MERTHYR TYDFIL Local Development Plan 2006-2021

Supplementary Planning Guidance Note No.4

Sustainable Design

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Contents

1.0 Introduction and Purpose

1.1 Sustainable development is defned in Wales as a means of enhancing the economic, social and environmental wellbeing of people and communities, achieving a better quality of life for our own and future generations in ways which:

- promote social justice and equality of opportunity; and
- enhance the natural and cultural environment and respects its limits - using only our fair share of the earth's resources and sustaining our cultural legacy.

(One Wales: One Planet – The Sustainability Development Scheme of the Welsh Assembly Government, 2009).

1.2 The principles of sustainable development are embedded in national planning policy and the Merthyr Tydfl Local Development Plan (2006-2021) which set out commitments to delivering new homes, infrastructure, investment and jobs in a sustainable manner. Both recognise that we need to respect our environmental limits in order to ensure that our resources are not irrecoverably depleted or the environment irreversibly damaged. This means, for example, protecting and enhancing our natural environment and cultural heritage, minimising harmful emissions and promoting sustainable use of natural resources.

1.3 Addressing climate change is also an important part of delivering sustainable development. It has the potential to signifcantly afect the way our society and economy functions and how the environment is managed. The climate change we experience will depend on the amount of greenhouse gases actually emitted over the coming decades, and it is therefore essential that we minimise such emissions to avoid the worst impacts of climate change in the future. This can be achieved by moving towards a low carbon economy through reducing energy demand and facilitating the delivery of more sustainable forms of energy.

1.4 It must be recognised that changes to our climate over the next 30 to 40 years caused by past emissions are largely unavoidable. We therefore need to plan for these impacts and facilitate adaptation measures that limit the risks to people, property, infrastructure and resources.

1.5 Welsh Government guidance, as set out in Local Development Plans Wales (2005), highlights the value of supplementary planning guidance (SPG) in setting out more detailed thematic guidance and advice on the way in which the policies of a local development plan (LDP) will be applied. The purpose of this SPG is to expand on and assist in the interpretation of LDP policies which seek to deliver sustainable development locally. It aims to provide advice on the various aspects of sustainable design and encourage the incorporation of sustainable design techniques into the design of new buildings. It is expected that this SPG will be used by developers, agents and other stakeholders involved in the planning and development process.

1.6 Whilst this guidance should be read as a whole, the various aspects of sustainable design are considered under individual chapters, allowing the user to focus on the most relevant chapter during the design process. The aspects of sustainable design considered in this guidance include:

- Reducing Energy Demand - Layout and Building Design;
- Energy - Low and Zero Carbon Technologies;
- Transport and Movement;
- Water Conservation and Sustainable Drainage;
- Materials;
- Waste Management;
- Green Infrastructure;
- Designing Out Crime; and
- Flexible and Adaptable Buildings.

1.7 It is recognised that there will be occasions where a development is unable to successfully deliver all aspects of sustainable design covered within this guidance. There will inevitably be situations where site constraints, the local context and urban design considerations result in the need for “trade-ofs” in the overall design solution proposed. Nevertheless, there is an expectation that all aspects of sustainable design are explored and that the proposed design solution is fully explained and justified.

1.8 This SPG is a material consideration to be used by the Town Planning Division to assess whether planning applications comply with the Merthyr Tydfl Local Development Plan (2006-2021).

2.0 Policy Context

2.1 National Planning Policy

2.1.1 Sustainable design is a broad topic covered throughout Planning Policy Wales (Edition 5, November 2012) and within a number of Technical Advice Notes. Of particular relevance are:

- **Chapter 4 – Planning for Sustainability of Planning Policy Wales (Edition 5, November 2012);**
- **Technical Advice Note 5: Nature Conservation and Planning (September 2009);**
- **Technical Advice Note 8: Planning for Renewable Energy (July 2005);**
- **Technical Advice Note 12: Design (June 2009);**
- **Technical Advice Note 15: Development and Flood Risk (July 2004);**
- **Technical Advice Note 18: Transport (March 2007);**
- **Technical Advice Note 21: Waste (November 2001); and**
- **Technical Advice Note 22: Planning for Sustainable Buildings (June 2010).**

2.2 Local Planning Policy

2.2.1 The Merthyr Tydfl Local Development Plan (2006-2021) contains a number of policies that seek to secure sustainable design in new developments. The main policy is **BW7: Sustainable design and place making**, which covers, amongst other things, reducing energy demand, energy and resource efciency, renewable energy, green infrastructure, waste management, 'inclusive design', adaptable buildings and 'designing out crime'. The Policy states:

The Council will support good quality sustainable design and require new development to:-

- **be appropriate to its local context in terms of scale, height, massing, elevational treatment, materials and detailing, layout, form, mix and density;**
- **integrate effectively with adjacent spaces and the public realm to enhance the general street scene and create good quality townscape;**
- **not result in unacceptable impact on local amenity in terms of visual impact, loss of light or privacy, disturbance and traffic movements;**
- **incorporate a good standard of landscape design;**
- **sensitively relate to existing settlement patterns and take account of natural heritage and the historic environment on site and in terms of potential impact on neighbouring areas of importance;**
- **foster 'inclusive design' by ensuring the development allows access for the widest range of people as possible;**
- **contribute to the provision of usable open and outdoor play space, ensuring its accessibility and connectivity to other green infrastructure, footpaths and cycleways;**

- **incorporate resource efficient/adaptable buildings and layouts using sustainable design and construction techniques, including the re-use and recycling of construction and demolition waste on site, and energy and water conservation/ efficiency measures;**
- **minimise the demand for energy and, where appropriate, utilise the renewable energy resource through appropriate layout, orientation, mix of uses, density of development, landscaping, optimal use of local topography and incorporation of renewable energy technologies;**
- **incorporate facilities for the segregation, recovery and recycling of waste; and**
- **provide a safe environment by addressing issues of security, crime prevention, and the fear of crime in the design of buildings and the space and routes around them.**

2.2.2 **Policy BW8: Development and the water environment** is relevant to sustainable design particularly in respect of the latter part which addresses the use of sustainable drainage systems. The Policy states:

Proposals for built development will only be permitted where:-

- **they avoid identified river flood plains in order that these areas continue to fulfil their flood flow and water storage functions;**
- **they do not have an adverse effect on the quality and/or quantity of surface waters or groundwater resources, and where opportunities exist, they incorporate measures to improve existing quality; and**
- **adequate water and sewerage systems exist, or are reasonably accessible, or are capable of being provided prior to the development becoming operational without placing unacceptable pressure on existing capacity or causing unacceptable environmental harm.**

In addition, development proposals will be required to avoid exacerbating flood risk locally and elsewhere within the river catchment by incorporating sustainable drainage systems (SuDS) for the disposal of surface water. Alternative methods of surface water disposal will only be considered where a developer demonstrates that the incorporation of SuDS is inappropriate for practical or environmental reasons.

2.2.3 **Policy BW12: Development proposals and transport** covers, amongst other things, reducing the need to travel and encouraging alternative modes of transport to the private car. The Policy states:

Where appropriate, the Council will expect all development proposals to demonstrate how they will:-

- **help reduce the need to travel;**
- **encourage the use of transport other than the private car;**
- **avoid increasing traffic to unacceptable levels; and**
- **avoid causing or exacerbating highway safety problems.**

Transport assessments will be required for developments likely to result in significant trip generation.

2.2.4 Finally, **Policy TB7: Renewable energy** seeks to facilitate renewable energy proposals that contribute to meeting national and local renewable energy targets provided they meet certain criteria. The Policy States:

Development proposals that contribute to meeting national and local renewable energy targets will be favourably considered providing:-

- **In the case of wind turbine developments, their capacity does not exceed 25 MW on urban and industrial brownfield sites, and 5 MW elsewhere in the County Borough;**
- **They do not have an unacceptable impact on biodiversity and landscape including the setting of the Brecon Beacons National Parking; and**
- **They do not have an unacceptable impact on the amenity of residential areas.**

3.0 Design and Access Statements

3.1 A design and access statement (DAS) is a useful communication tool that provides a clear way in which to demonstrate that a development proposal has gone through a proper design process and achieves an appropriate level of sustainability. The DAS should demonstrate how the physical, social, economic and policy context of the development has been appraised, and how the choice of design principles and concepts takes that context into account. This guidance forms part of the policy context and applicants are encouraged to illustrate how the sustainability issues raised have informed and infuenced the design of the development proposal.

3.2 A DAS should refer to the objectives of good design set out in Technical Advice Note 12: Design (2009)[1] and explain how they have informed the design process. These objectives can also provide a basis for considering the topics covered within this guidance. The link between the two is presented in Table 3.1.

Guidance Topics	**TAN 12 - Objectives of Good Design**
Reducing Energy Demand - Layout and Building Design	Character - particularly in respect of scale and layout of development Environmental Sustainability
Energy - Low and Zero Carbon Technologies	Environmental Sustainability
Transport and Movement	Access Movement
Water Conservation and Sustainable Drainage	Environmental Sustainability
Materials	Environmental Sustainability
Waste Management	Environmental Sustainability
Green Infrastructure	Environmental Sustainability
Designing Out Crime	Community Safety
Flexible and Adaptable Buildings	Access Character - particularly in respect of scale and layout of development Environmental Sustainability

Table 3.1

1 *Detailed guidance on design and access statements can be found in Appendix 1 of Technical Advice Note 12: Design (June 2009).*

3.3 Applicants are encouraged to use the DAS as a tool to identify the intended sustainable building standard [2] (BREEAM or Code for Sustainable Homes) and explain the approach taken to reducing the carbon emissions associated with the development through the implementation of the energy hierarchy. In respect of the latter, details and explanations of passive design solutions, energy efciency measures and the incorporation of low and zero carbon technologies (where appropriate) are recommended. The fndings of sustainable building standard pre-assessments and low and zero carbon feasibility studies (where undertaken) can also be summarised and cross-referenced in the DAS.

3.4 A DAS should be proportionate in length and complexity to the type and scale of development proposed. The level of detail required will depend on the nature and scale of development and the sensitivity of the location. Major new developments and developments in sensitive locations are likely to require greater levels of detail with illustrative material and cross references to additional information contained within supporting documents submitted with the application. Smaller, less complex developments, and those in less sensitive locations, may be much shorter and only require concise written explanations.

[2] *It should be noted that at the time of writing the Welsh Government propose to remove minimum sustainable building standards from Planning Policy Wales and to secure improvements to the energy performance of new and existing buildings through improvements to Part L of the Building Regulations. See 2012 Consultation on Changes to the Building Regulations in Wales Part L (Conservation of Fuel and Power) (WG, July 2012).*

4.0 Reducing Energy Demand – Layout and Building Design

4.1 Introduction

4.1.1 An efective way of harnessing the renewable energy resource of the sun is through the application of passive solar design principles to new developments. It is based on the concept of minimising the energy needs of a building by making the best use of solar gain. This reduces the need for energy to heat and light buildings, which in turn minimises CO2 emissions and energy bills for future residents. It is, however, also important to avoid excessive solar gain during the summer which can cause overheating and increase the energy demand for cooling.

4.1.2 Passive solar gain works by allowing solar radiation to enter a building through its glazing providing natural light and thermal energy which can be absorbed into the foor and walls. The thermal energy absorbed during the day is re-radiated at night into the living space, reducing diurnal fuctuations in temperature. To facilitate this process a number of complementary passive solar gain features need to be incorporated into the design of both the site layout and individual buildings.

4.1.3 The following sections consider the role of site layout and building design in delivering successful passive solar design. Ways of responding to the existing local microclimate in order to create a comfortable urban environment is also considered as well as the complementary role of landscaping.

4.2 The Role of Site Layout

4.2.1 The site layout needs to be based on an analysis of the site's natural features and its microclimate. Important microclimate considerations include: the position of the sun throughout the year; seasonal characteristics, including temperature ranges; and the direction of the prevailing wind. The site's natural features which contribute to naturally sunny or sheltered locations should be taken advantage of in the design of the site layout. Such features include slopes, tree belts and the shape and orientation of the site.

Orientation

4.2.2 Buildings need to be orientated within 30° of south to gain the full beneft of passive solar energy. Buildings orientated within 30° to the east will beneft from the morning sun while buildings orientated within 30° to the west will receive the late afternoon sun (see Figure 4.1). Rectangular shaped blocks with a west-east emphasis will facilitate optimal south-facing front or rear building layouts.

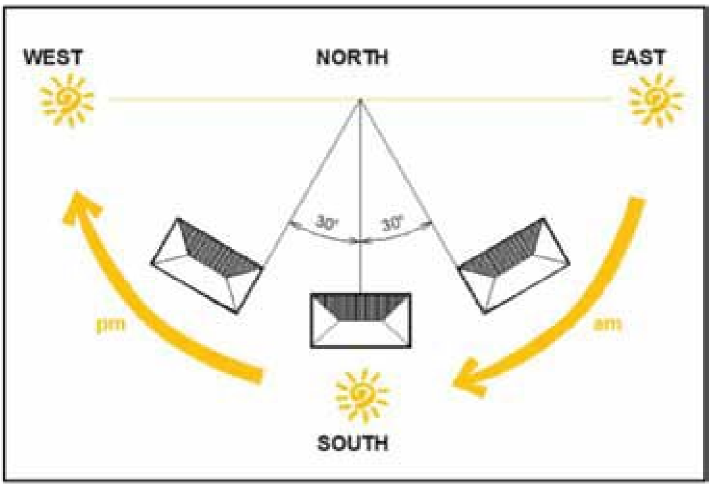

Figure 4.1

4.2.3 There may be instances where a west-east alignment is not favoured because of site shape or topography, or other urban design considerations, such as the need to respond to the street patterns of adjacent areas. In such circumstances opportunities will still exist to take advantage of solar gain. On north-south roads, detached buildings ofer greater fexibility for maximising solar gain. On diagonal roads (e.g. northwest-southeast), buildings need to be positioned at an angle to the road to optimise passive solar gain (see Figure 4.2). These approaches would need to be balanced against the need to create a common building line which provides continuity of frontage and provides defnition and enclosure to the public realm.

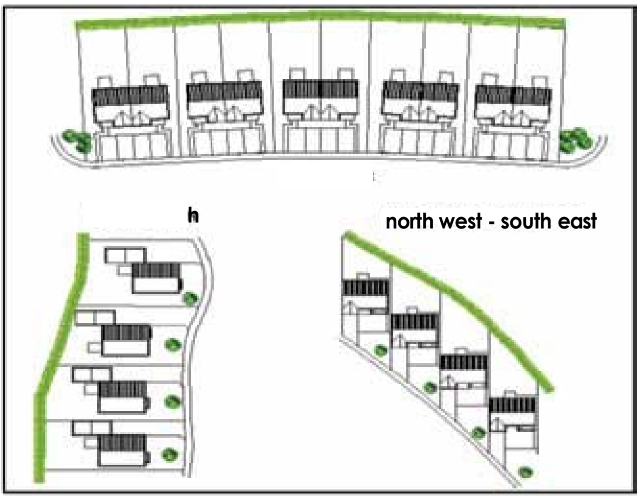

Figure 4.2

Overshadowing

4.2.4 The overshadowing of new buildings by neighbouring buildings, trees and other site obstructions can undermine solar gain. It is therefore important to ensure that trees and tall garden walls or fences do not unduly overshadow facades, and that adequate space is provided between buildings. Detailed information on how to calculate building spacing distances can be found in the Energy Savings Trust's guidance entitled "Sustainable Site Layout: An introduction to creating a sustainable housing development"[3].

4.2.5 Tall buildings have the potential to cause excessive overshadowing and need to be positioned carefully if this is to be avoided. It is recommended that tall buildings be located to the north of the site, or to the south of road junctions or car parks (see Figure 4.3).

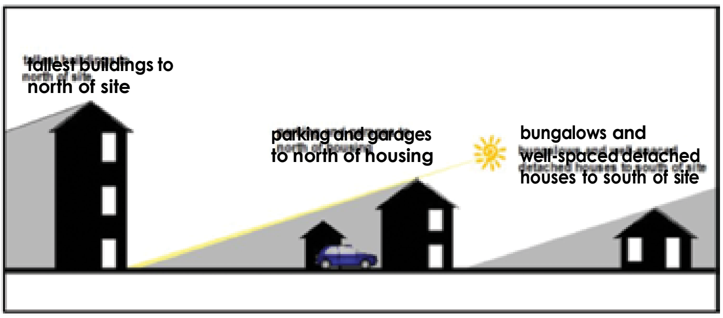

Figure 4.3

4.2.6 The slope of a site will have a considerable efect on the extent of overshadowing. South facing slopes are particularly advantageous as they can maintain suitable levels of solar access with less spacing between buildings. Consequently, this provides opportunities to achieve passive solar gain while building at higher densities. In contrast, north facing slopes can increase the amount of overshadowing making them less favourable for passive solar designs (see Figure 4.4).

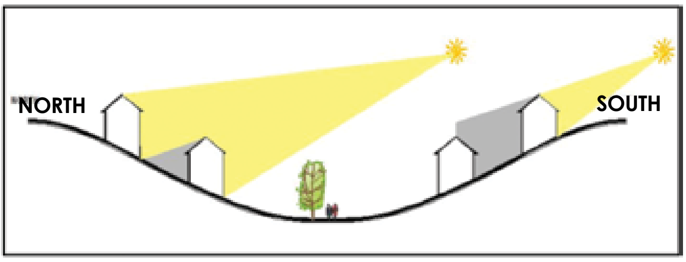

Figure 4.4

3 *Energy Saving Trust. 2010. Site Layout: An introduction to creating a sustainable housing development (London, EST).*

4.2.7 There can be tension between achieving higher levels of density and maximising opportunities for passive solar gain. In certain situations it may be more appropriate to ofset lower solar gains by incorporating more energy efcient built forms, such as terraced houses and low rise blocks of fats. These built forms have smaller external surface areas exposed to the elements which reduces the amount of heat escaping from the building and limits the infltration of cold air into the building from the wind.

Wind Sheltering

4.2.8 The site layout should use landform and landscape features to shelter from cold winds which would otherwise result in heat losses in the winter. A shelterbelt of hedges and trees can be used to provide protection from the prevailing south westerly wind, and less frequent, but particularly chilling, north easterly winds (see Figure 4.5). In both instances, the shelter belt needs to be orientated along a northwest-southeast axis and sited a distance of 3-4 times their mature height from the facing elevation of a building. The length of the shelterbelt should be at least ten times its height, and approximately 15m longer than the area to be protected to prevent the buildings being afected by circular movements of air (known as wind eddies). Any trees that grow above the shadow line should be deciduous to allow low angle winter sunlight to pass through. Low level planting should also be used around tree trunks to avoid the channelling of wind at ground level (see Figure 4.6).

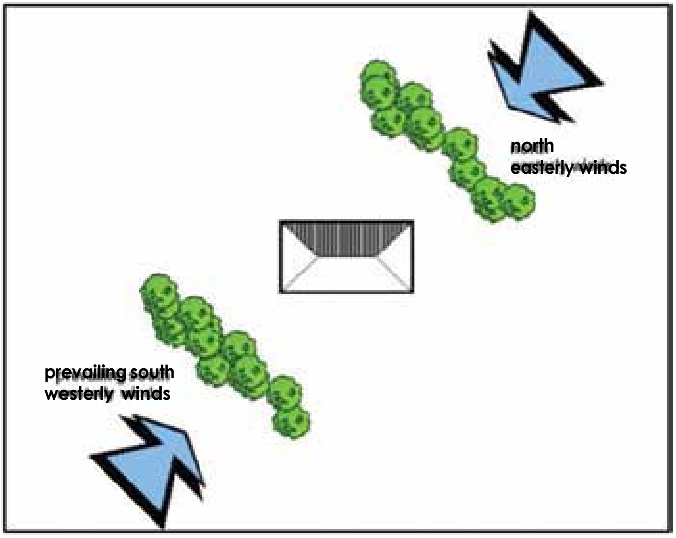

Figure 4.5

4.2.9 Wind patterns at street level can be infuenced by site layout. Buildings arranged in an irregular pattern minimise the funnelling of the wind, while long uninterrupted rows of buildings can channel the wind along streets. Passive solar design layouts tend to refect the latter as buildings need to have the same orientation in order to maximise solar gain. This problem can however be overcome by placing another building or landscape feature at right angles on the windward side of the row of buildings. The chilling efect of the wind on individual buildings can also be minimised by presenting the narrow frontage in the direction of the prevailing wind.

4.2.10 Tall freestanding buildings, such as blocks of ofces or fats, can create wind eddies which channel the wind to ground level. Where such buildings are proposed, consideration needs to be given to the environmental performance of nearby buildings and implications for adjacent open spaces. Buildings of uniform height, set within highly integrated street patterns, are preferable as they encourage high levels of air movement.

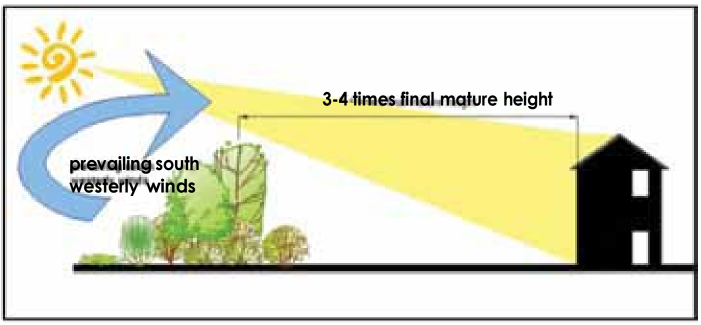

Figure 4.6

4.3 The Role of Building Design

4.3.1 There are a number of complimentary design features which need to be incorporated into new buildings in order to optimise passive solar gain. Some features facilitate the capture, storage and redistribution of the sun's energy, while others enable shading and cooling during the warmer summer months.

Internal Layout

4.3.2 The internal layout should ensure that the main living spaces (living room and ofce/study) are located on the south side and rooms which are less frequently used (bathroom and utility) are located on the north side. Kitchens should also be located on the northern side to avoid excessive heat gain. Bedrooms, which are unoccupied for the majority of the day, should face east in order to beneft from the morning sun. Conversely, they should avoid a westerly aspect as the late afternoon and evening sun can potentially warm the bedroom to temperatures which remain uncomfortable at night.

4.3.3 Building depth will afect the extent to which internal spaces can benefit from natural ventilation and lighting. The optimum building depth for naturally lit and well ventilated spaces is between 9-13 metres[4]. Buildings of greater depth will require some artifcial ventilation and lighting, and consideration should be given to the use of double-aspect cellular building forms with the insertion of an atrium/light well for particularly large buildings, such as ofces (see Urban Design Compendium for further information).

Glazing

4.3.4 The main windows should be located on the south elevation of the building (generally 75% of the window area should face within 30° of south). South facing windows should not be too large as heat loss may outweigh solar gain and the occupant's desire for privacy may result in the installation of net curtains or blinds which will restrict the amount of solar radiation entering the building. Windows on the north, east and west elevations should be limited in size and number to levels needed to allow reasonable levels of internal light.

Thermal Mass

4.3.5 Thermal mass is the ability of a material to absorb and store heat energy. Buildings with a high thermal mass take a long time to heat up and a long time to cool down, while buildings with a low thermal mass respond quickly to changes in internal temperatures resulting in greater temperature fuctuations. Generally, heavier construction materials such as concrete, stone and brick, have a higher thermal mass and are best for storing heat. In contrast, lightweight structures such as timber dwellings often have low thermal mass, and as such, tend to be less suited to passive solar design.

4.3.6 Phase change materials (PCM) can be used as an alternative to traditional heavier construction materials. These materials have high thermal properties with the practical advantage of coming as thin boards or sheets, which can be cut to size for ease of installation. PCMs are particularly useful for timber or steel structures and can be tailored to respond to the heating ranges experienced by a given building.

4.3.7 The location of the thermal mass within a building will have a signifcant efect on its year round efectiveness and performance. The thermal mass should be located internally, on the ground foor of south facing rooms which have good solar access and exposure to cooling summer night breezes. It can also be benefcial to locate thermal mass near to artifcial sources of heating or cooling. The thermal mass should be left exposed internally and not covered with thermally insulating materials such as carpets and dry lining.

4.3.8 The use of thermal mass is particularly benefcial in winter as it absorbs heat during the day from direct sunlight and releases it at night, helping the building to stay warm. To be efective, it is vital that the thermal mass is exposed to low angle winter sunlight.

4.3.9 In the summer, the thermal mass will absorb heat to keep the house comfortable during the day. However, there will be unwanted thermal energy released back into the building during the night which could result in thermal discomfort. It is therefore essential that the amount of thermal energy entering the building is reduced during the day by shading out high angle summer sunlight, and efective methods of ventilation are incorporated into the design of the building to

[4] *Llewelyn Davies Yeang/Homes and Communities Agency. 2000. The Urban Design Compendium (London, English Partnerships and Housing Corporation).*

carry away warm air at night. Further guidance on ventilation and shading is provided below.

Insulation and Ventilation

4.3.10 Insulation prevents heat from fowing into and out of the fabric of the building. High levels of insulation are an essential component of passive solar gain as it enables the re-radiated heat to remain within the building. Floors, walls and roofs should all have good levels of thermal insulation.

4.3.11 Dwellings that optimise solar gain need to incorporate a natural ventilation system within the design of the building so that it is able to regulate unwanted heat gains, particularly during the summer months. If it fails to do so, the thermal discomfort experienced by the occupier could lead to the installation of a mechanical cooling system that will increase energy use and CO2 emissions.

4.3.12 The required ventilation rate can be calculated and a suitable ventilation strategy formulated. Examples of natural ventilation strategies include the use of passive stack ventilation and cross ventilation. Whichever strategy is chosen, it is important to ensure that night time ventilation components, such as louvers or windows, are secure and can be locked in an open position.

Shading

4.3.13 Good passive solar design will need to incorporate solar control. This is particularly important on south and west facing facades where the solar gains coincide with the hottest part of the day. The most efective shading system will allow the building to prevent excessive sun in the summer, gain full sun in the winter and manipulate sun levels at other times.

4.3.14 Solar control devices come in diferent forms with fixed and adjustable types being commonly used. Fixed devices, such as brise soleil, are positioned horizontally above a window and work by obscuring part of the sky through which the sun passes. These shading devices are particularly efective at regulating solar gain on southern elevations throughout the year and require no user control. High angle summer sun is prevented from entering the building, while low angle winter sun is admitted beneath the device (see Figure 4.7).

Figure 4.7 Brise soleil incorporated into the design of the Woodland Resource Centre, Cyfarthfa Park.

4.3.15 Adjustable shading devices, such as shutters and external blinds, have the advantage of allowing control over the desired level of shading (see Figure 4.8). Such shading devices are particularly suited to east and west elevations where fxed shading devices are inefective at preventing low angle morning and afternoon sun from entering a building. They are also recommended for south-east and south-west elevations as they receive a combination of high and low angle sun throughout the day.

Figure 4.8 Externally mounted blinds providing solar shading on the Larch House, the Works Site, Ebbw Vale.

4.3.16 Landscape planting can also be used as an efective means of shading. Here it is important to match the vegetation's characteristics (such as foliage density and canopy height) with the shading requirements of the building. A common method is to use deciduous trees to control the amount of sunlight reaching a building at diferent times of year. In summer, a deciduous tree will shade the building from the sun. In winter, it will allow the sun to pass through and enter the building (see Figure 4.9). Shrubs can also be used for more localised shading of windows.

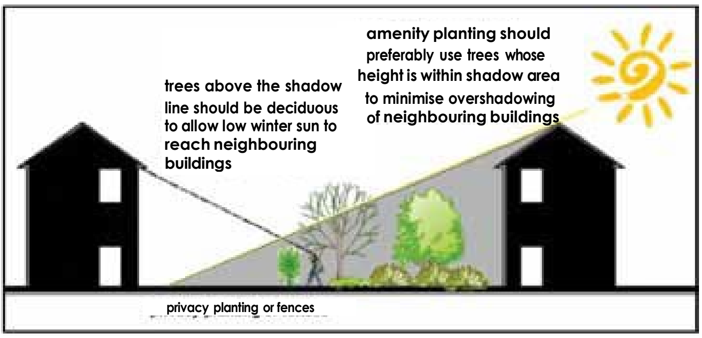

Figure 4.9

4.3.17 Confict can arise between optimising solar gain and providing adequate levels of privacy for occupiers of buildings. If living spaces are overlooked from public highways occupants may install net curtains or blinds which can reduce solar gain. Appropriate landscape planting, such as hedges, can provide a solution in such circumstances provided they are at a height which afords privacy without overshadowing the building. Where higher hedges are considered necessary, for example where a building fronts on to a busy road, deciduous plants should be used[5].

Sunspaces

4.3.18 A sunspace is a heavily glazed area located outside the main fabric of the building. They can adjoin an external elevation of a building, or be embedded within the main structure. For whichever option is chosen, it is essential that the shared wall and any doors and windows adjoining the sunspace are thermally equivalent to those used for external elevations to prevent uncontrollable heat gains and losses.

4.3.19 Sunspaces function by using passive solar heat gains to warm the air within the glazed area. The warm air is then transferred into the main living space of the building via a natural ventilation system. Warm air flows into the adjoining living spaces through openable vents located in the common wall at the top of the sunspace. Cool air is then returned from the living spaces through lower vents. Mechanical ventilation systems can also be used to extend the reach of the warm air by blowing it via ducting to other areas of the house.

4.3.20 Sunspaces also have a number other benefcial attributes: they act as a thermal bufer by providing an intermediate space between the inside and outside of the building; they shelter the envelope of the building from wind chill and rain; and they provide additional living space when natural conditions make them comfortable for occupation.

4.3.21 South facing sunspaces can be susceptible to overheating in the summer, and as such, it is essential that an appropriate ventilation system is incorporated that allows warm air to be vented out to the external environment when heat gains are not required. Additional shading techniques, such as the use of opaque roofs, louvers and vegetation, should also be considered.

Roof Design

4.3.22 A building's roof design will afect the extent of overshadowing of neighbouring buildings. This in turn infuences the required separation distances between buildings to allow solar gain. Generally, high pitched roofs will have a greater shadowing efect than lower pitched roofs. Consideration should therefore be given to confguring buildings to accommodate lower pitched roofs or alternative roof arrangements such as asymmetric, mansard and split-level pitches. Whilst hipped roofs will not reduce the distance of overshadowing, they do have the beneft of reducing the area of overshadowing.

5 *It should also be noted that high boundary treatments can reduce the amount of the natural surveillance provided by the occupiers of buildings. As such, consideration should also be given to the need to design out crime. See Section 11.*

5.0 Energy – Low and Zero Carbon Technologies

5.1 Introduction

5.1.1 Developments need to contribute to tackling climate change by reducing carbon emissions. New buildings should approach this through the application of the energy hierarchy which provides a series of steps that should be taken to minimise the carbon emissions in an efcient and cost efective way. The energy hierarchy is set out as follows:

- Firstly, reduce the need for energy - Site layout and orientation of buildings can reduce the energy demands of buildings by maximising passive solar gain (See Section 4 - Reducing Energy Demand).
- Secondly, use energy efficiently - There are various measures that can be incorporated into the design of buildings to help save and efciently use energy, such as thermal efcient glazed window, draught proofng, insulation, and energy efcient appliances (washing machines, light fttings etc.).
- Thirdly, use low and zero carbon energy - Developments can incorporate technologies that provide energy efciently, such as combined heat and power, or, generate energy from sources that are continuously and sustainably available from our environment, such as solar, wind, water, geothermal and biomass.

5.1.2 This section considers the fnal step of the hierarchy and focuses on low and zero carbon technologies that can either be incorporated into the fabric of the building, or built within the development. Some of the technical considerations and potential constraints are identifed for each of the low and zero carbon technologies. Further detailed information, including potential planning issues, can be obtained from Welsh Government practice guidance on renewable and low carbon energy6.

5.2 Wind

Description of Technology

5.2.1 Wind energy generation uses the wind's energy to turn a rotor connected to an electrical generator. There are two types of wind turbine - horizontal axis turbines and vertical axis turbines. Whilst the majority of wind turbines are currently designed using a horizontal axis, vertical axis turbines are more common at the micro scale as they are designed to perform more efciently

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6 *See Welsh Assembly Government. 2010. Practice Guidance – Planning Implications of Renewable and Low Carbon Energy (Cardif, WAG), Cadw/Welsh Assembly Government. 2010. Renewable Energy and Your Historic Building. Installing Micro-Generation Systems: A Guide to Best Practice. (Cardif, Cadw/WAG), and Welsh Government. 2012. Practice Guidance – Renewable and Low Carbon Energy in Buildings (Cardif, WG).*

at the more turbulent wind speeds typically experienced in built-up areas.

5.2.2 Small and micro scale wind turbines can be installed with a free standing mast or fxed to a building. They are often deployed as single machines to supply power to a specifc building or development. At the micro-scale, turbines range from 5W battery charging models to around 2.5kW roof top devices. Small scale turbines generally have a generating capacity range up to around 50kW. While individual large (1-3MW range) and medium (up to around 750kW) scale turbines can also be deployed as single machines, they are more often used in groups in the form of a wind farm development7.

Constraints

5.2.3 The principal constraint for small and micro scale wind turbines is wind speed. Roof top micro turbines in particular are prone to low wind-speeds as a result of building-induced turbulence. Sites should therefore be accurately monitored as far as possible at the feasibility stage to ensure wind speeds are sufcient to allow the wind turbines to perform satisfactorily.

5.3 Solar

Description of Technology

5.3.1 Solar energy generation uses the sun's energy to provide hot water via solar thermal systems or electricity via solar photovoltaic systems. Both technologies are technically well-proven and their installation on the roofs of new and existing buildings is now commonplace.

5.3.2 **Solar thermal systems** use solar collectors, to preheat water for use in sinks, showers and other hot water applications. There are two main types of solar thermal collector: fat plate collectors which consist of an absorber plate with a transparent cover to collect the sun's heat; and evacuated tube collectors which consist of a row of glass tubes, each containing an absorber plate connected to a manifold heat exchanger. In both cases, the solar thermal collectors work in conjunction with a water tank which stores the hot water. A supplementary heating source, such as a boiler or immersion heater, is also necessary to supply hot water when there is insufcient solar energy to meet the hot water needs of the building.

5.3.3 Solar thermal collectors are usually roof mounted and are increasingly being incorporated into a new or existing roof in much the same way as roof windows. They can also be wall mounted or free standing ground structure. A typical roof-mounted collector on a domestic building would usually protrude no more than 12cm beyond the plane of the roof, be dark in colour and measure 3-5m^2 in area (see Figure 5.1).

5.3.4 A well designed solar thermal system can make a valuable contribution to the hot water demand for domestic buildings (50-60% during May-September). It is potentially the cheapest form of renewable energy for domestic buildings and is also suitable for non-domestic buildings with a high hot water demand, such as hospitals, swimming pools and industrial buildings.

Figure 5.1 Roof mounted solar thermal panels on residential dwellings at Glanmor Gardens, Dowlais.

5.3.5 **Solar photovoltaic systems** use solar cells to convert daylight into electricity which can directly power appliances, be stored in batteries, or be fed into the grid via the mains supply. Whilst there are many types of solar PV with diferent characteristics (crystalline cells, thin-flm, hybrid), they commonly

7 *Typical scales of individual wind turbine technologies taken from Welsh Assembly Government. 2010. Practice Guidance – Planning Implications of Renewable and Low Carbon Energy (Cardif, WAG).*

consist of a number of semiconductor cells which are interconnected to form a solar panel or module. There is considerable variation in appearance, but usually solar panels/modules are dark in colour and have low refective properties.

5.3.6 Solar photovoltaics can either be roof mounted or free standing in modular form, or integrated into the roof or facades of buildings using technologies such as solar shingles, solar slates, solar tiles and solar glass laminates. A small scale array of panels, typically installed on a domestic property, would measure 9-18m2 in area and produce 1-2 kW peak output. Solar photovoltaics are particularly well suited to buildings that have a day time demand for electricity, such as ofces, schools and shops.

Constraints

5.3.7 The main technical constraint relates to the availability of unshaded and suitably orientated roof or external wall space, both in terms of area and structural integrity. For optimum performance, solar collectors need to face due south, not be overshadowed by trees and buildings, and be inclined at an angle of 30°-40° and 20°-40° for thermal and photovoltaic collectors respectively. Whilst some fexibility may be necessary when installed on existing buildings, performance will be compromised when designed outside these criteria. The availability of space for the storage of system components, such as a water tank, may also be a constraint.

5.4 Ground, Air and Water Source Heat Pumps

Description of Technology

5.4.1 Heat pump systems extract the solar heat energy stored in the ground (ground source heat pumps), bodies of water (water source heat pumps) or air (air source heat pumps). This heat can be used for space heating, water heating, heat recovery, space cooling and dehumidifcation in both residential and commercial buildings.

5.4.2 Although all the heat delivered by heat pumps comes from renewable energy, a supply of electricity is required to pump the system, which may or may not come from renewable sources. A good quality installation will, however, extract signifcantly more useful heat energy than the electrical energy needed to operate the system. Consequently, heat pumps will usually have a much lower carbon footprint than other conventional heating systems.

5.4.3 **Ground source heat pumps** (GSHP) utilise the heat energy stored in the ground surrounding (or even under) buildings. Heat is removed from the ground at certain temperatures and passed through a heat exchanger to release it into a building at a higher temperature. A typical GSHP system consists of three main components: a heat pump (located within the building and similar in size to a large refrigerator); a ground collector loop (either pipes laid in trenches in the ground or vertical pipes within boreholes); and an interior heating or cooling distribution system. GSHP are most suited to low temperature heat distribution systems, such as under foor heating systems or low temperature radiator systems with a large surface area. These systems work best in highly insulated buildings.

5.4.4 **Air source heat pumps** (ASHP) use the outside air as a heat source for heating a building. This type of heat pump can either be directly fxed to an external wall where they look like and basically act as an air conditioning unit operating in reverse, or they can be fed into a centralised ducted warm air central heating system (see Figure 5.2). ASHPs tend to be much easier and cheaper to install than GSHP, but tend to be less efcient due to the seasonal variability of ambient air temperatures.

Figure 5.2 Air source heat pump attached to the side elevation of a house.

5.4.5 **Water source heat pumps** (WSHP) extract heat from large bodies of water or rivers with a reasonably high fow volume using a similar heat collection system to GSHPs. An abstraction licence from Natural Resources Wales is normally required.

Constraints

5.4.6 As all types of heat pump operate most efciently at lower temperature outputs (no more than 40°C), they are not usually suited to high temperature radiator systems.

5.4.7 The use of GSHPs can be constrained by the amount of space available to accommodate trenched collector loops. While bore hole loops can overcome this issue, they are considerably more expensive and dependent on favourable geological conditions.

5.4.8 Consideration should be given to seasonal variations in ambient air temperatures when contemplating the use of ASHPs as this will infuence the system's overall efciency.

5.4.9 WSHPs can be constrained by variations in the amount of water available for abstraction. This could be due to difering groundwater levels or river fows. Any abstraction licence issued is likely to include certain conditions/restrictions which will also afect the water available for these schemes.

5.5 Hydropower

Description of Technology

5.5.1 Hydropower schemes harness the energy of fowing water to generate electricity. The amount of electricity generated is proportional to the volume of water and the height it falls. Hydropower is a well developed and reliable source of renewable energy, which has further potential in Wales, particularly for small scale 'run of river schemes'. A typical scheme consists of an inlet pipeline (penstock) to direct water, turbine generating equipment and housing, a 'tailrace'(channel) to return water to the watercourse and electricity transmission equipment (see Figure 5.3). An abstraction and/or impoundment licence is likely to be required from Natural Resources Wales.

Figure 5.3 Micro hydropower scheme with a 26 kW power output providing electricity to the Blaenavon World Heritage Centre. Photos include the water intake (left), turbine generator (centre) and generator building (right).

5.5.2 Small scale hydropower schemes generally relate to those generating up to 300 kW of electricity which is fed directly into the national grid. Micro hydropower schemes, typically generating up to 50 kW, can supply electricity to several homes, farms and business units.

Constraints

5.5.3 The main technological constraint relates to the need for sufcient water fall distance and fow rates throughout the year. There is also the need for adequate site access, space to accommodate the necessary equipment and a means of transmitting the electricity generated to its end user. Any abstraction and/or impoundment licence issued is likely to include certain conditions/restrictions which will also afect the water available for these schemes.

5.6 Biomass

Description of Technology

5.6.1 Biomass is a form of bio-energy typically sourced from wood fuel, energy crops or wood waste, agricultural residues and the biological component of municipal solid waste. Although biomass systems have traditionally been used to provide heat to buildings, they are increasingly being used to generate electricity or combined heat and power (see below for more information on combined heat and power).

5.6.2 Biomass systems typically comprise of the following elements: fuel delivery and storage facilities; combustion or advanced thermal processing plant with or without electricity generation plant; fue and ash extraction mechanisms; and connecting pipework.

5.6.3 Biomass systems are available at the following scales[8]:

- **Small scale** (less than 500kWth) biomass systems typically focus on the production of heat for domestic and small commercial uses. They can either comprise of a stove that provides warmth for individual rooms, or a boiler that meets the central heating and hot water needs of a building. Consideration should be given to how the fue will be accommodated within the design of a building and the amount of space available for fuel storage, particularly in relation to biomass boilers which have larger requirements.
- **Medium scale** (500kWth - 10MWth) biomass systems again tend to prioritise the production of heat for larger individual buildings and developments serving multiple buildings. Biomass combined heat and power systems which serve community facilities, schools or industrial units also tend to fall within this category. A biomass heat plant for a school would typically consist of a boiler house with a 4m by 3m footprint, a fuel bunker with similar proportions to the boiler house and a 3m to 10m high chimney. Sufcient space will also be required for fuel deliveries.
- **Large scale** (Over 10MWe) biomass systems are primarily electricity generating plants with much larger site footprints.

Constraints

5.6.4 The main technical constraints for biomass installations relate to the availability of space, particularly for the delivery and storage of fuel, and the adequate provision for a fue. The availability of suitable fuel sources, in terms of both quality and quantity, can also act as a major constraint.

5.7 Combined Heat and Power

Description of Technology

5.7.1 Combined heat and power (CHP) systems generate both electricity and useful heat that can be used for space heating and hot water. This type of system can have a much higher efciency than thermal systems that generate electricity alone, provided that it is sized correctly to meet power and heating demands, and is located in close proximity to the heat user. Combined cooling, heat and power (CCHP), or trigeneration, systems are also available which provide additional cooling through the use of absorption chillers.

5.7.2 CHP systems can be fuelled by both renewable and non-renewable sources, such as biomass and natural gas respectively. They typically comprise of the following components: fuel delivery and storage facilities (if using solid fuel, such as biomass); boiler/turbine; connecting pipework; and a heat exchanger/heat recovery generator.

5.7.3 CHP systems can be installed at a various scales ranging from micro-CHP domestic applications to CHP systems supplying district heating to an estate of houses or whole

8 *Typical scales of individual biomass schemes taken from Welsh Assembly Government. 2010. Practice Guidance – Planning Implications of Renewable and Low Carbon Energy (Cardif, WAG).*

communities. Micro-CHP domestic systems primarily generate heat with some electricity generation, typically around 1 kW. They are similar in size and shape to standard domestic boilers and likewise can be wall hung or foor standing. CHP systems supplying district heating typically require their own building and need to incorporate heat distribution network infrastructure. Solid fuel based CHP plants, such as biomass, will require a larger footprint than gas fred CHP plants, due to space requirements for on-site fuel storage, processing and deliveries.

Constraints

5.7.4 The viability of CHP systems, in cost and efciency terms, is dependant on the heat and power requirements of the end user. In particular, CHP systems supplying district heating are generally more viable with developments that include high heat users, such as leisure centres and hospitals, or those including a variety of users that spread the demand for heat over the day and week.

5.8 District Heating

Description of Technology

5.8.1 District heating (DH) is a means for delivering heat to multiple buildings from a central energy centre. It typically delivers space heating and domestic water, but can also provide cooling by means of heat driven chillers. A DH scheme can usually generate and deliver heat more efciently than multiple individual systems.

5.8.2 The basic components of a DH scheme are an energy centre containing the heat source/s; a distribution network of insulated pipes used to deliver the heat to end users; and a hydraulic interface unit, such as heat exchangers linking each customer to the heat distribution network. DH is adaptable and the energy centre can consist of traditional gas boilers, biomass boilers, gas or biomass CHP systems, and waste heat.

5.8.3 In principle, a DH scheme can be connected to any building and can range in scale from serving a number of buildings on a single site to serving a whole community, town or city centre. They can be operated under a range of business models, which are generally referred to as energy service companies (ESCos). The end-user commonly purchasestheenergyfromthe ESCowhoconstructs, operates and maintains the DH network.

Constraints

5.8.4 A signifcant constraint to district heating is the need for a sufcient heat demand density. The heat demand density is a spatial characteristic that indicates the levels of heat required for a certain area. They are typically highest in town and city centres where high building densities are also found. Here, shorter distances are required between connected buildings and the energy centre, which reduces capital costs for the installation of pipe-work and minimises the heat distribution loss across the network.

5.8.5 A further constraint is the lack of overall size and diversity of the heat loads. DH schemes typically generate heat at a constant rate so there needs to be a continuous demand for the energy. This can be resolved by connecting the DH network to a mix of building types which have heat demands at diferent times.

6.0 Transport and Movement

6.1 Introduction

6.1.1 As Merthyr Tydfl's built environment changes through development and regeneration, there continues to be opportunities to plan and design areas in ways that reduce the need to travel and ensure the efective use of more sustainable modes of transport. The benefts of this include reducing the emission of greenhouse gases, improving the health of the local population, increasing social inclusion and cutting the costs of congestion.

6.1.2 The following sections consider some of the key elements involved in infuencing sustainable travel patterns[9].

6.2 Layout and Connectivity

6.2.1 People's travel choices are signifcantly infuenced by the layout of a development and its links with surrounding street networks. In general terms, layouts should provide direct routes, be permeable and connect well to surrounding routes in order to ofer the greatest opportunities for walking, cycling and travel by public transport.

6.2.2 The chosen layout and connection points of a new development should be informed by the fndings of a contextual appraisal which considers the range of facilities and services in the neighbourhood; existing public transport services; public rights of way and cycle routes; and travel desire lines through and around the site. The fndings can then inform decisions on how best the site can connect into the wider movement network and how best to arrange the movement structure of the development proposal.

6.2.3 As part of this process, it is important to consider how to create an inclusive built environment which meets the needs of all people regardless of age or ability. New developments should provide equal and convenient access for all potential users, including disabled people, older people, children and families. Routes should be kept as near to level as possible along their length and width as this will beneft wheelchair and pram users. A legible layout will also make it easier for people with sensory or cognitive impairment to work out where they are and where they are going.

6.2.4 The perimeter block layout can help provide a pedestrian friendly design solution which integrates well with the neighbourhood. It connects existing and proposed streets and provides direct, convenient routes to local facilities, community infrastructure and bus stops. In contrast, typical cul-de-sac style

9 *Please note that the parking standards applied in Merthyr Tydfl can be found in the document entitled "CCS Wales – Wales Parking Standards 2008".*

developments produce introverted layouts which lack connectivity with its surroundings. The result of this is convoluted, illegible routes which are less convenient for the pedestrian and cyclist and encourage short car trips.

6.2.5 It should be recognised that highly permeable layouts can lead to anti-social behaviour if they are only achieved through the provision of footpaths and cycleways that are poorly overlooked, such as those routed to the rear of buildings. Superfuous access points and routes should be avoided.

6.3 Density

6.3.1 Higher densities should be considered for development sites that are well served and connected to local facilities and public transport services. The aim should not be to achieve a defned residential density, but to create a critical mass of users that will secure the long term viability of facilities and services. Development sites within Merthyr Tydfl's town and local centres are likely to ofer the greatest opportunity for delivering higher densities.

6.4 Walking and Cycling

6.4.1 Developments should seek to deliver convenient, safe and attractive pedestrian and cycling routes that encourage people to choose walking as the prime means for local journeys and cycling as a substitute for shorter car journeys. To achieve this, careful consideration needs to be given to the location, access arrangements and design of new developments.

6.4.2 It is preferable that cars, pedestrians and cyclists share the same route as people feel safer on streets where there is natural surveillance from drivers, residents and other users. However, to create a safer environment for pedestrians and cyclists, streets need to be designed for low trafc speeds (ideally 20mph or less) and detailed design measures need to be implemented which address junctions, desire lines and road crossings, surfacing, lighting and road calming. Home zones are an efective means of creating a truly shared street where no single use dominates. They also have the additional benefits of fostering community interaction, promoting a sense of ownership of the street and reinforcing the sense of place.

6.4.3 Pedestrian and cycle-only links can be acceptable if they provide a more direct route than the road and are designed well. Such links should be wide, open, short, well overlooked by buildings and barrier free. They should also clearly demarcate between cycling and pedestrian paths to prevent confict between diferent users. Narrow routes enclosed by tall, blank elevations should be avoided as they create a sense of claustrophobia and insecurity for the user. Such routes are likely to be poorly used and can attract antisocial behaviour.

Figure 6.1 A"cyclepod" providingspaceefcient bicycle storage in a residential garden.

6.4.4 Developments also need to incorporate a number of additional facilities which support cycling as a preferred means of transport. Residential developments should provide bicycle storage which is both convenient for everyday use and secure (see Figure 6.1). Other major travel generating uses and transport interchanges should provide secure bicycle parking as well as shower and changing facilities (see Figure 6.2). The latter facilities are important for encouraging cycling as part of longer journeys, particularly when combined with public transport.

Figure 6.2 Bus stop and bicycle parking provided at the Keir Hardie Health Park.

6.5 <u>Public Transport</u>

6.5.1 A key element of creating connections between new and old development is the integration of public transport. Bus-based public transport is the most common mode serving residential areas in Merthyr Tydfl and improvements to services and/or infrastructure shouldbeconsideredaspartofnewdevelopments, where appropriate.

6.5.2 The choice of routes and location of stops are important factors in achieving walkable neighbourhoods. Routes need to follow principal roads and streets which pass through the area's core. Stops should be located where activity is concentrated, near specifc destinations or near road junctions. Bus stops must be easily accessed by foot and bicycle.

7.0 Water Conservation and Sustainable Drainage

7.1 Introduction

7.1.1 Climate change projections indicate that in the future Wales is likely to experience hotter, drier summers and warmer, wetter winters. Extreme weather events – both heavy rainfall and heat waves – are also likely to be more common. Less rainfall in the summer and prolonged periods of hot, dry weather will lead to pressure on water resources, while more rainfall in the winter and extreme rainfall events will increase the likelihood of fooding and challenge the capacity of our existing sewerage systems.

7.1.2 There is therefore a need to adapt to climatic changes by adopting more efective methods of managing our water resource and dealing with the food risk posed to our communities. The following sections consider a number of sustainable water conservation and sustainable drainage methods which can be integrated within new developments.

7.2 Water Conservation

7.2.1 Whilst South East Wales is in a relatively strong position on water resources, it does not have an abundant public water supply that can be taken for granted. There is a need to value our water resources much more than in the past, particularly with future challenges to our water supply resulting from predicted impacts of climate change and reduced water abstraction from the Wye and Usk rivers.

7.2.2 There are two main approaches to reducing the consumption of mains drinking water: the use of water efcient fttings and appliances; and the use of water (rainwater and greywater) recycling systems. Both of these can be incorporated into new developments and can contribute to the sustainability rating awarded under Code for Sustainable Homes and BREEAM standards.

Water saving measures

Water saving measures should be considered in the frst instance as these can provide signifcant benefits at a relatively low cost. The following measures can be incorporated into new developments to minimise water consumption:

- The volume of water used to flush toilets can be reduced by installing dual fush, interruptible fush, variable fush and cistern displacement devices. Delayed action water inlet valves can also be used ensure that the refll of the system does not begin until the fush has stopped.
- Showers can be fitted with simple flow regulators or 'water saver shower heads' to the limit the maximum fow rate. 'Water saver shower heads' usually work by creating fner drops or by incorporating air into the fow.
- The volume and shape of a bath will determine how much water is used. Tapered or peanut shaped baths may provide more space for bathing with less water. Insulating

a bath also minimises heat loss reducing the need to top up the bath with hot water.

- Spray taps can save approximately 80% of the water and energy used for hand washing. Tap inserts, such as Tapmagic, can be used to allow the full fow of water for the flling of the basin where necessary.
- The use of small bore pipes and short distances to the most frequently used appliances will reduce the volume of water wasted while waiting for the tap/shower to run hot.
- Commercial and public buildings should install fush control or waterless urinals and sensor or timed turn of taps to prevent water wastage.

Water Recycling Systems

7.2.4 Water recycling systems can provide an alternative source of water to mains water supply, but do not reduce overall water consumption. They are also often more expensive than simple water efciency devices and can have other trade-ofs, such as energy costs and carbon emissions. Consequently, water recycling systems should only be considered once all feasible water efciency measures have been incorporated into the development. Two common methods of water recycling, namely rainwater harvesting and greywater recycling, are discussed below. In both cases, important considerations include: the amount of water needed to meet anticipated demand; design specifcs and cost of system; and maintenance requirements.

Rainwater harvesting

7.2.5 Rainwater harvesting is the collection of rainwater directly from the surface it falls on. It is most often collected from the roof of a property; however, other hard surfaces, such as a permeable paving, can be used to increase the yield. Once collected the water can be stored and subsequently used for non-drinking purposes, such as toilet fushing, garden watering and clothes washing. The use in clothes washing is however dependent on the quality of the water collected.

7.2.6 Rainwater harvesting has a number of benefts, including reducing the demand for mains water, reducing the risk of fooding and pollution and creating fnancial savings for customers with water meters. Savings are particularly noticeable for commercial/industrial buildings and schools as they tend to have large roof areas and a high demand for non-drinking water.

7.2.7 The Environment Agency estimates that using rainwater to fush the toilet alone could potentially reduce the demand for mains water by approximately 39 litres of water per day (26%)[10]. Using rainwater to supply the washing machine and water the garden would further increase the saving of main water for non-drinking uses.

7.2.8 The volume of water collected from a rainwater harvesting system will depend on a number of factors, including the amount of rainfall in the region, the roof and/or hard-standing surface area, tank storage capacity and needs of the user. Further information on the method of calculating the amount of rainwater you can collect is available in the Environment Agency's guidance entitled "Harvesting rainwater for domestic uses: an information guide".

7.2.9 The most basic form of rainwater harvesting is the use of a garden rainwater butt which collects water from the roof's guttering system (see Figure 7.1). Here, the rainwater does not require any treatment or mains backup and can be used directly to water the garden and wash the car. Rainwater harvesting systems can however be much more sophisticated and typically include components which:

- collect, filter and store water;
- distribute water to points of use;
- provide a mains water backup when rainwater levels run low; and
- control the mains backup and monitor water levels.

10 *Environment Agency. 2010. Harvesting Rainwater for Domestic Uses: An Information Guide (Bristol, EA).*

Figure 7.1 A garden rainwater butt.

7.2.10 Rainwater harvesting systems range in scale from individual domestic installations to large scale commercial schemes. There are two general types which transfer water to points of use in the following ways:

- Direct pumped systems which pump the water directly to the point of use as and when required; and
- Gravity fed (header tank) systems which pipe the water to a header storage tank and then deliver it to the point of use using gravity.

7.2.11 Each system type has its advantages and disadvantages in terms of energy efciency and installation and maintenance requirements. A schematic diagram of a typical rainwater harvesting system is shown in Figure 7.2.

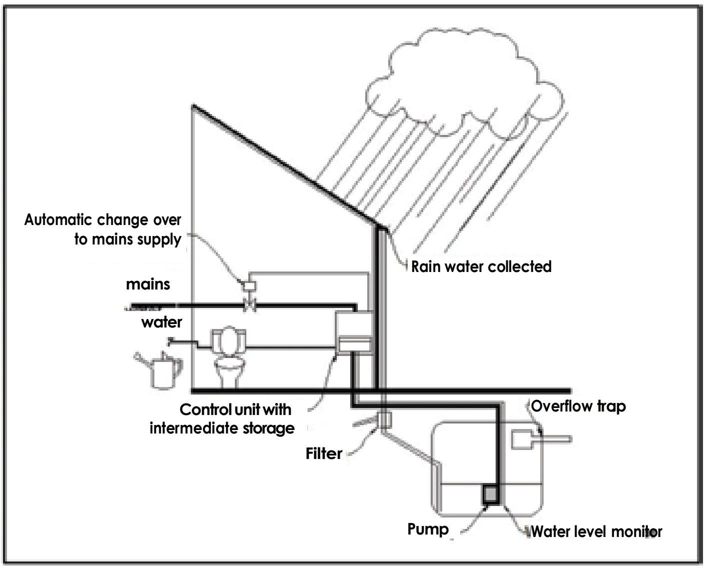

Figure 7.2 A rainwater harvesting system.

Greywater recycling

7.2.12 Greywater recycling involves the collection, treatment and re-use of waste water for purposes that do not require drinking water quality, such as toilet fushing and garden watering. The waste water is typically sourced from showers, baths and hand basins.

7.2.13 The use of greywater recycling to fush the toilet can potentially save a third of the mains water used in the home[11]. Other benefits include better reliability of supply over rainwater harvesting systems, fnancial savings for consumers with water meters and reduced pressure on the sewerage system. It is worth noting that cost savings tend to be more reliable with larger communal systems.

7.2.14 Greywater systems can operate on a single dwelling scale or on a development wide scale and vary signifcantly in their complexity. They do, however, tend to have the following common features:

- a tank for storing treated water;
- a pump;
- a distribution system for transporting water to the point of use; and
- a method of treatment which prevents a deterioration in the quality of water.

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11 *Environment Agency. 2011. Greywater for Domestic Users: An Information Guide (Bristol, EA).*

7.2.15 There are a variety of grey-water systems available which can be categorised based on the method of treatment they use. They include the following:

- Direct reuse systems which require no storage or treatment;
- Short retention systems which provide a basic standard of treatment and ensure that the greywater is not stored for too long;
- Basic physical and chemical systems which flter out debris and treat stored grey-water with chemical disinfectants to prevent bacterial growth;
- Biological systems which use bacterial cultures in aerated environments to remove organic matter from wastewater; and
- Bio-mechanical systems which use a combination of biological and physical treatment including bacterial cultures, fltration and ultraviolet disinfection.

7.2.16 Further information on each of these systems can be found in the Environment Agency's guidance entitled "Greywater for domestic users: an information guide".

7.3 Sustainable Drainage

Benefts of Sustainable Drainage

7.3.1 Our traditional drainage system is based on the collection of rain water in gutters and gullies and its conveyance through underground pipes (drains and sewers). Whilst this drainage system is designed to cope with large rainstorms, it can be overwhelmed by intense events with the potential for pollution and fooding. Further pressure will be placed on the existing system as a result of additional urbanisation and more common extremes in heavy rainfall caused by climate change.

7.3.2 Sustainable drainage systems (SuDS) are a more natural way of managing rainwater runof on site. In controlling runof as near to its source as possibleandmimickingnaturaldrainageprocesses, SuDS can reduce the efect of development on both the quality and quantity of surface water runof. Water quality improvements arise from the reduction in sediments and contaminants from runof either through settlement or biological breakdown of pollutants. The quantity of runof can be reduced by allowing water to infltrate into the ground, slowing down water before it enters the watercourse and providing areas for water storage in the natural contours of the land. In doing so, the impact of urbanisation on fooding can be mitigated.

7.3.3 SuDS have a number of additional environmental advantages over conventional drainage systems, including water resource, amenity and biodiversity benefts. Water resource benefts relate to SuDS' ability to assist natural groundwater recharge and enable water conservation. In respect of amenity and biodiversity benefts, SuDS can be integrated with green infrastructure to create habitats and encourage biodiversity whilst also providing attractive public open spaces (see Chapter 10 for more details).

7.3.4 SuDS can also ofer benefts to developers, including providing savings on the overall cost of construction and maintenance of drainage schemes, and increasing house values by 10%-20% through the use of SuDS which improve the visual attractiveness of a development[12].

7.3.5 The extent to which all the benefts of sustainable drainage can be realised will depend on the opportunities and constraints of the development site.

SuDS Techniques

7.3.6 There are a variety of SuDS techniques available which deal with surface water in three diferent ways: they allow water to infltrate into the ground; they convey water into a watercourse; or they provide storage on site and attenuate the fows of water. A SuDS scheme will often use of a combination of techniques to allow each of these processes to occur.

12 *Dickie, S., McKay, G., Ions, L. and Shafer, P. 2010. Planning for SuDS – Making It Happen, C687, (London, CIRIA).*

7.3.7 The diferent types of SuDS technique[13] are broadly summarised below:

- **Preventive Measures** - good site design and housekeeping measures and rainwater recycling.
- **Filter Strips and Swales** – vegetated landscape features with smooth surfaces and gently sloping gradients that drain water evenly of impermeable surfaces (see Figure 7.3).

Figure 7.3 A swale incorporated into the design of a business park.

- **Filter Drains and Pervious Pavements** – permeable surfaces that allow rainwater and runof to infltrate into the underlying ground for storage prior to discharge.
- **Infiltration Devices** - below ground or surface structures that drain water directly into the ground. These structures can act as source, site or regional control measures. Examples include soakaways, infltration trenches, swales with infltration and infltration basins (see Figure 7.4).

Figure 7.4 An infltration trench incorporated into open space within the grounds of a hospital.

- **Basins and Ponds** – structures designed to hold water when it rains. These range from basins that are free from water to water flled depressions that have spare capacity to take in additional water. Examples include detention basins, ponds and wetlands (see Figure 7.5).

Figure 7.5 A pond incorporated into the design of a business park.

7.3.8 SuDS techniques have diferent spatial requirements which makes some more suited to a particular development setting than others. For instance, higher density developments tend to have less space available for the use of SuDS, making larger scale site and regional measures, such as detention basins and ponds, unsuitable. Source control measures, such as green roofs and rainwater harvesting, are however suitable for all scales of development and will also minimise the amount of land needed for other SuDS components. In general, the following SuDS techniques are suited to high, medium and low density developments.

7.3.9 <u>High density developments</u>

- Green roofs and rain water harvesting can be integrated into the design of the building.
- Permeable paving can be located in the streetscape or the public realm and combined with underground storage systems, such as modular geo-cellular storage.
- Bio-retention components can be located along road-sides.
- Micro-wetlands and bio-retention components can be integrated with squares, courtyards or hard paved spaces.

13 *For more detailed information on individual SuDS techniques, see Woods-Ballard, B., Kellagher, R., Martin, P., Jefries, C., Bray, R. and Shafer, P. 2007. The SUDS Manual, C697 (London, CIRIA).*

- Channels and rills can be used in curtilage or open space settings.

7.3.10 Medium density developments

- Green roofs and rain water harvesting can be integrated into the design of the building.
- Water butts or rain gardens can be incorporated within residential curtilages.
- Permeable paving and filter strips can be incorporated into the streetscape.
- Bio-retention components and swales can be located along road-sides.
- Micro-wetlands and bio-retention components can be integrated with squares, courtyards or hard paved spaces.
- Ponds and wetlands can be integrated with open space.

7.3.11 Low density developments

- Green roofs and rain water harvesting can be integrated into the design of the building.
- Water butts or rain gardens can be incorporated within residential curtilages.
- Bio-retention and swales can be located along road-sides.
- Permeable paving can be incorporated into the streetscape.
- Swales, ponds and wetlands can be integrated with open space.

Design Approach to SuDS

7.3.12 The preferred method of managing surface water runof is through the use of SuDS. Alternative methods should only be used where there are practical and/or environmental reasons for doing so. Examples of the latter include inadequate infltration rates, shallow water tables and unacceptable risks relating to ground stability and land contamination. The following methods of managing surface water should be considered in order of preference.

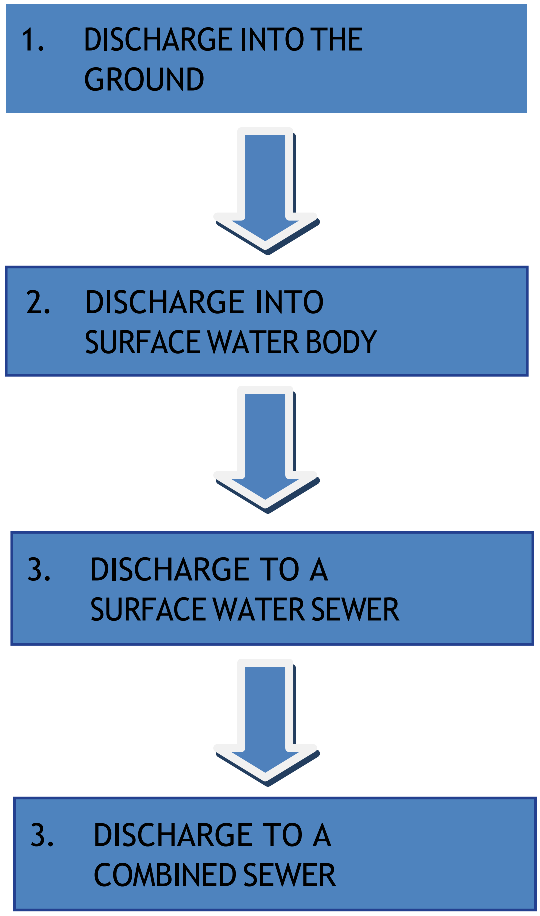

Figure 7.6 Order of preference of methods of managing surface water runof.

7.3.13 Sustainable drainage needs to be considered at the beginning of the site design process if it is to be delivered successfully. Retroftting drainage solutions into a pre-determined development layout may increase costs and limit the multiple benefts that SuDS can provide.

7.3.14 A good SuDS scheme is based on an understanding of the site conditions and the range of design requirements relevant to the development proposed. The suitability of a particular SuDS technique will depend on the characteristics of the site and it is important to identify opportunities and constraints at early stage in the design process. The aim should be to create design solutions which integrate chosen SuDS components with other urban design features. In doing so, communities and stakeholders are more likely to approve, operate and maintain SuDS as part of the development as a whole.

7.3.15 The following factors should be considered as part of the design process:

- The need to respond to natural drainage systems and processes, including natural fow paths, existing water bodies and potential infltration areas;
- Land use and density requirements and their efect on water treatment and storage capacity;
- The potential mix of permeable and impermeable surfaces;
- The likely space requirements for site and regional control SuDS;
- The integration of SuDS components with open space, landscape and streetscape features;
- The potential for enhancing biodiversity interests; and
- Long term maintenance and management requirements.

7.3.16 In terms of controlling surface water runof from a development site, the SuDs scheme will need to be designed so that the volume and rate of surface water runof from the site does not exceed those experienced under the undeveloped situation. For re-development, the SuDS scheme should reduce runof where possible. An allowance for the increase in future rainfall intensities will need to be taken into account based on the predicted efects of climate change.

7.3.17 Early consultation with Natural Resources Wales[14] and the Council's Drainage Engineer is recommended in order to identify local surface water issues and establish design standards and performance parameters. A technical appraisal of the proposed SuDS scheme demonstrating how it will meet the agreed criteria will be required in support of the planning application.

Adoption and Maintenance

7.3.18 Sustainable drainage systems require appropriate inspection and maintenance in order to maintain their efectiveness and prevent failure. The maintenance of specifc SuDS components should be considered as part of the design process and a management plan should accompany development proposals. The latter should include an overview of the design concepts of the SuDS scheme and a maintenance schedule that includes both initial and on-going maintenance of the SuDS components.

7.3.19 Thenatureofthemaintenancerequirements can be categorised as regular, occasional and remedial, and will vary depending on the type of SuDS scheme and components involved. A number of SuDS techniques are on or near the surface and most can be easily managed by standard landscape practice. For example, vegetated SuDS require routine maintenance to control growth, ranging from regular (swales and flter strips) to annual (basins) grass cutting. Balancing ponds require both longer term management of vegetation and periodic de-silting to maintain storm water capacity. Below-ground SuDS, such as modular geocellular storage, will require maintenance in accordance with manufacturer or designer specifcations.

7.3.20 The Council, in its role as Lead Local Flood Authority, is likely to be become the SuDS Approval and Adopting Body[15] in the near future. In this role, the Council will be responsible for both approving the original design of the SuDS and adopting and maintaining the fnished system. Before handover the SuDS will need to be inspected to ensure it has been constructed and functions in accordance with the approved scheme. Any remedial works identifed will need to be completed by the developer. For the time being a Section 106 Agreement will be required for the transfer of the SuDS to the Council, along with the management plan and appropriate commuted sum for future maintenance and management responsibilities.

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14 *It should be noted that an Environment Permit to Discharge may be required from Natural Resources Wales for a SuDS to discharge to a surface water body.*

15 *See Schedule 3 of the Flood and Water Management Act 2010.*

8.0 Materials

8.1 Introduction

8.1.1 Developments can improve their environmental performance by using building and construction materials that have a lower environmental impact over their life cycle. There are a range of factors that need to be taken into account in choosing the most appropriate materials for a development and it is recommended that consideration is given to this early in the design process. Some of the key factors for consideration are identifed below.

8.2 Low-Impact Materials

8.2.1 Re-used and recycled materials should be used in preference to virgin materials. Materials from renewable sources, such as timber, should also be chosen ahead of those from non-renewable sources, such as plastics, where possible.

8.2.2 Another important consideration is the embodied energy of a material. This is typically described as the energy used in the extraction, production and transportation of that material. There is considerable variation in the embodied energy of materials. For instance, aluminium, concrete, glass and plastics require energy intensive production processes, while timber and straw bales come from low energy, natural sources that have the added advantage of storing carbon.

8.2.3 In general, developments should limit the use of high embodied energy materials as much as possible. There can however be instances where the use of high embodied energy materials is integral to the design of the scheme, such as the use of concrete in building designs which seek to maximise solar gain. Here it is possible for the energy saved over the operational life of the development to ofset the high levels of energy embodied in the building material.

8.3 Responsible Sourcing

8.3.1 Materials should be selected from a sustainably managed source. In particular, any timber used should carry Forest Stewardship Council (FSC) certifcation in order to have the confdence that the development is not contributing to the destruction of the world's forests. FSC is an international, non-governmental organisation dedicated to managing the world's forests to the highest environmental, social and economic standards. Harvested trees are replanted or allowed to regenerate naturally and due respect is given to the wildlife and the people who live and work in them.

8.4 Local Materials

8.4.1 The transportation of materials can have a number of environmental impacts, including the consumption of non-renewable energy and the emission of greenhouse gases. These impacts can be reduced by sourcing materials from as close to a site as possible (see Figure 8.1).

Figure 8.1 Pembrokeshire larch cladding used on the Larch House, the Works Site, Ebbw Vale.

8.4.2 Local materials have traditionally contributed to the distinctiveness and sense of place of an area. The use of local materials can therefore contribute to preserving local character as well as helping support the local economy.

9.0 Waste Management

9.1 Introduction

9.1.1 Wales produced 12.2 million tonnes of construction and demolition (C&D) waste in 2005-06[16]. Out of this waste, 56% was re-used on site, 11% was reused of site and 18% was recycled. Whilst this reveals existing good waste management practices, around 1.2 million tonnes (10%) of waste still went to landfll and it is essential that all opportunities are taken to reduce and then reuse C&D waste as a resource if the amount landflled is to be reduced by 50% by 2015/16[17].

9.1.2 Waste continues to be generated throughout the lifetime of a development as a result of the occupiers' activities. In 2010-11, the total amount of municipal waste, excluding abandoned vehicles, generated in Wales measured 1.62 million tonnes[18]. Around 87% of this municipal waste came from households, a total of 1.4 million tonnes. Even though the amount of waste disposed of in landfll continues to fall, it remains the main method of managing municipal waste with 0.8 million tonnes sent to landfll in 2010-11. Sustainable waste management practices are, however, becoming more common with the percentage of municipal waste that was reused, recycled or composted increasing to over 45 percent in 2010-11.

9.1.3 The following sections consider how waste can be reduced in the design and construction of new developments, and how adequate and efective waste management facilities can be incorporated in new developments which facilitate future sustainable management practices.

9.2 Designing Out Waste in New Developments

9.2.1 Guidance prepared by WRAP on designing out waste[19] identifes fve key principles that can be used as part of the design process to reduce waste:

- Design for reuse and recovery;
- Design for off-site construction;
- Design for materials optimisation;
- Design for waste efficient procurement; and
- Design for deconstruction and flexibility.

Reuse and Recovery

9.2.2 The reuse of material components and/or entire buildings reduces waste by extending the efective life of existing materials and minimises

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16 *Environment Agency Wales. Building the Future 2005-2006: A Survey on the Arising and Management of Construction and Demolition Waste in Wales 2005-2006. (Cardiff, EAW).*

17 *Target set out in Towards Zero Waste – The Overarching Waste Strategy Document for Wales, June 2010.*

18 *Welsh Government. 2011. Statistical Bulletin SB105/2011. (Cardiff, WG).*

19 *Davis Langdon LLP. Designing Out Waste: A Design Team Guide for Buildings. Less Waste, Sharper Design (Banbury, Waste and Resource Action Programme (WRAP)).*

the demand for new resources which have their own environmental impacts (e.g. embodied energy and CO2 emissions). It also lowers material purchasing costs and reduces handling and disposal costs.

9.2.3 Reuse can involve the refurbishment or conversion of existing buildings, the reuse of materials or components from demolition on site, or the reuse of materials or components that have been salvaged from other sites[20] .

9.2.4 Where demolition and site clearance is an essential part of the development, consideration should be given to the following:

- the potential for materials from the demolition of existing buildings or other phases to be reused in the design of the new development;
- the potential to reuse reclaimed products or components;
- the reuse of materials at their highest value;
- the potential to reuse excavation materials; and
- the need to optimise a cut and fill balance in order to minimise the removal of spoil of site.

9.2.5 Where no opportunities exist for reusing materials and/or components, the recovery of materials through recycling should be maximised by implementing good practice.

Ofsite Construction

9.2.6 Of site factory production has the potential to considerably reduce waste especially when factory manufactured elements and components are used extensively. This method of construction uses prefabricated building components that are efciently assembled on site. Benefts of this method include: shortened construction timescales; reduced construction related transport movements; reduced site waste through improved workmanship quality and reduced site errors; and efcient reuse and recycling of factory generated waste.

Materials Optimisation

9.2.7 Design approaches that give adequate consideration to the efcient use of materials, can deliver developments that minimise the use of materials in their design, and/or produce less waste during construction, without compromising the overall design concept. Efective ways of reducing waste include: minimising excavation and/or optimising the cut and fll balance; simplifying and standardising material and component choices to encourage reuse of of cuts; and incorporating dimensional co-ordination which minimises excess cutting and jointing of materials that generate waste.

Waste Efcient Procurement

9.2.8 The sequence of construction activities can afect the generation of waste and it is important to understand and identify how the causes of waste can be 'designed out'. An important aspect of this is to work with contractors and other specialist subcontractors and set tight specifcations of work procedures and clear contractual targets.

Deconstruction and Flexibility

9.2.9 Materials can potentially be recovered during the life of the building when maintenance and refurbishment is being undertaken or when the building reaches the end of its life. Generally, construction methods that enable efcient disassembly should be chosen in preference to the more contiguous structural systems. Designs using prefabricated building elements, components and materials tend to lend themselves to more efcient reuse and recycling.

9.2.10 In order to increase opportunities for reducing waste at the deconstruction stage, consideration should be given to the following:

- designing adaptable buildings that can be used for a variety of purposes during its operational life;

[20] *It should be noted that an exemption or Environment Permit may be required from Natural Resources Wales to carry out waste activities such as the reuse of waste in construction.*

- the use of building elements and components that can be maintained upgraded or replaced without generating waste;
- incorporating reusable/recyclable materials and components into the design of the building;
- the ease in disassembling building elements, components and materials; and
- the creation of a Building Information Modelling (BIM) system or building handbook which records which and how elements, components and materials have been designed for disassembly.

9.3 Incorporating Waste Management Facilities in New Developments

9.3.1 The need to provide suitable opportunities for the storage and collection of waste is an important consideration in the design of new developments. In general, new developments will need to provide on-site residual waste, recycling and composting storage and collection facilities. Adequate access arrangements for refuse vehicles and workers for collection purposes will also be required.

9.3.2 In residential developments, provision should be made for separate internal and external storage of compostable waste, dry recyclables and residual waste. Communal facilities, which may be necessary for larger developments, should be appropriately sized to facilitate the adequate separation of waste streams and secure to prevent misuse. In all instances, storage areas should be located within the property boundary and be visible and accessible to residents in order to encourage use. The use of signage and labelling will assist residents in identifying and appropriately using waste facilities.

9.3.3 Commercial developments should also provide adequate storage space for composting, recycling and residual waste. The provision of a compactor or baler should also be considered. Bin provision and storage requirements will need to refect the collection frequency and specifc requirements of the selected contractors. All waste must be containerised and stored of the public highway.

9.3.4 Mixed developments, such as commercial and residential, will need to provide separate storage facilities and collection arrangements. Commercial waste must not be mixed with residential waste.

9.3.5 It is important to ensure that new developments provide appropriate access arrangements for waste collection. These should include:

- appropriate space for refuse collection vehicles to pull up and collect waste containers which minimises the travel distance from the vehicle to kerbside collection points;
- adequate access arrangements that enable residents or staf to safely move containers to collection points;
- sufficient space for a collection vehicle and workers to safely manoeuvre when collecting waste containers from non-kerbside collection points; and
- adequately sized access pathways and service roads which are free of obstruction with suitable dropped kerbs and crossovers.

9.3.6 The operation of the waste collection service should be an integral part of the street design and achieved in ways that do not compromise quality of place. Care should however be taken to avoid designs which severely restrict access by waste collection vehicles and cause the creation of undesirable, ad hoc communal collection points, which inconvenience the householder and collection service.

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 foodplains, woodlands and traditional feld 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 identifed.

10.2 Benefits

10.2.1 In **environmental** terms, green infrastructure provides a number of ecological services including: fltering 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 efects of climate change through evapotranspiration and direct shading, and help cope with the increased frequency of sudden, heavy rain by reducing runof and increasing rainfall capture.

10.2.2 Green infrastructure can also be benefcial 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 afected 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 benefcial 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 infrastructure21. 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 benefcial measures which are particularly suited to the scale of developments likely to be undertaken in Merthyr Tydfl 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 walls22. 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 benefcial 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 waterproofng 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 ofer 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 fll 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.

11.0 Designing Out Crime

11.1 Introduction

11.1.1 The prevention of crime and the enhancement of community safety are an essential component of sustainable design. This section provides an overview of the practical ways in which a development can be designed in order to reduce the opportunity for crime and fear of crime. Recognised standards that have been shown to reduce crime and anti-social behaviour can be found in *The Safer Places*[23] and *Secured by Design*[24] initiative, and it is recommended that more detailed advice is sought from these sources. In addition, pre-application advice should be sought from South Wales Police Crime Prevention Design Advisors[25].

11.2 Layout

11.2.1 The urban structure of a development plays a key role in creating a safe environment. The layout design of new developments should seek to:

- Minimise the number of building sides exposed to the public realm;
- Maximise the number of active frontages, which provide natural surveillance, without compromising the privacy of residents;
- Create a regular movement framework that directs people and vehicles on to a small number of principal routes; and
- Create defensible spaces, such as private and communal gardens that can only be accessed from the surrounding building.

11.2.2 The use of a perimeter block layout is a good way of achieving the above. Cul-de-sac developments can also produce secure environments provided they are short and straight. Problems can, however, arise when cul-de-sacs are joined by networks of footpaths that are irregularly used.

11.3 Access and Routes

11.3.1 Whilst internal permeability and connections to adjacent street networks is an important aspect of creating sustainable communities, it is also important to avoid ill-conceived connections that increase vulnerability to or facilitate crime. In general, new developments should avoid superfuous and overly secluded access points and routes.

11.3.2 Routes for pedestrians, cyclists and vehicles

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[23] *Office of the Deputy Prime Minister/Home Office. 2004. Safer Places: The Planning System and Crime Prevention (Tonbridge, Thomas Telford Publishing).*

[24] *www.securedbydesign.com*

[25] *Relevant planning applications include: residential developments comprising of 10 or more dwellings; commercial, office, industrial, retail or leisure developments with a floor space of 1000 square metres or more; development involving new neighbourhood or district community facilities; car parking schemes with more than 50 spaces, or built to achieve the Park Mark Award; and any other development that could have a significant impact on future crime and general community safety.*

should, in most cases, be accommodated on streets and not be segregated. Where segregated footpaths and cycleways are necessary, the following principles should be adhered to:

- Routes should only be provided if they are likely to be well used;
- Active frontages should overlook the routes;
- Routes should be of a generous width and have a suitable landscape setting to avoid creating narrow corridors that can feel threatening;
- Routes should be lit in built up areas;
- Good visibility should be maintained along the route and sharp changes in direction should be avoided; and
- Routes to the rear of buildings should be avoided.

11.3.3 Where the routeing of footpaths and cycleways to the rear of buildings is unavoidable, it is benefcial to plant a substantial bufer between the property boundary and the footpath/cycleway margins. Access points to the rear of buildings should be controlled by security measures, such as lockable gates.

11.4 Public Spaces

11.4.1 New developments should aim to provide well defned and purposeful public spaces. Public spaces which meet the needs of the community will be used more frequently and limit opportunities for crime. Unnecessary and ambiguous space should be avoided. In an urban setting, public spaces should be overlooked from buildings and/or trafc routes (see Figure 11.1)

Figure 11.1 A well defned children's playground, overlooked by residential properties at Woodland Walk, Ynysfach.

11.4.2 The management and maintenance of public open space is an important factor in the creation of safer places. Without on-going cleaning and up-keep, places quickly become untidy and unattractive, reducing the likelihood that it is used by the community and increasing the potential for crime and anti-social behaviour. Long-term management and maintenance arrangements should therefore be considered at an early stage in the planning process, with ownership responsibilities and resources clearly identifed.

11.4.3 Community stewardship can help ensure that amenities respond to local needs, dissuade vandalism and reduce management costs. Nurturing stewardship requires a genuine feeling of local ownership and control. To realise these benefts active community participation from a diverse range of community members should be facilitated duringthe design, ongoingmanagement and maintenance of the public space.

11.5 Boundaries

11.5.1 It is essential that new developments provide a clear distinction between public, semi-private/communal and private space. Boundary treatments are a key element in defning the ownership of space and the creation of defensible spaces.

11.5.2 Private spaces, particularly to the side and rear of properties, which adjoin public land, need to be secured by high fences and landscape that actively impede access. Where landscape is the preferred option, thorny and prickly species should be considered as these are particularly efective in protecting properties. In all situations, it is benefcial if the boundary treatment is visually permeable to enable surveillance and avoid providing places for ofenders to hide.

11.5.3 Lower barriers, hedges and bushes can be used to efectively defne the public/private divide. Where the use of barriers is inappropriate, space can be defned through changes in paving and surface texture/colour, such as open plan gardens in modern residential schemes.

11.6 Parking

11.6.1 For residential development, parking should be provided close to and visible from the owner's home. The most secure place to park a vehicle is in the home's garage or driveway. On-street parking is the next best option provided the vehicle is suitably overlooked. Parking courtyards can also be acceptable as long as they are adequately overlooked, small in size and close to the owner's home. A single, gated, narrow entrance will also make vehicle crime more difcult.

11.7 Lighting

11.7.1 Appropriate lighting increases the opportunity for surveillance, suggests that an area is well managed, reduces the fear of crime and in certain circumstances reduces the incidence of crime. The selected lighting source should be sensitive to the needs of local residents and users. It should improve security whilst minimising glare and respecting residents' privacy. In order to avoid vandalism, the design of lighting and the positioning of lighting fxtures and columns should be robust and secure.

11.7.2 Places that do not require access at night can be left unlit in order to discourage the presence of victims and potential ofenders. Security lighting can be used to alert others of unauthorised access.

12.0 Flexible and Adaptable Buildings

12.1 Introduction

12.1.1 New buildings should be designed so that they are fexible and adaptable from the outset, enabling them to respond to changing socio-economic and environmental conditions. Such buildings can adapt to changing needs and lifestyles of the occupier and allow for a variety of uses over time. Equally, they can respond to the impacts of climate change. Buildings that can successfully adapt to changing circumstances will prove more robust over time and are less likely to require demolition.

12.2 Building Design

12.2.1 Buildings should be designed to facilitate adaptation, conversion and extension in the future. In general, open plan forms with a steel and concrete frame construction can create broader spans which make reconfguration of internal space easier. Cellular forms with load-bearing internal walls tend to be less fexible. The option to extend in the future can also be incorporated into the original design of the building.

12.2.2 Commercial developments are more likely to require conversion by successive occupiers, while dwellings commonly need to adapt to changing needs and lifestyles. In respect of the latter, developers are encouraged to have regard to the Lifetime Homes Standard26. This standard seeks to deliver houses that are accessible, functional and convenient for a wide range of people, including some wheelchair users27, elderly people with reduced mobility and families with young children. It also introduces some adaptability into the housing layout and design so that simple adaptations can be undertaken to suit any changing needs of the household. For example, in addressing the needs of an individual with reduced mobility, a home can be adapted by converting a room into a downstairs bedroom, or by providing a stair lift or downstairs toilet and shower room. Any future adaptations should be more cost-efective as the original design accommodates for their provision from the outset.

12.3 Adapting to Climate Change

12.3.1 The UK Climate Impacts Programme28 (UKCIP) predicts that by 2080 Wales will experience:

- greater warmth all year round by between 2 and 4°C;
- greater summer maximum temperatures by between 3 and 6°C;
- greater winter minimum temperatures by

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26 *http://www.lifetimehomes.org.uk*

27 *It should be noted that many wheelchair users will require purpose designed wheelchair housing.*

28 *Figures are based on central estimate of the medium emission scenario from the most recent UK Climate Projections, published in June 2009. See http://www.ukcip.org.uk*

between 3 and 4°C;

- lower summer rainfall by between 10 and 40%;
- greater winter rainfall by up to 30%;
- more variability from year to year; and
- more frequent and more violent storms (involves increased rain intensity).

12.3.2 The efects of climate change should be considered over the lifetime of a development, especially with regard to its location and design. The long term sustainability of a development will largely depend on the adaptation measures adopted as they reduce the risk of buildings being too uncomfortable to live in or too expensive to run and maintain in the future.

12.3.3 The key issues to consider for adapting to climate change are set out in the table below29. It should be noted that many of the adaptation measures highlighted are discussed in more detail within other chapters of this Guidance.

Location	Particularly in respect of fooding, higher temperatures and water resources. Developers should establish food risk designations with Natural Resources Wales, undertake food risk assessments and incorporate green spaces and natural shading in the design of schemes.
Site layout	Particularly in respect of heat gain and the provision of outdoor spaces. Developers should minimise solar gain in summer, maximise natural ventilation, maximise natural vegetation and provide adequate private outdoor space wherever possible.
Buildings	In terms of structure, developers should ensure that buildings are: strong enough for increased wind speeds; capable of incorporating ventilation and cooling techniques/ mechanisms; and of an appropriate thermal mass for the intended use. In relation to the physical envelope of the structure, developers should ensure that: drainage systems and entrance thresholds have the capacity for more intense rainfall; there are opportunities for green roofs/walls; the exterior reduces heat gain in summer; the overall envelope is sufciently air tight to avoid infltration from increased wind and temperatures; and cladding materials are able to withstand higher wind speeds. In respect of materials, developers should ensure that materials specifed will perform adequately in the climate throughout the lifetime of the development.
Ventilation and Cooling	Developers should ensure that buildings are capable of delivering comfortable temperatures through ventilation and cooling systems (including natural and low and zero carbon based systems) throughout the lifetime of the development.
Drainage	Particularly in respect of surface run-of, fash foods and traditional drainage systems. Developers should incorporate sustainable drainage systems into the design of the development wherever possible.

29 *Greater London Authority. 2005. Adapting to Climate Change: A Checklist for Development. Guidance on Designing Developments in a Changing Climate (London, GLA).*

Water	Particularly in respect of water services, water efciency and water recycling. Developers should consider net water consumption of the development under normal and water conservation (drought) conditions, water efciency measures, rainwater collection and grey water recycling.
Outdoor Spaces	Particularly in respect of demand for public and private outdoor spaces, types of surface, natural shade, soils, vegetation, water features and waste storage.

Connectivity	Particularly in respect of infrastructure resilience and impact on neighbours. Developers should ensure that there are safe access routes in the event of a food, consult with utility companies and others over the resilience of services and infrastructure to the development, and work with neighbouring developments to identify immediate and cumulative impacts.

13.0 Further Information and Advice

Copies of this guidance and other relevant documents can be downloaded from the Council’s website at www.merthyr.gov.uk

Further information is available from:

Planning Policy and Implementation
Town Planning Division
Merthyr Tydfl County Borough Council
Unit 5
Triangle Business Park
Merthyr Tydfl
CF48 4TQ

Tel: 01685 726213
E-mail: devplanning@merthyr.gov.uk

Appendix 1 – Glossary of Terms

Advanced thermal processes: Typically relates to gasifcation and pyrolysis. These processes chemically transform feedstock into a gas or oil which can subsequently be combusted to generate electricity.

Cross ventilation: A natural ventilation system which relies on the pressure generated on a building by the wind, to drive air through it. When wind meets a building, it generally creates a positive pressure on the windward side and a negative pressure over the roof and leeward side. Ventilation air will fow along this pressure gradient provided there are openings on each side of the building. This system can be adopted whenever a building is exposed to the prevailing wind.

Evapotranspiration: The process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and transpiration from plants.

Legible layout: A layout that is easy to understand and traverse.

Microclimate: The climate of a very small or restricted area, especially when it difers from the climate of the surrounding area.

Passive stack ventilation: A natural ventilation system which relies on air being driven through a building by vertical pressure diferences developed by thermal buoyancy. The warm air inside the building is less dense than cooler air outside, and will therefore seek to escape from openings in the building fabric at the top of the house. At the same time cooler air is drawn into the building through low level openings.

Permeable layout: A layout that has a variety of pleasant, convenient and safe routes through it.
Modular Geocellular Storage: Plastic structures, containing modular boxes or honeycomb blocks, which control and manage runof either as a soakaway or as a storage tank.

Modular Geocellular Storage: Plastic structures, containing modular boxes or honeycomb blocks, which control and manage runof either as a soakaway or as a storage tank.

Appendix 2 – List of References

One Wales: One Planet - The Sustainability Development Scheme of the Welsh Assembly Government (May 2009)

Local Development Plans Wales: Policy on Preparation of LDPs (December 2005)

Planning Policy Wales (Edition 5, November 2012)

Technical Advice Note 5: Nature Conservation and Planning (September 2009)

Technical Advice Note 8: Planning for Renewable Energy (July 2005)

Technical Advice Note 12: Design (June 2009)

Technical Advice Note 15: Development and Flood Risk (July 2004)

Technical Advice Note 18: Transport (March 2007)

Technical Advice Note (Wales) 21: Waste (November 2001)

Technical Advice Note 22: Sustainable Buildings (June 2010)

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Ofce of the Deputy Prime Minister/Home Ofce. 2004. *Safer Places: The Planning System and Crime Prevention* (Tonbridge, Thomas Telford Publishing).

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http://www.lifetimehomes.org.uk

http://www.ukcip.org.uk

Greater London Authority. 2005. *Adapting to Climate Change: A Checklist for Development. Guidance on Designing Developments in a Changing Climate* (London, GLA).

Appendix 3 – Summary of Comments Received to Draft SPG Consultation with Council Response in Each Case

Representor: The Coal Authority

Issue: No specifc comments to make on the document.

Council response: The Council welcomes The Coal Authority's consideration of the SPG.

Recommended changes: None.

Representor: South Wales Police

Issue: A request is made for the inclusion of additional text within Chapter 11 Designing out Crime, encouraging developers to seek pre-application advice from the Police Crime Prevention Design Advisors on specifc applications.

Council response: It is considered that the additional text would be of beneft to users of the SPG in terms of raising awareness of the service provided by South Wales Police. As such, it is recommended that an amendment is made to section 11.1 as set out below.

Recommended changes: Add sentence at the end of paragraph 11.1.1 to read: *In addition, pre-application advice should be sought from South Wales Police Crime Prevention Design Advisors*.

Add related footnote at the bottom of the page to read: *Relevant planning applications include: residential developments comprising of 10 or more dwellings; commercial, ofce, industrial, retail or leisure developments with a foor space of 1000 square metres or more; development involving new neighbourhood or district community facilities; car parking schemes with more than 50 spaces, or built to achieve the Park Mark Award; and any other development that could have a signifcant impact on future crime and general community safety.*

Representor: Natural Resources Wales (NRW)

Issue: NRW highlight the need for a Design and Access Statement (DAS) to clearly identify how the landscape context of the site has been taken into consideration in the design of the development, and the way in which the development has been designed to ft into that landscape context.

Council response: Whilst *Chapter 3 Design and Access Statements* does not refer specifcally to the landscape context of site, it does refer to the need for the DAS to demonstrate how the physical context (which includes landscape) of the development has been appraised, and how the choice of design principles takes that context into account. The reader is also advised to refer to Technical Advice Note 12: Design (June 2009) for more detailed guidance, which includes consideration of the local landscape context.

The Council is satisfed that the SPG provides an appropriate amount of guidance on the use of a DAS when considering sustainable design matters without going into the level of detail adequately covered by other existing documents. As such, it is not considered necessary to amend the SPG in respect of this matter.

Recommended changes: None.

Representor: Natural Resources Wales (NRW)

Issue: NRW suggest an amendment to paragraph 3.4 in order to make it clear that in a sensitive location even a small development can have signifcant impacts, and as such, may require more detailed consideration in a DAS.

Council response: The Council accepts that paragraph 3.4 would beneft from further clarifcation and recommend that this paragraph is amended as set out below.

Recommendedchanges: Amendthirdandfourthsentenceofparagraph3.4toread: Majornewdevelopments and developments in sensitive locations are likely to require greater levels of detail with illustrative material and cross references to additional information contained within supporting documents submitted with the application. Smaller, less complex developments, and those in less sensitive locations, may be much shorter and only require concise written explanations.

Representor: Natural Resources Wales (NRW)

Issue: NRW welcomes the recognition in paragraph 4.2.1 of the need for site layout to be informed by natural features, and the important contribution of landscape features to maintain and improve the energy conservation performance of buildings. They also welcome the recognition of the numerous benefts provided by trees.

Council response: Noted.

Recommended changes: None.

Representor: Natural Resources Wales (NRW)

Issue: NRW welcome the cross-reference in paragraph 5.1.2 to the Welsh Government's *Practice Guidance – Planning Implications of Renewable and Low Carbon Energy (2010)*, which highlights the ecological and landscape considerations which should be taken into account for each low and zero carbon technology.

Council response: Noted.

Recommended changes: None.

Representor: Natural Resources Wales (NRW)

Issue: NRW welcome the acknowledgement in paragraph 5.4.5 that an abstraction licence is likely to be required for water source heat pumps (WSHPs). They also highlight the need to change the reference from the Environment Agency Wales to Natural Resources Wales and the existence of an additional constraint to WSHPs relating to variations in the amount of water available for abstraction.

Council response: The Council accepts that paragraph 5.4.5 should be updated to refect the organisational change at the Environment Agency Wales, and that the inclusion of text highlighting the additional constraint to WSHPs would be of beneft to users of the SPG. As such, it is recommended that Section 5.4 be amended as set out below.

Recommended changes: Amend fnal sentence of paragraph 5.4.5 to read: An abstraction licence from ~~the Environment Agency~~ Natural Resources Wales is normally required.

Add paragraph at the end of section 5.4 to read:

5.4.9 WSHPs can be constrained by variations in the amount of water available for abstraction. This could be due to difering groundwater levels or river fows. Any abstraction licence issued is likely to include certain conditions/restrictions which will also afect the water available for these schemes.

Representor: Natural Resources Wales (NRW)

Issue: NRW highlight the potential need for hydropower schemes to obtain an abstraction and/or impoundment licence from NRW. They also indicate that any abstraction and/or impoundment licence issued is likely to afect the amount of water available for such schemes.

Council response: The Council accepts that additional information on the potential need for an abstraction and/or impoundment licence and the related implications for the amount of water available for such schemes would beneft users of the SPG. As such, it is recommended that Section 5.5 be amended as set out below.

Recommended changes: Add sentence at the end of paragraph 5.5.1 to read: *An abstraction and/or impoundment licence is likely to be required from Natural Resources Wales.*

Add sentence at the end of paragraph 5.5.3 to read: *Any abstraction and/or impoundment licence issued is likely to include certain conditions/restrictions which will also afect the water available for these schemes.*

Representor: Natural Resources Wales (NRW)

Issue: NRW highlight that hydropower schemes should be assessed on a case by case basis as some schemes may be detrimental to the ecology of a watercourse. As a consequence, they advise that potential applicants and/or developers undertake pre-application discussions with NRW.

Council response: Whilst the Council acknowledges that hydropower schemes can impact on the ecology of a watercourse, consideration of the potential impacts of renewable technologies within the SPG is considered undesirable given the number of issues that would need to be covered. The approach taken has been to cross-reference other existing documents which adequately address these issues in detail, such as the Welsh Government's *Practice Guidance – Planning Implications of Renewable and Low Carbon Energy (2010). A reference to this document is provided in the introduction of Chapter 5 Energy – Low and Zero Carbon Technologies.*

Recommended changes: None.

Representor: Natural Resources Wales (NRW)

Issue: NRW welcome the acknowledgement that we are facing challenges to our water supply resulting from reduced water abstraction from the Wye and Usk rivers.

Council response: Noted.

Recommended changes: None.

Representor: Natural Resources Wales (NRW)

Issue: NRW request the inclusion of an informative within Section 7.3 relating to the potential requirement for an Environment Permit to Discharge if a SuDS discharges to a surface water body.

Council response: The Council accepts that the informative would provide useful information to users of the SPG, and as such, it is recommended that an amendment is made to Section 7.3 as set out below.

Recommended changes: Amend frst sentence of paragraph 7.3.17 to read: *Early consultation with ~~the Environment Agency Wales~~ Natural Resources Wales and the Council's Drainage Engineer is recommended in order to identify local surface water issues and establish design standards and performance parameters.*

Add related footnote at the bottom of the page to read: *It should be noted that an Environment Permit to Discharge may be required from Natural Resources Wales for a SuDS to discharge to a surface water body.*

Representor: Natural Resources Wales (NRW)

Issue: NRW request the inclusion of an informative within Section 9.2 relating to the potential requirement for an exemption or Environment Permit to carry out waste activities such as the re-use of waste in construction.

Council response: The Council accepts that the informative would provide useful information to users of the SPG, and as such, it is recommended that an amendment is made to Section 9.2 as set out below.

Recommended changes: Add footnote, which relates to the fnal sentence of paragraph 9.2.3, at the bottom of the page to read: *It should be noted that an exemption or Environment Permit may be required from Natural Resources Wales to carry out waste activities such as the reuse of waste in construction.*

Representor: Natural Resources Wales (NRW)

Issue: NRW welcome the recognition in Section 10 of the multiple benefts of integrating green infrastructure into the design of development.

Council response: Noted.

Recommended changes: None.

Representor: Natural Resources Wales (NRW)

Issue: NRW welcome the recognition of the role of green infrastructure in supporting biodiversity enhancement, and that such provision is an important consideration in achieving sustainability through good design.

Council response: Noted.

Recommended changes: None.

Representor: Natural Resources Wales (NRW)

Issue: NRW requests that the SPG clarifes the need for developers to understand local habitats and species, and suggests that they contact the Local Planning Authority and the local environmental records centre to obtain local biodiversity data. They also indicate that the information should be used to inform how measures to protect and enhance biodiversity could be integrated into the design and layout of proposal. NRW can provide advice to developers on biodiversity considerations.

Council response: The Council initially considered including more detailed information on biodiversity issues within *Chapter 10 Green Infrastructure*, but felt that this would shift the focus away from the broader consideration of green infrastructure. Moreover, the Council intends to produce an SPG on biodiversity in the future, which will contain detailed information on the biodiversity issues raised by NRW. Notwithstanding this, in order to prevent these issues being overlooked by developers while the forthcoming SPG on biodiversity is being prepared, the Council recommends that amendments are made to Section 10.3 as set out below.

Recommended changes: Add footnote, which relates to the frst sentence of paragraph 10.3.1, at the bottom of the page to read: *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.*

Representor: Natural Resources Wales (NRW)

Issue: NRW indicate that it is important to plant native species of local provenance as they will protect and enhance the natural features and character of an area. They also indicate that species of local provenance will be best suited to the microclimate and of most beneft to wildlife.

Council response: The Council accepts these statements and recommends an amendment to Section 10.3 as set out below.

Recommended changes: Add sentence at the end of Paragraph 10.3.2 to read: *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.*

Representor: Natural Resources Wales (NRW)

Issue: NRW welcome the clarifcation in paragraph 10.3.1 that developers should seek to understand the nature and function of existing green infrastructure at the beginning of the design process, but suggest that the SPG should seek to protect, and where appropriate, enhance existing green infrastructure functions.

Council response: The Council accepts the approach suggested by NRW and it is recommended that an amendment is made to Section 10.3 as set out below.

Recommended changes: Amend second sentence of paragraph 10.3.1 to read: *This knowledge can then be used to design new developments in ways ~~that provide opportunities to add to, or enhance~~ protect, and where appropriate enhance, the function of existing green infrastructure.*

Representor: Natural Resources Wales (NRW)

Issue: NRW welcome the advice in paragraph 10.3.9 on measures that should be put in place to protect trees and hedgerows. Additionally, they also request that the SPG recommends that developers seek advice from their local authority as to whether a species survey should be undertaken prior to commencing works which would involve the felling or lopping of trees and hedgerow works.

Council response: The Council initially considered including more detailed information on biodiversity issues within *Chapter 10 Green Infrastructure*, but felt that this would shift the focus away from the broader consideration of green infrastructure. Whilst the Council agrees with the sentiment of the additional information suggested by NRW, it is considered more appropriate to address these biodiversity issues within an SPG on Biodiversity. The Council intends to produce the latter in the future and will give further consideration to the matter raised at that time.

Recommended changes: None.

Representor: Natural Resources Wales (NRW)

Issue: NRW highlight the potential impact of artifcial lighting on wildlife using and inhabiting watercourses, ponds and wetlands, and assert that lighting levels should be maintained at background levels in these locations. They also recommend that advice is sought from a suitably qualifed ecologist when planning a lighting scheme in areas where protected species are known to be present and in the countryside.

Council response: Whilst the Council recognises the potential impact of insensitive lighting schemes on biodiversity interests, it is felt that these matters would be more appropriately addressed within an SPG on Biodiversity. The Council intends to produce the latter in the future and will give further consideration to the matter raised at that time.

Recommended changes: None.