

RICS Practice Standards, UK

Green infrastructure in urban areas

1st edition, information paper



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Acknowledgment

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RICS information papers

This is an information paper. Information papers are intended to provide information and explanation to RICS members on specific topics of relevance to the profession. The function of this paper is not to recommend or advise on professional procedure to be followed by members.

It is, however, relevant to professional competence to the extent that members should be up to date and have knowledge of information papers within a reasonable time of their coming into effect.

Members should note that when an allegation of professional negligence is made against a surveyor, the court is likely to take account of any relevant information papers published by RICS in deciding whether or not the member has acted with reasonable competence.



1 Introduction

The purpose of this information paper is to provide members of the Royal Institution of Chartered Surveyors (RICS) with background information on the issues surrounding the delivery and promotion of green infrastructure in urban areas. The paper provides an overview of what green infrastructure is, the functions it can support, and refers to the various scales across which it can be provided.

The paper also provides general information on the impacts associated with green infrastructure. Particular reference is made to the growing body of evidence that details some of the wide-ranging benefits that green infrastructure can generate. Alongside these strengths, the document also reflects upon those aspects of green infrastructure that have attracted concern and debate in the past, such as the planting of urban trees in and around built development.

Although the relationship between green infrastructure and the monetary value of its benefits is not well understood or easily measured, the paper does identify areas in which additional work is needed to better understand the relationship. Examples of further reading are provided for those wishing to seek more detailed information.

This paper focuses on the role of green infrastructure within built-up areas, including measures to reduce the risk of flooding. It also recognises that intervention in areas outside the built-up area can contribute to reducing the impact of flood-water and reducing the risk of flooding. This is beyond the scope of this paper and will be dealt elsewhere in RICS guidance.

The benefits that can come from providing green space have been understood for some time. The garden city idea of Ebenezer Howard, for example, was first visualised in 1898. Howard's vision for a garden city, which was underpinned by a desire to combine the 'comforts of the town' with the 'health of the country', included a number of proposals to help 'green' each city and the countryside in between. Howard's 'green' concept involved each city having a central park surrounded by circular bands of homes and gardens and then by an active

yet protected countryside, capable of supporting agriculture, forestry and other rural uses. Users of parks could benefit from being outside in the fresh air, helping to forge a closer relationship between the community and their surrounding environment. It was also seen as a device for promoting civic pride and local engagement. While these traditional benefits still remain true, recent work has also shown green infrastructure to be instrumental towards:

- adapting environments to the effects of climate change, in terms of surface temperatures, shade provision, energy use and urban cooling
- local food production and the rearing of livestock; and
- enabling the social and economic regeneration of towns, cities and regions.

Green infrastructure is now an important concern for those involved in land, property and construction, with planners being urged to help protect, manage and deliver green infrastructure improvements. This re-positioning of 'green' infrastructure against 'grey' infrastructure, which has tended to have the ascendancy in the past, appears to have growing currency and appeal both within the UK and internationally.

Particular guidance in this area was provided in the last government's draft planning policy statement on *Planning for a Natural and Healthy Environment*, which was published in 2010. Although this guidance was intended to apply to England and Wales, similar commitments are also evident in Scotland and Northern Ireland. The current government's intention, however, is to provide a single national planning policy, which will result in the foregoing document being superseded, with the majority of green-infrastructure-related policy being generated at a local level, in line with the emerging 'localism' agenda.

While this information paper considers how green infrastructure can be delivered and funded, particularly through development and via the planning system, it also raises some important considerations about the management of green

space in the longer term. In doing so, the paper refers to a number of successful development projects where green infrastructure has been incorporated. The paper also discusses the ongoing planning reforms that are seeking to give greater power to communities in shaping the places in which they live. It is likely that the recent emphasis towards green infrastructure will be maintained. Furthermore, it is highly likely that green space will become a common area of interest for many communities, both in terms of its creation and protection. As a result, green infrastructure is likely to feature prominently in future planning and development debates.

2 Definition of green infrastructure

2.1 What do we mean by the term 'green infrastructure'?

The term 'green infrastructure' has evolved over recent years and several definitions now exist.

One of the most commonly cited is provided by Natural England and it is this definition that this information paper takes:

Green infrastructure is a 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.

(Natural England 2009, p.7)

A more recent definition was included in the draft planning policy statement on *Planning for a Natural and Healthy Environment*, published in March 2010 (Department for Communities and Local Government 2010a). While this new definition reiterates the strategic approach in thinking about, and planning for, green infrastructure, it elaborates on the various functions that green infrastructure can support, namely:

- conserving and enhancing the natural environment
- providing wildlife corridors

- reducing noise and air pollution
- helping communities to adapt to a changing climate through water and carbon management
- providing routes (e.g. footpaths and cycleways) which link areas of open space within settlements
- providing sustainable drainage, flood storage and urban cooling, and
- providing a wide range of opportunities for engagement and active citizenship, relaxation and quiet contemplation, sport, recreation and children's play' (DCLG 2010a, p.25).

2.2 What does green infrastructure comprise?

Recent policy approaches have consistently sought to protect, and successfully manage, this diversity of resources. Notwithstanding this, a variety of concerns have been expressed about the reduction in certain types of green infrastructure (in either perceived or actual terms). Examples include:

- the loss of 34,000 playing fields between 1992 and 2005 (MacLeod 2005)
- the annual conversion of 5,000ha of greenfield for development purposes (Bibby 2009)
- the loss of about 800ha of green belt land each year (Campaign to Protect Rural England 2010), and
- the annual decline of unimproved lowland meadow by approximately 2–19% per annum (Government Office for Science 2010, p.124).

Furthermore, according to some research, the majority of people over-estimate the extent to which the UK, and England in particular, is developed (even though the proportion stands at under 10%) (Government Office for Science (2010)).

Table 2.1 provides a summary of the land use categories that can contribute towards green infrastructure.

Table 2.1. An open space and green infrastructure typology

Parks and gardens	including urban parks, country parks and formal gardens
Natural and semi-natural urban green spaces	woodlands, urban forestry, scrub, grasslands (e.g. downlands, meadows), common land, wetlands, open and running water, wastelands and derelict open land, rock areas (e.g. cliffs, quarries and pits)
Green corridors	including river and canal banks, cycleways, rights of way, railway cuttings and embankments
Outdoor sports facilities	including tennis courts, bowling greens, sports pitches, golf courses, athletics tracks, school and other institutional playing fields, other outdoor sports areas
Amenity greenspace	informal recreation spaces, green spaces and landscaping in and around housing and business developments, domestic gardens and town or village greens
Provision for children and teenagers	play areas, adventure playgrounds, skateboard parks, outdoor basketball hoops, and other more informal areas (e.g. 'hanging out' areas, teenage shelters)
Land used for food production	allotments, community gardens, city (urban) farms and land used for permaculture
Cemeteries and churchyards	
Accessible countryside in urban fringe areas	
Civic spaces	civic and market squares, and other hard-surfaced areas designed for pedestrians.
Green roofs and walls	

3 The impacts of green infrastructure

This section is structured around green infrastructure and its contribution to the three pillars of sustainable development: environment, society and economy.

3.1 Environmental impacts

3.1.1 Air quality

Green infrastructure can have a positive impact on air quality. Vegetation is capable of removing ammonia (NH₃), carbon dioxide (CO₂), oxides of nitrogen (NO_x), ozone (O₃), particulate matter (PM; dust) and sulphur dioxide (SO₂) from the air (Broadmeadow and Freer-Smith 1996, Nowak et al 2006, Powe and Willis 2004). This can have positive impacts in terms of climate change mitigation (CO₂) and human health (PM, SO₂ and O₃).

The ability of trees to intercept pollution varies between species, throughout the age of the tree, and with the planting design. Trees with dense foliage (e.g. conifers), sticky or hairy leaves (e.g. birch) and those in leaf all year round have been shown to capture more particles than those with sparse foliage or smooth, waxy leaves. Trees planted on the outer edges of a block of woodland have a greater potential to intercept particles than those in the middle suggesting that tree planting could be designed to achieve a greater surface area of woodland (i.e. in strips as opposed to blocks). In addition, trees can be planted to intercept the prevailing wind direction to maximise the surface area of woodland exposed to particles. Planting can also be targeted along sources of pollution, for example by planting trees alongside roadsides, to allow trees to act as a barrier to pollution.

Some species of vegetation produce volatile organic compounds (VOCs). VOCs have been implicated in the production of ozone (a greenhouse gas), peroxyacetyl nitrate (PAN) and secondary particulates in a reaction with NO_x in the presence of sunlight (Donovan et al 2005). However, the contribution of VOCs from vegetation in urban areas is likely to be relatively small compared with other sources; a recent study in

Hong Kong estimated it at less than 2 per cent (Lau et al, in press). A study carried out using an urban forest in the West Midlands as a case study reported that overall some species of tree (e.g. alder, maple and birch) have a greater potential to improve air quality (O₃, NO₂, HNO₃, NO and PAN) while others (e.g. oak, willow and poplar) could have a detrimental impact (Donovan et al 2005). Hay fever sufferers may also be more sensitive to some species' pollen than others.

A recent study used a suite of models to predict the impacts of a 10 x 10 km area of the proposed East London Green Grid on particulate pollution (Tiwarly et al 2009). This estimated that 25 per cent tree cover (20 per cent broadleaf, 5 per cent conifer) on the green spaces could result in 90 tonnes of particulate matter being removed from the air each year, corresponding to the avoidance of two deaths and two hospital admissions per year.

Species selection and location play an important role in the use of vegetation to improve the air quality, but this needs to be balanced against other factors, based on the objectives for the green infrastructure. Species selection also impacts on biodiversity, aesthetic appeal, perception of security and accessibility.

3.1.2 Biodiversity

Biological diversity or, in its shortened form, biodiversity has been defined as 'the variety of plants and animals found on earth, and the place in which they live' (www.sustainable-development.gov.uk). The biodiversity of green infrastructure could refer to the range of invertebrate species on individual street trees through to the habitats and species present across a whole region.

Green infrastructure and urban green spaces are increasingly being recognised for their ecological significance (Harrison and Davies 2002). This may include both the preservation and protection of rare and vulnerable species, and the provision of a valuable educational resource. However, biodiversity is being lost from the UK, in terms of

the variety of species, population numbers and the range of habitats that they occupy (Sinnett 2006). Often this loss is as a result of some change in the land use or management practices, which either causes the direct removal or reduction in the size of a given habitat or the fragmentation of a habitat. This leads to disconnected habitats that are unable to support a healthy population of a given species; the optimum size of a habitat depends on the species.

Green roofs and walls in towns and cities where ground level landscaping is at a premium can considerably add to supporting biodiversity. The re-emergence of the black redstart in English cities has been very much linked to the habitat provided by such roof coverings. A green roof on the Sharrow School in Sheffield is the first roof top in the country to be declared a 'local nature reserve'.

Biodiversity is protected within the UK via a number of mechanisms, including the EU Biodiversity Directive and national statutory protection (e.g. SSSIs). These are controlled by Natural England, Scottish Natural Heritage, the Countryside Council for Wales or the Northern Ireland Environment Agency as appropriate. In addition, there is a UK biodiversity action plan (BAP) through which over 1000 priority species and 65 priority habitats have been identified for conservation protection across the UK. Each priority habitat or species has a national action plan, which provides information on the habitat or species, its current status and the trends in its coverage or population and targets and actions towards its conservation. These national action plans are used in local biodiversity action plans (LBAPs), which are produced, generally at a county level, to provide specific information and guidance on the conservation of biodiversity in that area. The LBAPs often also contain information on habitats and species for which there may not be national actions plans but that are regionally or locally important or vulnerable. Further information on BAPs can be found at www.ukbap.org.uk.

Organisations should work with local authorities to identify the presence of priority habitats and species, as well as areas that may provide the opportunity for the restoration or recreation of habitats. Local planning authorities will judge proposals for developments that will affect protected or locally important habitats or species

against criteria-based policies. This includes avoiding development that may result in habitat fragmentation (DCLG 2010a). Where the benefits of development outweigh potential loss of biodiversity conditions or planning obligations may be put in place to mitigate harmful aspects of the development (DCLG 2010a). Where new green infrastructure is planned it should be designed and managed to be complementary to existing BAPs and work with them to support priority species or habitats.

3.1.3 Climate change adaptation

Green infrastructure can also play an important role in reducing some of the impacts of climate change in our urban environments. Trees, in particular, have been identified as a key element of urban climate change adaptation strategies (Greater London Authority 2008, Department for Environment Food and Rural Affairs 2007), without which the cities of the future are likely to become very inhospitable places (Trees and Design Action Group 2008).

Urban areas have warmer air and surface temperatures compared with non-urban areas. Buildings, roads and paved surfaces store heat during the day which is then released in the evening and night resulting in increased temperatures. Under current climate change predictions summer temperatures may be 1.5–3.5°C greater than the present by 2050, exacerbating the urban heat-island effect. For example, in central London the urban heat island currently adds 5–6°C to summer night-time temperatures and this is likely to intensify in the future (London Climate Change Partnership 2002).

The urban heat island effect can be reduced by increasing albedo (the reflection of incoming radiation away from a surface) or by increasing vegetation cover with sufficient soil moisture for evapotranspiration (Obendorfer et al 2007). A study in Greater Manchester predicted that increasing urban green cover, in high-density areas could decrease expected maximum surface temperature in the 2080s by approximately 2.5°C (Gill et al 2007). Conversely, removing 10 per cent of the green cover in such areas was estimated to increase maximum surface temperature by 7°C by the 2080s.

The study in Greater Manchester found that roof greening made the largest contribution to reducing

surface temperatures in areas that have a high proportion of buildings and a low evaporating fraction (e.g. high-density residential, manufacturing areas). Roofs can represent up to 32 per cent of the horizontal surface of urban areas (Frazer 2005, cited in Oberndorfer et al 2007) and are important in terms of energy flow and rainfall water management in buildings. Adding vegetation and growing media to roof surfaces can lessen several negative effects of buildings on local ecosystems and can help reduce buildings' energy consumption. Green roofs can reduce the energy required for the maintenance of interior climates (Del Barrio 1998) because the growing vegetation can intercept and dissipate solar radiation. Green roofs can also mitigate storm-water runoff from building surfaces by collecting and retaining rainfall, and reducing the volume of flow into stormwater infrastructure and urban waterways (see below).

In addition, large trees can provide shade to protect people from UV exposure and heat stress (GLA 2008). Incidences of skin cancer are increasing in the UK, particularly among young people and the Chartered Institute of Environmental Health has highlighted the role of trees in shade provision as one measure that can reduce skin cancer (Chartered Institute of Environmental Health 2005).

The impact of large, mature and long-lived trees in helping cities adapt to climate change will be assessed in a forthcoming CIRIA publication.

3.1.4 Sustainable urban drainage

Impervious surfaces such as streets, driveways and buildings also displace open land, which is 'soft' and absorbent of water, which helps reduce the intensity of run-off or stormwater discharge when it rains. Not only will hard surfaces increase the risk of flooding but will also threaten water resources through pollutants transported from impervious surfaces.

Gill et al's study (2007) estimated that increasing green cover by 10 per cent in high-density residential areas could result in a 4.9 per cent reduction in the run-off from a 28 mm rainfall event by the 2080s. If this 10 per cent green cover consisted of trees this figure would increase to 5.7 per cent, however, as with surface temperatures, green roofing was predicted to have the greatest impact in areas with a high proportion of buildings

and a low evaporating fraction (e.g. high-density residential, manufacturing areas). But this 10 per cent increase in green cover was not found to be capable of maintaining future run-off levels at current levels; they were still predicted to be 65 per cent greater in the 2080s than currently experienced.

It is clear that roof greening alone will never fully solve the urban runoff problem and it needs to be combined with other run-off reduction measures. Other methods of reducing run-off and increasing retention include storage reservoirs and ponds where water can be temporarily stored; and green areas, where water can infiltrate and evaporate.

The sustainable urban drainage systems (SUDS) approach utilises a wide range of different techniques, including green roofs, rainwater harvesting, attenuation tanks, permeable pavements, wetlands and balancing ponds, to delay stormwater discharge.

Villarreal et al (2004) assessed the effect of disconnecting impervious areas from a combined sewer in favour of a new open rainfall management (including open channels, ponds and green roofs) in Augustenborg, an inner city, high density housing suburb of Malmö (Sweden). They found that it not only improved stormwater management in the area, but also the performance of the combined sewer system that serves the surrounding area. They further found that while green roofs are effective at reducing overall flow volumes, they were not as effective at reducing storm flow peaks. They also pointed to an important advantage of green roofs over ponds and open channel systems: green roofs do make use of previously unused space and thus, do not limit the demands of the people for 'open space' on the ground.

In addition to the capital costs of installing SUDS devices, the adoption of and maintenance of these systems also requires a long-term management solution, which needs to be considered by the developer.

3.1.5 Imported trees and plants

The establishment of green infrastructure may sometimes be reliant on vegetation that has been imported from outside the UK. This may cause a significant risk of the importation of pests and diseases not currently present in the UK,

particularly if mature trees are bought in with large quantities of soil. In addition, some invasive species have not previously been capable of surviving in the UK, but as our climate changes to one more suitable to them, they may be able to establish sustainable populations.

The *Plant Health Act 1967* and *Plant Health (Forestry) Order 2005* are the mechanisms through which the introduction and spread of serious pests and diseases of plants and soil within the UK is prevented. However, the number of imported plants entering the UK makes it difficult to enforce the legislation. The recent outbreak of Oak Processionary moth in London illustrates that plant pests can cause significant problems in the urban environment. This moth feeds on the leaves of oaks and, to a lesser extent, other species of tree (Forest Research, undated). The oak processionary moth is covered in fine hairs that coated with a toxin. These hairs cause skin and eye irritations and, if inhaled, can cause respiratory problems (Mindlin 2008). They can therefore also represents a significant risk to humans and animals. The moths were first reported in 2006 in several London boroughs and, although eradication programmes have taken place annually since this time, and the number of nests has reduced, significant populations are still present in these areas. It is likely that these moths were brought into the UK as eggs with the mature trees used in a nearby development (Forest Research, undated).

3.2 Social impacts

3.2.1 Education

The importance of outdoor learning is recognised in the UK National Curriculum where the need for fieldwork and data-recording skills, as well as the ability to discover information about the local environment, are required from as early as primary education (The Countryside Agency 2005, Natural England 2010). Green infrastructure provides a valuable, local resource for local schools and parents to use to teach children about sustainable development, conservation, environmental change, places, plants, animal and natural and man-made processes, all of which are taught as part of the National Curriculum. As well as a resource for learning, green spaces can also be used to develop understanding of healthy, active lifestyles, e.g. by

providing an opportunity for trails and orienteering activities, which are a component of physical education.

The educational value of green infrastructure can be achieved through both formal education, e.g. field trips with school, and informal education, e.g. through visits with friends and family. In order to derive the maximum benefits from outdoor learning and play, the greenspace should offer a variety of vegetation types and topographies, as well as the ability to interact with the environment (Fjørtoft and Sageie 2000).

Lifelong learning skills can also be enhanced by engagement with green infrastructure. The fostering of greater respect of green infrastructure among adults can also assist in reducing management costs through reduction in litter, fly tipping and other inappropriate uses.

3.2.2 Health and well-being

Green infrastructure also has a beneficial effect on health and well-being (Bird 2007). The presence of green infrastructure, particularly green spaces, corridors and individual street trees, can have a positive impact on the transport networks in our towns and cities encouraging people to walk or cycle as an alternative mode of transport.

The health benefits of regular walking have been widely reported. For example, studies have shown the benefits walking can contribute to reducing coronary heart disease and type 2 diabetes. (Hakim et al 1999)

People who have better perceived access to green spaces have been reported to have greater physical activity (Coombes et al 2010). A study in Bristol found that green space use has been shown to decline with increasing distance; residents who lived within 0.1 km of green spaces were 36 per cent more likely to use these spaces than those living more than 0.5 km away. In addition, those living close to formal parks were more likely to engage in regular physical activity. They were also less likely to be overweight or obese than those living 0.5 km away.

As well as the increased likelihood of physical activity, green environments also appear to have a positive effect on the impact of physical activity compared with non-green or unpleasant scenes

(Pretty et al 2005). However, the links between green space and physical activity are not clear and different studies have found contradictory results (Jones et al 2007).

Natural settings have also been shown to have a restorative effect on those suffering from psychophysiological stress and to improve attention compared with urban settings (Hartig et al 2003). Greater reductions in blood pressure were observed in subjects who had recently taken part in tasks demanding attention, when they were in a room with a view of trees compared with those in a room with no view. Similarly, blood pressure reductions, as well as reductions in anger and greater attention, were also found in those walking in a nature reserve compared with those walking in an urban setting (Hartig et al 2003).

The potential for green infrastructure to positively influence health needs to be balanced with other important factors, such as both the real and perceived personal safety of accessing and being in such areas (Jones et al 2009). This links very much to both good design and the management of such places.

3.2.3 Quality of life

Green infrastructure and other public spaces have also been demonstrated to have positive impact on the quality of life of people living in the local area. A recent survey found that 92 per cent of those questioned visited green spaces in the UK with 97 per cent believing that they helped improve the liveability of an area (Greenspace 2007). This may include increased recreational opportunities, improved health and better connection to nature and sense of place (Benedict and McMahon 2003) as well as community growth (Wolf 2003), social capital and community building (Younger et al 2008). Studies carried out in the Netherlands found that urban parks are more inclusive green spaces than non-urban green areas, and that urban parks can promote social cohesion by means of social interaction and place attachment (Peters et al 2010). Although the function, image and design of urban parks is crucial for understanding the extent to which these places facilitate social cohesion, the success of a particular public space relies on people adopting, using and managing the spaces, not only on the design and spatial aspects.

However, green spaces are often in poor condition; one survey found that only 18 per cent of parks were described as in good condition (Urban Parks Forum 2001). Similarly, Greenspace (2007) found that 20 per cent of respondents in Britain claimed that they use an alternative green space or park because their local facility is poorly maintained. Poor quality green infrastructure, either in initial design or ongoing maintenance, often results in areas that are underused and fall into dereliction. People living in areas with relatively high levels of green-space provision, in terms of area of land, often perceive that they have much lower access to greenspace because of the low quality of the greenspace and concerns over personal safety (Jones et al 2009).

The design of the surroundings will also impact on the use of green spaces; neighbourhoods that are more walkable (i.e. greater density, mixed use and more permeable street patterns) have been suggested to facilitate the use of green spaces by local residents (Coombes et al 2010). The active use of green spaces, streets and communal spaces can help achieve a key urban design objective – a livelier public realm (Llewelyn-Davies 2000). Learning about your neighbourhood can nurture a sense of ownership and belonging, which in turn encourages respect for your local surroundings (Commission for Architecture and the Built Environment 2010). Participating in the design and stewardship of green space can help strengthen communities (Dunnet et al 2002) and offers scope for taking part in community projects and voluntary work. This, in turn, adds to the protection and enhancement of cultural heritage.

3.3 Economic impacts

3.3.1 Economic performance

Economic performance of an area, be it at the town, city or regional scale, is related to the condition of physical, social and cultural infrastructure (Office of the Deputy Prime Minister 2006). Given that good quality green infrastructure can have positive impacts on environment and society, it follows that it can also positively contribute to economic performance. Green infrastructure can improve the functional and aesthetic appeal of an area, its social capital and quality of life for those working or residing there;

this, in turn, can encourage inward investment (Land use Consultants with SQW Ltd 2005) and community enterprise, increase property prices and provide volunteering and employment opportunities (Department for Transport, Local Government and the Regions 2002).

In deciding to go ahead with a development scheme, developers and investors will seek to establish a robust business case for the development or enhancement of green infrastructure assets. This is broadly similar to developers contributing to public realm investment. With the use of transactional data to demonstrate comparable values, they are likely to look for clear links between rents and values achieved and sites delivering sustainability (Sayce et al 2010). The same ethos may be applied to the wider context of a green infrastructure strategy.

Empirical evidence demonstrating a clear link between sustainability and value is in its infancy (Sayce et al 2010). In the USA, research has demonstrated the link between US office buildings with sustainability accreditation and increased rental values (Fuerst and McAllister 2008, Eichholtz et al 2008, 2009, Miller et al 2007). In the UK, however, a lack of transactional transparency has hampered robust research, although, well-designed, well-planned and well-managed public spaces have been linked to increased economic performance (CABE Space 2004). Green infrastructure may also form a distinctive part of property portfolio reporting to clients. Properties benefiting from established or proposed green infrastructure may show increases to tangible or intangible values.

While most suburban home owners will recognise how a good garden may enhance the value and marketability of an otherwise standard house, there is, as yet limited, research on the impact of wider green infrastructure and the residential market. A study by Garrod and Willis (1992) found that increasing the land cover of trees by 20 per cent could increase the value of local house prices by 7.1 per cent. Similarly, the same authors found, in another study using a hedonic price model, that properties on the waterfront (overlooking a canal, for example) attracted a premium of 3 and 5 per cent (Garrod and Willis 1994). Research undertaken by Dehring and Dunse (2006) found that public open spaces were of greater value to high-density housing without private open space. No, or little,

impact on price was found in relation to lower-density housing benefiting from private open space and proximity to public open spaces. These findings could help with green infrastructure strategy, helping to guide the scale and density of developments to ensure that all households benefit equally from open space (Dehring and Dunse 2006).

Research being undertaken by the IPD (Investment Property Databank) in the UK seeks to establish a link between sustainability criteria and a building's performance over time. The increasing importance of sustainability and green infrastructure is reflected in the emergence of a number of metrics to measure sustainability internationally. The most widely known are:

- BREEAM (Building Research Establishment Environmental Assessment Method) – UK
- LEED (Leadership in Energy and Environmental Design) – developed in the USA and Canada
- Green Star and NABERS (National Australian Built Environment Rating System), and
- Passivhaus.

In the UK, green infrastructure may provide an opportunity to improve BREEAM performance scores for new construction or major refurbishment projects. BREEAM aims to mitigate the impact of buildings on the environment, providing a credible, recognisable rating system, highlighting good or best practice in the field of sustainable design and procurement (BRE Global Limited 2010). Green infrastructure has a role to play in achieving credits for many key BREEAM performance categories such as energy, transport, water use, pollution, land use and ecology, materials and innovation. With the majority of BREEAM issues, tradable, green infrastructure may provide developers with a 'quick win'. The recent introduction of BREEAM communities provides further indication that industry recognises the importance of wider development issues, including green infrastructure. BREEAM communities seeks to help developers and planners to improve, manage and independently certify the sustainability of a development through the planning stages (BRE Global Limited 2009).

MediaCityUK was the first scheme to achieve BREEAM approved sustainable community certification. This was primarily due to the use of the Manchester ship canal to power, heat and cool

the buildings on the 36 acre site (www.breeam.org/page.jsp?id=117). BREEAM communities assessment criteria focus on key green infrastructure issues: climate and energy, community, place shaping, transport, ecology, resources, business and buildings. A break-down of the assessment criteria is included in appendix 1.

BREEAM ratings are becoming increasingly important for some government and regulatory organisations with many now specifying minimum standards in their conditions for procurement and capital spending. Similarly, many local authorities are requesting that the planning applications for new developments achieve minimum standards using either BREEAM, the Code for Sustainable Homes or equivalent.

However, there are a number of challenges in measuring sustainability which surveyors need to be aware of:

- Measures principally look at new build schemes and are constantly evolving, meaning that a building rating can rapidly become out of date; however they do provide a sector-wide comparison.
- There is, as yet, no consistent EU or international approach to the valuing of green infrastructure and sustainability.
- Research supports the view that buildings and sites shown to rate highly in sustainability terms should translate to value (Sayce et al 2010); however, there is a lack of transactional evidence to support this claim.

3.3.2 Maintenance and ongoing management

All types of green infrastructure will require ongoing management and maintenance at some level. This may range from the pruning and removal of leaf fall of individual street trees to regular mowing, replacement of bedding plants or removal of refuse from green spaces. It is essential that those planning and designing green infrastructure consider who will be responsible for the maintenance in the long term. This will ensure that maintenance and management costs are realised from the outset and will allow green infrastructure to be designed so that it can be maintained within the budget that is available or that additional revenue streams are sought.

Unless intended, green infrastructure that is not sufficiently maintained quickly falls into dereliction and underuse, and will be unlikely to fulfil the original objectives. Once the spiral of decline starts it is often difficult and costly to turnaround as underuse is often associated with misuse and fears over personal safety, which further fuels underuse. Unfortunately, there are many examples of green spaces that are not used by local populations because they are not perceived as being assessable (e.g. due to poor condition or concerns over security) (Jones et al 2009).

Maintenance costs may also influence on how the wider area is managed. If a site is in private ownership, where green infrastructure is predominately for the use of the development's occupiers, maintenance costs may fall to residents or tenants, as management fees are passed on. Higher service charge or management fees may result in lower rental incomes, but equally the reverse may also be true.

3.3.3 Damage to property and buildings

The use of trees, has often been perceived in a negative light when present in close proximity to buildings. Tree roots expand in the often limited space under streets and are capable of exerting enough pressure to damage pavements, roads, foundations, walls, and pipes (Roberts et al 2006). Roots also take up water from the soil, which can result in desiccation of the soil and subsidence to nearby buildings. As trees grow and age their structural stability may decline, making them more susceptible to cause damage particularly, in strong winds (Ellison 2005).

The roots of trees are often damaged during the installation or repair of services and utilities. When roots are severely damaged or severed the health of the tree suffers, in some cases resulting in the death of the tree. Loss of roots can also make the tree less stable and at a greater risk of wind damage. There are guidelines for trenching to reduce the risk of root damage which are available at www.njug.org.uk.

New developments should allow sufficient space for tree roots at the design stage. A number of guidance documents, materials and approaches are now available to ensure that tree roots are able to grow without causing damage to property and to protect them from disturbance or damage.

There are also concerns associated with the structural stability of trees, which may pose a risk to property and personal injury from falling trees and their branches. The structural stability of trees may decrease as they age; however, many of the benefits of trees outlined in the preceding sections are only realised once the trees reach a certain age and/or size (for example biodiversity, shade provision and urban heat island effect mitigation). In order to balance the risks of tree failure (for example, a branch causing damage to nearby property) against these benefits there are a number of risk assessment methodologies available (e.g. Ellison 2005) that can be implemented.

3.3.4 Valuation of green infrastructure

RICS' advice to its members does not currently extend to the valuation of green infrastructure, although the difficulty of translating sustainability factors to market value is recognised (RICS 2009). The advice pertaining to the sustainability of developments may be of use when considering the value of green infrastructure (RICS 2009). In spite of the paucity of empirical evidence to support links between green infrastructure and rental and capital values, surveyors should remain vigilant with regard to a number of key factors:

- Fiscal and legislative initiatives increasingly encourage sustainable development (and green infrastructure), for example, developments or enhancements of existing buildings that do not comply with sustainability criteria may lose value through regulatory barriers or taxes levied on emissions, while fiscal and planning initiatives and credits from low carbon developments could enhance asset value (RICS 2009).
- The impact of green leases where landlords and tenants are bound by lease terms to manage the asset in line with sustainability principles, metrics or management systems such as ISO 14001. This may reduce risk and enhance value; however, it could also be linked to lower rents if terms are onerous (RICS 2009). The benefits of green infrastructure in cost terms may be shared between landlord and tenant to incentivise investment in GI, potentially varying rental value and yield.
- The growing emergence of corporate social responsibility (CSR) policies may influence

tenant and purchaser decision-making in commercial property transactions. Rental and purchase decisions may be influenced by CSR criteria with non-compliant sites and buildings less attractive, driving down rental and capital values.

- Investors will look at green infrastructure in terms of operational costs, tenant demand and ability of buildings and sites to provide future-proofing against environmental and social changes. Green infrastructure may provide a longer development life cycle, with a reduced requirement for redevelopment and lower risk of obsolescence.
- The growing importance of sustainable buildings and sites benefiting from green infrastructure may need to be reflected in terms of risk when analysing development value, adjusting sensitivity analyses accordingly. Surveyors may also be required to adjust exit yields to reflect the growing importance of sustainability and green infrastructure on investment yields.
- When valuing green infrastructure, special consideration may be given to ongoing maintenance strategy and costs. An insufficient maintenance strategy could impact on risk, costs and insurance and, in turn, tenant and purchaser demand and rental and capital values.
- In the foreseeable future, surveyors should be prepared for the possible role of large-scale green infrastructure in carbon offsetting.

The valuation of existing trees for their non-timber value has been given increased attention in recent years and there are a number of tools available to achieve this (RICS 2010).

4 Planning for green infrastructure

As the previous section has explained, green infrastructure has the potential to deliver wide-ranging benefits for the environment, the economy and society in general. It is fair to say that these various qualities have helped to underpin a refocusing of policy in the UK planning system on the need to protect, enhance and create green infrastructure assets and networks. Building upon previous policy stances towards such themes as open space promotion, nature conservation and the celebration of good design, the planning of green infrastructure is now central to key government campaigns. These include strategies to adapt to, and mitigate against, the effects of climate change; the development of sustainable communities; and the promotion of healthy and liveable environments. This section provides a summary of this policy development by identifying the growing importance of green infrastructure across the English planning system. Following a review of relevant national policy guidance, the paper focuses on the increasing role that the promotion of green infrastructure is having in local plan-making and the day-to-day management of development. The section concludes by focusing on how green infrastructure can be delivered, and how it might be funded. Although the information contained in this section mainly focuses on England, with reference to practices across the devolved administrations of Scotland, Wales and Northern Ireland, many of the underlying principles connected to the planning of green infrastructure can be applied internationally.

4.1 Promoting green infrastructure through national policy

In England, the government's objectives for planning are currently set out in a series of theme-based planning policy statements (PPSs). Where a more up-to-date PPS has yet to be published, relevant policy can be found in older planning policy guidance (PPG) notes. The guidance in these documents needs to be taken into account by local planning authorities in the preparation of local development documents (see 4.3) and by the Mayor of London in relation to the preparation of the spatial development strategy for London (see

below). The policies in a PPS or a PPG are also treated as a material consideration in the determination of planning applications and at appeals. Since their election in 2010, however, the current government's intention is to rescind specific national guidance provided through PPSs and PPGs and to provide a single broad statement of national planning policy in a National Planning Policy Framework. This part of their strategy is intended to simplify and reduce the detail and impact of centrally drawn policy making.

Until recently, policy supporting the protection and promotion of green infrastructure has been scattered across national guidance, with the most relevant PPG tending to be *Planning for Open Space, Sport and Recreation* (PPG17) (ODPM 2002). The draft planning policy statement on *Planning for a Natural and Healthy Environment* seeks to address this issue by bringing together relevant policy objectives into a single document (DCLG 2010a). The draft statement offers a definition of green infrastructure, an overview of common benefits, and a series of policies designed to underpin and influence plan-making and development management in England. It also identifies the need for planning authorities:

- to take a strategic approach to the creation, protection and management of green infrastructure networks
- to develop an appropriate evidence base for green infrastructure that details existing provision and future demand with respect to green infrastructure resources, such as children's play space or allotments
- to identify opportunities for enhancing or creating green infrastructure resources, particularly where development opportunities exist
- to identify opportunities for enhancing the functions that green infrastructure resources can perform, such as the provision of improved access or possibilities for food production
- to protect and conserve green infrastructure resources and the wider natural environment, including the quality, character and value of the landscape, biodiversity, geology and soils

- to oppose development that would result in the loss of existing areas of open space, or resources contributing to green infrastructure
- to ensure developments provide appropriate mitigation where a development proposal poses harm to green infrastructure resources.

Many of these objectives are also pursued in another draft planning policy statement, *Planning for a Low Carbon Future*, which was also published in March 2010 (DCLG 2010b). This document guides English planning authorities to take a positive approach to green infrastructure planning, for instance, by allocating those sites that would enable green infrastructure resources and networks to be enhanced. Significantly, the draft policy statement makes it clear that a commitment towards green infrastructure can satisfy a wide range of goals that the government has set for the English planning system. These include the ability to:

- create places, streets and spaces which meet the needs of people, are visually attractive, safe, accessible, functional and inclusive and have their own distinctive identity (DCLG 2010d, p.8)
- provide for safe and attractive walking and cycling opportunities (DCLG 2010d, p.24)
- secure new development and shape places that minimise vulnerability, and provide resilience, to climate change (DCLG 2010b, p.15)
- offer urban cooling and local access to shady outdoor space (DCLG 2010b, p.19)
- provide appropriate leisure opportunities to enable urban and rural dwellers to enjoy the wider countryside (ODPM 2004, p.6)
- support the promotion of renewable and decentralised energy (DCLG 2010b)
- reduce the causes and impacts of flooding by facilitating the re-creation and expansion of flood-plains and the implementation of sustainable urban drainage systems (DCLG 2010c, p.2)
- promote health and well-being, as well as reduce social inequalities (DCLG 2010a) and
- encourage sustainable economic regeneration and development (DCLG 2009).

The objectives contained in the two draft policy statements are likely to be taken forward in the National Planning Policy Framework that is currently being prepared to consolidate existing guidance into a single document.

Similar policy commitments exist across the devolved administrations of Scotland, Wales and Northern Ireland. However, as with the English system, relevant policy for supporting green infrastructure tends to be scattered across a range of policy documents.

In Scotland, the role for green infrastructure is promoted in both the Scottish Government's *Second National Planning Framework* (June 2009) and in *Scottish Planning Policy* (Feb 2010) (Scottish Government 2009, 2010). The detail within this latter document is elaborated by Planning Advice Note 65 which deals with open space provision (SG 2008).

In Wales, relevant documents include Planning Policy Wales (Welsh Assembly Government 2010) and three technical advice notes on *Nature Conservation and Planning* (TAN5), *Recreation and Open Space* (TAN16) and *Sustainable Buildings* (TAN22) (WAG 2009a/b, 2010).

In Northern Ireland, the document *Shaping Our Future: the Regional Development Strategy for Northern Ireland 2025* (Department of Environment 2001), contains clear commitments towards protecting and enhancing the physical, natural and manmade assets of the region. More detailed advice, supporting the themes associated with green infrastructure, are also set out in a number of planning policy statements. For example, Planning Policy Statement 8 focuses on open space, sport and outdoor recreation.

Wide-ranging guidance on green infrastructure is provided by other government departments, and an array of non-departmental public bodies across England and the devolved administrations. Notable examples include the green infrastructure guide published by Natural England (Natural England 2009), and the various 'grey to green' infrastructure documents published by the Commission of Architecture and the Built Environment (CABE 2009). These documents were almost certainly very influential in guiding the past government thinking.

4.2 Promoting green infrastructure through sub-regional coordination

With the exception of London, all regional plans produced under the 2004 Planning and Compulsory Purchase Act are in the process of being revoked. The latest version of the London Plan, a consultation document published in October 2009, includes a specific green infrastructure policy. This encourages strategic cooperation among the London planning authorities and identifies a need for developers to contribute, where possible, to the protection and enhancement of green infrastructure resources (GLA 2009). It also makes a pledge to respond to identified deficiencies in provision across the capital and to support sub-regional initiatives designed to deliver multi-functional green space and networks. Projects are proposed to help plug identified shortfalls, such as the East London Green Grid, which is summarised in **box 1**. The London Plan also includes a specific policy for promoting living roofs and walls.

A significant, and growing, body of work has also been produced by local authorities working in partnership. This enables resources to be pooled and allows for infrastructure to be planned across authority boundaries. The strategies, which tend to

be delivered with the cooperation of other key delivery stakeholders (such as Natural England or the National Trust), provide an important source of evidence and ideas for local planning authorities to use and take forward in local development plan documents. Notable examples include the Cambridgeshire Green Infrastructure Strategy that is summarised in **box 2**, and the Bedfordshire and Luton Green Infrastructure Strategy (Bedfordshire and Lincolnshire Green Infrastructure Consortium 2007, Cambridgeshire Horizons 2006).

This type of collaboration is expected to continue in the future, either by local authorities choosing to work together, or under the stewardship of the Local Economic Partnerships that were announced at the end of 2010. These partnerships seek to support economic growth via an organisational framework that will involve English planning authorities working alongside identified business interests.

Cross-border collaboration is also promoted across the devolved national administrations. For example, green infrastructure is seen as a relevant policy theme for each of the four strategic development plans being prepared for the city regions of Aberdeen, Dundee, Glasgow and Edinburgh in Scotland.

Box 1: East London Green Grid

Over the next twenty to thirty years, East London will become a major focus for regeneration and development, posing quality of life challenges to both new and existing residents. The East London Green Grid forms part of a wider initiative to help green the Thames Gateway and aims to create an interlinked and multi-functional resource through the creation of new public spaces, the enhancement of existing open spaces and improvements to the links in between (RUDI 2007). The grid seeks to achieve a number of objectives, including:

- the provision of improved public access
- the addressing of identified deficiencies through the creation of new public space
- the protection or enhancement of wildlife sites
- the restoration of flood plain and the provision of sustainable urban drainage systems
- the provision of management systems to ensure the grid is maintained in the longer term.

The grid has been developed in partnership with a variety of organisations, including the East London boroughs, the Environment Agency, Natural England and the London Development Agency. The grid is supported by the Greater London Authority with policy support coming from the London Plan and specific supplementary planning guidance (RUDI 2007).

Box 2: Green infrastructure planning across the Cambridge sub-region

Cambridgeshire is expected to accommodate a significant amount of strategic growth over the next twenty years, equating to at least 73,000 new homes, 50,000 new jobs and over £4 billion worth of new infrastructure in the period to 2021. In planning for this expansion, care is being taken towards ensuring that appropriate infrastructure is in place to provide both new and existing residents with a sufficient quality of life (Cambridgeshire Horizons 2010).

As part of this agenda, particular attention has been given to the role that green infrastructure can play, with planning authorities being encouraged to protect and provide additional green infrastructure resources through plan-making and day-to-day development management. Specifically, rather than being seen as a threat, the strategic growth that the Cambridge sub-region is expected to accommodate is seen as a valuable facilitator that will enable previously held aspirations for green infrastructure to be achieved. Key to realising this potential has been the work of Cambridgeshire Horizons, a company that was established by the Cambridgeshire authorities in 2004. As part of the body's Quality of Life programme, the Landscape Partnership was commissioned to prepare a Green Infrastructure Strategy, which was subsequently published in 2006 (Cambridge Horizons 2006). The strategy was developed in partnership with input coming from organisations including the National Trust, the Forestry Commission, Natural England and the Cambridge Preservation Society. The strategy is underpinned by a desire to generate collective action across the sub-region in order:

To create a comprehensive and sustainable network of green corridors and sites that enhance the diversity of landscape character; connect and enrich biodiversity habitats; and extend access and recreation opportunities for the benefit of the environment as well as current and future communities in the Cambridge Sub-region. (Cambridge Horizons 2006, p.15).

In order to help achieve this vision the strategy introduces a series of objectives:

- to promote the connectivity of habitats
- to extend public access
- to enhance landscape and biodiversity interests
- to secure greater multi-functionality in use.

The strategy promotes the idea of developing a green grid capable of linking new and existing sites, and identifies a series of landmark projects to help drive the project on the ground (a key development in one of these project areas, the southern fringe of Cambridge, is explored in **box 6**). Four years on, the strategy has been judged a success, with the project having helped to provide improved understanding of green infrastructure and the benefits that it can provide. It has also promoted greater collaboration amongst partners (including the development industry), and has helped to develop some common ground with respect to translating the vision and associated objectives into local development plan documents (such as the area action plans that depict where growth is to be directed).

The original strategy is currently being reviewed to incorporate the latest thinking on the benefits that green infrastructure can bring about (e.g. improved health and tackling climate change), and to reflect the planning, funding and delivery changes that have occurred since the document was first published. The 'Green Vision', as the updated document will be called, is also being expanded to cover the whole of Cambridgeshire rather than just the sub-region around Cambridge (Cambridge Horizons 2010).

4.3 Promoting green infrastructure through local policy

Local spatial planning has a very important role to play in the delivery of green infrastructure and provides the mechanism through which national objectives can be translated into action on the ground. Although differences exist in the form that local policy planning takes across the UK, a common thread is that each of the systems are ‘plan-led’. Despite some differences in terminology, the local plans of each of the systems have an important role in creating visions for the growth and management of a community, and for assessing and determining individual planning applications for development. Neighbourhood planning, as indicated in the present government’s commitment to ‘localism’ and through emerging legislation, will give a new dimension to local planning. However, it is not envisaged that the delivery of green infrastructure will be any less important in the plan-making process.

Since 2004 English planning authorities have been preparing local development frameworks (LDFs). Within each LDF, local authorities are required to produce a number of documents. Some of these have development plan status and are therefore an important reference point in the determination of planning applications.

The most significant of these is known as the ‘core strategy’, which sets out a vision for how an area is to be developed and managed over a 15 to 20-year period. The core strategy is expected to include policies and proposals for achieving this vision, which could include the identification of a number of strategic sites. Each core strategy needs to be supported with evidence about the type of infrastructure needed to fulfil the vision, which could include proposals for protecting and promoting green infrastructure. Strategies need to be prepared with the full involvement of the community and be shown to be deliverable. Area action plans also have development plan status and are prepared to give further direction to those areas where significant change or conservation is needed.

Supporting planning guidance may be prepared to help provide additional detail on certain policies or proposals included in a development plan document. To date, supplementary planning

documents (SPDs) have been produced on a variety of themes connected with green infrastructure, such as the management of ecological sites and the use of trees in development.

Some local authorities have yet to adopt a core strategy or any supporting area action plans. Consequently, in many areas, the development plan may include saved policies or previous plans produced prior to 2004. The context against which development proposals are assessed will therefore depend on the date on which the plan was published. Recent plans are more likely to reflect latest government thinking, and use the latest terminology, compared to older plans.

Newer plans may include one or a number of policies that are specifically targeted towards the delivery of green infrastructure. Policy in older plans may be more scattered and be found in sections dealing with open space, nature conservation and design. **Box 3** below details the green infrastructure policy included in a recent plan published by Hinckley and Bosworth Borough Council. **Box 4** refers to the policy support that Sheffield City Council gives to green roofs.

The latest plans are almost certain to respond, in policy terms, to the guidance set out in the draft planning policy statement on *Planning for a Natural and Healthy Environment* (DCLG 2010a) which directs English planning authorities to:

- provide sufficient high quality, multifunctional open space, sports and recreational facilities, and space suitable for play to meet the needs of local communities
- include local standards in their local development frameworks for the quantity, quality and accessibility for open space, and facilities for sport, recreation and play
- identify opportunities to enhance existing areas or facilities, or to create new ones, where identified deficiencies exist; and
- identify opportunities for the co-location of facilities (DCLG 2010a, p.18).

Box 3: Green infrastructure in the core strategy: Hinckley and Bosworth Borough Council

The core strategy for Hinckley and Bosworth Borough Council was adopted in December 2009, making this the statutory development plan for the borough. The core strategy sets out the spatial objectives for the whole borough: three of which directly refer to green infrastructure. These are:

- spatial objective 7: healthier active communities;
- spatial objective 10: natural environment and cultural assets;
- spatial objective 12: climate change and resource efficiency.

Green infrastructure issues are dealt with directly via policy 20 of the core strategy. This identifies three zones, southern, western and north eastern and outlines the green infrastructure issues for each of these zones; some relating to specific places and features, while others considering the whole zone. It also states that developers will be expected to contribute to the aims of these policies where appropriate, and that development that compromises these aims will not be permitted. The policy is supported by four maps, which are in line with the key diagram included in the core strategy. The first of the maps outlines the GI network for the whole borough. The following three maps focus on the zones identified above. Green Infrastructure issues are also dealt with in the following policies:

- policy 19: green space and play provision
- policy 21: national forest
- policy 22: Charnwood forest.

See www.hinckley-bosworth.gov.uk/ppimageupload/holding/Image89317.PDF for more details.

Box 4: Green roofs in Sheffield

Sheffield City Council is one council that has embraced sustainable housing. The council is particularly encouraging towards the use of green roofs, both in new developments and as part of the retrofitting of existing housing stock. The efforts of the Council and a group at the University of Sheffield and Groundwork are coordinated through the Green Roof Forum and projects now include city centre apartment blocks, a primary school, bus stops and research trials around the city.

The council has recognised that green roofs have an important role to play in improving the biodiversity, air quality, drainage and temperature of a city centre with 98 per cent hard surfaces, and are using their sustainable drainage, landscape and sustainable design, and green network policies to encourage their use in new developments (Sheffield City Council, undated). They have also provided a guide for those wishing to retrofit their own properties (e.g. garages and sheds) with green roofs (The Green Roof Forum, undated).

The adopted core strategy of 2009 promotes green roofs implicitly through policies CS64 (climate change, resources and sustainable design of developments) and policy CS67 (flood risk management) (SCC 2009). More detailed guidance on green roofs is included in draft supplementary guidance (Design for environmental sustainability) which was published in June 2010 (SCC 2010).

Sheffield City Council. Undated. Green Roof Policy in Sheffield. Presentation available at: www.shef.ac.uk/landscape/greenroof/pdf/keithmissen.pdf.

The Green Roof Forum. Undated. DIY Green Roofs. Available at: www.sheffield.gov.uk/in-your-area/housing-services/environmental-sustainability/sustainable-housing/green-roofs.

To ensure policy is sufficiently robust, planning authorities are expected to gather together, and act upon, appropriate evidence. This is likely to include detailed studies of the plan area, to identify areas where green infrastructure needs to be protected and where it might be improved.

Local authorities also need to produce, and keep up to date, open space strategies that draw from quantitative and qualitative assessments of local need. Surveys also need to identify, and assess the quality of, existing green infrastructure resources. Those involved with producing open space strategies also need to look at green infrastructure in a strategic sense, particularly in relation to how green infrastructure resources are linked together.

In terms of identifying future need, most strategies tend to adopt thresholds or standards for defining the optimum position for green or open space provision. These standards can vary locally but many authorities refer to those issued by Natural England as a starting point. These are set out in **box 5**.

Box 5: Natural England's Accessible Natural Greenspace (ANGSt) standards

ANGSt aims to address the spatial distribution of natural greenspace, its accessibility at different size limits and the hectareage of Local Nature Reserve per head of population. This therefore seeks to secure access to natural greenspace close to where people live. The standards recommend that people living in towns and cities should have an accessible natural greenspace:

- of at least 2 hectares in size, no more than 300 metres (5 minutes walk) from home
- at least one accessible 20 hectare site within two kilometres of home
- one accessible 100 hectare site within five kilometres of home, and
- one accessible 500 hectare site within ten kilometres of home, plus
- statutory Local Nature Reserves at a minimum level of one hectare per thousand population.

Source: Natural England (2009), p.51.

The role for local policy has recently been enhanced in England through the publication of the Localism Bill at the end of 2010. Two significant proposals include:

- the ability for non-binding referendums to be arranged by anyone in a community on any issue that is of importance to them if a petition is received by a local authority. For example, in the case of green infrastructure, a referendum could be proposed to discuss the future management of a local public park; and
- the potential for a parish council, or a neighbourhood forum, to create a neighbourhood development plan. The plan would need to be independently examined and would need to be subject to a referendum. Over half of those voting would need to support the plan in order for it to be adopted and subsequently form part of the statutory development plan.

In addition to the different forms that a local development plan may take across the English planning authorities, there are also variations in the form of the local plan across the devolved administrations. However, irrespective of their particular name, all plans are similar in that they are expected to take into account national policy and form the starting point in the consideration of planning applications.

Rather than having to produce a local development framework, authorities in Wales have had to produce a single local development plan (LDP) since 2004. Local development plans are also produced by each council in Scotland; although, as noted above, authorities in the city regions of Aberdeen, Dundee, Glasgow and Edinburgh also have to refer to a strategic development plan. In Northern Ireland, the central planning service produces development plans (covering an area, a locality or a subject) for each divisional area.

4.3.1 Retrofitting and temporary green infrastructure

While specific attention will need to be directed to areas of future growth, equal regard will also need to be given to existing areas to allow for positive 'retrofitting' of currently developed land. These types of assessment will enable a variety of measures to be identified for inclusion in a plan or

strategy. These might be significant, such as the desire for a new public park or improvements to a waterside habitat, or be more limited in scale, such as areas where green roofs or walls might be encouraged. The majority of proposals are likely to be permanent interventions. However, others might be of a more temporary nature, with green space being targeted towards vacant or derelict land. A recent CABI Space guide has identified possible options for this 'land in limbo', with ideas ranging from the sowing of flower meadow to the conversion of land into allotments (CABI Space 2008).

4.4 Development management

The development management process provides an opportunity to help deliver the type of objectives set out through green infrastructure policy. Policies for the protection and promotion of open and green space, and the preservation and enhancement of biodiversity, are long-standing. However, the renewed emphasis towards green infrastructure introduces further considerations that need to be understood and acted upon if proposals for development or changes of use are to be successful.

Specific green infrastructure requirements will vary with each individual or collection of projects and the administrative area within which applications fall. In addition, although the principles of development management are similar across England and the devolved national administrations, minor differences exist in the way in which planning applications are dealt with.

In England, the draft planning policy statement on *Planning for a Natural and Healthy Environment* sets out a number of policies covering open space, the natural environment and green infrastructure, which are expected to be taken forward in local development plan documents (such as a core strategy) (DCLG 2010a). These plans, together with the draft policy statement itself (as well as the forthcoming *National Planning Framework*), exist as a key material consideration in the determination of planning applications (DCLG 2010a). The policies of the draft statement are more specific, and in certain cases more demanding, than policy included in more dated plans. In broad terms, the policies of the draft statement direct English planning authorities to:

- avoid harm to the natural environment through development, with appropriate mitigation or compensation being required where harm is anticipated. Where these measures are judged to be insufficient in alleviating significant harm, the draft PPS states that planning permission should be refused
- refuse planning permission where development would result in the loss or deterioration of species and habitats of particular importance, ancient woodland or aged or veteran trees;
- maximise opportunities through development to build in beneficial biodiversity or geodiversity features
- retain, where possible, significant biodiversity, geology or landscape interests of regional or local importance within development proposals on previously developed land. Existing opportunities for public access should also be considered for retention and be incorporated into the design of the scheme
- refuse permission for schemes that would result in the loss of existing areas of open space or land and buildings used for sport, recreation or play unless they are shown to be surplus to requirements, or if the development would give rise to wider public benefits
- encourage planning authorities to impose planning conditions, or enter into planning agreements, in order to mitigate any harmful aspects of any development on the functioning and connectivity of a green infrastructure network. Planning permission is to be refused in those cases where mitigation is incapable of addressing identified significant harm, and;
- favourably consider proposals that can remedy identified deficiencies in particular types of open space, green infrastructure or sports, recreational or play facilities.

Most development projects can contribute towards green infrastructure in some way, either through protecting existing resources or by improving local provision. The scale and cost of each intervention will inevitably vary but every project can and arguably should play its part. For instance, a development involving a single house could contribute by providing an adequately sized garden and a green roof and, mid to high density housing schemes could include the provision of allotment

growing areas like Urban Splash's Saxton development in Leeds (<http://www.urbansplash.co.uk/projects/saxton>).

Of course, the opportunity for making a significant contribution to green infrastructure provision is likely to be more achievable, and expected, on larger development sites. Again, possible interventions will vary with each project, but major projects are likely to require a detailed and innovative strategy towards the protection and promotion of green infrastructure. For the largest schemes, expectations may mirror the type of interventions that have been set out in guidance to support the eco-towns programme that was launched in 2007.

These measures are set out in **box 6** and are driven by a desire to achieve the type of development or living environments seen elsewhere in Europe. For example, in the Rieselfeld district of Freiburg in Germany, only 76ha out of a total of 320ha is used for housing (22%) with the rest being devoted to green space (TCPA 2008).

Box 7 refers to the provision of green infrastructure in the development of Trumpington Meadows in Cambridge. This scheme is accompanied by a wide range of green infrastructure proposals to help deliver the kind of benefits outlined in the previous section. Lastly, **box 8** refers to the planning and development of Barking Riverside.

Box 6: Communities of the future: eco-towns

The eco-towns programme was launched by government in 2007. Following a call for potential sites, four possible locations for eco-town development were outlined in a policy statement on eco-towns, which was published in July 2009 (DCLG 2009b). Additional locations have since been identified. Each eco-town will have a minimum of 5,000 homes and will be expected to provide residents with a highly sustainable environment. The statement outlines wide-ranging standards that eco-town development is expected to incorporate (DCLG 2009a). In relation to green infrastructure, design teams are being expected to:

- allocate at least half of the eco-town's total area to green space, of which at least half should be public and consist of a network of well-managed and high-quality spaces linked to surrounding countryside
- offer variety in terms of the type of green space being provided, for example, by providing woodland, wetland areas and public parks;
- ensure space is multi-functional in use
- help support local food production
- demonstrate a net gain in local biodiversity; and
- incorporate sustainable urban drainage systems (DCLG 2009a all items in list).

The Town and Country Planning Association (TCPA) was an important resource in helping to frame these requirements, although their separate worksheet on green infrastructure goes further by encouraging developers to also:

- provide at least one major, well-equipped, high-quality park
- plan for a network of greenways to connect GI resources
- ensure all streets and roads are tree-lined
- provide the type of services and facilities needed to enable the full use of available green infrastructure, such as public toilets and appropriate signage
- ensure that all hard surfaces are permeable, and
- construct all buildings, structures and underground services in a way that minimises the risk of structural damage from subsoil ground movements caused by vegetation and changes in water content (TCPA 2008).

Box 7: From policy to practice: the planning of Trumpington Meadows, Cambridge

A recent example of how green infrastructure policy has been translated into practice exists with the development of Trumpington Meadows in Cambridge's southern fringe. This 154ha site, which lies on either side of the M11 motorway, extends across the administrative areas of Cambridge City and South Cambridgeshire District Council. The site lies alongside the River Cam and comprises mostly agricultural land, except for the built remains of a former crop-testing facility. Permission for the development of the site was granted to the Trumpington Meadows Land Company, a joint venture between Grosvenor and the Universities Superannuation Scheme, in 2009. This followed the allocation of the location as a focus for strategic growth (Grosvenor 2010).

The master plan, which was developed by consultancy Terence O'Rourke, was based upon detailed site surveys and close stakeholder involvement. The plan provides for the development of approximately 1,200 homes, a site for a new primary school (which will include a community facility), plus a small local centre offering retail and commercial space. Importantly, the scheme makes a significant contribution to protecting and enhancing local green infrastructure, with many of the proposals reflecting the kind of aspirations set out in the Cambridgeshire Green Infrastructure Strategy (Cambridgeshire Horizons 2006) (as set out in **box 2**). Specific provisions include:

- a 60ha community park, which will offer a variety of habitats including wet and dry meadow and woodland. The park adjoins the River Cam and will include two balancing ponds as part of a sustainable urban draining system. The park also provides shared cycle and pedestrian routes to connect the site with surrounding countryside, and restores the previous agricultural landscape with the re-planting of historic hedgerows
- formal and informal open space and children's play space, including a multi-use games area and a tennis court
- allotments
- well-designed, and naturally landscaped streets
- a public square, and a series of pocket parks, within the development area, together with a series of green fingers that permeate from the heart of the development into surrounding countryside
- enhancement of existing nature conservation interests by improving the quality and extent of on-site habitats (SCDC 2008).

The first phase of the development will be built by Barratt Homes. Work on site infrastructure, including road access and the country park, commenced in autumn 2010. Construction of the housing is anticipated to begin in early 2011 (Grosvenor 2010).

Box 8: Barking Riverside

Barking Riverside is a £3.5bn project, which is being developed between Bellway Homes and the Homes and Communities Agency. Buzzards Mouth Court, which has been designed by architects Sheppard Robson, is the first of four development areas and provides 1,450 homes and over 20ha of formal and informal open space. The scheme won a housing award in 2010 by virtue of its overall design and its commitment towards sustainability. For example, most of the properties across the scheme have been designed to be fitted with a green roof. The wider Barking Riverside project provides a variety of measures for enhancing green infrastructure. For example, the key area of open space, currently known as Pylon Park, provides a variety of interventions, including a landscaped amphitheatre, attenuation and flood alleviation ponds, forest and meadow land, a dog park, educational resources and a range of play spaces.

More information about Barking Riverside can be found at www.barkingriverside.co.uk/

A master plan is likely to be required for major projects in order to identify those resources that are likely to require protection, or those areas of the site where some enhancement is either sought or is to be provided. Master plans will need to be developed with the involvement of relevant stakeholders and be carefully explained and justified. Project teams will also need to:

- understand the broad objectives relating to green infrastructure, as set out nationally or locally via a core strategy, an area action plan, some kind of neighbourhood plan or through relevant supplementary planning documents
- respond to any specific guidance published for the site that may contain specific aspirations, or pre-conditions, associated with development. Policies may stipulate the amount of green or open space required, or the proportion of the site that can be developed
- undertake detailed site surveys to prepare an audit of existing features and their current condition to identify what features should be retained and what might be enhanced (these baseline studies may be undertaken in any case as part of the preparation towards a more formal environmental impact assessment)
- consult with key stakeholders to develop a strategy for green infrastructure, open space and nature conservation across the site (and adjoining areas) that can be used to influence the design and form of the scheme;
- discuss green infrastructure proposals as part of detailed pre-applications with the planning authority. Once appropriate agreements are in place, the overall scheme will need to be explained and justified through the final planning submission in order to demonstrate adherence with policy
- ensure that the costs and arrangements for delivering, managing and connecting green infrastructure resources are explicit and are fully reflected in the wider proposals for the site. For instance, development proposals will need to create sufficient value to fund green infrastructure proposals, and adhere to any planning conditions or any planning agreement obligations both during and after construction.

While much of the focus will be on the infrastructure that will be in-situ once the

development is complete, planning authorities may also give encouragement to delivering improvements in the short term; specifically, rather than leave future development sites boarded up, developers may be asked to consider some kind of interim use that could help to enhance local green infrastructure and contribute to addressing other possible problems (such as fly-tipping).

4.5 Delivery

Planning authorities can impose conditions, or enter into a legal agreement with a developer, to ensure that the policies and proposals of a local development plan are properly pursued and realised.

Planning conditions are frequently attached to a planning permission in order to limit, control or direct the manner in which development is carried out. Conditions should serve a useful planning purpose, be fairly and be reasonably related to the permitted development, not be unreasonable in all other respects, and be clear in their meaning. With respect to green infrastructure, conditions can be used to require the restoration, enhancement or creation of green space. They can also be used to ensure that the applicant provides certain information about the scheme by a certain date or event. For instance, in relation to the Trumpington Meadows scheme outlined in **box 7**, a planning condition required the applicant to submit a design code in order to provide detailed information about how the scheme will look once developed. As part of this submission it was necessary for the development team to identify measures capable of enhancing on-site biodiversity.

A planning authority can enter into a planning agreement with a developer under s. 106 of the *Town and Country Planning Act 1990*. A developer can also offer to deliver certain undertakings or obligations unilaterally. Being negotiated on a site-by site-basis, planning agreements can:

- restrict the development or use of land in a specified way
- require that certain operations or actions be carried out in, under or over the land
- require the land to be used in a specific way
- require a sum, or sums, of money to be paid to a planning authority on a specified date, or on certain dates in the future.

Each of these opportunities can clearly be helpful in satisfying the type of requirements that a local development plan may have for supporting green infrastructure. For example, the ability to restrict development is often pursued by planning authorities wishing to save a certain part of the site from development, for instance, if the area is judged to be important for its biological value.

Planning agreements play an important role in ensuring that the signatories to the agreement are clear with respect to individual undertakings. For example, the planning agreement for the Trumpington Meadows development in Cambridge sets out detailed obligations for each of the scheme's main provisions. In relation to the 60ha country park, the agreement reaffirms the objectives for creating the park, phases its development over time, and outlines how it is to be managed (in essence, the management of the park is to be transferred to a local Wildlife Trust who will be granted a 125-year long lease across land forming the park).

With respect to the requirement for payments, planning agreements have traditionally played an important role in enabling funds to be collected for improving infrastructure on and off site. These payments are intended to mitigate the potential impacts of a development, thus helping to make the project acceptable in planning terms. The form and size of payments differ with each scheme but often include contributions to help improve highway infrastructure, provide additional school places or, with relevance here, to allow for green spaces to be upgraded. **Box 9** below refers to current practice in Swindon.

Changes have recently been made to the way in which this financing role can be used. Essentially, in order to make funding more efficient and fair, local planning authorities are able to apply a community infrastructure levy (CIL) in order to fund improvements to local or sub-regional infrastructure (i.e. off-site mitigation). The legislation has been live since April 2010 and enables local planning authorities in England and Wales to make a charge on developments with a gross internal floor space of more than 100m².

Box 9: Swindon Borough Council: developer contributions

The Swindon Borough Local Plan, which covers the period between 1991 and 2011, was adopted in 1996. Although Swindon Borough Council has embarked on a review of this document, to create a borough-wide development framework, the local plan remains the statutory plan for decision making. In order to support the implementation of policy DS8 (infrastructure needs resulting from development), the council has recently updated its guidance note on 'developer contributions' (SBC 2010), which builds upon other, more specific, supplementary guidance. The note refers to the future infrastructure demands of the borough and the costs that will be incurred in its delivery. On the basis of this analysis, the document then presents typical charges that applicants will have to pay in bringing development forward. While the document refers to how costs will be calculated on a case by case basis, a selection of charges include:

- a charge of between £246 (per 2-bed dwelling) and £611 (per 4+bed dwelling) should a locally equipped area for play (LEAP) need to be provided off-site
- a charge of between £1,263 per 1-bed dwelling to £3,000 per 4+bed dwelling to help deliver public realm improvements in the centre of Swindon, and
- a charge of between £95 per 1-bed dwelling to £226 per 4+bed dwelling to help improve the benefits arising from the Great Western Community Forest that extends across the whole of the borough. Money is identified as being necessary for planting new woodland, improving public access and developing community and educational outreach work.

The rate of an individual CIL will vary with each administering authority, with each charge having to be supported by an evidence base that details the type of infrastructure required and its likely cost (DCLG 2010e). The legislation also requires that a CIL be implemented on the basis of an up-to-date development plan that incorporates a fully tested charging schedule capable of explaining how the levy is to be administered across the authority. Charging authorities have the opportunity to collaborate in the operation of a CIL and can pool their receipts to fund infrastructure spanning administrative areas. This is likely to be an important mechanism for helping to fund green infrastructure networks.

The term 'infrastructure' is broadly defined by the supporting guidance, which refers to how the levy can be used to fund play areas, parks, green spaces and cultural and sporting facilities (DCLG 2010e). Payments can be used to fund capital projects, as well for the subsequent maintenance of infrastructure. Local authorities will also be required to allocate a proportion of the revenue received via the levy to the neighbourhood from which it originated (HM Government 2010).

In order to avoid duplication, the legislation precludes those authorities with a CIL in place to charge, via a traditional planning agreement, for improvements to local or sub-regional infrastructure. Specifically, only on-site forms of mitigation can be financially supported (obligations will represent the principal mechanism for the delivery of affordable housing). This restriction is to be extended to the whole of England and Wales by April 2014 (DCLG 2010e, DCLG 2010f).

5 Funding for green infrastructure

Funding is critical if the objectives and goals of green infrastructure policy are to be successfully delivered. For commercial projects, the direct and indirect costs associated with preparing and delivering a green infrastructure strategy are likely to be borne, at first, by the individual developer. The magnitude of these costs will obviously vary with each project, the size of the site, and the type of measures proposed. Direct costs will arise with proposals to create or enhance green infrastructure assets or networks, for instance through the delivery of playing fields, structural landscaping, allotments or new green route-ways. Direct costs may also arise where certain features need to be protected, for instance through the erection of fencing or via signage to help direct public access away from designated nature sites.

Indirect costs may arise in those circumstances where a developer has chosen, or has been encouraged through negotiation, to restrict the scale and density of development. Such a strategy may be justified on the basis of reducing the overall level of pressure placed on green infrastructure assets, both in the site and across the surrounding area. Similarly, an indirect cost would also be generated in those cases where development activity is scaled back completely to help preserve certain interests, such as an area of ancient woodland or a site of identified nature conservation value. The cost in this case would be the loss of value from the undeveloped land. However, in this latter scenario, certain areas of exclusion may be generally unsuitable for development in any case, for instance where there is an identified risk of flooding.

In addition to initial capital costs, thought should also be given to the costs associated with maintaining the quality and functionality of green infrastructure assets and networks over a certain period or, in some cases, in perpetuity. The approach should be the same as for whole life costing applied to buildings. A small-scale intervention made at the beginning of a development project could have long-term implications if maintenance costs are high. A key challenge for developers and their project teams is

to keep these maintenance costs as low as practically possible, but in a way that allows for the original intention of the proposal to be fully realised. This may bear an influence on the type of facilities provided, or the specific way in which space is designed. Uplifts in local value can quickly depreciate if a green resource, such as parkland, is poorly maintained.

As with such things as roads and pavements, developers have traditionally handed responsibility for the up-keep and maintenance of green space to the local authority in which the development is located. To enable this, the local authority gives detailed consideration to the type of green space and infrastructure being provided to ensure that future costs can be accommodated. Alterations to this approach do exist and are beginning to find greater currency with developers. For example, rather than passing the ownership of a development's environmental assets to the local authority, a developer may also choose to retain the freehold themselves. In order to ensure that the assets are properly maintained, and capable of contributing to the quality of the site, the developer may decide to appoint a contractor who is paid by imposing a charge on all the site's occupiers. Another option might involve leasing the same assets to a locally-run trust or charitable body for control and upkeep in the longer term. **Boxes 10 and 11** below refer to practices at Fairfield Park in Bedfordshire and Elsea Park in Lincolnshire.

In discussing these costs, it is important to re-consider the many benefits that a single or interlinked network of green infrastructure assets can yield. Consequently, interventions identified initially as a cost may, in fact, be a driver for generating greater value. For instance, developers investing in open space and structural landscaping in a residential scheme may be able to offset these initial costs by charging a premium on those properties that overlook, or take some benefit, from the provision. There is, therefore, a need for a creative approach to scheme design, in order that the development and commercial opportunities arising from a site-level green infrastructure strategy can be maximised. Furthermore, green

infrastructure resources may be capable of supporting income streams in their own right. An example of such an opportunity could arise where residents are charged to use the allotment space that the developers of a scheme provide.

A time dimension also exists in the consideration of these benefits, since the value accruing from green infrastructure investments may continue into the longer term (i.e. well into a development's life cycle). For instance, a creative and integrated approach to landscaping (rather than designing the bits of space left over) in one development, may lead to a permanent increase in property value when compared alongside similar schemes with only moderate landscaping.

Since policy concerning the protection and promotion of green infrastructure is becoming embedded into plans and strategies across the UK planning system, planning applications that satisfy the type of objectives set out in this note are more likely to succeed than those that do not. Avoiding this potential conflict could enable planning applications to be processed and approved in a shorter amount of time, enabling start dates on site to be brought forward. Schemes that fail to accord with policy on green infrastructure are likely to meet resistance and could, in certain circumstances, be refused planning permission. The present government's commitment to a presumption in favour of sustainable development, would seem to underline this.

Box 10: Fairfield Park, Bedfordshire

Fairfield Park is a new community of some 1,200 homes, which is located in open country between the villages of Stotfold and Arlesey in Bedfordshire. The scheme has been built by eight different house builders including Taylor Wimpey, Bovis and David Wilson Homes. The development occupies the site of the former Fairfield Hospital that closed in 1999. The main hospital building has been converted into apartments, with a wide-range of homes being developed in the surrounding grounds. A range of community facilities have been provided across the development.

Existing landscape features around the site have been protected and enhanced, with the design and green space provision of the development complementing the informal appearance of the wider park. The streets of the scheme have been adopted by the local authority, Central Bedfordshire Council. Green space within the scheme is maintained by Scanslans Property Management Ltd. on behalf of Fairfield Redevelopments Ltd. The costs of this arrangement are met by the residents of the development, who pay a rental charge. Householders are not able to sell their house unless these payments are up-to-date. In addition, residents are also subject to a range of covenants in order to protect the appearance of the site. Residents are restricted from having washing and refuse bins displayed in front gardens, and from planting fast-growing shrubs.

Box 11: Elsea Park, Lincolnshire

Elsea Park is being developed by Allison Homes on a 300 acre site to the south of Bourne in Lincolnshire. The development comprises approximately 2,000 homes, together with community facilities and open space. In addition to requiring the delivery of a primary school, a community centre, a library, and a relief road and affordable housing, the planning obligation associated with the scheme also requires the provision of recreational open and play space. It also requires the developer to protect and enhance habitats around the site. Once all the development is complete, a Community Trust will manage and oversee the community and environmental areas and facilities of the development. The developer sold the relevant land to the trust for a nominal fee. The trust employs a full-time grounds man to maintain the areas that the trust has adopted.

For more information about the Elsea Community Trust, please see: www.elseapark.co.uk.

Although developers and local planning authorities have tended to bear the largest proportion of costs associated with the delivery and enhancement of green infrastructure, other funding sources have included the European Union, lottery grants and central government programmes. For instance, in terms of the latter, the Department for Communities and Local Government has financed a number of green infrastructure strategies at a number of English growth points (such as the Thames Gateway). Other relevant programmes include Natural England's Environmental Stewardship and Access to Nature Fund and the Forestry Commission's English Woodland Grant Scheme. The emphasis on providing multi-functional space may assist in allowing a number of potential funding streams to be brought together, thereby creating an outcome that is sufficiently larger than what an individual grant may be expected to produce in isolation.

A recent CABI report has usefully reviewed a range of approaches towards the funding of sustainable high quality urban green space (CABI Space 2006). By looking at projects and initiatives across the world, the report sets out eight possible models. Alongside the opportunity for providing green space through planning and development (as outlined above), the remaining options include:

- traditional local authority funding, where costs associated with the provision of new, or the up-keep of existing, green space is funded from local authority budgets
- multi-agency public sector funding, where costs are borne by a range of public sector stakeholders, such as the police or local health interests
- taxation, where the costs are met through the application of some kind of tax. The CABI Space (2006) report refers to the case of Minneapolis in the USA which takes 9% of a general property tax for funding parks and green space
- bonds and commercial finance, where funds can be provided through the issuing of local authority bonds
- income-generating approaches, where costs can be met through businesses applying for sponsorship, or for the management of key facilities and events
- endowments, where funds can be provided via the interest generated by an asset. While not widely used in the UK, the CABI report refers to the case of Milton Keynes where the assets of the town's development corporation were transferred to a newly established Park's Trust, and
- voluntary sector involvement, allowing for certain costs to be saved through groups and individuals providing their time and services free of charge.

6 Considerations and recommendations for RICS members

	Consideration	Recommendation
1	There is a growing body of evidence on the beneficial role of green infrastructure in urban environments, like good public realm, it can add value to property assets and communities as a whole.	Communicate the importance and relevance of green infrastructure to your clients. Through CPD, keep up to date with changes in green infrastructure, fiscal and legislative policy, so clients can be advised appropriately. <i>Action</i> – read the government's national infrastructure plan and follow discussion and emerging detail and impacts of localism
2	Building and living sustainably is mandated through European Directives, and National policies and laws	Familiarise yourself with emerging policies and legal measures to ensure compliance with current policy <i>Action</i> – look at the government's policies for biodiversity off-setting and what opportunities exist for urban land to be turned over to growing more local food?
3	Green infrastructure measures have been shown to help mitigate some climate change impacts and bring about more sustainable development.	Identify possible different green infrastructure measures to reduce energy consumption of your clients' buildings: saving money and increase ratings. <i>Action</i> – think about what opportunities exist for more green roofs. They can be beneficial for winter insulation, but more particularly for summer cooling, as well as rain water attenuation.
4	Land where development has been postponed can be adapted to contribute to a wider green infrastructure provision.	Surveyors can explore and discuss possibilities with clients as an interim measure for such land. <i>Action</i> – think about interim land uses; for example, could such land be turned in to a temporary park or wildlife haven.
5	There is a range of relevant national and sub-national policy directions about the role of green infrastructure.	Keep abreast of relevant policies, and be alert to changes brought about through ongoing planning reform. <i>Action</i> – read the current draft planning policy statement on Planning for a Natural and Healthy Environment, for example.
6	Organisations such as Natural England, and Scottish Natural Heritage provide knowledge and information on green infrastructure. CABI has published guidance too.	Keep abreast of what government supported bodies, charities and other professional bodies are saying about the subject. <i>Action</i> – read CABI's Grey to Green, for example.

7	Local planning authorities have policies about the provision and protection of green infrastructure. These are expressed differently across the country.	Familiarise yourself and clients with how green infrastructure is dealt with in the local development plan. Also be aware of what stage of production development plan documents are at in order that their contents can be influenced, or how the information can be used in a planning application or appeal. <i>Action</i> – go to your local government website and see what is currently an issue or what is being proposed, for example.
8	Local planning authorities have policies about the delivery of green infrastructure, and what payments or provisions developers are expected to provide.	Examine these measures on a site-by-site basis with the relevant planning authority in light of policies included in a development plan. <i>Action</i> – as above
9	The value, valuation and evaluation of green infrastructure is less developed in terms of methodology, methods and market evidence than other areas of practice.	There is much debate as to whether green infrastructure can be truly given a monetary value. However in a commoditised world that perspective has to sometimes be given and surveyors should be in a lead position to do this. <i>Action</i> – See RICS Valuation Information Paper 13 Sustainability and commercial property valuation and stay abreast of ongoing RICS work in this area.
10	The management of green infrastructure is crucially important if it is to provide the value and benefits that it can deliver.	This needs to be at both a strategic and operational level to be effective, whether it be public or privately owned land. <i>Action</i> – As well as day to day management surveyors need to look strategically at assets under their management.
11	Green infrastructure arguably includes everything from a single tree and window box in a flatted dwelling to sports fields, graveyards, parks and allotments.	All members can contribute directly or indirectly to its enhancement.
12	Increased public concern about energy conservation and sound environmental stewardship is being reflected in the adoption of ‘corporate social responsibility’ measures by some companies.	Keep abreast of changing public and corporate attitudes.

7 Conclusions

There is a growing body of evidence that green infrastructure provides many and significant social, environmental and economic benefits to urban areas. This increased awareness of the positive aspects that green infrastructure can bring about has led to a renaissance in thinking. Green infrastructure can play a pivotal role in dealing with a range of contemporary issues, such as climate change, social inequality and improving the public's health. As Dusty Gedge, green infrastructure campaigner said in relation to green roofs, they do 'lots of things in medium ways.... A bit of nature here, less airconditioning there, preventing run-off rainwater there – but it all adds up to quite a lot'.

Growing policy support and increased developer interest has led to a variety of innovative and creative solutions coming forward. While these often vary in size, cost and type, each intervention has the opportunity to provide some benefit to both the development and the wider locality. The challenge will be to maintain this through the coming years, particularly given the scaling back of public funding and the implementation of further planning reforms.

However, the cumulative effect of all these impacts is likely to be substantial. There is also a need to improve transparency of transactional data to establish empirical evidence supporting/or not supporting the link between value and green infrastructure. Furthermore, additional thought also needs to be directed towards the financial and management arrangements associated with green infrastructure, drawing in domestic and international best-practice where possible.

Finally, the challenge of creating more green infrastructure will be to maintain this through the coming years, particularly given the scaling back of public funding and the implementation of further planning reforms. There is however an increasingly widespread roll out of carbon related taxation. This needs to be monitored in relation to the potential of offsetting such costs by investing in and developing more new green infrastructure. The introduction of such offsets in the future, would create a much needed incentive in providing more green infrastructure. This is to everyone's benefit: a greener and more sustainable world. Surveyors should work with their co built environment professionals in exploring the opportunities of developing such policies.

7 Further Reading

Social impacts

CIRIA, *Large trees in the urban environment: a design and management guide* (Research Paper 39), CIRIA, London

Commission for Architecture and the Built Environment (CABE) (2006) *Making contracts work: How to encourage biodiversity in urban parks*, CABE, London (available at www.cabe.org.uk/publications/making-contracts-work-for-wildlife)

Early, P., Gedge, D., Newton, J., Wilson, S. (2007), *Building Greener: Guidance on the use of green roofs, green walls and complementary features on buildings*, London, CIRIA.

Stewart, H., Owen, S., Donovan, R., MacKenzie, R., Hewitt, N., Skiba, U., Fowler, D. (Undated). *Trees and sustainable urban air quality: Using trees to improve air quality in cities*, University of Lancaster and CEH Edinburgh (available at www.es.lancs.ac.uk/people/cnh/docs/UrbanTrees.htm.)

Town and Country Planning Association (TCPA) (2004) *Biodiversity by Design: a guide for sustainable communities*, TCPA, London (available at www.tcpa.org.uk/data/files/bd_biodiversity.pdf)

UK Green Building Council (2009) *Sector-specific Biodiversity Guidance*, UK-GBC Biodiversity Task Group, London (available at www.ukgbc.org/site/document/download/?document_id=591)

Woods Ballard, B., Kellagher, R., Martin, P., Jefferies, C., Bray, R., Shaffer, P. (2007), *The SUDS Manual*, CIRIA, London

Environmental impacts

Morris, N. (2003) *Health, Well-Being and Open Space*, OPENspace Research Centre, Edinburgh College of Art and Heriot-Watt University

Health Scotland, Greenspace Scotland, Scottish Natural Heritage, Institute of Occupational Medicine (2008), *Health Impact Assessment of greenspace: A Guide*, Stirling: Greenspace Scotland.

Dunnett, N., Swanwick, C., Woolley, H. (2002) *Improving urban parks, play areas and open spaces*, Urban Research Report, The Stationery Office, London

Natural England (2010) *'Nature Nearby': Accessible natural greenspace guidance*, Natural England, Sheffield

Economic impacts

BRE (1999) Digest 298: *Building Foundations: The influence of trees in clay soils*, BRE, London

CABE (2009) *Grey to green: how we shift funding and skills to green our cities*, CABE, London

CIRIA, *Large trees in the urban environment – a design and management guide* (Research Paper 39), CIRIA

National Joint Utilities Group (2007) Volume 4: *NJUG Guidelines for the planning, installation and maintenance of utility apparatus in proximity to trees* (available at: www.njug.org.uk/publication/51)

Natural Economy Northwest [Ca. 2009] *Putting the green in the grey: creating sustainable grey infrastructure. A Guide for developers, planners and project managers* (available at: www.naturaleconomynorthwest.co.uk/esources-reports.php)

Natural England (2009), *Housing growth and green infrastructure policy*, Natural England, Sheffield

Royal Institution of Chartered Surveyors (2009) *Sustainability and commercial property valuation* RICS Valuation Information Paper 13, RICS Books, Coventry

Royal Institution of Chartered Surveyors (2010) *The valuation of trees for amenity and related non-timber uses* (RICS guidance note), RICS Books, Coventry

Roberts, J., Jackson, N., Smith, M. (2006) *Tree roots in the built environment*. Research for amenity trees 8, The Stationery Office, London

References

- Beck, H. (2009) *Understanding the links between the quality of public spaces and the quality of life*, Journal of Place Management and Development, 2, 240–248.
- Bedfordshire and Luton Green Infrastructure Consortium (BLGIC) (2007), *Bedfordshire and Luton Strategic Green Infrastructure Plan*, Bedfordshire County Council, Bedford
- Benedict, M. A., McMahon, E. T. (2003), *Green Infrastructure: smart conservation for the 21st Century*. Renewable Resource Journal, 20(3), 12–17.
- Bibby, P. (2009) *Land-use change in Britain*, Land Use Policy, 26S, S2–S13.
- BRE Global Limited (2009) *BREEAM Communities Assessor Manual Development Planning Application Stage* (BREEAM Communities SD5065B Technical Guidance Manual). BRE Global Limited, Watford (available at www.breeam.org/filelibrary/breeamcommunities/SD5065B_-_BREEAM_Communities_Technical_Guidance_Manual.pdf)
- BRE Global Limited (2010) *Scheme Document SD 5068: BREEAM Data Centres*, BRE Global Limited, Watford (available at www.breeam.org/filelibrary/SD5068_1_0_BREEAM_Datacentres_2010.pdf)
- Broadmeadow, M. S. J., Freer-Smith, P. H. (1996) *Urban woodland and the benefits for local air quality*, The Stationery Office, London
- CABE Space (2008) *Land in limbo: making the best use of vacant sites*, CABE Space, London
- CABE Space (2006) *Paying for parks: eight models for funding urban green spaces*, CABE Space, London
- CABE Space (2004) *The value of public space: How high quality parks and public spaces create economic, social and environmental value*, CABE Space, London
- Cambridge Horizons (2006) *Green Infrastructure Strategy*, Cambridge Horizons, Cambridge
- Cambridge Horizons (2010) *Green Infrastructure*, Cambridge Horizons, Cambridge (available at www.cambridgeshirehorizons.co.uk/our_challenge/green_spaces/)
- Campaign to Protect Rural England (2010) *Green belt: the issues* (available www.cpre.org.uk/campaigns/planning/green-belts/green-belts-the-issues)
- Chartered Institute of Environmental Health (CIEH) (2005) *Saving our skins toolkit. Raising awareness of the risk of skin cancer*, Chartered Institute of Environmental Health,
- CABE (2010) *Engaging Places Programme*, CABE and English Heritage, London
- CABE (2010) *Urban green nation: building the evidence base*, CABE Space, London
- CABE (2009) *Grey to Green: How we Shift Funding and Skills to Green our Cities*, CABE Space, London
- Coombes, E., Jones, A.P., Hillsdon, M. (2010) *The relationship of physical activity and overweight to objectively measured green space accessibility and use*, Social Science and Medicine, 70, 816–822.
- The Countryside Agency (2005) *Engaging and learning with the outdoors: a summary of the outdoor classroom in a rural context action research project (Countryside Research Note 98)*, The Countryside Agency, Cheltenham
- Dehring, C., Dunse, N. (2006) *Housing density and the effect of proximity to public open space in Aberdeen*, Real Estate Economics, Scotland 34, 553–566.
- Del Barrio, E. P. (1998) *Analysis of the green roofs cooling potential in buildings*, Energy and Buildings, 27, 179–193
- Department for Communities and Local Government (2009a) *Planning Policy Statement: Planning for Sustainable Economic Growth*, The Stationery Office, London
- Department for Communities and Local Government (2009b) *Planning Policy Statement: Eco-towns. A Supplement to Planning Policy Statement 1*, CLG, London
- Department for Communities and Local Government (2010a) *Consultation paper on a new Planning Policy Statement: Planning for a Natural and Healthy Environment*, CLG, London
- Department for Communities and Local Government (2010b) *Consultation paper on a new*

- Planning Policy Statement: Planning for a Low Carbon Future in a Changing Climate, CLG, London
- Department for Communities and Local Government (2010c) *Planning Policy Statement: Development and Flood Risk*, The Stationery Office, London
- Department for Communities and Local Government (2010d) *Planning Policy Statement: Housing*, CLG, London
- Department for Communities and Local Government (2010e) *Community Infrastructure Levy: An Overview* (November) CLG, London
- Department for Communities and Local Government (2010f) *New Policy Document for Planning Obligations. Consultation*, CLG, London
- Department for Environment Food and Rural Affairs (2007) *A Strategy for England's Trees, Woods and Forests*, Defra, London
- Department of Transport, Local Government and the Regions (2002) *Greenspaces, Better Places*, DTLR, London
- Donovan, R. G., Stewart, H. E., Owen, S. M., MacKenzie, A. R., Hewitt, C. N. (2005) *Development and application of an Urban Tree Air Quality Score for photochemical pollution episodes using the Birmingham, United Kingdom, area as a case study*, Environmental Science and Technology 39, 6730–6738.
- Dunnett, N., Swanwick, C., Woolley, H. (2002) *Improving urban parks, play areas and open spaces, Urban Research Report*, Department of Transport, Local Government and the Regions, London
- Eichholtz, P., Kok, N., Quigley, J.M. (2008) *Doing Well By Doing Good? Green office buildings*, European Centre for Corporate Engagement, Maastricht
- Eichholtz, P., Kok, N., Quigley, J.M. (2009) *Doing Well By Doing Green? An Analysis of the Financial performance of green office buildings in the USA: A research report*. RICS, London
- Ellison, M. (2005) *Quantified tree risk assessment used in the management of amenity trees*, Journal of Arboriculture, 31, 57–65.
- Faber-Taylor, A., Kuo, F.E., Sullivan, W.C. (2001) *Coping with ADD. The surprising connections to green play settings*, Environment and Behavior, 33, 54–77.
- Fjørtoft, I. (2001) *The natural environment as a playground for children: The impact of outdoor play activities in pre-primary school children*, Early Childhood Education Journal, 29(2), 111–117.
- Fjørtoft, I., Sageie, J. (2000) *The natural environment as a playground for children: landscape description and analyses of a natural playscape* Landscape and Urban Planning, 48, 83–97.
- Frazer, L. (2005) *Paving Paradise. Environmental Health Perspectives*, 113, 457–462.
- Fuerst, F., McAllister, P. (2008) *Green Noise or Green Value? Measuring the price effects of environmental certification in commercial buildings* (MPRA Paper 11446), University Library of Munich, Munich, Germany.
- Garrod, G.D., Willis, K.G. (1992) *Valuing goods' characteristics: an application of the hedonic price method to environmental attributes*, Journal of Environmental Management, 34, 59–76.
- Garrod, G.D., Willis, K.G. (1994) *An economic estimate of the effect of a waterside location on property values*, Environmental and Resource Economics, 4, 209–217.
- Getter, K. L., Rowe, D. B. (2006) *The role of green roofs in sustainable development*, HortScience, 41, 1276–1286.
- Gill, S.E., Handley, J.F., Ennos, A.R., Pauleit, S. (2007) *Adapting cities for climate change: the role of the green infrastructure*. Built Environment, 33(1), 115–133.
- Government Office for Science (2010) *Foresight Land Use Futures Project*, Main report, London
- Government Office for the East of England (GOEE), (2008) *East of England Plan, The Revision to the Regional Spatial Strategy for the East of England*, Government Office for the East of England, London
- Greater London Authority (2008) *The London Climate Change Adaptation Strategy*, GLA, London
- Greater London Authority (2008) *The London Plan: Spatial Development Strategy for Greater London Consolidated with Alterations since 2004*, GLA, London

- Greater London Authority (2009) *Draft Replacement Local Plan: Spatial Development Strategy for Greater London*, GLA, London.
- Greenspace (2007) *The park life report: the first every public satisfaction survey of Britain's parks and greenspaces*, Greenspace, Reading
- Grosvenor, (2010) *House Builder on Board for Trumpington Meadows Scheme*, Grosvenor, London (available at www.grosvenor.com/NR/rdonlyres/400FDE78-06DF-4318-ACCC-5480920F63A7/11203/HouseBuilderonBoardforTrumpingtonMeadowsScheme1Mar.pdf)
- Hakim, .A. A., Curb, J. D., Petrovitch, H., Rodriguez, B. L., Yano, K., Ross, G. W., White, L. R., Abbott, R. D. (1999) Effects of Walking on Coronary Heart Disease in Elderly Men: The Honolulu Heart Program. *Circulation*, 100, 9–13.
- Harrison, C., Davies, G. (2002) *Conserving biodiversity that matters: practitioners' perspectives on brownfield development and urban nature conservation in London*, *Journal of Environmental Management*, 65, 95–108.
- Hartig, T., Evans, G.W., Jamner, L.D., Davis, D.S., Gärling, T. (2003) *Tracking restoration in natural and urban field setting*, *Journal of Environmental Psychology*, 23, 109–123.
- HM Government (2010) *Decentralisation and the Localism Bill: an essential guide*, CLG, London.
- Horticultural Trades Association (2010) *Greener Planning Greener UK*, Horticultural Trades Association.
- Huston, S., Evenson, K., Bors, P. and Gizlice, Z. (2003) *Neighborhood Environment, Access to Places for Activity, and Leisure-Time Physical Activity in a Diverse North Carolina Population*, *American Journal of Health Promotion*, 18, 58–69.
- Jones, A., Bentham, G., Foster, C., Hillsdon, H., Panter, J. (2007) *Tackling Obesities: Future Choices – Obesogenic Environments – Evidence Review*, Foresight Review for the Government Office for Science. Department of Innovation Universities and Skills, London
- Jones, A., Hillsdon M., Coombes, E. (2009) *Greenspace access, use, and physical activity: Understanding the effects of area deprivation*, *Preventive Medicine*, 49(6), 500–505.
- Knowler, W. C., Barrett-Connor, E., Fowler, S. E., Hamman, R.F., Lachin, J. M., Walker, E. A., Nathan, D.M. (2002) *Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin*, *The New England Journal of Medicine* 346(6), 393–403.
- Llewelyn-Davies (2007) *Urban Design Compendium* (2nd Ed.), English Partnerships, London
- London Climate Change Partnership (2002) *London's Warming: the impacts of climate change on London*, Climate Change Partnership, London (available at www.london.gov.uk/lccp/publications/docs/londons_warming02.pdf)
- Millennium Ecosystem Assessment (2005) *Living beyond our means: Natural assets and human well-being*, [s.l.]: Millennium Ecosystem Assessment.
- Miller, N., Spivey, J., Florance, A. (2008) *Does Green Pay Off?* *Journal of Real Estate Portfolio Management*, 14, 385–400.
- Mindlin, M. (2008) *Incident response: Oak processionary moth. Chemical Hazards and Poisons*, Report 12, Health Protection Agency, London
- Natural England (2009) *Green Infrastructure Guidance*, Natural England, Sheffield
- Natural England (2010) *Wild Adventure Space: its role in teenagers' lives* (Natural England, Commissioned Report NECR025) Natural England, Sheffield
- Northern Ireland Planning Service (2004) *Planning Policy Statement 8: Open Space, Sport and Outdoor Recreation*, The Northern Ireland Planning Service, Belfast
- Nowak, D. J., Crane, D. E., Stevens, J. C. (2006) *Air pollution removal by urban trees and shrubs in the United States*, *Urban Forestry and Urban Greening*, 4, 115–123.
- Obendorfer, E., Lundholm, J., Bass, B., Coffman, R.R., Doshi, H., Dunnett, N., Gaffin, G., Kohler, M., Liu, K. K. Y., Rowe, B. (2007) *Green roofs as urban ecosystems: ecological structures, functions, and services*, *BioScience*, 57 (10), 823–833.
- Office of the Deputy Prime Minister (2004) *Planning Policy Statement 7: Sustainable Development in Rural Areas*, ODPM, London

- Office of the Deputy Prime Minister (2002) *Planning Policy Guidance Note 17: Planning for Open Space, Sport and Recreation*, ODPM, London
- Pan, X.R., Li, G.W., Hu, Y.H., Wang, J.X., Yang, W.Y., An, Z.X., Hu, Z.X., Lin, J.L., Xiao, J.Z., Cao, H.B., Liu, P.A., Jiang, X.G., Jiang, Y.Y., Wang, J.P., Zheng, H., Zhang, H., Bennett, P.H., Howard, B.V. (1997) *Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance: the Da Qing IGT and Diabetes Study*, *Diabetes Care*, 20, 537–544.
- Peters, K., Elands, B., Buijs, A. (2010) *Social interactions in urban parks: Stimulating social cohesion?*, *Urban Forestry and Urban Greening*, 9, 93–100.
- Plymouth City Council (2008) *Plymouth Local Delivery Framework: Central Park Area Action Plan 2006-2021*, PCC, Plymouth
- Plymouth City Council (2009) *Plymouth's Green Infrastructure Delivery Plan: Positive Planning for the Natural Environment*, PCC, Plymouth
- Powe, N. A., Willis, K. G. (2004) *Mortality and morbidity benefits of air pollution (SO₂ and PM₁₀) absorption attributable to woodland in Britain*, *Journal of Environmental Management*, 70, 119–128.
- Pretty, J., Peacock, J., Sellens, M., Griffin, M. (2005) *The mental and physical health outcomes of green exercise*, *International Journal of Environmental Health Research*, 15(5), 319–337.
- Resource for Urban Design Information (2007) *East London Green Grid plans to create network of interlinked, open spaces*, RUDI, London (available at www.rudi.net/node/18445)
- RICS (2009) *Sustainability and commercial property valuation* (RICS Valuation Information Paper 13), RICS Books, Coventry
- RICS (2010) *The valuation of trees for amenity and related non-timber uses* (RICS guidance note), RICS Books, Coventry
- Roberts, J., Jackson, N., Smith, M. (2006) *Tree roots in the built environment. Research for amenity trees*. London: The Stationery Office.
- Sayce, S., Sundberg, A., Clements, B. (2010) *Is Sustainability reflected in commercial property prices: an analysis of the evidence base* (RICS Research), RICS, London
- Scottish Government (2008) *Planning Advice Note 65: Planning and Open Space*, Scottish Government Directorate for the Built Environment, Edinburgh
- Scottish Government (2009) *National Planning Framework for Scotland 2*, Scottish Government Directorate for the Built Environment, Edinburgh
- Scottish Government (2010) *Scottish Planning Policy*, Scottish Government Directorate for the Built Environment, Edinburgh
- Sheffield City Council (2009) *Sheffield Core Strategy*, Sheffield City Council, Sheffield
- Sheffield City Council (2010) *Draft Supplementary Planning Guidance: Design for Environmental Sustainability*, Sheffield City Council, Sheffield
- Sinnett, D. (2006) *Maximising Biodiversity. Best Practice Guidance Note 9*, Forest Research, Farnham
- Stephenson, A. (2003) *Physical risk-taking: dangerous or endangered?*, *Early Years*, 23(1), 35–43.
- Swindon Borough Council (2010) *Developer Guidance Note: Developer Contributions*, Swindon Borough Council, Swindon
- Trees and Design Action Group (2008) *No Trees, No Future: Trees in the urban realm*, TDAG, London
- Tiwary, A., Sinnett, D., Peachey, C.J., Chalabi, Z., Vardoulakis, S., Fletcher, T., Leonardi, G., Grundy, C., Azapagic, A. and Hutchings, T. R. (2009) *An integrated tool to assess the role of new planting in PM₁₀ capture and the human health benefits: a case study in London*, *Environmental Pollution*, 157, 2645–2653.
- Town and Country Planning Association (2008) *The Essential Role of Green Infrastructure: Eco-towns Green Infrastructure Worksheet*, Town and Country Planning Association, London
- Urban Greenspaces Task Force (2002) *Green spaces: better places*, Department for Transport, Local Government and the Regions, London
- Urban Parks Forum (2001) *Public Park Assessment: A survey of local authority owned parks focusing on parks of historic interest*, Reading: Urban Parks Forum

Welsh Assembly Government (2009) *Technical Advice Note 5: Nature Conservation and Planning*, The Welsh Assembly Government, Cardiff

Welsh Assembly Government (2009a) *Technical Advice Note 5: Nature Conservation and Planning*, The Welsh Assembly Government, Cardiff

Welsh Assembly Government (2009b) *Technical Advice Note 16: Sport, recreation and open space*, The Welsh Assembly Government, Cardiff

Welsh Assembly Government (2010) *Planning Policy Wales*, (2nd ed.), The Welsh Assembly Government, Cardiff

Welsh Assembly Government (2010) *Technical Advice Note 22: Sustainable Buildings*, The Welsh Assembly Government, Cardiff

Younger, M., Morrow-Almeida, H. R., Vindigni, S. M., Dannenberg, A. L. (2008) *The Built Environment, Climate Change, and Health: Opportunities for co-benefits*, American Journal of Preventative Medicine, 35 (5), 517–526.

Appendix

BREEAM Communities assessment criteria (from BES5065)

Climate and energy	Flood risk issues Passive design principles Water consumption management Energy consumption management Infrastructure
Community	Inclusive communities Community consultation Information/ownership
Place shaping	Land use Form of development Open space Inclusive design Mix of use
Transport	Public transport Cycling requirements General policy Car parking Traffic management
Ecology	Ecological survey Biodiversity action plan Native flora Wildlife corridor
Resources	Impact of materials Waste management (operation and construction) Water resources management Pollution issues Land remediation
Business	Business investment Employment Business facilities Connectivity
Buildings	Residential buildings (CSH or EcoHomes) Non-domestic buildings (BREEAM)

Green infrastructure in urban areas

1st edition, information paper

This information provides RICS members with background information on the issues surrounding the delivery and promotion of green infrastructure. It provides an overview of what green infrastructure is, the functions it can support, and refers to the various scales across which it can be provided. The paper also provides general information on the impacts associated with green infrastructure.

The following main topics are covered:

- Definition of green infrastructure
- Evidence for the impacts of green infrastructure
- Planning for green infrastructure
- Funding of green infrastructure
- Considerations and recommendations for RICS members



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