10.0 Green Infrastructure

10.1 Introduction

10.1.1 Green infrastructure is the sub-regional network of habitats, greenspaces and connecting corridors. The connecting corridors link one habitat to another and include rivers and their floodplains, woodlands and traditional field boundaries, such as hedgerows. It is important to consider green infrastructure at both individual sites and across the local area as a whole.

10.1.2 Green infrastructure is often multifunctional in use and can deliver a range of environmental, social and economic benefits. A number of key benefits are considered in the following sections and some practical 'green' measures that can be incorporated in new developments are identified.

10.2 Benefits

10.2.1 In **environmental** terms, green infrastructure provides a number of ecological services including: filtering air and water pollution; improving the local microclimate through shading and wind sheltering; and contributing to mitigating the causes, and adapting to the consequences, of climate change. In relation to the latter, trees and other vegetation can reduce the impacts of climate change by absorbing carbon dioxide from the atmosphere. They can also ameliorate the warming effects of climate change through evapotranspiration and direct shading, and help cope with the increased frequency of sudden, heavy rain by reducing runoff and increasing rainfall capture.

10.2.2 Green infrastructure can also be beneficial to biodiversity by increasing habitat areas, increasing populations of some priority and protected species, and increasing species movement. A species population size is directly linked to the size of available habitat and it is important that green infrastructure links areas to wider habitats through wildlife connection corridors. Some species will be affected by climate change and will need to move to new habitats with more favourable climatic conditions. Even species which do not travel long distances will need to move to new habitats with a more favourable microclimate.

10.2.3 In respect of **social** benefits, green spaces can be beneficial to health and wellbeing by creating desirable places to live, generating opportunities for recreation and exercise, and providing an environment which can reduce stress and encourage relaxation. They can also improve social cohesion by encouraging outdoor activity and group interaction.

10.2.4 With regard to **economic** benefits, green infrastructure can improve the appearance of an area which in turn can increase inward investment, attract businesses and customers and increases property and land values. The value of developments can also be increased by providing well managed green spaces and incorporating

views of natural landscapes and waterways into the design of the scheme. Management costs can be minimised by providing ecologically self-sustaining green spaces that require minimal maintenance.

10.3 Design, Layout and Landscaping

10.3.1 At the beginning of the design process, it is important to undertake a contextual appraisal of the site and adjacent land in order to understand the assets, functional requirements and potential benefits of the existing green infrastructure[21]. This knowledge can then be used to design new developments in ways that protect, and where appropriate enhance, the function of existing green infrastructure. These can range from small scale building measures, such as the incorporation of green roofs, through to providing new recreational green spaces. A number of beneficial measures which are particularly suited to the scale of developments likely to be undertaken in Merthyr Tydfil are discussed below.

10.3.2 Networks of green spaces can be incorporated into developments through wildlife-friendly landscaping, provision of open space, installation of sustainable drainage systems, and features such as green roofs and walls[22]. Private gardens, courtyards, balconies and terraces also have the potential to create a mosaic of habitats which respond to varying microclimate conditions across the site. It is important that all spaces are planted with species that are suited to the microclimate and beneficial to wildlife. In general, native species are best suited to the local environment, sustaining biodiversity while protecting and enhancing natural features and the character of the area.

10.3.3 **Green roofs** comprise of a multilayered system that covers the roof of a building with vegetation cover (see Figure 10.1). The main benefits include: rain water management; enhanced biodiversity; reduced energy consumption and fuel costs by cooling buildings in summer and providing thermal insulation in winter; reduced air pollution; and extended roof life as a green roof protects the roof's waterproofing membrane.

Figure 10.1 Green roof incorporated into the design of the Woodland Resource Centre, Cyfarthfa Park.

10.3.4 There are three green roof types: intensive green roofs; semi-extensive green roofs and extensive green roofs.

10.3.5 Intensive green roofs offer greater plant/habitat diversity (plants and trees) and opportunities for recreation. They do, however, depend on a relatively deep growing medium (20 cm+) which requires a robust building structure, more complex irrigation and drainage systems, and regular ongoing maintenance. This results in them being quite costly and impractical for almost all domestic situations.

10.3.6 Semi-extensive green roofs rely on a soil depth of 10-20 cm and are typically vegetated with lawns and ground covering plants. Demands on the building structure are moderate and the vegetation will require regular maintenance. Whilst they are occasionally accessible, they are more often designed to be overlooked.

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[21] *This is particularly important for understanding local biodiversity and developers should contact the local planning authority and/or local environmental records centre to obtain data on known habitats and species located within, or close to, the application site. Natural Resources Wales can also provide advice to developers on biodiversity considerations which should inform the design and layout of development proposals.*

[22] *Green walls are essentially a living, cladding system using climbing plants.*

10.3.7 Extensive green roofs are the cheapest option as they rely on thinner soils (5-10 cm) with little or no irrigation, drainage or maintenance requirements. On the downside, the choice of plants is limited to hardy, drought tolerant species and there is usually no access for recreation.

10.3.8 **Street trees** can make a valuable contribution to enhancing the quality of the local environment by improving air quality, creating continuous habitats for birds and insects and making neighbourhoods more visually attractive (see Figure 10.2). It is important to ensure that the chosen tree species can survive urban conditions as well as provide wildlife benefits. Other considerations include the impact of trees on buildings, streets and utilities at maturity; maintenance requirements; and the potential for vandalism. The likelihood of the latter can be reduced by planting semi-mature trees.

Figure 10.2 Avenue of street trees along Tramroad Side North.

10.3.9 Opportunities should always be taken to retain existing mature trees and hedgerows wherever possible. Appropriate protection measures must be in place during construction in order to avoid damage either directly from equipment or indirectly through soil compaction or pollution incidents. New forms of drainage may also be necessary where changes to the water table occur as a result of development.

10.3.10 **Sustainable drainage systems** (SuDS) can be a form of green infrastructure that can have multiple benefits including contributing to the enhancement of developments' amenity and providing opportunities for biodiversity enhancement. To maximise these benefits, SuDS should be designed in response to the local topography, landscape character and local biodiversity needs.

10.3.11 Ponds and wetlands can provide important aesthetic, amenity and wildlife benefits to an area. Recreational opportunities can be enhanced by including footpaths, boardwalks, benches and picnic tables. These can be linked to other areas of open space within the public realm using other SuDS components, such as swales, in order to create an integrated network of green spaces. There can be concerns over the safety of ponds and wetlands due to the potential for drowning. These risks can, however, be designed out of schemes by incorporating shallow side slopes, shallow shelving edges and strategically placed vegetation.

10.3.12 Detention basins that fill infrequently can also be integrated in public space and used for informal play when they are not providing their hydraulic function. Signage can be provided to advise the public of their primary use and mitigate health and safety risks.