honeydew deposited on the leaves). The flowers provide nectar and pollen for insects, particularly bees. UTAQS = medium
Purple leaf plum	*Prunus cerasifolia nigra*	Flowers are attractive to bees and other insects. Birds eat the ripe fruits. UTAQS = medium
Rowan	*Sorbus aucuparia*	Flowers provide pollen and nectar for bees and other pollinating insects, while the berries are a rich source of autumn food for birds, especially the blackbird, mistle thrush, redstart, redwing, song thrush, fieldfare and waxwing. Larval food plant for autumn green carpet. UTAQS = medium
Small leaved lime	*Tilia cordata*	As T. platyphyllos above.
Tulip tree	*Liriodendron tulipifera*	Good source of nectar and pollen for bees. UTAQS = not available
Whitebeam	*Sorbus aria*	Larval foodplant for moths Parornix scoticella, Phyllonorycter corylifoliella and Phyllonorycter sorbi. Berries attractive to birds. UTAQS = not available
Wild cherry	*Prunus avium*	As *P. padus* above. UTAQS = medium
Willow	*Salix spp.*	Caterpillars of a number of moth species feed on the foliage, including the puss moth, eyed hawk-moth and red underwing. The catkins provide an important source of early nectar and pollen for bees and other insects, and the branches make good nesting and roosting sites for birds. UTAQS = low (*S. alba*)
Yew	*Taxus baccata*	Nesting sites for many birds. Fruit is eaten by birds such as the blackbird, mistle thrush, song thrush and fieldfare, and small mammals such as squirrels and dormice. The leaves are eaten by caterpillars of the satin beauty moth. UTAQS = not available

Larch	*Larix decidua*	Seeds eaten by birds, including the siskin and lesser redpoll. The caterpillars of many moths feed on the foliage, including the case-bearer moth and larch pug. Larch tortrix moth caterpillars eat the cone scales. UTAQS = high
Laurel	*Prunus laurocerasus*	Good nesting value for birds. Attracts bees and hoverflies. UTAQS = high
Lawson cypress	*Chamaecyparis lawsoniana*	Dense foliage provides shelter for nesting birds, including various finches, when many broadleaved trees are still in bud UTAQS = high
Norway maple	*Acer platanoides*	Larval foodplant for several moths. Bees and other invertebrates are attracted to the pollen. Birds and small mammals forage on the seeds. UTAQS = high
Black pine	*Pinus nigra*	Shelter for birds and small mammals. Foraging resource for birds. UTAQS = high
Silver birch	*Betula pendula*	Provides food and habitat for more than 300 insect species. Larval foodplant for angle shades, buff tip, pebble hook-tip and Kentish glory. Seeds are eaten by birds such as siskins greenfinches and redpolls. UTAQS = high
Species Name	***Latin Name***	**Wildlife Benefit**
Alder buckthorn	*Frangula alnus*	Larval food plant of the brimstone butterfly, whose caterpillars eat the leaves. Its flowers provide a source of pollen and nectar for bees and other insects, and its berries are eaten by birds.
Blackthorn	*Prunus spinosa*	Early source of nectar and pollen for bees in spring. Larval food plant for lackey, magpie, common emerald, small eggar, swallow-tailed and yellow-tailed. Used by the black and brown hairstreak butterflies. Birds nest among the dense, thorny thickets, eat caterpillars and other insects from the leaves, and feast on the berries in autumn.
Broom	*Cytisus scoparius*	Food source for honey bees.
Buckthorn	*Rhamnus cathartica*	As *F. alnus* above.
Common box	*Buxus sempervirens*	Attracts bees and provides a dense, sheltered habitat for small birds, mammals and insects.
Dog rose	*Rosa canina*	Nectar source for invertebrates and food source for birds.
Dogwood	Cornus sanguinea	Attractive to Blackbird, Carrion crow, Chaffinch, Fieldfare, Mistle thrush, Redwing, Robin, Waxwing, Yellowhammer and the Holly blue butterfly

Common Dogwood ‘Midwinter fire’	Cornus sanguine ‘Midwinter fire’	As above
Gorse	Ulex europaeus	Pollen and nectar source for invertebrates.
Guelder rose	Viburnum opulus	Red berries are an important food source for birds, including bullfinch and mistle thrush. The shrub canopy provides shelter for other wildlife. The flowers are especially attractive to hoverflies
Hawthorn	Crataegus monogyna	Can support more than 300 insect species. Larval foodplant of the hawthorn, orchard ermine, pear leaf blister, rhomboid tortrix, light emerald, lackey, vapourer, fruitlet mining tortrix, small eggar and lappet moths. Important for many other species of bird as a food source and nesting habitat.
Honeysuckle	Lonicera periclynemum	Important resource for many taxa including butterflies, dormice, bumblebees, moths and birds.
Juniper	Juniper communis	Cover for nesting birds. Larval foodplant of juniper carpet moth, juniper pug and chestnut-coloured carpet.
Old man's beard	Clematis vitalba	Good for pollinators such as bees and hoverflies. Larval foodplant of pretty chalk carpet, small waved umber and small emerald moths. Seeds are food source for birds.
Wayfaring tree	Wayfaring tree Viburnum lantana	Birds will eat the berries and insects like hoverflies feed on the nectar. The larvae of several moth species will feed on the leaves.
Wild privet	Ligustrum vulgare	Good source of nectar and pollen for pollinators.

GENERAL LANDSCAPING SPECIES LISTS

1.6 All new developments should provide wildlife friendly landscaping.

1.7 The tables table below provides an example selection of appropriate species for a variety of conditions; shaded understorey, full sun herbaceous beds, seasonal bulbs, shrub and tree planting, SuDS planting, and biodiverse roof/wildflower meadows.

1.8 Please note this is simple an example selection to guide potential species selection for landscape architects. All new developments should be assessed on individual merit with bespoke advice provided by an ecologist.

1.9 For a broader selection of species' the RHS's Perfect for Pollinators list[xli] should be consulted.

Species Name	Latin Name	Wildlife Benefit	Growing Conditions
Shade tolerant herbaceous perennial			
Wood avens	*Geum urbanum*	Attracts pollinators	Semi-shaded sites in a variety of soils
Lords and ladies	*Arum maculatum*	Early flowering, unusual	Grows in moist, well-drained soils in light shade.
Pignut	*Conopodium majus*	Delicate white flowers, pollinated by insects	Grows in light shade or full sun
Ferns (e.g. soft shield fern *Polystichum setiferum* or male fern *Dryopteris filix-mas*)	*Various*	Valuable for invertebrates	Shade tolerant and year round
Primrose	*Primula vulgaris*	Attracts pollinators	Grows in most well-drained soils, in full sun or partial shade
Dog's mercury	*Mercurialis perennis*	Flowers in spring	Grows in shaded areas
Honeysuckle	*Lonicera periclymenum*	Sweetly scented in autumn	Grows in fertile, well-drained soil, with top growth in full sun

Celandines	*Ficaria sp.*	Early flowering, beneficial for early emerging invertebrates	Grows in damp areas
Lesser stitchwort	*Stellaria graminea*	Attracts pollinators	Grows in moist, well-drained soils in full sun.
Dog violet	*Viola riviniana*	Attracts pollinators	Grows in moist, well-drained soils, in any level of shade.
Wild strawberry	*Fragaria vesca*	Attracts pollinators	Grows in fertile, moist but well-drained soil. Tolerates shade but flowers best in full sun.
Red campion	*Silence dioica*	Attracts pollinators	Grows in well-drained, moderately fertile soil, in full sun or partial shade
Bulbs			
Snowdrops	*Galanthus sp.*	Flower: winter/early spring	Grows in moist but well-drained soils in full sun or partial shade.
Narcissus spp.	*Narcissus sp.*	Flower: early spring – late spring (variety dependent)	Grows in well-drained acidic soils in full sun
Snake's head fritillary	*Fritillaria meleagris*	Flower: spring	Grows in fertile, well-drained soils in full sun or partial shade.
Wood anemone	*Anemone nemorosa*	Flower: spring	Grows in moist, well-drained soils, in partial shade.
Bluebell	*Hyacinthoides non-scripta*	Flower: spring	Grows in well-drained soils and tolerates any level of shade
Camassia spp.	*Camassia sp.*	Flower: spring	Grows in well-drained, fertile soil. Requires a sheltered spot in full sun or partial shade.
Wild garlic	*Allium ursinum*	Flower: spring	Grows in fertile, well-drained soil in full sun.
Allium spp	*Allium sp.*	Flower: Spring – late summer (dependent on variety)	Grows in sheltered areas with well-drained soils in full sun.
Lilly of the valley	*Convallaria majalis*	Flower: summer	Grows in fertile, moist soil, in full sun or partial shade.

Cyclamen spp.	*Cyclamen sp.*	Flower: late summer	Grows in moderately fertile, well-drained soils in partial shade.
Crocus spp.	*Crocus sp.*	Flower: autumn	Grows in poor to moderately fertile soil, in full sun.
Colchicum spp.	*Colchicum sp.*	Flower: autumn	Grows in moist but well-drained, fertile soil in full sun.
Full sun herbaceous perennial			
Common lavender	*Lavandula angustifolia*	Attracts Goldfinch, Honey bee, Red mason bee and Small white.	Exposure: Full sun Hardiness: Hardy Soil type: Well-drained/light, Dry, Sandy
Common thyme	*Thymus vulgaris*	Butterflies, Common carder bumble bee, Honey bee, Red mason bee, White-tailed bumble bee	Exposure: Full sun Hardiness: Hardy Soil type: Well-drained
Common rosemary	*Rosmarinus officinalis*	Bees and wasps	Exposure: Full sun Hardiness: Hardy Soil type: Well-drained/light, Dry, Sandy
Chamomile	*Matricaria chamomilla*	Attractive to moths	Exposure: Full sun/partial shade Hardiness: Hardy Soil type: Well-drained
Chives	*Allium schoenoprasum*	Attractive to bees and wasps	Exposure: Full sun Hardiness: Hardy Soil type: Well-drained/dry
Sage	*Salvia officinalis*	Attractive to Common carder bumble bee, Green tortoise beetle, Red mason bee, White-tailed bumble bee	Exposure: Full sun Hardiness: Hardy Soil type: Moist but well-drained
Common Dogwood	*Cornus sanguinea*	Attractive to Blackbird, Carrion crow, Chaffinch, Fieldfare, Mistle thrush, Redwing, Robin, Waxwing, Yellowhammer and the Holly blue butterfly	Exposure: Full sun, Partial shade Hardiness: Hardy Soil type: Well-drained or Moist but well-drained
Wild Marjoram	*Origanum vulgare*	Late flowering, attracts bees and butterflies	Drought resistant, low growing, tolerant of partial shade or full sun

Wild Marjoram ‘Aureum’	*Origanum vulgare*	Late flowering, attracts bees and butterflies	Drought resistant, low growing, tolerant of partial shade or full sun
Yarrow	*Achillea millefolium*	Attracts beneficial Syrphid flies.	Exposure: Full sun, Hardiness: Hardy Soil type: Well-drained/ Moist/chalk/ Clay/sand/loam
Cornflower	*Centaurea cyanus*	Attract many beneficial insects that come to nectar and feed on the pollen	A hardy plant which grows of many soil types and prefers full sun.
Californian poppy	*Eschscholzia californica*	Bees and wasps, Flies, Marmalade hoverfly	Exposure: Full sun, Hardiness: hardy Soil type: Well-drained/dry
Clustered bellflower	*Campanula glomerata*	Common carder bumble bee, Red-tailed bumble bee	Exposure: Full sun, Hardiness: hardy Soil type: Well-drained/dry
Common bistort	*Bistorta officinalis*	Small copper butterfly	Exposure: Full sun, Hardiness: Hardy Soil type: Well-drained/ Moist but well-drained
Ice plant	*Hylotelephium spectabile*	Buff-tailed bumble bee, Comma, Orange-tip, Painted lady, Peacock, Red admiral, Small tortoiseshell	Hardiness: hardy Soil type: Well-drained/dry
Sea-holly	*Eryngium maritimum*	Buff-tailed bumble bee, Butterflies, Common carder bumble bee, Honey bee, Red mason bee, Red-tailed bumble bee, Syrphus ribesii, White-tailed bumble bee	Hardiness: hardy Soil type: Well-drained/dry
Small scabious	*Scabiosa columbaria*	Meadow brown, Small skipper butterflies	Exposure: Full sun, Hardiness: Hardy Soil type: Well-drained
Vervain	*Verbena sp.*	Insects including the honey bee	Exposure: Full sun, Hardiness: Hardy Soil type: Well-drained
Cosmos	*Cosmos sp.*	Bees and wasps, Flies, Hummingbird hawk-moth	Exposure: Full sun, Hardiness: Hardy Soil type: Well-drained/ Moist but well-drained

Purple moor-grass -	*Molinia caerulea*	Common sun beetle, moths including *Eupelix cuspidata,* Large skipper butterfly, and insects including *Myrmus miriformis*	Exposure: Full sun, Hardiness: Hardy Soil type: Well-drained/ Moist but well-drained
Quaking-grass	*Briza sp.*	Attractive to Atomaria mesomela, Common sun beetle, Greenfinch, Linnet, Yellowhammer; and the House sparrow	Exposure: Full sun, Hardiness: Hardy Soil type: Well-drained/ Moist but well-drained/chalk/ clay/sand/loam
Shrubs			
Wild privet	*Ligustrum vulgare*	Can form dense hedging – semi-evergreen. Flowers attract pollinators and berries attract birds	Grows in well-drained soil in full sun or partial shade.
Holly	*Ilex aquilifolium*	Flowers attract pollinators and berries attract birds	Grows in well-drained soils in full sun. Can tolerate partial shade.
Barberry	*Berberis sp.*	Flowers attract pollinators and berries attract birds	Grows in most soils except when waterlogged. Fruits best in full sun but tolerates partial shade.
Bilberry	*Vaccinium myrtillus*	Flowers attract pollinators and berries attract birds	Grows well in full sun, in acidic soils. Tolerant of exposed locations.
Blackthorn	*Prunus spinose*	Flowers attract pollinators and berries attract birds	Grows well in many soils but prefers well-drained. Tolerates all levels of shade.
Hawthorn	*Crataegus monogyna*	Flowers attract pollinators and berries attract birds	Grows in full sun or partial shade in well-drained soils. Once established will tolerate pollution and exposure
Firethorn	*Pyracanth asp.*	Flowers attract pollinators and berries attract birds	Grows in full sun or partial shade. Pollution tolerant
Viburnum	*Viburnum sp.*	Flowers attract pollinators and berries attract birds	Grows in moist but well-drained soil, in any level of shade
Hazel	*Corylus avellana*	Nut-producing – good for birds and small mammals	Grows well in most well-drained soils in full sun or partial shade.
Dogwood	*Cornus sanguinea*	Flowers attract pollinators and berries attract birds	Grows well in full sun or partial shade in well-drained soils

Broom	*Cytisus scoparius*	Attracts pollinators	Grows in well-drained soils in full sun
Buckthorn	*Rhamnus cathartica*	Flowers attract bees and berries attract birds	Grows in most soils in full sun or partial shade.
Yew	*Taxus baccata*	Flowers attract pollinators and berries attract birds, coniferous	Grows in well-drained soils and tolerates urban pollution and exposure. Any level of shading.
Spindle	*Euonymus europaeus*	Flowers attract pollinators and berries attract birds	Grows well in most soil conditions, in full sun or partial shade.
SuDS planting			
Flowering-rush	*Butomus umbellatus*	Flowers in summer	Grows in fertile mud at pond margins in full sun
Gipsywort	*Lycopus europaeus*	Flowers in summer	Grows in wet soils on the edges of watercourses
Great water-dock	*Rumex hydrolapathum*	Flowers in summer	Grows along waterline or in shallows
Hemp agrimony	*Eupatorium cannabinum*	Flowers pollinated by insects in summer	Grows in damp areas
Lesser reedmace/lesser bulrush	*Typha angustifolia*	Flowers in summer	Grows in water with deep mud
Marsh woundwort	*Stachys palustris*	Pollinated by bumblebees.	Grows in marshes, banksides and damp areas.
Pendulous sedge	*Carex pendula*	Valuable for invertebrates	Grows in fertile, moist and wet soils in full sun or partial shade.
Purple loosestrife	*Lythrum salicaria*	Flowers in summer	Grows in moist soil in full sun
Rush	*Juncus spp.*	Valuable for invertebrates	A varied group, typically growing in cold and wet habitats.

Yellow iris	*Iris pseudacorus*	Flowers mid-late summer	Grows in wet soils in full sun. Thrives at waterbody margins
Amphibious bistort	*Persicaria amphibia*	Attracts pollinators	Grows in wet habitats such as ponds, streams and marshes.
Brooklime	*Veronica beccabunga*	Blooms spring - summer	Grows in margins of brooks and ditches
Fleabane	*Pulicaria dysenterica*	Flowers summer – early autumn. Important for bees, hoverflies and butterflies	Grows in damp areas
Floating sweet-grasses	*Glyceria spp.*	Valuable for invertebrates	Found in wetland areas
Marsh foxtail	*Alopecurus geniculatus*	Valuable for invertebrates	Grows in damp areas
Marsh marigold	*Caltha palustris*	Flowers in spring	Grows in rich, boggy soil in full sun
Meadowsweet	*Filipendula vulgaris*	Flowers in summer	Grows in fertile soil, moist but well-drained or poorly-drained, in full sun or partial shade
Water forget-me-not	*Myosotis scorpioides*	Attracts pollinators	Grows in wet soil in water margins, in full sun or partial shade
Water mint	*Mentha aquatica*	Attracts pollinators	Grows in moist soil in full sun or partial shade
Watercress	*Nasturtium officinale*	Pollinated by hoverflies	Aquatic to semi-aquatic habitats

Species Name	Latin Name	Height	Wildlife Benefit	Description/Growth Conditions
Wildflower meadow and biodiverse roof species				
Agrimony	*Agrimonia eupatoria*	Up to 65cm	The food plants by the larvae of some Lepidoptera species including Grizzled Skipper and Large Grizzled Skipper	A hardy plant that prefers partial shade
Autumn Hawkbit	*Leontodon autumnalis*	15-30cm	Late flowering, attracts beetles and butterflies	Drought tolerant, low nutrients, wind tolerant, open conditions
Birds Foot Trefoil	*Lotus corniculatus (do not confuse with introduced sown variety L. Corniculatus var sativus)*	20-40cm	Mid flowering, good nectar source for many insectsand a larval source for many species of Lepidoptera.	Drought and wind tolerant, low growing, sprawling habit. Common on grasslands and along roadsides. A member of the legume family therefore nitrogen fixing and will increase the nutrient value of the substrate over time
Biting Stonecrop	*Sedum acre*	10-15cm	Branched clusters of bright yellow flowers, which have long protruding stamens and are attractive to bees for pollen and nectar.	This is a spreading plant that thrives on virtually soil-less conditions. Favours full sunlight.
Black Medick	*Medicago lupulina*	Up to 50cm	Early flowering, attracts butterflies, hoverflies and bees.	Low growing, ground hugging plants. Very common on roads and roadsides and is drought and wind tolerant, and can survive relatively cold conditions. A member of the legume family therefore nitrogen fixing and will increase the nutrient value of the substrate over time
Bladder Campion	*Silene vulgaris*	40-80cm	The Bladder Campion is an important nectar source for butterflies and a favourite food plant of frog hoppers, the insects which create cuckoo spittle	It prefers neutral, dry soils and is generally found alongside paths and in open grassy or rough ground.
Breckland Thyme	*Thymus serpyllum*	5-20cm	Flowers are attractive to bees	Easily grown in average, dry to medium, well-drained soils in full sun. Tolerates drought and poor soils of low fertility. Loose, sandy or rocky soils with excellent drainage are best habitat
Bugle	*Ajuga reptans*	10-25cm	The flower is an important early source of nectar for butterflies, especially the Duke of Burgundy, Marsh Fritillary and the Pearl-Bordered Fritillary.	A small, spreading plant that produces a ring of blue flowers on top of each set of leaves. Prefers sunny of semi-shaded conditions

Bulbous Buttercup	*Ranunculus bulbosus*	20-50cm	The food plant of the larvae of some Lepidoptera species including Hebrew Character and Small Angle Shades	Favours nutrient-poor, well-drained soils
Common Corncockle	*Agrostemma githago*	Up to 80cm	Attracts lady-beetles and parasitic wasps	Hardy plant found in many conditions. Likes disturbed, nutrient poor soils
Common Field Speedwell	*Veronica persica*	10-30cm	Flowers most of the year, attracts butterflies.	Low growing, hardy plant, nutrient rich
Common Forget-Me-Not	*Myosotis arvensis*	10-35cm	Food plant of the larvae of some Lepidoptera species including *Setaceous Hebrew Character*	Shows a preference for soils with low pH
Common Mouse Ear	*Cerastium fontanum*	Up to 50cm	Early to late flowering, flowers are self or insect pollinating	Low growing, likes dry grassland and wasteland conditions, prefers richer nutrient levels
Common Poppy	*Papaver rhoeas*	Up to 60cm	Has no nectar but the flowers provide pollen for bees. Beetles feed in the seed capsules and some species may overwinter here when the capsules are empty	Hardy plant grows on disturbed soils
Common Vetch	*Vicia sativa*	15-40cm	Mid flowering, attracts bees, wasps, butterflies and aphids – aphids are beneficial for house sparrows	Particularly attractive to aphids, an essential food source for house sparrow chicks. A member of the legume family therefore nitrogen fixing and will increase the nutrient value of the substrate over time
Corn Camomile	*Anthemis arvensis*	Up to 30cm	Attract a range of pollinating insects	Preference for light chalky or sandy soils
Cornflower	*Centaurea cyanus*	30-80cm	Attract many beneficial insects that come to nectar and feed on the pollen	A hardy plant which grows of many soil types and prefers full sun
Cowslip	*Primula veris*	Up to 25cm	Food plant of the Duke of Burgundy Fritillary butterfly, Plain Clary and Northern Rustic moths	A hardy plant preferring well drained soils and full sun
Cut Leaved Crane's-Bill	*Geranium dissectum*	10-40cm	Mid to late flowering, attracts beetles and butterflies. Known to be growing locally in Bully Point Nature Reserve SNCI	Likes stony ground, wasteland, and thin soils. Low growing sprawling plant

Dove's-Foot Crane's-Bill	*Geranium molle*	Up to 20cm	Early flowering, attracts range of insects.	Low growing, sprawling habit. Drought tolerant and common on roadsides, wastelands and brownfield sites
Fox And Cubs	*Hieracium aurantiacum*	15-35cm	Mid flowering, attracts flies, good nectar source	Drought tolerant, hardy plant, low growing
Hares Foot Clover	*Trifolium arvense*	10-40cm	Late flowering, attracts flies, good nectar source	Drought and wind tolerant. A member of the legume family therefore nitrogen fixing and will increase the nutrient value of the substrate over time
Hoary Plantain	*Plantago media*	30-55cm	Mid flowering, large flowerhead, attracts bees and wasps	Drought tolerant, low growing
Kidney Vetch	*Anthyllis vulneraria*	Up to 60cm	Late flowering, attracts bees and wasps and butterflies.	Low growing, ground covering plant, found on wastelands, railway embankments etc. Drought tolerant. A member of the legume family therefore nitrogen fixing and will increase the nutrient value of the substrate over time
Knapweed	*Centaurea scabiosa*	Up to 50cm	Very attractive to butterflies and bees.	Tolerant of a wide range of soils. It's common throughout the British Isles.
Lemon-scented Thyme	*Thymus x citriodorus*	10cm	Very attractive to numerous species of butterflies and bees	Hardy low growing plant. Frost tolerant.
Musk Mallow	*Malva moschata*	Up to 80cm	Particularly attractive to several species of bees.	Prefers dry and fertile soils and full sun.
Ox Eye Daisy	*Leucanthemum vulgare*	Up to 60cm	Late flowering, attracts beetles and hoverflies.	Grows on disturbed soils and wastelands as well as wildflower meadows, tolerant of a wide range of environmental conditions including drought
Pale Toadflax	*Linaria repens*	Up to 80cm	Has pollen for bees and pollen beetles, *Brachtypterus spp*., in the flowers.	Grows on dry banks and stony ground over much of England and Wales.
Perforate St Johns Wort	*Hypericum perforatum*	20-50cm	Mid flowering, attracts bees, wasps and beetles.	Found on wastelands, dry stony ground, drought tolerant, robust plant
Red Campion	*Silene dioica*	30-80cm	The nectar of the flowers is utilised by bumblebees and butterflies, and several species of moth feed on the foliage	Grows in a variety of conditions but prefers to grow on damp, non-acid soils.

Red Clover	*Trifolium pratense*	20-60cm	Late flowering, attracts bumble bees, common carder bee, butterflies and weevils.	Low growing drought tolerant, hardy plant, low nutrient growth. A member of the legume family therefore nitrogen fixing and will increase the nutrient value of the substrate over time
Reflexed Stonecrop	*Sedum reflexum*	10cm	An excellent source of nectar for bees and butterflies	Low growing plant which grows in small bushes, spreading on the ground
Ribwort Plantain	*Plantago lanceolata*	10-40cm	Beneficial for bird species.	Drought tolerant and very common on wasteland, brownfield sites and roadsides
Rough Hawkbit	*Leontodon hispidus*	20-50cm	Yellow flower attracts butterflies and bees	A slow-growing, rosette-forming perennial of dry, neutral or calcareous soils. Dislikes nutrient-rich soils.
Scented Mayweed	*Matricaria recutita*	15-50cm	This plant is a very good source of nectar for bees and flies. One small weevil, *Omphalapion hookeri* lives on the seedheads. Scented mayweed is highly attractive to ladybirds that feed on aphids	It thrives best on lighter soils but can grow on loams and heavy clays. Prefers full sun.
Self Heal	*Prunella vulgaris*	30-60cm	Mid flowering, good for bees.	Prefers sun or semi-shade and some moisture but drought tolerant, low growing creeping plant.
Tunic Flower	*Petroraghia saxifraga*	10-15cm	Flowers attracts numerous butterfly and bee species.	Grows in sunny location in poor to moderately fertile soil, low water. Tolerates drought and neglect.
Viper's Bugloss	*Echium vulgare*	30-60cm	An important food source for species of bumblebee and butterflies.	Grows in dry, sunny position in well-drained or sandy soils.
White Clover	*Trifolium repens*	20cm	Late flowering, attracts, honey bee, bumble bees, weevils	Low growing, relatively drought tolerant, will not grow well in shade, low nutrient growth. A member of the legume family therefore nitrogen fixing and will increase the nutrient value of the substrate over time.
White Stonecrop	*Sedum album*	20cm	It provides nectar and pollen for bees including the buff-tailed bumble bee. Used as food plants by the larvae of some Lepidoptera species.	Grows well in a city environment. Is drought tolerant and prefers sunny positions.
Wild Basil	*Clinopodium vulgare*	30-70cm	Pollinated by bees and attractive to butterflies.	Very hardy plant and drought resistant.

Wild Marjoram	*Origanum vulgare*	30-60cm	Late flowering, attracts butterflies and bees	Drought resistant, low growing
Wild Mignonette	*Reseda lutea*	30-50cm	The green-yellow flowers are very attractive to bees.	Grows in waste, scrubby, disturbed soils that are well drained and in full sunlight.
Wild Pansy	*Viola tricolor*	Up to 40cm	Attractive to, and pollinated by, a variety of species of bee.	Prefers sandy substrates and partial shade.
Wild Thyme	*Thymus serpyllum*	2-10cm	It is an important nectar source plant for honeybees as well as the large blue butterfly which feeds exclusively on wild thyme	A hardy plant that thrives in full sun and often grows in pavement cracks. A low growing, creeping plant
Yarrow	*Achillea millefolium*	Up to 80cm	Attracts beneficial Syrphid flies.	Drought tolerant plant that prefers full sun and shallow, disturbed and nutrient poor soils.
Zigzag Clover	*Trifolium medium*	20-60cm	Attracts bumblebees and butterfly species.	Low growing drought tolerant, hardy plant, low nutrient growth. A member of the legume family therefore nitrogen fixing and will increase the nutrient value of the substrate over time
Thrift	*Armeria maritima*	10-50cm	Attracts bees, butterfly and beetle species.	Evergreen perennials forming tufts or mats of strap-shaped or linear leaves, with long-stalked, dense clusters of small cup-shaped flowers
Daisy	*Bellis perennis*	10cm	Attracts beetles and hoverflies.	Perennials forming a rosette of spoon-shaped leaves, with daisy-like flower-heads, often double in cultivars, from early spring to late summer
Common Hairbell	*Campanula rotundifolia*	10-50cm	Provides nectar and pollen	May be annuals, herbaceous or evergreen perennials, with bell or star-shaped, often blue, flowers in late spring or summer
Common Centaury	*Centaurium erythrea*	10-50cm	Attracts bees and wasps	Compact plant of dry, open ground. The flowers are pink or occasionally white, with a distinct yellow centre. They are arranged in dense branches, each with a single, terminal bloom.
Maiden Pink	*Dianthus deltoides*	10-50cm	Provides nectar for butterflies and moths	Dianthus can be annuals, evergreen perennials or subshrubs with narrow, often greyish leaves and showy flowers that are frequently fragrant.
Lady's Bedstraw	*Galium verum*	10-50cm	Bumblebees and solitary bees	Galium can be annuals or perennials, with weak, sometimes scrambling stems bearing whorls of narrow leaves and usually terminal panicles of small, white or yellow flowers

Water Avens	*Geum rivale*	10-50cm	Bees and wasps	Geum are rhizomatous perennials, occasionally spreading by stolons, with a basal rosette of pinnately lobed leaves and saucer-shaped flowers in loose clusters
Common Toadflax	*Linaria vulgaris*	10-90cm	Bumblebee	Common toadflax is a spreading plant that forms patches of bright yellow spires
Ragged Robin	*Lychnis flos-cu-culi*	50cm	Bumblebee	Lychnis can be biennials or perennials, with simple leaves and tubular, salver-shaped or star-shaped flowers in terminal clusters
Soapwort	*Saponaria officianalis*	50cm	Attracts moths	Saponaria can be annuals or perennials, with opposite, entire leaves and small clusters of pink or purple flowers in summer
Small Scabious	*Scabiosa columbaria*	50cm	Attracts bees and butterflies	Produces a mass of lilac-blue flowers, in round heads on long stalks.
Mosses				
Springy Turf Moss	*Rhytidiadelphus squarrosus*	Up to 15cm		It tolerates a wide range of soils and colonises on man-made habitats.
Wall Screw Moss	*Tortula muralis*	5-10cm		Commonly found on stone and concrete areas.
Grey Cushion Moss	*Grimmia pulvinata*	2cm		Grows on rocks and concreted areas.

COMMENT ON MAINTENANCE

1.2 To ensure the continued deliverance of ecosystem services, any new planting must be adequately maintained to meet long-term plant growth and establishment goals.

1.3 Typically, the first 3-5 seasons following planting are considered as the establishment period and landscape management plans normally cover this period as a minimum. A long-term 3-5 year management plan should therefore be devised and implemented across the estate following the installation of each new landscaping scheme.

1.4 Implementation of a well-designed plan will result in greater effectiveness and lower maintenance costs over the long-term.

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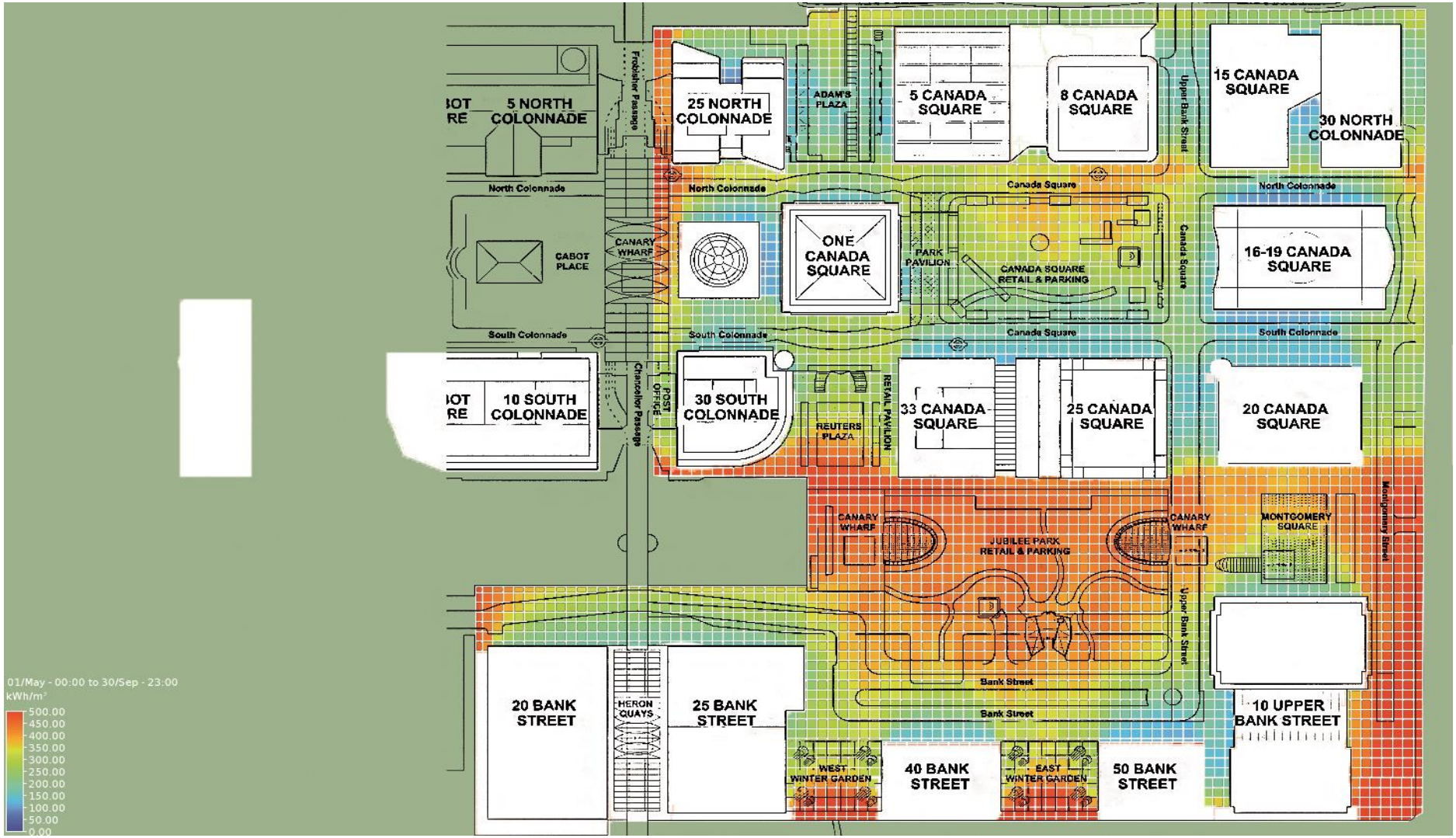
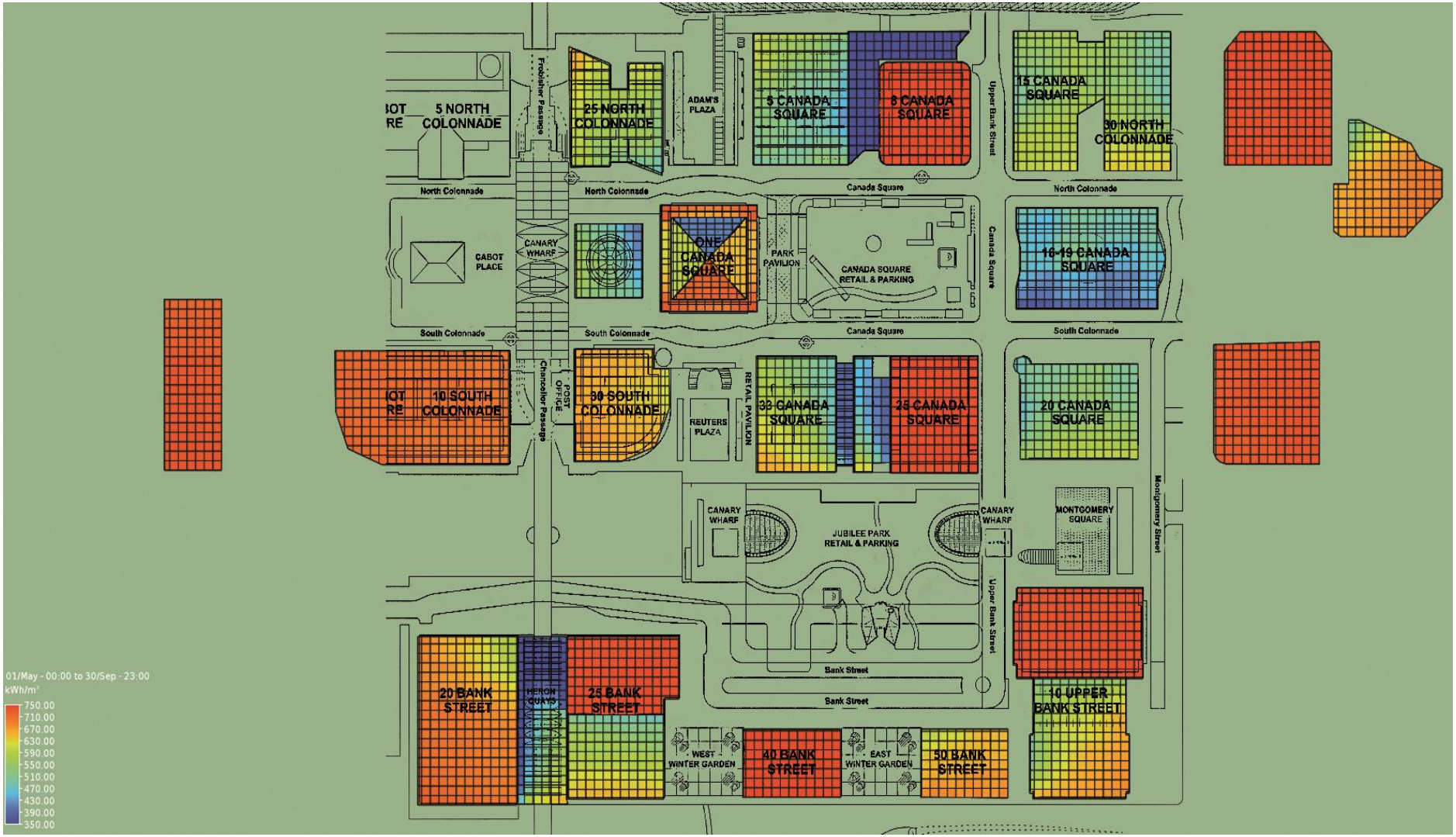
APPENDIX 6 URBAN HEAT ISLAND MODELLING

The following images present the results of the urban heat island effect modelling for three scenario years: 2017; 2050; and 2080. This identifies the areas of greatest heat stress and ground and roof level. The two levels have been modelled separately due to the relatively high heat exposure at roof level compared to ground level.

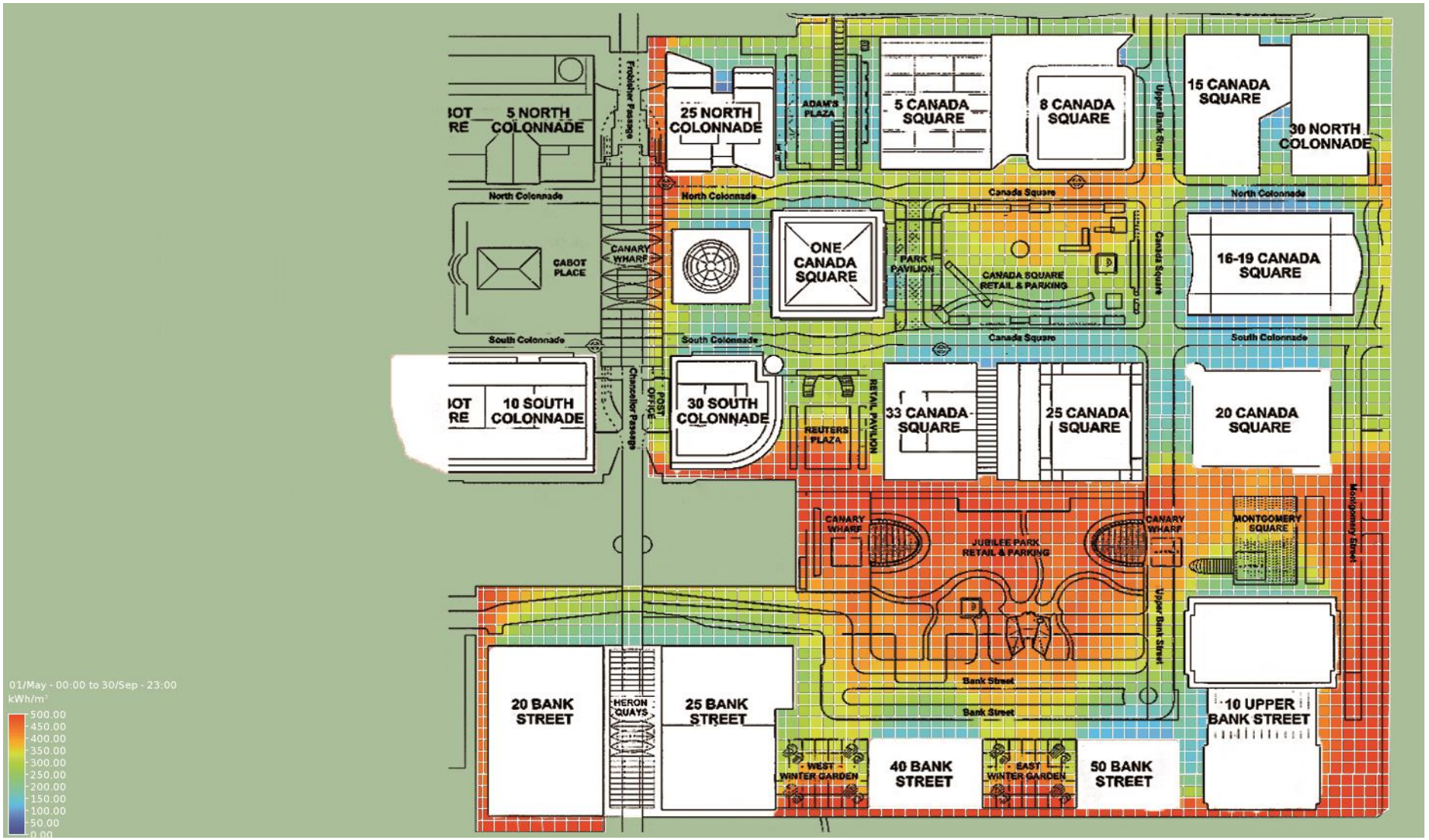
2017 Ground Level



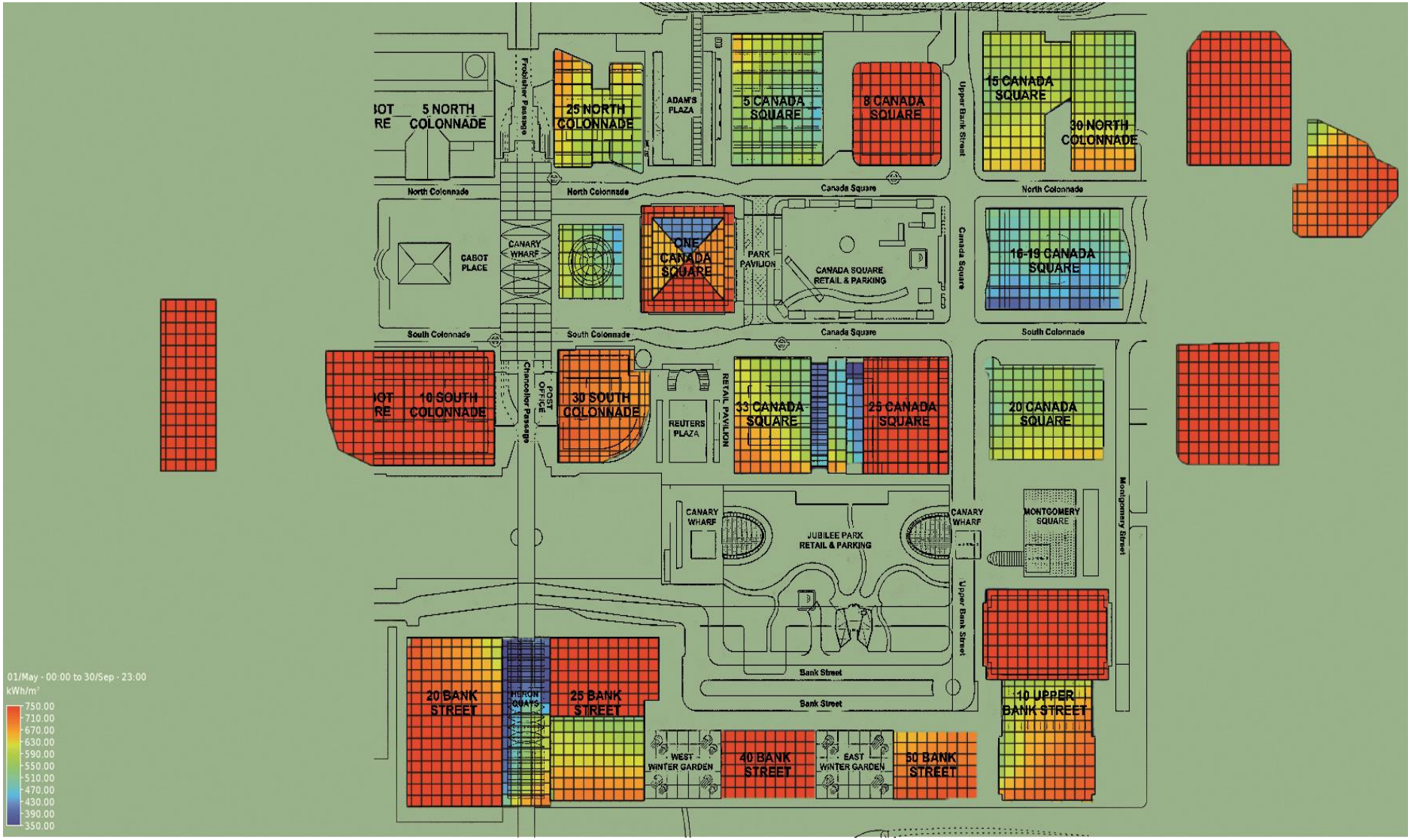
2017 Roof Level



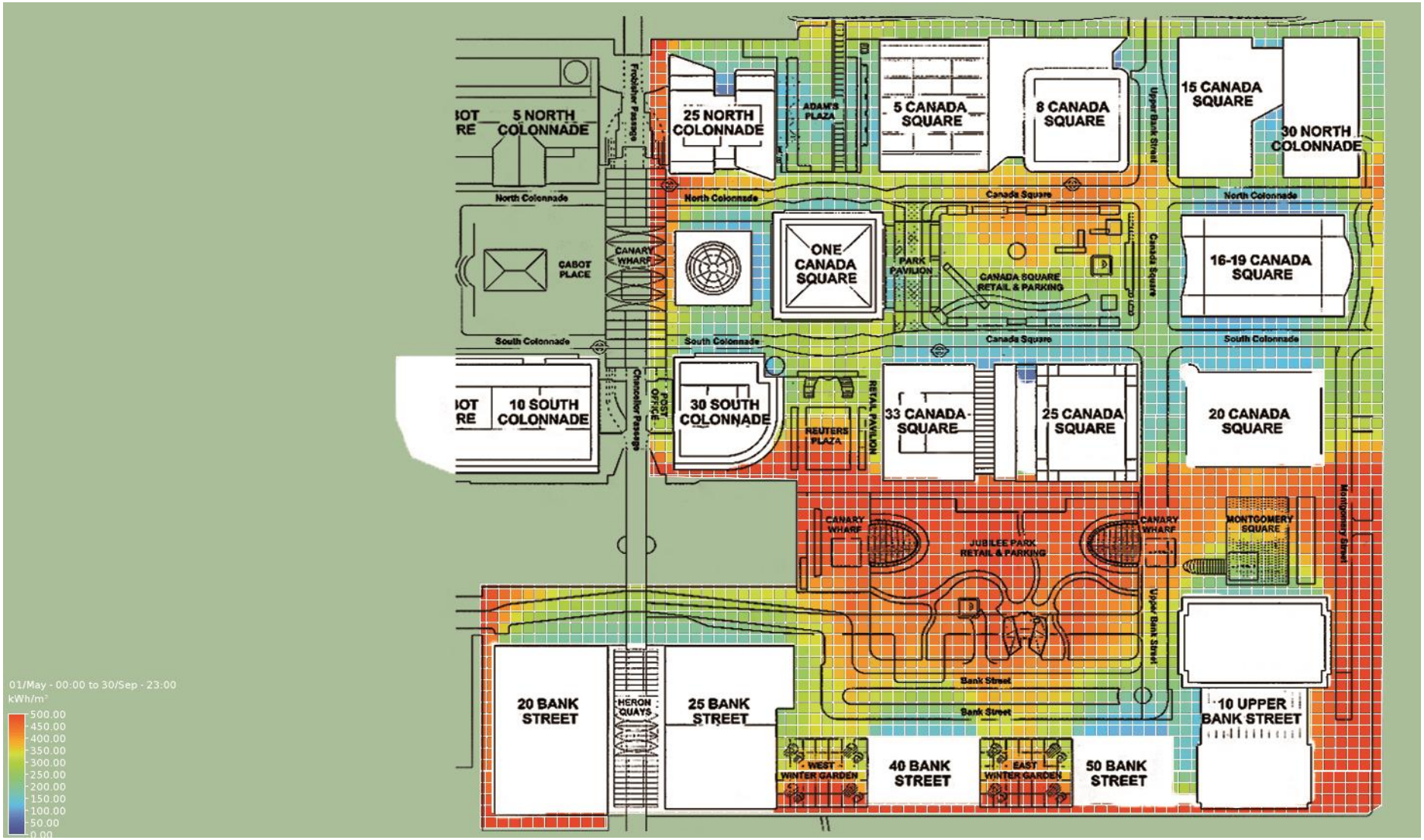
2050 Ground Level



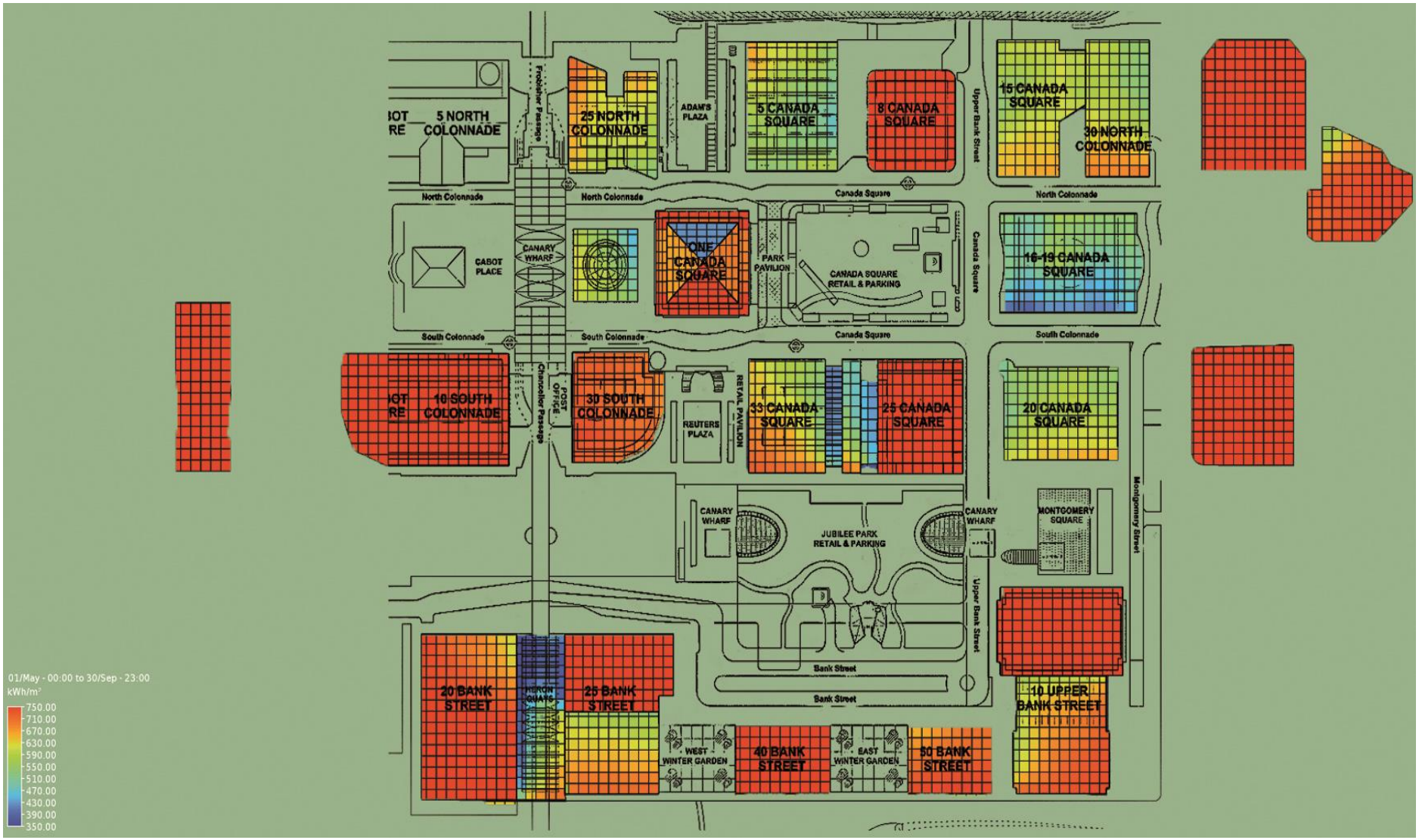
2050 Roof Level



2080 Ground Level



2080 Roof Level



APPENDIX 7 CHECKLIST PRINTOUT

RIBA Stage	Action	Responsibility	Checklist
0 Strategic Definition	• Project Manager (PM) to review current iteration of BAP and Biodiversity Design Principles Framework (BDPF).	PM	
1 Preparation and Brief	• PM and design team to consult with project ecologist.	PM	
	• Provide copy of BAP and BDPF to ecologist.	PM	
	• Ecologist should provide comments on likely constraints and appropriate actions which should be factored into design and approach.	Ecologist	
	• PEA and other appropriate baseline assessments required to inform planning application can be undertaken.	Ecologist, PM	
	• Ecological design should form part of Initial Project Brief.	Ecologist, Design Team, PM	
	• Seasonal time constraints related to ecological surveys should be considered.	PM, Ecologist	
2 Concept Design	• PEA and other appropriate baseline assessments required to inform planning application should be undertaken by this stage at the latest.	Ecologist, PM	
	• Ecologist to identify potential impacts and ensure that appropriate mitigation, compensation and enhancement actions, in accordance with legislation and relevant planning policy, best practice (see Appendix 3) and BDFP, are integrated within design and approach.	Ecologist	
	• Ecologist to consult local authority/statutory bodies where appropriate.	Ecologist	
	• If subject to BREEAM assessment ensure that baseline assessment is compliant, having been undertaken/signed off by Suitably Qualified Ecologist as per BRE definition (Appendix 3).	Ecologist, BREEAM Assessor, PM	

	• Subject to the creation of new and improved methodologies, an appropriate metric should be applied to measure the baseline and proposed biodiversity value of the site. Proposals should result in net gains in biodiversity as defined by this metric (see Appendix 4 for commentary on how to apply this).	Ecologist, Design Team, PM	
3 Developed Design	• Final planning reports provided by ecologist.	Ecologist	
	• Outputs to be rechecked against BDFP by project manager upon review.	PM	
4 Technical Design	• Ecologist to provide further detail relating to any relevant planning conditions/s106 commitments	Ecologist	
	• Ecological Management Plans (EMP) to be produced based on finalised proposals which include actions relating to maintenance and monitoring of ecological enhancements	Ecologist, PM	
5 Construction	• Ecologist to oversee key stages of construction in Ecological Clerk of Works (ECoW) role if required within EMP	Ecologist, PM	
	• Construction of key enhancement elements should be overseen by ECoW such as living roof installation	Ecologist, PM	
6 Handover and Close Out	• Ecologist to undertake Post Construction Review (PCR) to sign off compliance with legislative, planning and BREEAM (if appropriate) commitments.	Ecologist, PM	
	• Implement appropriate remedial actions identified by PCR.	PM, Ecologist	
	• Maintenance, Management and Monitoring to commence as per details within site specific EMP	PM, Site Management Team	
	• Handover of actions by ECoW to those responsible for day-to-day management	Ecologist	
7 In Use	• On going Maintenance, Management and Monitoring where appropriate.	Site Management Team	

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