



DUNDEE

SUSTAINABLE DEVELOPMENT GUIDE

FOR

CONSTRUCTION

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Dundee Sustainable Development Guide for Construction

Foreword by Leader of the Administration

We all want Dundee to be a city that offers a high quality of life and opportunities for all. Together we can all play a part in making it a more sustainable city in the future. This guide is an opportunity to help make that difference.

Working together with developers, public, private and community partners, and using this guidance I hope all can play their part in making new developments more sustainable. Each planning application and new building is an opportunity to follow good practice. Our homes, workplaces and other places will help provide a healthy and comfortable environment to live and work in. Thoughtful design, good consultation, and cost effective measures will be easier by using this guide. Many developments are already making a positive contribution and it is hoped many more will follow.

Please use the guide and give feedback to the council on how to improve it in the future.

Cllr Jill Shimi
Leader of the Administration

Aiming for a Sustainable City

The City Council has produced this guide to assist all developers (large or small) to adopt more sustainable approaches to how they plan and build. It is part of a voluntary process which starts with developers completing a 'Sustainable Development Profile' to be submitted with their planning application. The profile and guide are intended to encourage developers to think about a range of issues from community consultation to renewable energy and recycling at the earliest possible stage in the site planning and design process before finalising their project and submitting it for consideration.

The profile and guide do not constitute any formal agreement with the City Council and do not obviate the need to comply with Building Regulations or other statutory requirements.

Acknowledgements

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Dundee City Council Sustainable Policy (Implementation Group):	for feedback and input to text
Tayside Biodiversity Group:	for feedback and input to text
Dundee City Council Departments:	for feedback and input to text
Sustainable Construction Working Group:	for producing the document and carrying out consultation

Section 1 - Using the Guide

The purpose of the guide

This guide is directed at developers, architects, building professionals and others involved in building and construction to help them make Dundee a more sustainable city.

Sustainable Development Profile System

This Guide supports the 'Sustainable Development Profile' system that has been introduced by the Council. This means that for new large developments, developers are encouraged to complete a profile describing their approaches to delivering sustainability as part of the procedure set out in this guide. For the purpose of this guide, large development is defined as where the proposal includes:

- the development or change to residential use for approximately 10 or more units or a site area of 0.5 or more hectares; and/or
- significant developments of or change of use to a gross area over 1000 m² of floor space for retail, business or leisure, or health or educational developments; and/or
- industrial development.

Sustainable Development Profile procedure

1. Developers will be made aware of the Sustainable Development Guide and Profile as part of the pre-application advice or issued with the Acknowledgement of Application. The intention is to raise awareness of the Council's Sustainable Development policies. It will also be available on the Council's web site along with application forms
2. The developer is requested to complete the Sustainable Development Profile referring to this guide for help and guidance and send it in with the Planning/Building Application.
3. Copies of the completed profile are sent to the relevant council services for comment and follow up.
4. Development Control or other services may respond to approaches described in the profile with comments during the planning process, some issues as planning obligations, or promotional expectations, as appropriate

Meeting sustainable development objectives

Dundee City Council would like to see new developments in the city helping to meet the following 9 sustainable development objectives:

Cross Cutting Issues

1. **minimise carbon dioxide production** from all aspects of construction, management, occupation and demolition, including transport , and incorporate adaptation to climate change impacts
2. build in **participatory design and post-occupancy evaluation** to inform the design of future sustainable developments

Environmental Issues

3. maximise **efficient use of land** and buildings in relation to infrastructure requirements and carbon emissions.
4. maximise **sustainable energy** supply and use i.e. renewable energy and energy efficiency
5. **minimise waste and maximise recycling** both during construction and after occupation, including design for deconstruction/easy alterations in the future.
6. **conserve water** resources and minimise vulnerability to flood risk
7. **minimise polluting emissions** to water, air and soil and minimise noise and light pollution
8. maximise use of materials from **local and sustainable sources**, while minimising embodied carbon emissions in products and materials.
9. protect and enhance **biodiversity**

This guide provides advice on how to deliver sustainable development against these objectives.

Each objective has a series of related questions. Information is given to assist developers and architects in setting out their approaches to delivering sustainability against the objectives. It refers to relevant national policy, Planning Policy Guidance, regional policy and initiatives, Local Plan policies, and other Dundee City Council policy and strategies.

Further information is provided under all topics to enable the reader to obtain more detailed and specialist advice.

Phases of development

A key message of this guide is that sustainability, and previous design feedback, should be considered as early in the design process as possible in order to avoid the possibility of abortive work/costs, should consequent alterations to the scheme be desired.

This means that the inclusion of sustainability considerations should start at the very inception of the development by responding to the following key questions:

- Has the client been informed about the potential benefits of adopting sustainable design principles?
- Have strategic sustainability objectives been developed for the site?
- Have you ensured that the design team has access to the full range of expertise to enable sustainability to be adequately considered?
- If the community is involved in the development process how will they be involved?
- Has a feedback process to the client been initiated, for when the building is completed?

The outline proposal stage is a key point at which the sustainability of a proposed development can be checked and tested. This is the point at which developers may be asked to complete a Sustainable Development Profile. The Sustainable Development Profile should be applied to full planning applications where possible.

The Profile will be recorded by the Architectural Services Division of the Council and feedback may be given.

There will be no delay in processing Planning Applications or Building Control Consent due to the completion or non-completion of the Profile. It is for information purpose only.

Section 2 - Why do we need sustainable design and construction?

Principles for sustainable design and construction

The quality of life in Dundee is very closely linked to the quality of the built environment. It affects people's lives in their homes, at work, in education and in their leisure time. New developments constructed now may well still be in use in 150 years time - we owe it to ourselves and future generations to deliver a sustainable city.

The principles underlying sustainable development encompass three dimensions that interrelate to deliver a better quality of life. In applying sustainable development to the built environment, building design and construction, the core principles are:

Social Dimension

- To create a built environment that: meets people's needs whatever their circumstances; provides affordable and healthy homes, accessible services and leisure facilities, so that all can enjoy a good quality of life.

Economic Dimension

- To create high quality working environments that contribute to the development of healthy places of employment, increased productivity and competitiveness; that are adaptable to the changing needs of a vibrant economy and linked to sustainable modes of transport.

Environmental Dimension

- To use materials and adopt forms of design and construction that use resources efficiently, minimise waste and pollution, protect and enhance biodiversity and create a healthy environment.

An overarching principle is that local communities, workers, and building users should be involved in the development and post-occupancy feedback processes and given the opportunity to influence the key decisions that will affect their lives by helping to create environments that meet their needs and reflect their visions.

These principles should be applied at all stages including the choice of site, the design of the development, the procurement of materials, including all stages of the supply chain, during construction, occupancy, maintenance and demolition/alterations.

The Benefits of Going Beyond the Building Regulations

The Building Regulations are approved by Parliament and deal with the minimum standards of design and building work for the construction of domestic, commercial and industrial buildings. The new building regulations for Scotland (known as Building (Scotland) Regulations 2004) came into force on 1 May 2005 and cover a wide range of aspects of design and construction. Section 3 – Environment and Section 6 – Energy, offer key considerations for developments that exemplify good sustainable design. For more information go to: <http://www.sbsa.gov.uk/>

The Building Regulations are minimum legal standards so they do not represent best practice - only the standard acceptable and safe practice. For a developer or architect to say to a potential client that they design buildings to minimum legal standards will do very little to promote their services. Going beyond Building Regulations standards in some areas can differentiate quality sustainable design from mediocre off the shelf development.

Building users are increasingly conscious of running costs such as:

- maintenance and repair costs
- energy costs
- water and sewage costs

Good sustainable design can deliver buildings with low running costs - an attribute that is highly attractive to both householders and businesses.

There are also an increasing number of commercial organisations, public bodies and individuals who want to do their bit by being demonstrably socially and environmentally responsible. They want to show that they are minimising greenhouse gas emissions, recycling and re-using buildings and materials, and using renewable energy technologies. A number of recent sustainable building developments in the UK have generated huge interest and a queue of potential buyers e.g., Bedzed (London).

But ultimately the biggest selling point of good quality sustainable design is that it creates buildings that are healthy, comfortable, attractive and exciting places for people to live and work in.

Further information about sustainability issues in the built environment can be found at the following links:

Building a Better Quality of Life - sets out the government's agenda for working with the construction industry to improve sustainability.

www.dti.gov.uk/construction/sustain/bql/index

Movement for Innovation - brings together a broad partnership of interests to put forward innovative solutions and sustainability assessment tools.

www.m4i.org.uk/projects

Rethinking Construction - The Egan Report - set out a radical agenda for reshaping development and construction processes in the UK.

www.rethinkingconstruction.org/about/m4i.html

Scottish Climate Change Programme - sets out the significant challenges presented by climate change and the need to cut greenhouse gas emissions and adapt to climate change impacts.

<http://www.scotland.gov.uk/Topics/Environment/Climate-Change/16327/4825>

Taking it On – UK sustainable development strategy.

<http://www.sustainable-development.gov.uk/taking-it-on/index.htm>

Bed Zed Files - Materials Report and Carbon Neutral Development

<http://www.bioregional.com/retail/customer/home.php>

Sustainable Housing Design Guide for Scotland - Free on line

www.archive2.official-documents.co.uk/document/deps/cs/shdg/sitemap/

Design and Detailing for Deconstruction (SEDA) - Free on line

www.seda2.org/dfd/

Design and Detailing for Airtightness (SEDA) - Free on line

www.seda2.org

Adapting Buildings and Cities for Climate Change - Sue Roaf

Architectural Press, Oxford

The Green Guide to Specification 3rd Edition

BRE, Watford. www.bre.co.uk

National Green Specification

<http://www.greenspec.co.uk>

Dundee's Examples of Good Practice

Dundee Sun City – facilitating sustainable development through initiatives focussing on renewable energy and energy efficiency.

www.dundeesuncity.org.uk

Solar Cities Scotland - Limited Company formed by partners of Dundee Sun City to facilitate sustainable development.

www.solarcityscotland.org.uk

Section 3 - Cross cutting issues

3A Climate change

Objective: minimise carbon dioxide production from all aspects of construction, management, occupation and demolition/alterations, including transport, and incorporate adaptation to climate change impacts

The Intergovernmental Panel on Climate Change, made up of the world's leading scientists, observed in its ***Third Assessment Report*** that "there is now stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." Levels of carbon dioxide, the main greenhouse gas, have risen by more than a third since the industrial revolution and are now rising faster than ever before.

Some examples of how our climate is already changing include:

- All of the ten warmest years since records began have occurred since 1990, including each year since 1997;
- Winter storms have doubled in the UK over the past 50 years;
- Spring plants are blooming earlier in Scotland (on average three weeks earlier since 1978).

The impacts of climate change in the second half of this century could be enormous unless we take urgent action to mitigate the extent of climate change through greenhouse gas emissions reductions. A concerted global response is required to tackle this global problem, with the burden of responsibility on the developed world to lead by example by cutting its emissions and to develop the technologies that will help developing countries achieve sustainable development. But, due to the nature of the climate system and to past and present levels of greenhouse gas emissions, some climate change is now inevitable, with the change over the next 30-40 years effectively determined. Therefore, it is vital that we also adapt to the unavoidable impacts of climate change.

This means we are going to have to adapt to climate change and this will include changing how we design our built environment and look after natural systems.

We also have a duty to future generations to reduce our production of greenhouse gases - in particular carbon dioxide - to slow climate change and minimise the worst impacts in the second half this century. This can be achieved by a combination of reducing our overall energy requirements, using energy more efficiently, cutting our use of fossil fuels and increasing our use of renewable resources.

The international, national, regional and local context

Britain is a signatory to the international agreement on Climate Change, the Kyoto Protocol, committing the UK to a 12.5% reduction in greenhouse gas (GHG) emissions by 2008-12, while the current government has pledged to reduce emissions of carbon dioxide by one fifth by 2010. In the longer term, it has been estimated that we need to reduce our emissions by between 60% and 90% to prevent runaway climate change, according to the Royal Commission for Environmental Pollution. The government has set out its strategy in Climate Change - the UK Programme and the Scottish Climate Change Programme gives a Scotland-specific context.

Approaches to mitigating greenhouse gas emissions

Ideally all new developments should aim to be carbon dioxide neutral overall. This might mean that carbon dioxide production in one area is compensated for by another aspect of the development. For example carbon dioxide generated through travel to a new development might be offset by the development being a net exporter of renewable energy - the net result being carbon neutral. Mitigating emissions is covered in several different topics in this guide, the key topics being:

- Energy
- Waste management
- Materials
- Transport (will be included in future editions of the Guide)

Developers should set out their overall approach to mitigating greenhouse gas emissions by reference to the issues covered under these topics.

Approaches to adaptation to climate change impacts

New developments will need to take on board the risks and benefits posed by climate change impacts being experienced now and those we are likely to face in the future. Key topics addressing these issues are:

- Leisure, culture and community
- Land and buildings
- Quality design
- Energy
- Water resources
- Transport

ASSESSING RISK

Is the site in an area at risk from current or future climate change impacts and extreme weather events such as:

- Sea level rise
- Storm surges and extreme high water levels
- Flash floods
- Slow onset flooding
- Ground water rise flooding
- Land erosion/subsidence
- Wind damage (direct and indirect)
- Water shortage

Does the development potentially increase climate related risks in the locality in terms of:

- Increased surface water run-off
- Causing changes to the flood or groundwater regimes elsewhere
- Increased pressure for new or enhanced flood or coastal defence measures
- Loss of tree cover that provides wind protection or shade
- Fragmentation and vulnerability of habitats
- Increased pressure for water resources

DESIGN CONSIDERATIONS - ADAPTATION

Has the development adopted features that increase resilience/adaptability to climate impacts:

Flood risk and heavy rain events e.g.

- Incorporating landscape features to adsorb floodwater in larger developments
- Specifying Sustainable Urban Drainage Systems (SUDS)
- Ensuring building services are sited above potential flood levels
- Increasing resistance of building envelopes to penetration by driving rain
- Drought and extreme heat
- Specifying water recycling and rainwater collection features
- Incorporating passive ventilation and greater thermal mass
- Incorporating shading into landscaping and design of open public spaces
- Incorporating features which prevent excessive solar gain e.g. light shelves
- Connecting to district cooling systems where available
- Storms and strong winds
- Design to reduce aerodynamic loads
- Incorporating landscaping to provide protection from prevailing winds
- Emergency planning
- Access for emergency vehicles
- Use of “green” roofing to slow down and store run-off

Further information

IPCC Third Assessment Report - Climate Change 2001: Synthesis Report is available at

http://www.grida.no/publications/other/ipcc_tar/

Climate Change – the Scottish context

www.scotland.gov.uk/climatechange

The Energy White Paper – Our Energy Future - information about carbon reduction targets for the UK

United Kingdom Climate Impacts Programme (UKCIP)

www.ukcip.org.uk

Adapting Cities and Buildings for Climate Change - Sue Roaf,
Architectural Press, Oxford

Section 4 – Meeting Sustainable Development Objectives

4.0 - Environmental Issues

4.1. Land and buildings

Objective: maximise effective use of land and buildings to contribute to a high quality environment

Construction projects have a wide variety of impacts: on energy use, on the appearance of the built environment, on transportation, on ecosystems, on employment and social conditions, on greenspace and recreation. Decisions about the location and the initial appraisal of the site will fundamentally influence the sustainability of any new development. The shortage of development sites has placed a premium on reusing both buildings and land. In certain cases, the impact on the environment and surrounding land may just be so great that the development can not be allowed.

Sustainable development requires that the competing demands for land are balanced, creating communities that are diverse and of mixed-use and that provide high quality areas of public open and greenspace for leisure, recreation and relaxation while minimising transportation requirements. The impact of new developments on wildlife and biodiversity is another essential consideration.

The National and Regional Context

The Government has set out a strategy for more sustainable construction (Building a Better Quality of Life 2000) which suggests that the construction industry can contribute to achievement of sustainable development by:

- being more profitable and more competitive
- delivering buildings and structures that provide greater satisfaction, well-being and value to customers and users
- respecting and treating its stakeholders more fairly
- enhancing and better protecting the natural environment
- minimising its impact on the consumption of energy (especially carbon-based energy) and natural resources

Dundee's Examples of Good Practice

- Morgan Academy re-use of building and brownfield site
- Dundee Contemporary Arts (DCA) – re-use of building (and its materials) and brownfield for prime civic amenity in excellent location near public transport, naturally ventilated and excellent daylighting.

- City Quay Shopping – re-use of old buildings, brownfield site, use of low embodied energy materials (timber cladding), use of docks to cool air from south side in Summer.
- Dundee University Students Union – re-use and extension of existing building, extensive user consultation.
- Dundee City Council Housing which has retrofit solar panels, Abertay Housing Associations Solar Installation and Servite Housing Association proposed installation of CHP and solar water heating.

Key Questions for Land and Buildings

4.1.1 What are the findings of any site appraisal?

A site appraisal might address the following sustainability issues:

- Accessibility to local services and different transport modes (see Transport)
- The scope for existing buildings on site to be reused or refurbished
- Soil conditions on site and the level of contamination (if any) and how remediation can be carried out
- An ecological assessment
- The need to avoid disturbance and pollution of groundwater and watercourses
- The orientation of the site for solar gain, exposure of the site to prevailing winds and the extent of shelter provided by natural features and surrounding buildings
- For larger sites, the opportunities to include sustainable energy supply such as links to existing district heating and the inclusion of combined heat and power
- Opportunities as part of the development to retain or provide allotments, community gardens and other food production facilities
- Identification of any archaeological remains on or near the site
- Ground stability and risk of subsidence due to climate change impacts
- Vulnerability to flooding now and in the future
- Existing air quality (for health reasons!)

The preparation of such an appraisal should be developed in consultation with the City Council.

4.1.2 Will the design be assessed against an accredited scheme to assess the building's sustainability such as the BREEAM or Eco Homes standards (or equivalent)?

There are a range of tools available to help assess and demonstrate the sustainability of a development. One of the most widely used tools is BREEAM (Building Research Establishment Environmental Assessment Method). It is both an environmental assessment tool and an accreditation scheme.

The BRE's Envest software tool can help simplify the complex process of designing environmentally friendly buildings. Envest allows developers to identify those elements of a building with the greatest influence on the building's environmental impact. It also predicts the environmental impact of various strategies for heating, cooling and operating a building.

Also, BRE's "Green Guide to Specification", National Green Specification (NGS) for guidance on specifying materials etc.

4.1.3 How will the development use land effectively?

By using compact design and by creating high-density housing, a number of environmental and social benefits can be achieved. Greater concentrations of population helps support public transport and local services. However, there is a balance to be struck and the following factors should also be considered:

- The development must fit in with its surrounding buildings and townscape and views, and respect ecological features on site such as trees and areas of ecological significance
- The development must provide enough amenity for residents in terms of green space and also satisfy the need for peace and privacy
- The opportunities for Solar gain through viable combined Heat and Power and District Heating varies with housing density.
- Space should be allocated for recycling, storage of bulk items, bicycles and buggies, and food growing
- Water features and grey water recycling require space if they are to be incorporated
- See Sustainable Housing Design Guide for Scotland – freely available on the web – gives good guidance on this area.

4.1.4 How will the development use previously developed or derelict land?

Use of previously developed land helps create dense and vibrant mixed communities, preserve the city's shape, and character and reduce urban sprawl. Where possible, Dundee City Council wishes to see developments on reused land, and the potential for utilising brownfield sites should be considered at the start of the project design process. It should also be noted that where sites have been disused for some time they may have attained some ecological value and this should be assessed before development.

An environmental impact assessment should be carried out to identify any ground contamination and allow bioremediation.

4.1.5 How will the re-use or refurbishment of any buildings or structures on the site be incorporated into the design?

Given the large amount of energy used in the preparation and transport of construction materials, and in the construction process itself, it is usually a better environmental option to refurbish, reuse or redesign existing buildings rather than construct anew. As part of any initial site assessment the potential to use or refurbish existing structures should be considered (see SEDA guide “Design and Detailing for Deconstruction” for how to do this –freely downloadable on the web - see page 20).

4.1.6 How will any archaeological, historical or cultural remains, features or buildings on the site be safeguarded (with reference to any advice gained)?

Dundee has a rich and varied architectural heritage. From the ancient to the modern, the city has some exceptional buildings interspersed with communities of distinctive character. This heritage should be preserved for future generations. Where new buildings and communities are created, they should be sympathetic to their surroundings and add to the overall attractiveness of the city. The preservation and rehabilitation of any archaeological features can enhance the attractiveness and value of a development site.

4.1.7 How will the design of the development meet requirements to be fully accessible?

The Council's Equal Opportunities Policy should be recognised and addressed in all design considerations by carrying out sustainability and access audits at the design stage on all projects. Specific consideration in design should be given to people with disabilities to ensure barrier-free access to facilities.

Accessibility to Public Transport, Bike paths, Pedestrian Access, should be given careful consideration during the design process.

Objective 4.1: checklist

Pre-Inception

- Have you considered the option of adapting and rehabilitating existing buildings as opposed to new build?
- Have you considered the benefits of using a brownfield site over a Greenfield site?
- Have you considered how those using the development will have easy access to services and facilities?
- Have you considered the general infrastructure requirements that are necessary?

Feasibility

- Have you conducted a site appraisal and ecological assessment?
- If you are unsure about the ecological assessment have you spoken to the council's designated officer to obtain more information on the level and type of assessment needed?
- Have you developed detailed sustainable design objectives?
- Have you set a BREEAM performance standard, or equivalent, for the building?
- Have you considered the relative advantages of different built forms on the site in terms of comfort, energy use and compatibility with the surroundings?
- Have you ensured that the building complies with minimum Fire Safety and other Regulations?

Proposal

- Have you considered the benefits of more energy efficient housing types.
- Have you considered the possible future need for extensions and adaptations to the building?
- Have you included in the design space for waste storage and on – site recycling or storage?
- Have you considered Bicycle storage?

Design

- If you are building a narrow frontage, deep plan building, how have you compensated for the disadvantages of this built form, such as lack of light in some rooms?
- If you are building a wide frontage, shallow plan building, how have you compensated for the disadvantages of that from such as heat loss from north facing aspects?
- Have you specified native British species of shrubs and trees (preferably of local provenance) for landscaping?
- Is there a built-in safeguard regarding the incorporation of existing features such as mature trees, native hedges, tree lines, etc?

Further Information

- **BRE Sustainable Construction Unit (BRESCU)** provides a range of services to assist in sustainable design and construction
www.bre.co.uk/service.jsp?id=34
- **Construction Best Practice Programme** provides support to developers and others that are seeking to improve their performance
www.cbpp.org.uk

- **The Knowledge Exchange**
www.rethinkingconstruction.org.uk
- **Planning Green Paper**
www.planning.dtlr.gov.uk/consult/greenpap/index.htm
- BREEAM Office,
Centre for Sustainable Construction,
Watford, WD2 7JR
Tel 01923 664462
Fax 01923 664103
e-mail breem@bre.co.uk
- **Movement for Innovation** - environmental performance indicators for sustainable construction
www.m4i.org.uk/downloads/reports/m4i_epi_report2001.pdf.
- **Sustainable Housing Design Guide for Scotland** - free on line
<http://www.archive2.official-documents.co.uk/document/deps/cs/shdg/sitemap/>
- **Design and Detailing for Deconstruction (SEDA)** - free on line
<http://www.seda2.org/dfd/>
- **The Green Guide to Specification, 3rd Edition**
<http://www.bre.co.uk>
- **National Green Specification**
<http://www.greenspec.co.uk/>
- **Dundee City Council's Equal Opportunities Policy and Equality and Diversity Policy**
http://webstats/personnel/equal_ops/equalopps.htm#Introduction
<http://www.dundee.gov.uk/equanddiv/>

4.2 Quality design

Objective: contribute positively to a high quality environment.

Most new buildings have a design life of many decades. Decisions taken now will impact on communities for many years to come, and it is important for sustainable development that proper consideration is given to the durability, form and adaptability of any new structure, and its accessibility to all within the local community. By promoting good design using high quality materials that are compatible with the local built environment, developers can add value to homes and commercial developments. A good quality design can also significantly reduce the level of crime and the fear of crime, throughout the development.

The National Context

The Building Research Establishment (BRE) is assisting the construction industry in improving the quality of materials and in providing advice on whole life performance and environmental impact.

It is now accepted that the design and layout of buildings can have a significant impact on the level of crime. The police launched the 'Secured By Design' scheme to encourage developers to help prevent crime through the design, layout and construction of homes and commercial premises. The scheme offers both an award to developers who integrate crime prevention into new housing and commercial developments, and a list of approved products such as doors and windows.

Through the Disability Discrimination Act 1995 there is now a requirement that by 2004 all those providing goods, services and facilities will have to ensure that they have put facilities in place to allow disabled access. The Building Regulations also set in place requirements on developers to ensure access for disabled people. British Standard 8300 sets out more stringent accessibility standards and it is likely that this standard will be incorporated into the Building Regulations in the future. As access standards will continue to become more demanding, exceeding rather than merely meeting the existing regulations will reduce the risk of future costly adaptations, and is an important part of ensuring flexibility in the use of the building.

Dundee's Commitment to Action

- Dialogue with Tayside Police Crime Liaison Officer
- Disability Access Audits initiated by City Council's Access Officer

Key questions for quality design

4.2.1 How will the design of the development contribute to community safety?

In accordance with the Crime and Disorder Act of 1998, it is now the joint responsibility of the Local Authority and the Police to build community safety into all areas of service provision. Section 17 of this act states that this should be done 'by having due regard to the likely impact of crime and disorder due to their actions.' (See the Designing out Crime Protocol).

Recent research by the police indicates that residents of well designed developments are only half as likely to be burgled and two and a half times less likely to suffer from vehicle crime (Secured By Design). A number of simple design measures, most of which add little or nothing to developmental costs, can make a significant difference to public safety

- Mixed use developments ensure that some properties are occupied at all times of the day
- Better definition of the boundaries between public and private areas can deter criminals
- Adequate lighting of external passageways and car parks can increase the public's feeling of security and cut crime
- Sensible positioning of windows allows for supervision of car parks and communal areas
- Use of landscaping features such as thorny bushes on site boundaries and by walls can reduce crime and graffiti

Developers should consult the local police or Architectural Liaison Officer (ALO) who will be able to provide advice on these issues.

4.2.2 How has the design taken into account the current and potential future impacts of climate change?

Average temperatures are rising and the number of extremely warm days is increasing. Buildings should be designed to adapt to these changes with a greater emphasis being put on cooling and ventilation requirements (see Energy), utilising passive methods and the thermal properties of the building fabric as far as possible.

Changes in climate are also likely to result in people spending more time outside in public open spaces and green spaces. These need imaginative design to create interesting spaces with low water requirements and appropriate shade.

The increasing frequency of summer droughts will result in greater risks of subsidence and so attention needs to be given to assessing ground stability and the design of foundations.

4.2.3 How will the design of the development enhance and complement local character landscape and open spaces?

The choice of materials and other elements of design can have a significant effect on the attractiveness of a development to residents, workers and those using retail and other facilities. High quality and sustainable materials that are in keeping with the surrounding community should be used. The character, form and height of buildings should also be appropriate to the area. The use of local timber, aggregates, clay and other construction products will help the local economy and enhance local identity.

In larger developments, green or open spaces should be integrated into the design so as to avoid such provisions becoming ill-considered 'add-ons' at the end of the scheme. New development can encourage community interaction through provision of well-sited, well-designed green or open spaces that become focal points for informal socialising. Both green and open spaces should be overlooked particularly where they include play areas for children. Landscaped

areas should be designed to enhance biodiversity by specifying native species of trees and shrubs and by creating wild/undisturbed areas. Where appropriate landscaping should use material from the excavation and construction process on site (see Waste management).

Careful landscaping should be considered when designing 'wild/undisturbed areas', otherwise there could be a perception of untidiness - consider 'scalloping' wildflower grassland areas or delineating such areas with shrubs or varied-height tree canopy, mown pathways, SUDS, or tree lines.

Use local provenance plants (inc. grasses) and trees where appropriate. When considering fruit tree avenues or community orchards, use Scottish heritage varieties to increase cultural and genetic value as well as biodiversity value.

Objectives 4.2: checklist

Feasibility

- How have you considered the advantages of different built forms and building height in relation to the site and the surrounding area?
- Have you analysed the potential for the use of demolition and construction waste on site for landscaping purposes?
- Has an adequate site survey been carried out assessing features such as important views and vistas that need protection?
- Have you considered how to reduce the risk of crime through site layout and design features?
- Have you considered how to ensure ease of access to and through the site by all in the community?
- Have you considered the users of the scheme? For example, is an adequate amount of affordable housing included in a housing development?
- Has Section 17 of the Crime and Disorder Act been considered and included?

Proposal

- Have you considered the potential for future adaptations to the building?
- Have you assessed the relative benefits of different construction methods and the use of appropriate and low impact materials?
- How have you considered access to and through the site by elderly people, pushchair users, and disabled people?
- Have you taken the opportunity to enhance wildlife and landscape features on site?
- Consult with local police architectural liaison officer where doubts occur to ensure the design fulfils the requirements.

Design

- Have you selected materials with a long life and low maintenance requirements?
- Is the design simple? eg include a central vertical service duct to allow ease of access to building services.
- What design features have you incorporated to reduce the risk of crime?
- In relation to access requirements, have you met the standards specified by Dundee City Council and BS8300?

Further Information

- **BRE Green Guide to Specification**
www.bre.co.uk
- **DTI Sustainable Construction**
www.dti.gov.uk/construction/sustain/
- **Design Council**
www.designcouncil.org.uk
- **Royal Institute of British Architects**
www.architecture.com
- **Secured by Design**
www.securedbydesign.com
- **Commission for Architecture and the Built Environment**
www.cabe.org.uk
- **Housing Design Awards**
www.designforhomes.org
- **Crime and Disorder Act 1998**
www.homeoffice.gov.uk/cdact/

4.3 Energy

Objective: maximise sustainable energy supply and efficient use of energy

Dundee's buildings, in their construction and operation, account for around half the city's energy use. Through better design and operation, energy consumption could be dramatically cut, saving money and reducing emissions of greenhouse gases such as carbon dioxide (CO₂), the main cause of Climate Change. Reduction in the use of fossil fuels can also be aided by incorporating sustainable energy supply technologies such as Combined Heat and Power (CHP) and using renewable energy sources. By combining energy efficiency, passive solar design and sustainable energy supply it is now possible to design new developments with net zero carbon emissions.

Increasingly warmer summers in the next twenty years will affect our use of energy. This means we need a much greater emphasis on designs that keep buildings naturally cool in the summer and warm in the winter. Fuel poverty and the lack of access to affordable energy services to people on low incomes, is a problem for many residents of the city. Improving the availability of energy efficient affordable housing is a high priority of Dundee City Council.

The National and Regional Context

The UK Climate Change Programme recognises that buildings have to become more efficient in their use of energy and a greater proportion of our energy supply needs to come from sustainable sources. The UK is committed to increasing electricity generated from renewable energy sources by 10% and to generate 10,000MW of electricity from CHP by 2010.

In Scotland, the Executive has set a more ambitious target for the generation of electricity from renewable energy resources of 18% by 2010 and 40% by 2020. Further information is available in *Securing a Renewable Future: Scotland's Renewable Energy* (2003)

www.scotland.gov.uk/library5/environment/srfe-00.asp

EU Influences

The impetus towards improved sustainable development and use of renewable energy, is driven by numerous policies and a wealth of experience at the EU, national and regional levels.

One aspect of European legislation which will increase the need for developers to future-proof their buildings from a sustainable energy perspective is the EU Directive Energy Performance of Buildings

EU Directive Energy Performance of Buildings

The aim of the Directive is to promote building energy performance improvement within the European Union (rather than to set specific targets). The following are the key implications of the directive for Scotland.

Member States must use a methodology (e.g. SAP) to set their energy standards for buildings.

They must review their energy standards at least every five years.

New buildings over 1000m² floor area must have consideration given to the incorporation of low and zero carbon technologies (photovoltaic cladding, CHP, community heating, heat pumps, etc.)

Renovation/alteration of existing buildings over 1000m² floor area must have the energy performance upgraded.

Energy performance certificates must be made available when buildings are constructed, sold or rented out.

Energy performance certificates must be displayed in public buildings over 1000m² floor area.

Boilers need an inspection regime or their users need to be provided with information on boiler replacement.

Air conditioning systems need an inspection regime.

The directive will be implemented by the Scottish Building Standards Agency who will adjust the Building Regulations accordingly.

For further information see:

<http://www.sbsa.gov.uk>

Dundee Examples of Good Practice

Dundee City Council is a key partner in the Dundee Sun City initiative which aims to promote renewable energy and energy efficiency in all sectors across the city. It is also seeking to enable the development of a local installer and manufacturing base for renewable energy technologies. The City Council is leading by example in several projects:

- Morgan Academy - Geothermal Heat Pumps, Photovoltaic Panels, Energy Efficient Heating and Lighting; Sun Tubes
- Kirkton Housing - Solar Water heating
- Whitfield Demonstration Project - Geothermal, Photovoltaics, Solar, wind etc.

Housing associations in the city are also demonstrating the value of renewable energy in new build projects e.g. Abertay Housing Association's use of solar space heating in a social housing development in North Fintry, and the proposed use of gas CHP and solar water heating by Servite Housing Association in Kirkton.

- Michelin Factory - Installation of Wind Turbines to generate Electricity

The University of Dundee has installed a gas CHP plant with a generating capacity of 3MW and the University of Abertay Dundee is investigating the incorporation of renewable energy (solar and wind) as part of the refurbishment of the Kydd building.

Other projects are being developed with the support of Dundee Sun City and the Scottish Community and Householder Renewables Initiative.

Key questions for energy

Note that embodied energy i.e. the energy required to process and manufacture construction materials is covered under Materials in this section.

4.3.1 How will the design ensure the efficient use of energy?

From April 2005, stricter standards for energy conservation and carbon dioxide emissions have been introduced for new developments through Section 6 Energy of the Building (Scotland) Regulations 2004. For all types of buildings, insulation and efficiency standards far in excess of the Building Regulations can be achieved, leading to major cost savings over the lifetime of a building. High energy efficiency standards can be achieved through specifying measures such as:

- Super insulation of walls, roofs and floors
- Advanced glazing systems such as argon filled low-emission double glazing
- High-efficiency boilers (e.g. gas condensing boilers) with good heating controls
- High-efficiency luminaires and lighting controls
- In larger buildings - Building Energy Management Systems (BEMS) to control and optimise lighting, heating and ventilation
- Optimal use of *thermal mass* to control overheating in summer and provide extra warmth in the evenings

4.3.2 How will passive solar design principles be embraced in the development?

We have freely available to us the energy from the sun. Passive solar gains can provide significant contributions to space heating, lighting and ventilation in a building. Different approaches are needed depending on the size and use of buildings.

Useful solar gain in housing and smaller commercial buildings can be increased by measures such as:

- Siting of buildings to maximise access to solar gain and minimise overshadowing
- Orientating buildings so that the main elevation is facing within 30 degrees of due south
- Ensuring that the main living spaces are located on the southern facing sides of the building with bedrooms on the north
- Providing shelter from prevailing winds in the form of trees or landscaping (retention of existing trees, hedges and walls)
- Maximising the area of glazing on the south side of a building and minimising glazing on the north side. It is essential that any such design should incorporate means to regulate solar gain to prevent over-heating e.g. light shelves
- Incorporating heavy internal walls to store the heat from solar gain (thermal mass)

In large commercial offices as much as 40% of energy costs can be accounted for by lighting so good access to natural light should be a key design parameter. However excessive solar gain can add to the heat generated by lighting, equipment and people to cause overheating and increasing cooling demands. So design features to avoid excessive solar gain should be incorporated such as louvres, external blinds and large roof overhangs to provide shade in high summer sun but still allowing maximum daylight.

Passive solar design also includes the use of natural ventilation which can be achieved by fitting opening windows or vents in buildings, and on occasions using an atrium to create a rising 'heat stack'. This is a much more sustainable option than air conditioning systems, which are costly to install and run,

contribute climate change and have been linked to 'sick building syndrome'. However with increasing summer temperatures there may be a need for systems that supplement natural ventilation and cooling.

(see Planning for Passive Solar Design, BRESCU website)

4.3.3 How will the design incorporate the use of sustainable energy supplies?

By using energy from renewable sources such as wind, solar, hydro and biomass; and by increasing the efficiency of energy use through Combined Heat and Power (CHP) and District Heating (DH) systems major reductions in energy use and green house gas emissions can be achieved. Technologies can be incorporated into the design of new developments, such as:

- Solar water heaters can be placed on the roof
- Photovoltaic (PV) arrays can be incorporated into wall cladding, roof tiles or glazing to generate electricity
- CHP plant can provide both electricity and heat and can be fired by gas or renewable energy sources such as woodchip

In larger developments, installing a district heating or cooling network should be considered. These distribute heat or cooling from central plant (such as a CHP plant) across a neighbourhood (for more information contact the Community Energy programme). There may be potential to connect to an existing district heating or cooling network or to co-operate with neighbouring building developments. Cooling in commercial office building is already a significant energy requirement and is likely to grow with our changing climate.

4.3.4 Will any housing element of the development exceed a rating of 100 on the Building Research Establishment (BRE) SAP Rating?

The Standard Assessment Procedure (SAP) is the most widely used means of assessing the energy efficiency of domestic properties. SAP is measured on a scale of 1 to 120 that reflects the cost per sq metre of providing heating and domestic hot water in a dwelling; lower SAP ratings leading to greater expenditure on fuel and to lower levels of comfort and warmth in a dwelling. The factors that affect SAP rating include location and orientation, the size of the dwelling, fuel type and the hot water system used.

Designing to a high SAP rating ensures that even low-income householders can have affordable warmth. Being able to demonstrate low energy running costs is a good selling feature for private housing.

It should be noted that, while there is not a comparable system for non-domestic properties, BREEAM (BRE Environmental Assessment Method) allows for an overall environmental assessment of a building, including carbon dioxide emissions and lighting (see Land and buildings).

Bear in mind that SAP is currently under review in light of the pending EU Directive Energy Performance of Buildings. This is likely to have a significant impact on the importance of energy use in developments and it may be worth considering future-proofing developments.

Objective 4.3: checklist

Feasibility

- Have you considered the potential for using district heating or combined heat and power (CHP), including the potential to share such plant with others in the area?
- Have you assessed the energy running costs of the development against the costs of up-front investment in energy conservation?
- Have you considered linking the development to renewable energy supplies?

Proposal

- Have you assessed the proposed site, and considered how solar gain and shelter benefits could be maximised?
- Does the structure and form of the development enhance the potential for energy conservation?
- For housing developments, does the strategy provide affordable comfort conditions for occupiers?

Design

- Have you ensured that you have correctly sized heating and ventilation plant?
- Have you designed all installations so that they are easy to access and replace?
- Have you designed all installations so that they are easy to clean?
- Have your specifications ensured that energy use for lighting is minimised?
- Have you incorporated any renewable energy features in the design, or at least allowed for them to be introduced at a later stage?
- Have you adopted an Energy or Environmental Management System for the building?
- Have you optimised the positioning of heavy weight materials (thermal mass) for energy storage and overheating mitigation?
- Have you detailed adequately for airtightness? (see SEDA guide)
- Have you designed a means of checking internal air quality (Co2 levels)?

Further Information

- **Building Research Establishment** (incorporating BRESCU and BREEAM):
www.bre.co.uk
- **Energy Saving Trust (EST)**: The Trust offers advice on energy efficiency and conservation to home owners
www.est.org.uk
- **Scottish Community and Householder Renewables Initiative (SCHRI)** offers project development support and grants to non-profit distributing organisations, households and house builders to install renewable energy in buildings
www.est.org.uk/schri
- **The Carbon Trust** promotes low carbon energy saving for non-domestic uses in the private and public sector
www.thecarbontrust.co.uk
- **Scottish Energy Efficiency Office** energy and resource efficiency services for businesses in Scotland
<http://www.energy-efficiency.org>
- **ISO14000**: More information from the BSI:
www.bsi.org.uk
- **EMAS**:
www.emas.org.uk
- **Association for Environment Conscious Buildings (AECB)**
www.aecb.net
- **SAP 2005** – assessment methodology for the energy performance of domestic buildings.
<http://projects.bre.co.uk/sap2005/>
- **EU Directive Energy Performance of Buildings** – background information from the pan European perspective.
http://europa.eu.int/comm/energy/demand/legislation/buildings_en.htm
- **Community Energy Programme**: government grant scheme for the installation of district heating and CHP schemes in the UK
<http://www.est.org.uk/communityenergy/index.cfm>

4.4 Waste Management

Objective: minimise waste and maximise recycling both during construction and after occupation

The current amount of municipal solid waste, including domestic, produced in Dundee is about 100,000 tonnes each year. Analysis shows that 70-80% of collected household waste is recyclable or compostable, however 30% of this waste goes to landfill. Apart from squandering resources, landfill disposal creates a range of other environmental problems. Organic waste produces large amounts of methane (CH₄), a potent greenhouse gas that has 21 times the warming effect of carbon dioxide. Nationally, manufacture of construction materials generates an estimated 12 million tonnes of waste per annum, while an additional 30 million tonnes of excavated soil and clay arise from construction site preparation.

Building and demolition waste amounts to about 800,000 tonnes each year. Contracts managed by Dundee City Council result in all Building and Demolition waste being recycled, with no landfill. It is Dundee's aim to ensure Building and Demolition waste produced by all developments carried out in Dundee result in 100% being recycled and no landfill.

The National and Regional Context

Action is underway to reduce the proportion of waste going to Landfill. The European Community Directive 99/31 sets a target of reducing biodegradable municipal waste to landfill to 35% of 1995 levels by 2020. The National Waste Strategy for Scotland sets out the Government's vision for sustainable waste management, including a target for local authorities to recycle 25% of municipal waste by 2005 (three times the current amount), 30% by 2008 and 56% by 2020.

MPG6 outlines the Government's aim of replacing 20% of primary aggregate with reused or recycled waste material by 2006 and a whole range of recycled materials. The introduction of the Landfill Tax has created a significant financial incentive to reuse and recycle materials. It also makes recycled construction materials a more attractive financial option. The aggregate tax sends a similar message about reducing the unnecessary use of new minerals and supporting the re-use of construction and demolition materials.

On a construction site, as much as 20% of materials can be wasted. Burning surplus materials is common practice that is wasteful and causes pollution and smoke nuisance that can lead to prosecution. The government's strategy of more sustainable construction - 'Building a better quality life' - puts forward design for minimum waste as a key action for the construction industry.

Dundee's Commitment to Action

In order to increase the amount of municipal solid waste being recycled and composted within the Council's area, we plan on implementing the following proposal:

Green Waste Collection Scheme - Expand the existing kerbside collection services for green waste to cover a minimum of 23310 properties. This equates to 35% of all properties in the city, in line with our commitment in the Area Waste Plan. This scheme expansion will generate approximately 4000 additional tonnes of recycled green waste per annum by 2006.

Construction Sites

- Target to reduce site waste by 10% by end of 2006
- Target to increase recycling of site waste by 75% by end 2006

Key questions for waste management

4.4.1 How will the development provide space or facilities for the separate collection of all materials that can be recycled or re-used, or easy access to recycling facilities?

By creating space within the structure for the safe storage of waste for recycling, developers can make the option of recycling easier for residents and staff and assist the collection of material by waste contractors. For new developments:

- Space should be provided for storing recycling bins. This space should be sufficient to allow separate storage for paper, cans, organic waste, glass and plastics
- Where possible composting facilities should be provided. Compost provides a valuable and free nutrient source for food growing, whether on site or elsewhere
- Where composting is impractical, kitchen waste disposal units should be incorporated into the design
- Provide facilities for effective litter collection and cleansing.
- Arrangements for waste storage should not compromise the minimum standards in the Building Regulations.

Applicants for all significant developments should contact Dundee City Council to discuss provision for domestic waste storage, as in some instances it may be possible for a number of developments to share facilities or for new developments to use existing facilities adjacent to the site.

4.4.2 How will the development re-use demolition, construction or other reclaimed wastes on or close to the site and/or from elsewhere?

The redevelopment of brownfield sites usually leads to the production of quantities of demolition waste. In addition excavations for foundations and landscaping can result in the production of waste soils. These are potentially valuable materials. By reusing these materials developers can reduce their environmental impact and can also save on the now significant costs of landfill. Developers should:

- Audit the materials present on a site and assess the extent to which they could be put to use in the new development or in other developments elsewhere
- Identify any hazardous materials (e.g. asbestos) on site and arrange for containment and disposal by a licensed operator
- Where necessary, assess the potential for using reclaimed and recycled materials from elsewhere
- Consider the life span of all construction materials used, new and recycled, and the ease with which they could be disposed of or used again once the structure reaches the end of its life (see MATERIALS)
- (see SEDA guide on Design for Deconstruction on how to do this).

4.4.3 How will waste of new construction materials be minimised during construction?

The waste of materials during construction is a waste of money and adds to the burden of materials being disposed of to landfill. Waste of construction materials can be minimised by:

- Design that utilises whole units of construction materials
- Storage of materials on site that minimises losses to damage by damp and rain
- Separation of waste materials to facilitate recycling
- Designing materials to be mechanically fixed together rather than glued together (this facilitates re-use and recycling).

Objective 4.4: checklist

Feasibility

- Have you audited the site and assessed the extent to which any materials could be reused in the new construction project?
- Have you identified the extent to which recycled or re-used materials could be used in construction?
- How have you sought to minimise the amount of waste generated during construction. Have you considered outlets for unwanted or reusable materials that could be sent to reclamation businesses?

Proposal

- Does the design minimise the quantity of new materials wasted
- Have you considered using materials from the demolition of existing buildings on the site and using recycled materials?
- Does the proposal make the maximum use of space to avoid waste of valuable development land?
- Have you designed your building with a strategy for disassembly, to avoid creating waste in the future?

Design

- Have you selected recycled materials or salvaged components?
- Have you opted for materials with a long life span and low maintenance requirements?
- How have you made provision for storing and recycling waste materials for all users of the site? Is this space easily accessible?
- Have you made adequate provision for waste storage containers inside and outside the living space?
- Have you detailed your building for disassembly in the future, to avoid creating waste in the future?

Construction

- Have you set up weather-proof storage of materials?
- Have you set up facilities for the separation of waste materials for recycling?
- Have you arranged to return delivery and packaging materials such as pallets back to the suppliers?

Further Information

- **Construction Best Practice Programme** www.cbpp.org.uk
- **WRAP** - Government sponsored organisation creating markets for recycled products
www.wrap.org.uk/
- **Wastewatch** - National NGO providing information on waste and recycling
www.wastewatch.org.uk
- **Minimising and Recycling Construction Waste Guides.** www.rics.org

- **Smartwaste BRE** have developed the Smartwaste tool to assist companies to audit the waste produced on site, helping companies reduce environmental impact and save costs. The tool helps identify the current waste types and arisings, cost and disposal methods, helping companies to decide on the Best Practical Environmental Option (BPEO) for construction waste management for their site
www.smartwaste.co.uk

SEDA Design Guide No. 1 “Design and Detailing for Deconstruction”
www.seda2.org (under “New Guides”)

4.5 Water resources

Objective: conserve water resources and minimise vulnerability to flood risk

We use greater quantities of water than we ever have, placing great pressure on river ecosystems and groundwater supplies. The last decade has seen Scotland affected by drought and flooding with significant cost and discomfort to homeowners and businesses in affected areas. Simple design measures could conserve water resources, save money and reduce flood risk.

The National and Regional Context

The UK Climate Impacts Programme (UKCIP) has forecast that over this century global warming will lead to significant changes in rainfall distribution and intensity. Summer precipitation could fall by a fifth by the 2020s and over 50% by the 2080s (UKCIP 2002), increasing pressure on water supplies further. The Environment Agency is responsible for the national water resources strategy which is set out in Water Resources the Future Strategy (March 2001).

Drier summers will be accompanied by wetter winters, with rainfall in the Dundee area predicted to increase by up to a quarter by end of the century. This rain is expected to increasingly fall in heavy downpours, heightening the flood risk. Climate change is also predicted to raise sea levels.

Dundee’s Examples of Good Practice

- Waterless Urinals in Dundee City Council Offices and Olympia.
- Recycled Rainwater at Dundee International Sport Centre (DISC)
- Use of dual flush WC's
- Sensory Controls to Washhand Basin water and Flushing Urinal at Morgan Academy
- Use of SUDS on several Dundee projects.

Key questions for water quality

4.5.1 How will current or future risks of flooding be minimised?

Development and other land use changes have often heightened the risk of flooding through the creation of large areas of non-porous surfaces and drains which allow rapid flow of water off site. New developments, whether within flood plains or elsewhere, should aim to apply the Environment Agency Guidance on Sustainable Urban Drainage Systems (SUDS), which can slow run off and enhance water features and biodiversity on site. The principles of SUDS are that:

- The amount of non-porous hard surface should be minimised to enable water to filter through
- Landscaped areas should incorporate features such as swales (shallow, wide ditches) and filter strips. These help reduce peak flow run-off
- Existing water features on site, such as wetlands, should be protected and, where appropriate, new features created or restored. Wetlands again reduce the speed of water run-off
- Soakaways and other infiltration methods should be used where possible
- Where surface water cannot be absorbed on site, balancing ponds can help improve water quality and can also be developed as attractive features for wildlife
- Oil interceptors and silt traps should be installed where necessary to prevent pollution entering water courses
- The culverting and canalising of watercourses should be avoided as this can enhance the downstream flood risk and upstream if the culvert is undersize.
- Developers should also consider future risks of flooding (see Climate Change).

4.5.2 How will mains water be conserved and how will discharges of waste water into the main drainage system be minimised?

Water use per person has increased significantly over recent decades. The reasons for this include the greater use of water intensive white goods such as washing machines, the growth in the number of households and the increased watering of gardens and cars. The drawing of water from rivers and groundwater supplies puts great pressure on river and wetland ecosystems and can affect the water table. Houses in the UK use around 40% of all water consumed.

By incorporating water conservation measures into new and refurbished buildings, major savings in water use can be made, leaving businesses and home owners less vulnerable to possible future increases in water charges.

- Water butts or community storage facilities can be used to collect rainwater
- Buildings can be designed to allow recycling of 'grey' water for purposes such as flushing toilets and irrigation that do not require mains supplies
- Water efficient showers, toilets, taps and other appliances should be installed as standard
- The need for irrigation of any landscaped areas should be assessed and plants which require a large amount of water avoided

4.5.3 How will discharges of sewage and polluted water be minimised?

Sewage ('black water') treatment is expensive and an energy intensive process. Alternative, more natural treatment methods have been adopted in new developments across the country and been proven to be effective in treating waste. Developers should:

- Consider the potential of using reedbed sewage treatment or other black water recycling systems on site. Reedbeds can prove to be attractive landscape features although this can be issues of ownership and maintenance.
- In more urban/built up areas, or where there are major constraints on space, neighbourhood treatment can still be achieved through new technologies such as solar aquatic treatment

Objective 4.5: checklist

Feasibility

- Have you assessed the potential flood risk for the site, both now and in the light of predicted climate changes?
- Have you assessed the water features on and near the site and consider how these can be preserved and enhanced as part of the redevelopment?
- Have you considered the effect of the development on the quality and quantity of run-off from the site?
- Have you discussed storage requirements with the Environment Agency?

Proposal

- Have you considered the potential for treating waste-water on site and have you considered the potential to integrate reed-bed treatment into the landscaping of the site? This will also contribute to enhancing the Biodiversity value of the site.

- How do you propose to minimise the use of potable water supplies, for example through grey water collection or the use of water efficient appliances?
- Does the design incorporate facilities to collect and store grey water?
- How do you intend to protect and enhance water features on or near the development site?

Design

- Have you considered integration of rain/grey water collection for flushing toilets and irrigating landscape features?
- Do your plans for landscaping the site minimise the need for watering?
- Have you specified water efficient taps, WCs, showers and urinals?

Further Information

- **The Environment Agency - SUDS and Flood Risk Information**
www.environment-agency.gov.uk
- **CIRIA - Sustainable Urban Drainage Systems** www.ciria.org.uk/suds
- **PPG 25: Development and Flood Risk**
www.planning.dtlr.gov.uk/consult/revppg25
- **Water Resource Information Site**
www.water.org.uk
- **UK Climate Impacts Programme** offers information on the potential national and regional impacts of predicted climate change
www.ukcip.org.uk
- **Association of British Insurers**
www.abi.org.uk

4.6 Pollution

Objective: minimise polluting emissions to water, air and soil and minimise noise and light pollution

New development can enable polluted land to be restored but can also be a source of pollution both on and off site. The construction process can create noise, dust, water and air pollution, damaging the environment and causing nuisance to those living nearby. In 2000, the Environment Agency recorded 483 pollution incidents arising from construction activities, making the sector a major contributor to the overall total of pollution incidents. Noise pollution has a significant impact on quality of life in the UK, and the problem is getting worse.

Between 1984/5 and 1994/5 noise complaints to Local Authorities increased by 62%, with complaints about construction sites rising by 65%. Excessive construction noise can stem from equipment used on site, and also other factors such as vehicle movements. The manufacture and transport of construction materials releases about 10% of the UK's Carbon Dioxide (CO₂) emissions and also is responsible for significant release of volatile organic compounds (VOCs), methane (CH₄), oxides of nitrogen (NO_x) and sulphur dioxide (SO₂). All such impacts can be reduced significantly through good environmental practice.

The National and Regional Context

Reducing pollution is comprehensively addressed in the UK strategy for sustainable development - A better quality of life.

Prevention of pollution is highly regulated and is covered by a raft of both European Union and UK legislation. Some of the legislation that is relevant to development and construction includes:

- EU Contaminated Land Directive
- Noise Act 1996
- Circular 11/94 Environmental Protection Act 1990
- Water Resources Act 1991
- Integrated Pollution Prevention and Control (IPPC)
- Control of Pollution (Amendment) Act 1989
- Environment and Safety Information Act 1988

The Environment Agency also produce a range of Pollution Prevention Guidance Notes including some specific to construction guides. The full range of the 26 guides can be found on the Environment Agency Website.

Planning Policy Guidance: 23 Planning and Pollution Control provides good guidance on how to minimise pollution risks in new development.

Dundee's Example of Good Practice

- Introduction of an Annual Award Scheme in conjunction with Chartered Institute of Builders (CIOB) to recognise Contractors who implement good site management and respect for people.

Key questions for pollution

4.6.1 How will pollution of all kinds be minimised during construction?

It is in the interests of construction companies to minimise pollution as breaches of regulations can result in significant fines. In most cases complying with codes of practice and adopting best practice should minimise nuisance to neighbours

and safeguard the environment. The following are relevant sources of information:

- A model Code of Practice on Particulate Emissions has been produced by the BRE, to cut particulate emissions from construction activity and reduce its impact on human health and the local environment.
- The Environment Agency publishes Pollution Prevention Guidelines 6 - Working at Construction and Demolition Sites
- Control of pollution from construction sites - CIRIA
- Noise on construction sites is regulated by Local Authorities under the Control of Pollution Act (COPA) 1974
(See also WATER RESOURCES)

4.6.2 How will the development impact on external air quality?

The environmental impact of new developments can extend far beyond the site, most especially in relation to traffic movements and related air pollution. Transport impacts should be mitigated through the development of traffic reduction measures and the promotion of more sustainable modes of transport. This may be calculated using the 'Proximity Principle' in sourcing raw materials and waste disposal sites.

Non-transport air quality impacts can also be significant. Developers and operators need to assess the emissions that would result from heating cooling and ventilation plant. In particular they should specify heating plant with low nitrous oxide emissions.

4.6.3 How will noise pollution be minimised within the development and from external sources?

Transmission of noise can be a problem between dwellings such as flats and terraced housing. It can also be a problem in other building such as open plan offices. Ventilation and heating plant can also produce noise pollution particularly when located on roofs. Buildings located near to busy roads, railways or industrial sites may also suffer from high noise levels. Design of buildings can minimise these problems if attention is given to:

- Adequate sound insulation in floors and walls
- Sound insulation for plant rooms and plant housing
- Double glazing on all aspects exposed to high levels of noise
- Ventilation on aspects exposed to high levels of noise - natural ventilation by opening windows may not be a practical option

4.6.4 How will light pollution be minimised in and around the development?

Light pollution has emerged as a significant issue in populated areas. Light pollution obscures the night sky, is wasteful of energy and can also be disruptive to those living in and beside any new development. Public safety requires that highways and other public space are illuminated. However, by the use of directional lighting the light pollution can be reduced, as can energy costs.

Objective 4.6: checklist

Feasibility

- Have you considered the local environmental impact caused by the development, in terms of air, water, land and noise pollution?
- Have you surveyed the site for contamination?

Proposal

- Have you considered how to minimise exposure of the local community to external noise, air pollution, run off, traffic and wastes?
- Have you determined appropriate methods for remediation of contaminated land?
- Does the design minimise the nuisance from external noise on the inhabitants of the completed development?

Design

- Have you assessed the potential light pollution impact of the site and the potential to reduce this?
- Have you specified adequate sound insulation?
- Have you specified low toxicity paints, sprays etc?

Construction

- Are you complying with best practice in controlling pollution during construction?

Further Information

- **Environment Agency Contaminated Land site**
www.environment-agency.gov.uk/subjects/landquality
- **Environment Agency information on environmental regulation**
www.environment-agency.gov.uk/netregs/resources
- **National Society for Clean Air**
www.nasca.org.uk
- **Are you doing Your Bit?** Government campaign to promote individual environmental responsibility
www.doingyourbit.org.uk/yourbit/noise.html
- **European Noise Policy** europa.eu.int/comm/environment/noise
- **UK Quiet Pages**
www.quiet.org.uk

- **Building Research Establishment**
www.bre.co.uk
- **The Noise Net**
www.noisenet.org
- **Construction Industry Research and Information Association**
www.ciria.org.uk
- **Campaign for Dark Skies (Light Pollution Site)**
www.dark-skies.org

4.7 Materials

Objective: maximise use of materials from local and sustainable sources

The choice of construction materials has wide potential impacts in terms of transportation, pollution, and embodied carbon emissions, but sustainability can be greatly enhanced by careful specification. Reusing and recycling materials is often the most sustainable choice. Some plastics, paints, treatments and chemicals may contribute to health problems for those using the building (so-called 'sick building syndrome'), are energy intensive and can leave a toxic legacy that is expensive and difficult to dispose of. Materials that need the minimum of processing e.g. timber from sustainable sources are generally preferable to highly processed materials such as plastics. Use of locally sourced materials e.g. local stone, helps to maintain local character and reduce transport impacts. Longevity and low maintenance are highly desirable qualities. In all instances a balance needs to be drawn between factors, for example the use of aluminium might be justified on grounds of low maintenance, long life and recyclability even though it has high embodied energy. Construction in the UK uses 60 % of all softwood and 44% of hard wood timber, most of which is from unmanaged sources world-wide. Construction materials and energy use in buildings accounts for 50% of all energy consumption in the UK and account for 90% of mined aggregates.

The National and Regional Context

The Government is promoting the use of sustainable materials through its Strategy for more sustainable construction - Building a Better Quality of Life. It is promoting the Eco Management and Audit Scheme (EMAS) and ISO 14001 that for companies involved in development and construction would embrace the use of sustainable materials. The government also commissioned BRE to produce the Green Guide to Specification which provides a systematic assessment of the environmental impacts and benefits of all types of building elements.

In March 2001 the Prime Minister reiterated the UK commitment to require all timber supplied under government contracts to be from legal and sustainable sources.

Dundee's Commitment to Action

A timber and wood products policy was adopted by the City Council in April 2001 committing all departments to review their contracts and service specifications over a five year period to emphasise preferential use of timber. Contractors will also be informed of the preference for independently certified timber.

Key questions for the use of materials

4.7.1 How will the materials be specified to help maintain local character and ensure long life?

If it is decided that new build is required (see Land and buildings), the choice of locally sourced materials will contribute towards local character in keeping with the surrounding community. Traditional materials such as local stone, brick and wood (particularly hardwoods) are not only attractive but have proved more durable than many synthetic materials and have lower lifetime environmental costs. Longer-lasting materials can save on repair costs and reduce the long-term use of energy and resources but may be less 'green' than simpler materials. The impact of local air pollution on the weathering of materials should be taken into account particularly where developments are adjacent to busy roads. Consideration should be given to sulphate attack.

4.7.2 How will materials be specified to ensure low environmental impact and to maintain good internal air quality?

Current synthetic building materials create a range of environmental and health problems, from the impact of extraction and processing through to disposal. By opting for sustainable, natural and local materials, a healthier internal environment can be created in buildings while minimising environmental impact and supporting the local economy. Where possible, the aim should be to

- Use reclaimed materials, or if not, recycled materials (such as aggregates) for construction. This minimises energy use and the other environmental impacts linked to extraction and disposal. The best environmental option is to reuse materials already present on the development site.
- Use locally-sourced materials thereby reducing transport impacts and sustaining employment
- Where using locally sourced materials, do not automatically assume that they are better for the environment. Ensure that their extraction is not destroying an area important for nature conservation.
- Select materials which have low levels of energy in manufacture (embodied energy)
- e.g., use of lime mortars, where appropriate, should be considered and lichens, or re-used stone, where appropriate, should be safeguarded

- consider carefully how materials are joined together in construction and design for disassembly i.e., try to avoid products with an excessive amount of glued joints.

The U-value (or heat loss factor) is a measurement to express the heat loss factor of a material. The lower the U value, the less heat can be transmitted through the material. This should be considered and taken into account when selecting materials to be used in the construction.

Many chemicals used to treat and coat walls, as solvents and as insulation have been shown to cause health problems for staff and to provide disposal problems on demolition. Designers should specify materials with low toxicity and that are benign during use and on disposal. Natural, non-toxic and low VOC (volatile organic compounds) glues, solvents, treatments and coatings should be used wherever possible. Self-finishing materials such as mill-finished aluminium or untreated timber are generally easier to recycle than those with applied coatings.

4.7.3 How will PVC be avoided where an alternative is available?

PVC is a hazardous, non-biodegradable material that has also been linked to health problems in humans, both during use and on disposal through incineration or landfill. In almost every case PVC can now be replaced by more sustainable alternatives, and its use should be avoided, if at all possible.

4.8 Biodiversity

Objective: protect and enhance biodiversity.

4.8.1 How will the development have a positive ecological impact?

Developers should try to ensure that their proposals enhance the biodiversity of the site and surrounding area, by considering the issues raised by an ecological assessment and implementing positive action wherever possible.

4.8.2 What are the findings of an ecological assessment of the existing site and proposed development, including off-site impacts?

Preserving biodiversity is a significant component of sustainable development. Developers should ensure that distinctive ecological features are preserved and even enhanced as part of their proposals. An ecological survey of the site should be undertaken as part of an initial site assessment. This survey should examine both the ecology that exists on the site, and the potential to enhance and restore ecological features. The survey should consider:

- How damage to wildlife habitats during the construction process can be minimised
- How existing natural landscape features such as ponds, trees and hedges could be retained and integrated into the overall design

- The possibility of creating new wildlife features and habitats on the site or to substitute for losses on site.
- The linking of newly created habitats to existing habitats and wildlife networks where appropriate. This will improve resilience and allow migration of species in response to climate change. For example the planting of one or more local heritage fruit trees in each garden of a new housing development would create an orchard on a landscape scale, add perceived value to the development and create a wildlife corridor.
- The wider ecological impacts of the proposed development on surrounding areas and the global environment through specification of products and materials that are harmful in production or harvesting.
- The means by which existing protected wildlife habitats and species can be conserved and enhanced
- The use of native species, preferably of local provenance in landscaping. Where native species are not appropriate, non-native species of benefit to wildlife should be used
- The potential for roof gardens, living roofs and turf roofs and walls
- The use of peat free soil
- The involvement of local people/residents in maintaining any wildlife and landscape features
- The provision of community gardens, allotments, etc.
- Use any potential show house or industrial unit to promote wildlife-friendly planting, nest boxes and retained mature trees

Consideration may also be given to the type or wildlife present in the development area. For example, birds migrating to a certain location to nest and breed. In some cases, it may be possible to phase the development to cause minimum disruption to animals and cause least ecological damage.

Objective 4.8: checklist

Feasibility

- Have you analysed the potential for on-site re-use and recycling of demolition and construction waste?
- How have you sought to minimise the amount of waste generated during construction and decommissioning of the development?

Proposal

- Have you considered the relative benefits of different construction techniques and materials?
- Have you sought to minimise the quantities of new materials used?
- Have you considered the compatibility of the new building(s) and materials with the surrounding neighbourhood?
- Have you ensured that as far as possible all materials used are locally sourced?
- Have you sought local suppliers for materials produced in or near Dundee?
- Have the SAP and U-values of the building and material been considered?

Design

- Have you selected materials with low energy intensity (embodied energy)?
- As far as possible, have you opted for natural and non-toxic materials?
- Have you specified accredited timber and wood products for all appropriate purposes?
- Have you selected materials with a long life and low maintenance requirements?

Further Information for materials, consultancy and case studies

- To assist in this process, the Building Research Establishment (BRE) has developed an Environmental Profiles website which provides reliable and independent information about building materials and components. Another useful information source is Achieving Sustainability in Construction Procurement, produced by the Office of Government Commerce.
- **BRE Green Guide to Specification**
www.bre.co.uk
- **Timber Recycling Information Centre**
www.recycle-it.org
- **Construction Best Practice Programme**
www.cbpp.org.uk

- **Building for a Future** - regular magazine for the association for Environment Conscious Builders with search facility. AECB also offers lists of contractors www.aecb.net
- **CIRIA**
www.ciria.org.uk
- **Office of Government Commerce**
www.ogc.gov.uk
- **UK Timber Scoping Study for DEFRA**
www.forestforum.org.uk
- **Movement for Innovation**
www.m4i.org.uk
- **Forest Stewardship Council**
www.fsc-uk.demon.co.uk/index.html
- **Stroud - Green building shop**
www.greenshop.co.uk
- **Construction Resources**
www.constructionresources.com
- **New Builder Online**
www.newbuilder.co.uk
- **Worldwide Fund for Nature - newsletter**
www.wwf.co.uk
- **Friends of the Earth Good Wood Guide**
www.foe.co.uk
- **For advice on materials, methods and other issues:**
www.constructsustainably.com
- **Tayside Biodiversity Action Plan**
www.taysidebiodiversity.co.uk
- **UK Biodiversity Action Plan**
www.ukbap.org.uk
- **Business Environment Partnership**
www.thebep.org.uk

- **Business and Biodiversity**
www.businessandbiodiversity.org.uk

National Green Specification (Greenspec)

Section 5 – Conclusion

Dundee is working towards being among the most sustainable cities in the UK but the task is a large one and will require the co-operation of everyone to realise this ambition. We have a responsibility to ensure that vulnerable resources are conserved to ensure the long term viability of the city for future generations. The ideas and recommendations in this guide can make a significant contribution to moving to a more sustainable future, especially when combined with other initiatives within the city such as the Community Plan, and Dundee Sun City.

The three key issues for sustainable development are energy, waste and transport, and these are all significantly affected by new development. Half the energy used in Dundee is heating buildings; a substantial proportion of all waste generated is construction and demolition waste; and transport is the fastest growing source of carbon dioxide emissions. New developments which reduce and reuse waste, encourage sustainable transport and are designed to be low energy will make a real difference.

Please contact the Sustainable Construction Working Group with comments on this guide and suggestions for future editions - contact details below:

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