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Planning Guidelines

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Chapter 1

Introduction and Policy Context

1.1 Purpose and Status of Guidelines

These Guidelines offer advice to planning authorities on planning for wind energy through the development plan process and in determining applications for planning permission. The guidelines are also intended to ensure a consistency of approach throughout the country in the identification of suitable locations for wind energy development and the treatment of planning applications for wind energy developments. They should also be of assistance to developers and the wider public in considering wind energy development.

The Department originally issued guidelines in September 1996 to planning authorities on wind energy development. These guidelines supersede the 1996 guidelines and are one of a series of guidelines aimed at assisting planning authorities in the exercise of their functions.

The Minister of the Environment, Heritage and Local Government issues these guidelines under Section 28 of the Planning and Development Act, 2000, which requires both planning authorities and An Bord Pleanála to have regard to them in the performance of their functions. Planning authorities are also required under Section 28 to make copies of the guidelines available for inspection by members of the public. It should, however be noted that these guidelines relate solely to land use and environmental issues related to on-shore wind energy and do not deal with issues concerning purchasing agreements, matters relating to grid capacity or off-shore wind energy.

Offshore wind farms are excluded from the provisions of the Planning & Development Act 2000. They are, however, subject to the Foreshore Acts which are administered by the Minister for Communications Marine and Natural Resources. That Departments procedures can be seen in the booklet "Offshore Generating Stations

- Notes for Intending Developers which is available free from the Department or may be downloaded from the Department's website at: www.dcmnr.gov.ie.

1.2 Policy Context

The development of renewable energy sources, together with measures aimed at a reduction and more efficient use of energy, are priorities, nationally and at European level, on both environmental and energy policy grounds. The implementation of renewable energy policies must also have regard for the environment. Specifically, there is a legal requirement to integrate the conservation and sustainable use of biological diversity, manifest in Ireland's ratification of the Convention on Biological Diversity and the binding requirements of the EU Directives on Birds and Habitats, into all sectoral guidance, plans and policies.

The government has to date supported the development of renewable energy-based electricity generating plant including wind turbine generators, mainly through the administration of competitions under the Alternative Energy Requirement Programme, which gave wind energy companies a guaranteed market to sell power.

The need to fulfil Ireland's national and international commitments to renewable energy, and the acknowledged quality of the Irish wind energy resources is expected to lead to continued growth in wind energy developments. The Department of Communications, Marine and Natural Resources is currently undertaking a review of options for future renewable energy policy targets and programmes. The review will consider indicative increases in Ireland's green energy output between now and 2020.

1.2.1 The National Development Plan (2000-2006)

The National Development Plan provides support under the Economic and Social Infrastructure Operational Programme, for the promotion of alternative energy. In this regard, expansion of the use of renewable energy and promotion of the development of technology, which contributes to meeting our international climate change obligations, are prime objectives.

1.2.2 *Sustainable Development: A Strategy for Ireland (1997)*

The key sustainable energy policy is the reduction in and more efficient use of energy and also the greater use of renewable energy in order to significantly reduce environmental degradation and contribute to mitigating global problems such as climate change.

1.2.3. *EU White paper on Renewable Energy (1997)*

This paper identified a potential growth in the contribution of renewable energy to total energy supply from 14.3% to 23.5% by 2010. Consequently, Directive 2001/77/EC of September 2001 on the promotion of electricity from renewable sources in the internal electricity market[1] addresses an obligation on Member States to establish a programme to increase the gross consumption of renewable energy-based electricity generating plant ("green electricity"). The indicative target addressed to Ireland in the Directive is to increase green electricity from 3.6% of gross electricity consumption in 1997 to 13.2% by 2010.

1.2.4 *Green Paper on Sustainable Energy (1999)*

This paper set a target of increasing the percentage of electricity generated by renewable sources from 6.3% in 2000 to 12.39% in 2005, which will be achieved by the installation of an additional 500 MW from renewable energy sources by 2005, mainly from wind energy. Following on from the Green Paper, the main aim of the Strategy for Intensifying Wind Energy Deployment (July 2000) is to support the delivery of this 500 MW target of renewable energy-based electricity generating plant.

1.2.5 *The Electricity Regulation Act 1999*

The Electricity Regulation Act, 1999, provided for the commencing of the liberalisation of the electricity market to competition in line with the requirements of the EU electricity and Competition Directives.

1.2.6 *National Climate Change Strategy (2000)*

International action to address the global problem of climate change led to the adoption of the *1997 Kyoto Protocol to the United Nations*

1 The Renewable Energy Directive.

Framework Convention on Climate Change. The Government's *National Climate Change Strategy* sets out a ten year policy framework for achieving the necessary greenhouse gas reductions towards Ireland's compliance with its 13% limitation target on 1990 emissions, within the overall EU reduction target of 8%, by the first commitment period 2008-2012. In addition to taking action now to reach this first step target, further action will be required to meet deeper level commitments. The scientific consensus developed in the Intergovernmental Panel on Climate Change is that cuts in global emissions of 60-70% over the century are needed to stabilise greenhouse gas levels in the atmosphere at concentrations that prevent dangerous human-induced impacts on global climate systems.

1.2.7 Habitats & Birds Directives

The EU Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Flora and Fauna[2] requires Ireland to propose relevant areas for designation as Special Areas of Conservation for the conservation of listed habitats and species, and to maintain their favourable conservation status. The Habitats Directive was transposed into Irish law by The European Communities (Natural Habitats) Regulations, 1997 (S.I. 94 of 1997).

The EU Directive 79/409/EEC on the Conservation of Wild Birds[3], requires that special measures be taken to conserve the habitats of listed migratory and wetland species in order to ensure their survival and reproduction in their area of distribution. The most suitable areas for these species are classified as Special Protection Areas. Ireland is obliged to "take appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds". Only activities that do not have significant effects on birds are acceptable in Special Protection Areas. The Birds Directive also requires the avoidance of pollution or deterioration of habitats generally outside specifically protected sites. A listing of Special Areas of Conservation and Special Protection Area sites is available at www.heritagedata.ie.

2 The Habitats Directive

3 The Birds Directive

1.2.8 Convention on Biological Diversity and National Biodiversity Plan (2002)

The National Biodiversity Plan 2002 was prepared in response to Article 6 of the Convention on Biological Diversity. This plan "pays special attention to the need for the integration of the conservation and sustainable use of biological diversity into all relevant sectors. The full and effective integration of biodiversity concerns into the development and implementation of other policies legislation and programmes is of crucial importance if the conservation and sustainable use of biodiversity is to be achieved".

1.2.9 Making Ireland's Development Sustainable (2002)

Making Ireland's Development Sustainable was produced by the Department of the Environment, Heritage and Local Government for the Johannesburg World Summit on Sustainable Development held in 2002. The report examines progress made in the ten years since the Rio de Janeiro Earth Summit, assesses the challenge we now face, and sets out policies and actions to meet that challenge. It concludes that a high quality environment is essential for economic progress and for sustainable development generally.

Chapter 2

Technology and Wind Energy Development

2.1 Technology

Wind turbines are used to convert the wind's kinetic energy to electricity. Wind energy proposals may be for single turbines or for groupings of turbines (wind energy development). Planning authorities should be aware that wind turbine technology is continually changing.

A **wind turbine** will generally include the following elements(see diagram 2.2)

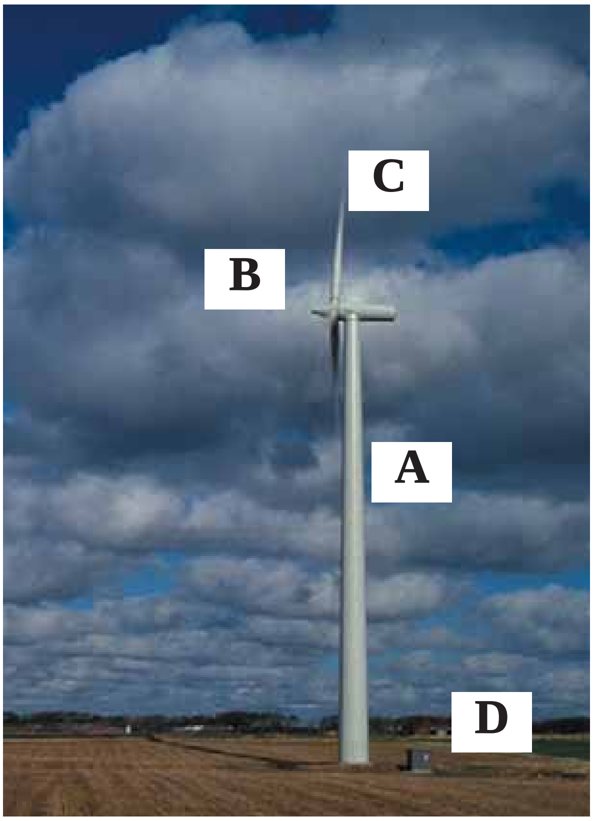

Fig 2.2

Tower: (A) Currently may vary in height from 35 metres upwards. Tubular steel towers typically have a base diameter of 3-7 metres and display a slight tapering to the nacelle. Larger towers may require a larger base diameter.

Nacelle: (B) This contains the key mechanical components of the wind turbine including the gearbox and generator. A yaw mechanism is employed to turn the nacelle so that the rotor blades face the prevailing wind.

Blades: (C) The blades, which capture and are set in motion by the wind, are most commonly made of glass reinforced plastic or wood epoxy but can be made of aluminium or steel. Modern turbines typically have three blades. These may vary in rotor diameter from 35 metres upwards.

Transformer: (D) This is a device for changing the voltage of the alternating current. Electricity is typically generated at less than 1000 volts by the wind turbine and the transformer "steps up" this voltage to match that of the national grid. This may be housed either inside or alongside the tower.

Concrete foundation bases: Turbines typically have bases of between 7 and 18 metres square and a hardstanding area at the base of each turbine.

A typical wind energy development may include the following elements:

Wind turbines	
Wind monitoring mast	
Transformers	Serving each turbine.
Internal tracks	Giving access to the turbines.
Substation compound	Including transformers, circuit breakers and control building
Power cables	Usually underground within the site.
Poles / pylons	Connecting wind energy development site to the national grid

2.2 Size and Scale of Wind Turbines and Wind Farms

Wind turbines can be deployed singly, in small groups or in larger numbers in wind energy developments. Various factors may influence the size of a wind energy development, including technical issues relating to the physical nature of the site, the wind resource and the capacity of the local transmission or distribution grid, as well as landscape and heritage considerations and development plan policies.

Chapter 3

Wind Energy and the Development Plan

3.1 Introduction

It is important that all development plans incorporate both a statement of the planning authority's policies and objectives in relation to wind energy development and matters it will take into account in assessing planning applications for specific wind energy development proposals.

The development plan must achieve a reasonable balance between responding to overall Government Policy on renewable energy and enabling the wind energy resources of the planning authority's area to be harnessed in a manner that is consistent with proper planning and sustainable development.

The assessment of individual wind energy development proposals needs to be conducted within the context of a "plan-led" approach. This involves identifying areas considered suitable or unsuitable for wind energy development. These areas should then be set out in the development plan in order to provide clarity for developers, the planning authority, and the public.

3.2 Relevant National and Regional Policy Documents

Important documents to be considered by planning authorities in the context of preparing and adopting strategic policies and objectives in relation to wind energy development in their development plans include all relevant Ministerial planning guidelines and guidance notes.

3.3 Consultation

Planning authorities are required to consult appropriate bodies to ensure that development plan policies have regard to relevant considerations, policies and views (Section 11(3)*(c) of Planning and Development Act, 2000).* In the context of wind energy development, this will include the Department of Communications, Marine and Natural Resources, the Department of Environment, Heritage and Local Government, in terms of the natural and built heritage, and electricity providers. In addition to the above, it is advisable to consult with Sustainable Energy Ireland, recreational and tourism bodies, and other heritage organisations as deemed appropriate.

3.4 Development Plan – Strategic Aims and Objectives

Following consideration of the strategic context in regional and national terms for wind energy development, and also after full consultation with the appropriate bodies, the development plan should set out the following policies and objectives:

- a positive and supportive statement of the importance of wind energy as a renewable energy source which can play a vital role in achieving national targets in relation to reductions in fossil fuel dependency and therefore greenhouse gas emissions, together with an objective to ensure the security of energy supply;
- objectives to secure the maximum potential from the wind energy resources of the planning authority's area commensurate with supporting development that is consistent with proper planning and sustainable development;
- the identification on development plan maps of the key areas within the planning authority's functional area where there is significant wind energy potential and where, subject to criteria such as design and landscape planning, natural heritage, environmental and amenity considerations, wind energy development will be acceptable in principle;
- the specific criteria for wind energy development that the planning authority will take into account when considering any wind energy or related[4] proposals in the key areas

[4] These may include energy networks and temporary wind anemometers that measure wind potential.

identified, based on the recommended siting and design criteria referred to in these guidelines. Wind energy project developers, the public and other interested parties require a clear framework to indicate where wind energy development should locate, and what factors will be taken into consideration in dealing with such proposals; and

- the investigation of the potential for relatively small-scale wind energy developments within urban and industrial areas, and for small community-based proposals outside the key areas that are identified as being appropriate for wind energy development. Community ownership of wind energy projects enables local communities to benefit directly from local wind energy resources being developed in their local areas, ensuring long-term income for rural communities.

3.5 Step-by-Step Guide to the Analysis of Suitable areas for Wind Energy by the Planning Authority

In order to assist planning authorities to identify, on development plan maps, key areas where there are good wind energy resources capable of exploitation in a manner consistent with proper planning and sustainable development, a step-by-step approach is proposed. This ordered approach involves a sieve mapping analysis of the key environmental, landscape, technical and economic criteria which must be balanced in order to identify the most suitable location for wind energy development. In carrying out this exercise, it is advised to consult with neighbouring planning authorities to ensure a consistent approach across county boundaries. The methodology for this approach is outlined in the following paragraphs.

Step 1

Assess the areas of wind potential ranging from areas with extensive wind energy resources to lesser wind resources using Sustainable Energy Ireland's *Wind Atlas for Ireland*. The *Wind Atlas* for Ireland displays wind speeds at 50 metres, 75 metres and 100 metres above ground level. The three heights represent the hub heights of current and near-future wind turbine technology. Assistance in this regard can be obtained from Sustainable Energy Ireland's Renewable Energy Information Office in Cork (tel: 023-42193, e-mail: renewables@reio.ie).

Step 2

Prepare or utilise an evaluation of the landscape and its sensitivity for wind energy developments. Factors that can inform landscape sensitivity to wind energy development, include scenic quality, rarity, uniqueness and natural and cultural heritage considerations. (Some local authorities have prepared landscape characterisation maps, which could support this process). A methodology for landscape sensitivity mapping is outlined at Appendix 1.

Step 3

Prepare an overlay of the landscape evaluation and sensitivity analysis, and sensitivity and wind energy mapping, together with information regarding built and natural heritage, archaeological and amenity designations in the Development Plan. This will identify those areas affected by statutory obligations and will facilitate optimising visual integration into the landscape while at the same time maximising the utilisation of wind energy resources. The process of overlaying wind energy mapping and landscape assessment with the development plan designations will produce a basis for identifying broadly, the areas where wind energy developments would be 'acceptable in principle', where they would be 'open for consideration', and where they would be 'not normally permissible'.

Step 4

Integrate the areas identified in step 3 with information regarding accessibility to electricity transmission and distribution grids. Details of the electricity transmission and distribution network are provided in Sustainable Energy Ireland's *Wind Atlas for Ireland.* In addition, transmission network details are updated on a yearly basis in the Transmission System Operator's Forecast Statement, available on the internet at www.eirgrid.com. If further network information is required, it is recommended that the planning authority consult with the Transmission System Operator (National Grid) or the Distribution System Operator (ESB Network) as appropriate.

This process will establish, at a general level, areas where wind energy resources are readily capable of development as well as identifying other areas where wind energy resources are capable of being developed but where there is a need for corresponding development of electricity grid infrastructure.

Regional Planning Guidelines

Many Regional Planning Guidelines propose coordination between planning authorities in relation to the development of renewable energy. The sieve analysis approach outlined above would assist regional authorities in developing a common framework within and between regions for the development of wind energy.

3.6 Geographical Information Systems (GIS) and Wind Energy Development

There are particular benefits for planning authorities in using specialised Geographical Information Systems in wind energy-related issues. There are three main areas, in particular, in which planning authorities are encouraged to develop Geographical Information Systems expertise, viz.:

3.6.1 Identification of Areas

Geographical Information Systems can form an integral part of policy formulation. It is particularly useful when identifying the suitability of areas for the deployment of wind energy, given the amount of information and considerations involved in such an analysis. Many of the datasets required in an area-based analysis, such as wind speed information and nature and heritage designations, are now readily available in Geographical Information Systems format.

3.6.2 Assessment of Wind Energy Proposals

Planning authorities, where possible, should utilise Geographical Information Systems software for in-house assessment and verification of wind energy proposals. The basic models used to assess wind energy development proposals, such as Zones of

Visual Influence and Zones of Theoretical Visibility[5] calculations, are now an increasingly standard feature of much Geographical Information Systems software, while integrated links to programmes producing wireframes and photomontages are commonplace. Due to the choice and availability of such proprietary software, these can now be obtained relatively easily and in a cost effective manner.

3.6.3 Monitoring of Wind Energy Development

Planning authorities, where possible, should set up systems, incorporating a Geographical Information Systems component, to monitor wind energy development (including planning application decisions). This can help review the degree to which the policies and objectives of the development plan are being achieved.

3.7 Natural and Built Heritage and Wind Energy Development

The designation of an area for protection of natural or built heritage or as an amenity area does not automatically preclude wind energy development. However, consideration of any wind energy development in or near these areas must be subject to Ireland's obligations under the Habitats Directive (92/43/EEC), the EU (Birds) Directive (79/409/EEC) and the Environmental Impact Assessment Directive. Clear guidance on policy and objectives should be available in development plans on the natural and built heritage, and the information contained therein on location and status should be accurate and up-to-date.

3.8 Amenity Designations

The visibility of a proposed wind energy development from designated views or prospects would not automatically preclude

5 It is felt that the title "Zone of Theoretical Visibility" is a more accurate description than "Zone of Visual Influence" – the maps produced are *theoretical* because they estimate exposure of turbines based upon landform data only and take no account whatsoever of intermittent screening by vegetation or structures. Furthermore, the maps estimate *visibility* of the turbines in the surrounding landscape and not their "visual influence".

an area from future wind energy development but the inclusion of such objectives in a development plan is a material factor that will be taken into consideration in the assessment of a planning application. Accordingly, such objectives should be up-to-date and accurate, and reflect the current situation on the ground.

3.9 Tourism and Recreation

The effect of wind energy development on tourism and recreational activities must be assessed. In this regard, it is desirable that the relevant regional tourist authority should be consulted. In many areas in Ireland, tourism and recreation underpin the local economy and can depend to varying degrees on the quality of the environment. Wind energy developments are not incompatible with tourism and leisure interests, but care needs to be taken to ensure that insensitively sited wind energy developments do not impact negatively on tourism potential. The results of survey work indicate that tourism and wind energy can co-exist happily[6].

The educational potential of wind energy developments should also be considered. For example, there may be scope for interpretive centres on alternative energy resources to be located at accessible locations in proximity to some wind energy developments. It would be helpful if established long distance walking routes / amenity rights-of-way were identified and mapped in the Development Plan. This would enable an assessment both of the extent to which recreational pursuits can be accommodated and facilitated either within or adjacent to wind energy developments.

6 Attitudes Towards the Development of Wind Farms in Ireland - Sustainable Energy Ireland, 2003.

Chapter 4

Planning Applications and Environmental Impact Assessment

The purpose of this Chapter is to advise planning authorities on issues that will arise both before and during the planning process. It includes guidance on pre-planning consultations, grid connections, public consultation, and the requirements in relation to environmental impact statements.

4.1 Pre-Application Consultation[7]

The primary purpose of consultation is to improve the quality of a subsequent application, to avoid the necessity for seeking additional information and in some cases to spare the costs of what is likely to prove an unsuccessful application.

Consultation can be of value in:

- highlighting development plan objectives on wind energy as referred to in Chapter 3, and
- suggesting need for specialist input as referred to in Chapters 5 and 6.

It would be helpful if planning authorities maintained an up to date database for all granted and "built" wind energy developments including transboundary information where applicable.

To ensure that pre-application consultation is as productive as possible a developer may be invited to submit a minimum level of documentation in advance of the meeting. This might include site location maps, initial description of the development including

[7] Section 247 of the Planning and Development Act, 2000, provides that a person who has interest in land and who intends to make a planning application may enter into consultations with the planning authority in order to discuss any proposed development in relation to the land. A person with no such interest has no statutory entitlement.

any initial economic or market factors, sample zones of theoretical visibility, etc.

It is strongly recommended that the planning authority consult with the Development Applications Unit of Department of the Environment, Heritage and Local Government at the earliest planning and design stages in relation to wind energy developments that may have a potential impact on the built and natural heritage. Good research and wide consultation by all parties at the site selection stage can avoid unnecessary time delays and expense in considering unsuitable sites.

4.2 Wind Measuring Masts

Planning applications for wind anemometers and measuring masts are generally sought for a limited period only. Permissions should be granted for approximately a two-year period, in consultation with the developer, to allow a wind resource analysis to be carried out. It would be inadvisable for the planning authority to grant planning permission for a wind measuring mast in an area where there is a presumption against wind energy development in the development plan. In a case where a developer wishes to extend the period of the permission an application must be made to the planning authority to retain the wind measuring mast; otherwise the developer should be required to remove it.

4.3 Access to the Electricity Grid

In addition to consultation with planning authorities and statutory bodies, wind energy developers should consult with the relevant electricity transmission or distribution grid operators who have responsibility for access to the local grid system in relation to the nature and location of proposed grid connections.

Where the works required to connect the wind energy development to the local electricity transmission / distribution network are not exempt, it will be necessary to submit a planning application to the planning authority. Best practice would suggest that an integrated planning application that combines grid interconnection information together with details of the wind energy development should be submitted to the planning authority. However, if this is not possible, then the planning authority should agree in advance with the developer the information on the grid connection that they consider necessary to enable them to fully assess a planning application for the wind energy project, and which the developer is in a position to furnish.

Details of indicative and feasible options for grid interconnection lines and facilities should in general be adequate for a planning authority to consider a wind energy application as the precise capacity required for connection will not be known until planning permission is obtained. Suggested content for these indicative and feasible options include (a) the general direction of connection, (b) connecting line capacity (e.g. 38 kV, 110 kV) and (c) line supporting structure (e.g. single pole, twin pole, lattice tower).

The planning authority should note that it may not be possible, due to reasons outside the applicant's control, to provide information on indicative grid connections at the pre-planning consultation or planning application stage of the wind energy development.

It is therefore inappropriate for the planning authority or An Bord Pleanála on appeal to attach conditions to planning permissions for wind energy developments in regard to the location of the connection to the grid. In these instances, a separate application for the grid connection will be necessary.

However, where such information is available and is submitted as part of a planning application, it would be appropriate, if considered necessary, to attached conditions in regard to the grid connection.

In order to minimize project development risks and to ensure appropriate grid infrastructure which takes account of potential impact on the built or natural heritage, wind energy developers and electricity companies should consult with the planning authority and with the Development Applications Unit of the Department of Environment, Heritage and Local Government in regard to the submission of a separate application for a grid connection.

Typical Medium Voltage (10kV or 20kV) line. Wayleave clearance required but not planning permission, except in particular circumstances.

Typical (38kV) line. Requires wayleave and planning permission.

4.4 Public Consultation with the Local Community

Planning authorities should encourage developers to engage in public consultation with the local community. While it is not a mandatory requirement, it is strongly recommended that the developer of a wind energy project should engage in active consultation and dialogue with the local community at an early stage in the planning process, ideally prior to submitting a planning application.

The developer should work with the local community on the format of any future consultation to allow for the free flow of information between the community and the wind energy developer at all stages in the project. Consultation should be meaningful and should give the local community an opportunity to comment upon and to have an input into the planning and design of the scheme. It may be helpful to put formal procedures in place to deal with queries and complaints from the general public.

In accordance with best practice the developer should appoint an individual to be accessible to the local community from the construction to the commission stages to allow for dialogue and communication and to keep the public informed about the progress of the project. A lo-call number for further contact thereafter may also be appropriate. It may also be worth considering providing an opportunity for residents of areas in which it is proposed to develop a wind energy project to invest in the scheme, particularly where an interest in investing has been expressed by the local community. Best practice guidance on the pre-application public consultation is contained in Appendix 2.

4.5 General Considerations in the Assessment of Wind Energy Planning Applications

Planning authorities should have regard to national policy regarding the development of alternative and indigenous energy sources and the minimisation of emissions of greenhouse gasses in considering a planning application for wind energy development.

In addition, in order to assess fully the impact of a wind energy development a planning authority may need information on some if not all of the following matters:

- Ground conditions, including peat stability;
- Site drainage and hydrological effects, such as water supply and quality and watercourse crossings;
- Size, scale and layout and the degree to which the wind energy project is visible over certain areas;
- Potential impact of the project on natural heritage, to include direct and indirect effects on protected sites, on habitats of ecological sensitivity and biodiversity value and ,where necessary, management plans to deal with the satisfactory co-existence of the wind energy development and the particular species / habitat identified;
- Potential impact of the project on the built heritage including archaeological heritage;
- Landscape issues;
- Visual impact of ancillary development, such as access roads;

- Local environmental impacts including noise, shadow flicker, electromagnetic interference, etc;
- Adequacy of local access road network to facilitate construction of the project and transportation of large machinery and turbine parts to site;
- Information on any cumulative effects due to other projects, including effects on natural heritage and visual effects;
- Information on the location of quarries to be used or borrow pits proposed during the construction phase and associated remedial works thereafter;
- Disposal or elimination of waste / surplus material from construction / site clearance, particularly significant for peatland sites; and
- Decommissioning considerations.

4.6 Need for an Environmental Impact Assessment

An Environmental Impact Assessment is mandatory for wind energy developments that exceed the following thresholds:

- have more than five turbines, or
- will have a total output greater than 5 megawatts.

In these circumstances, an Environmental Impact Statement must be submitted with the relevant planning application (Section 176 of the Planning and Development Act 2000, and Article 93 and Schedule 5, of the Planning and Development Regulations, 2001). Certain sub-threshold developments also require an Environmental Impact Assessment.

The information gathered during the Environmental Impact Assessment process should be used to guide the planning and design of the wind energy development so that sensitive ecological or hydrological areas are avoided, and any negative impacts are minimised insofar as is possible.

Avoidance or reduction of negative impacts on the environment and the consideration of alternatives are fundamental components of Environmental Impact Assessment, both in terms of legal requirements and best practice. In designing wind energy projects, there is huge potential to avoid or reduce negative environmental impacts, owing to the small size of the actual development footprint.

4.7 Sub-EIA Threshold Developments

An Environmental Impact Assessment shall be carried out for wind energy developments below the above mandatory limits if the planning authority (or An Bord Pleanála on appeal) considers that the development would be likely to have significant effects on the environment, by reference to the significant criteria in Annex III of the Environmental Impact Assessment Directive as transposed in Schedule 7 of the Planning and Development Regulations, 2001. Regard should also be had to the guidance contained in Environmental Impact Assessment (EIA) Guidance for Consent Authorities regarding Sub-threshold Development, issued by the Department in August 2003.

Chapter 5

Environmental Implications

5.1 Introduction

Wind energy development, like all development, has the potential to impact on the natural and built environment. There is huge potential to avoid or reduce negative environmental impacts in designing wind energy projects, owing to the small size of the actual development footprint.

The relevant Local Authority Development Plan(s) should be consulted in relation to the natural, built and geological heritage, particularly those areas statutorily designated or protected. In addition, the Development Applications Unit of the Department of the Environment, Heritage and Local Government is available for consultation with regard to built and natural heritage aspects of proposed wind energy development, whether at pre-planning or planning application stage.

The potential impacts on environmental heritage will be dealt with in the following paragraphs.

5.2 Natural Heritage

Natural heritage refers to habitats and species of flora and fauna. These natural heritage features may be located within sites that have been designated as Special Protection Areas, Special Areas of Conservation, candidate Special Areas of Conservation, Natural Heritage Areas, proposed Natural Heritage Areas, Nature Reserves, Refuges for Flora and Fauna and as National Parks.[8] Natural heritage sensitivities identified to date relate to impacts on certain habitats, such as peatlands, certain species, particularly birds, and

8 Natural Heritage Areas and proposed Natural Heritage Areas, Nature Reserves and Refuges for Flora and Fauna protect nationally and regionally important habitats, species and geological features. Special Protection Areas and candidate Special Areas of Conservation and Special Areas of Conservation are of international importance, constituting the EU's Natura 2000 Network of protected sites for habitats and species.

the integrity of sites designated for the purpose of their protection (conservation).

Natural heritage may be impacted by wind energy developments both during the construction and operational phases. These impacts may be either temporary or permanent.

Planning authorities should have full regard to biodiversity considerations in determining applications for wind energy developments. All aspects of the proposal that could, in themselves, or in combination with other proposals, affect the areas' conservation objectives should be identified.

Planning authorities must ensure that a proposal which is likely to have a significant effect on an SAC or other designated area, is authorised only to the extent that the planning authority is satisfied will not adversely affect the integrity of the area. If necessary, they can seek changes to the development proposed or attach appropriate planning conditions.

In coming to a decision, planning authorities should also consider the importance of the development of wind energy projects, including those proposed on designated sites, in view of their strategic importance in contributing significantly to the achievement of targets set out in the National Climate Change Strategy by decreasing dependence on fossil fuels, with subsequent reductions in greenhouse gas emissions.

In circumstances where a wind energy project is likely to have an adverse effect on the integrity of a site of international importance for nature conservation (e.g., an SAC or SPA), planning permission should only be granted where there is no alternative solution and where there are imperative reasons of overriding public interest, including those of a social or economic nature. Mitigation measures to negate the negative impacts will have to be considered, or the provision of compensatory sites.

5.2.1 Habitats

Habitats that may be impacted by wind energy developments include peatlands (mainly blanket bog, heaths, flushes and various other wetland habitats including water courses and lakes), sand dune systems, including machair, semi-natural grasslands and woodlands. All are vulnerable, but those located in the uplands are particularly so owing to their location in high rainfall areas and where the growing season is short.

The main potential impacts on habitats that can result in the reduction, or loss, of biodiversity are:

- Direct loss of habitat to the developments' infrastructure, including turbine foundations, buildings, roads, quarries and borrow pits;
- Degradation of habitats through alteration or disturbance, in particular arising from changes to hydrology that may alter the surface or groundwater flows and levels, and drainage patterns critical in peatlands and river headwaters;
- Fragmentation of habitats and increased edge effects; and
- Degradation and loss of habitats outside the development site, especially wetland habitats that may arise from pollution, siltation and erosion originating from within the development site.

5.2.2 Species

Birds

The extent to which birds will be impacted by wind energy developments will vary depending on species, season and location, and these impacts may be temporary or permanent.

Those species groups considered to be most at risk are raptors, Swans, Geese, Divers, breeding waders and concentrations of waterfowl. Potential impacts on migratory birds and local bird movements between breeding, feeding and roosting areas require careful consideration.

The main potential impacts to birds from wind energy developments have been identified as:

- Disturbance during the construction and operational phases leading to the temporary or permanent displacement of birds from the development site and its environs;
- Collision mortality, although studies have shown this to be low risk;
- Barrier to movement, although studies have indicated that the response by birds to wind energy development may be variable and related to species and / or season; and
- Direct loss or degradation of habitats for breeding, feeding and / or roosting purposes, particularly in wetland sites.

Other Species
The potential impact on other rare flora, mammals, birds, and amphibians and fish including those listed for protection in the Flora (Protection Order), 1999, would also need to be assessed.

5.3 Ground Conditions/Geology

In assessing wind energy developments, the underlying geology is a critical factor. Information on the following issues must be submitted as part of a planning application to enable the planning authority to adequately assess the impact of the proposed wind energy development and any mitigating measures proposed to counter the impacts:

- A geological assessment of the locality;
- A geotechnical assessment of the overburden and bedrock;
- A landslide and slope stability risk assessment for the site for all stages of the project, with proposed mitigation measures where appropriate (this should also consider the possible effects of storage of excavated material);

- An assessment of whether the development could create a bog burst or landslide hazard;

- Location of the site in relation to any area or site that has been identified by the Geological Survey of Ireland as a geological Natural Heritage Area, a proposed Natural Heritage Area or as a County Geological Site. (If so, are there any impacts discussed, or mitigation measures proposed);

- Location of the site in relation to areas of significant mineral or aggregate potential;

- An assessment of any potential impacts of the development on groundwater, and

- Details of any borrow-pits proposed on site should be shown on the planning application and details given where blasting is proposed, such as on the avoidance and remediation of land slippage.

Provision must be made for carrying out site-specific geo-technical investigations in order to identify the optimum location for each turbine. These investigations may suggest minor adjustments to turbine location. In order to accommodate this practice there should be a degree of flexibility built into the planning permission and EIS. The extent of flexibility will be site specific but should not generally extend beyond 20 metres. Any further changes in location beyond the agreed limits would require planning permission.

In order to ensure that the above issues have been fully addressed, a developer should consult with the Geological Survey of Ireland and obtain professional advice / source reports from suitably qualified geotechnical engineers, engineering geologists or geologists as appropriate. If upland sites are proposed, the application should be accompanied by a statement from a geologist, a hydro-geologist or an engineer with expertise in soil mechanics.

5.4 Archaeology

The potential impact of the proposed wind energy development on the archaeological heritage of the site should be assessed. The assessment should address direct impacts on the integrity and visual amenity of monuments and include appropriate mitigation measures, such as through a desktop study and a field inspection where necessary.

5.5 Architectural Heritage

The planning authority should assess the potential impact of the proposed wind energy development on the architectural heritage of the locality and its landscape context, where relevant. This is particularly necessary in the case of structures included in the Register of Protected Structures.

5.6 Noise

There are two distinct noise sources associated with the operation of wind turbines; aerodynamic noise caused by blades passing through the air, and mechanical noise created by the operation of mechanical elements in the nacelle - the generator, gearbox and other parts of the drive-train. Aerodynamic noise is a function of many interacting factors including blade design, rotational speed, wind speed and inflow turbulence; it is generally broadband in nature and can display some “character” (swish). Mechanical noise from a wind turbine is tonal in nature.

Advances in turbine technology and design have resulted in reduced noise emissions. Aerodynamic refinements that have combined to make turbines quieter include the change from lattice to tubular towers, the use of variable speed operations, and the switch to 3 blade turbine designs. Improvements in gearbox design and the use of anti-vibration techniques in the past ten years have resulted in significant reductions in mechanical noise. The most recent direct drive machines have no high-speed mechanical components and therefore do not produce mechanical noise.

Turbine noise increases as wind speeds increase, but at a slower rate than wind generated background noise increases. The impact of wind energy development noise is therefore likely to be greater at low wind speeds when the difference between noise of the wind energy development and the background noise is likely to be greater. Wind turbines do not operate below the wind speed referred to as cut-in speed, usually around 5 metres per second. Larger and variable speed wind turbines emit lower noise levels at cut-in speed than smaller fixed speed turbines. Noise from wind turbines is radiated more in some directions than others, with areas down-wind experiencing the highest predicted noise levels. At higher wind speeds noise from wind has the effect of largely masking wind turbine noise.

Good acoustical design and carefully considered siting of turbines is essential to ensure that there is no significant increase in ambient noise levels at any nearby noise sensitive locations. Sound output from modern wind turbines can be regulated, thus mitigating noise problems, albeit with some loss of power.

An appropriate balance must be achieved between power generation and noise impact.

Noise impact should be assessed by reference to the nature and character of noise sensitive locations. In the case of wind energy development, a noise sensitive location includes any occupied dwelling house, hostel, health building or place of worship and may include areas of particular scenic quality or special recreational amenity importance. Noise limits should apply only to those areas frequently used for relaxation or activities for which a quiet environment is highly desirable. Noise limits should be applied to external locations, and should reflect the variation in both turbine source noise and background noise with wind speed. The descriptor[9], which allows reliable measurements to be made without corruption from relatively loud transitory noise events from other

9 LA90, 10mm

sources, should be used for assessing both the wind energy development noise and background noise. Any existing turbines should not be considered as part of the prevailing background noise.

In general, a lower fixed limit of 45 dB(A)[10] or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours. However, in very quiet areas, the use of a margin of 5dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of the LA90, 10min of the wind energy development noise be limited to an absolute level within the range of 35-40 dB(A).

Separate noise limits should apply for day-time and for night-time. During the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance. A fixed limit of 43dB(A) will protect sleep inside properties during the night.

In general, noise is unlikely to be a significant problem where the distance from the nearest turbine to any noise sensitive property is more than 500 metres. Planning authorities may seek evidence that the type(s) of turbines proposed will use best current engineering practice in terms of noise creation and suppression.

10 An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20Hz-20 kHz) with A- frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies. The decibel scale is logarithmic. A 10 dB(A) increase in sound level represents a doubling of loudness. A change of 3 dB(A) is the minimum perceptible under normal circumstances.

5.7 Safety Aspects

There are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations. People or animals can safely walk up to the base of the turbines.

There is a very remote possibility of injury to people or animals from flying fragments of ice or from a damaged blade.

Most blades are composite structures with no bolts or separate components and the danger is minimised as a result. The build up of ice on turbine blades is unlikely to present problems. Most wind turbines are fitted with anti-vibration sensors, which will detect any imbalance caused by the icing of the blades. The sensors will cause the turbine to wait until the blades have been de-iced prior to beginning operation.

5.8 Proximity to Roads and Railways

In general, turbines may distract motorists when they are being constructed or when they are new. Over time the turbines become part of the landscape and in general do not cause any significant distraction to motorists. The provision of appropriately sited lay-bys for viewing purposes can help reduce distraction by giving an opportunity to view the wind energy development in safety; lay-by size should be adequate to cater for tour buses. Although wind turbines erected in accordance with standard engineering practice are stable structures, best practice indicates that it is advisable to achieve a safety set back from National and Regional roads and railways of a distance equal to the height of the turbine and blade.

5.9 Proximity to Power Lines

Adequate clearance between structures and overhead power lines as specified by the electricity undertaker should be provided. It should be noted that there is a statutory obligation to notify the electricity distributor of proposed developments within 23 meters of any transmission or distribution line.

5.10 Interference with Communication Systems

Wind turbines, like all electrical equipment, produce electro-magnetic radiation, and this can interfere with broadcast communications. The interference with broadcast communication can be overcome by the installation of deflectors or repeaters. Planning authorities should advise the developer to contact the individual broadcasters, both national and local, and inform them of the proposals. A list of the licensed operators is available on the ComReg website at www.comreg.ie. Mobile phone operators should also be advised of the proposed development.

5.11 Aircraft Safety

The siting of wind turbines may have implications for the operations of the Communications, Navigation and Surveillance systems used for Air Traffic Control for the separation and safety of aircraft. Wind turbine siting may also have implications for the flight paths of aircraft.

Regard must be had to the Irish Aviation Authority's *Obstacles to Aircraft in Flight Order, 2002,* (S.I. 14 of 2002), as amended, which specifies the criteria used to determine whether or not any object anywhere in the State is deemed to be an obstacle affecting aircraft operations. In addition, in order to assure the safety and efficiency of aircraft operations in the vicinity of airports, the International Civil Aviation Organisation (ICAO) has defined a volume of air space above which new objects are not permitted. No part of the wind turbine should penetrate these defined surfaces.

Accordingly, wind energy developers should be advised to contact the Irish Aviation Authority at the pre-planning stage of consultation, with details of locations and proposed heights of turbines, to ensure that the proposed development will not cause difficulties with air navigation safety.

5.12 Shadow Flicker

Wind turbines, like other tall structures, can cast long shadows when the sun is low in the sky. The effect known as shadow flicker occurs where the blades of a wind turbine cast a shadow over a window in a nearby house and the rotation of the blades causes the shadow to flick on and off. This effect lasts only for a short period and happens only in certain specific combined circumstances, such as when:

- the sun is shining and is at a low angle (after dawn and before sunset), **and**
- the turbine is directly between the sun and the affected property, **and**
- there is enough wind energy to ensure that the turbine blades are moving.

Careful site selection, design and planning, and good use of relevant software, can help avoid the possibility of shadow flicker in the first instance. It is recommended that shadow flicker at neighbouring offices and dwellings within 500m should not exceed 30 hours per year or 30 minutes per day[11] .

At distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. Where shadow flicker could be a problem, developers should provide calculations to quantify the effect and where appropriate take measures to prevent or ameliorate the potential effect, such as by turning off a particular turbine at certain times.

11 The shadow flicker recommendations are based on research by Predac, a European Union sponsored organisation promoting best practice in energy use and supply which draws on experience from Belgium, Denmark, France, the Netherlands and Germany.

5.13 Windtake

The question of windtake should be dealt with at scoping stage and / or during pre-application discussions, to ensure that any proposed layout of wind turbines takes into account the development potential of an adjoining site for a similar development.

In general, to ensure optimal performance and to account for turbulence and wake effects, the minimum distances between wind turbines will generally be three times the rotor diameter (=3d) in the crosswind direction and seven times the rotor diameter (=7d) in the prevailing downwind direction. Bearing in mind the requirements for optimal performance, a distance of not less than two rotor blades from adjoining property boundaries will generally be acceptable, unless by written agreement of adjoining landowners to a lesser distance. However, where permission for wind energy development has been granted on an adjacent site, the principle of the minimum separation distances between turbines in crosswind and downwind directions indicated above should be respected.

5.14 Decommissioning and Reinstatement

The decommissioning of a wind energy development once electricity ceases to be generated must be assessed. Plans for decommissioning should be outlined at the planning stage. Issues to be addressed include restorative measures, the removal of above ground structures and equipment, landscaping and / or reseeding roads. It may be appropriate to allow tracks to remain, e.g., as part of a walking route after decommissioning.

Chapter 6

Aesthetic Considerations in Siting and Design

6.1 Introduction

The primary purpose of this chapter is to provide guidance to planning authorities on decision-making in relation to the siting and design of wind energy developments in the landscape when assessing applications for planning permission.

The guidance provided is indicative and general. It typifies 'best fit' solutions to likely situations and is thus, proactive. It does not suggest that wind energy developments are appropriate in any given situation. These questions can be informed and / or qualified by the values people attach to landscape and by evaluating their sensitivity through the sieve analysis described in Chapter 3 on the development plan process, or otherwise at a strategic and / or project specific level.

The highest standards of siting and design for a wind energy development, as presented in this chapter, should be expected where the sensitivity of the landscape is high and the locations from where it is viewed are critical. Where a wind energy development is close to and visible from an area of high sensitivity, it should be designed to achieve similar standards as viewed from key viewpoints in that area. Particular landscapes of very high sensitivity may not be appropriate for wind energy development

The first section of this chapter deals with the general principle of landscape siting and design of wind. It comprises a series of line diagrams that are conceptually illustrative of typical problems and solutions as viewed from a fixed idealized location. These diagrams are presented under the following headings:

- Siting
- Spatial extent and scale
- Cumulative effect
- Spacing of turbines (regular, irregular, graduated)

- Layout of turbines (single line, staggered line, clustered, grid)
- Height of turbines (tall, medium, short)[12]

The second section considers how these principles can be best applied within different types of landscapes. Guidance is also given in relation to associated development, including substation compounds, access tracks and fencing.

A more detailed elaboration of the tools required for landscape impact assessment of wind energy development proposals is provided in Appendix 3.

6.2 Aesthetic Considerations

While many issues in relation to wind energy development can be assessed in quantitative terms, aesthetic considerations are more subjective and qualitative. They represent, nevertheless, some of the most critical issues in relation to wind energy development, and can be discussed with reasonable objectivity.

Considering wind energy development in respect of the following concepts can be helpful in the creative and critical analysis of aesthetic issues in relation to wind energy developments, and can help in achieving reasonable objectivity on the subject:

- Conventional visual aesthetic, such as compositional balance and harmony, rhythm, positive tension, aesthetic order and clarity, and including perception of wind energy developments as sculptural elements in the landscape.

- Positive association, where, for example, a wind energy development relates thematically to modern structures in terms of form, function and / or operation, perhaps even affirming an identity in a given landscape.

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12 The notion of what constitutes tall, medium and short turbines will change over time with technological advances and thus a shift in turbine height relative to capacity. In 2005, less than 60m to blade tip are considered short, 75-100m medium and over 100m tall.

- Symbolism, whereby a wind energy development represents or is a public sign for technological efficiency, progress, environmental cleanliness and utility.

These concepts provide the conceptual basis necessary for practical guidance on the relationship of wind energy developments to typical landscapes and landscape characteristics and can be applied to key landscape siting and design issues.

6.3 Siting of Wind Energy Developments

6.3.1 Location

The elevation and position of a wind energy development in the context of the character and feature of the landscape. Issues to be addressed include:

- Consideration of lower ground, where feasible, may be necessary in sensitive landscapes, but otherwise location on ridges and hilltops may be visually acceptable;

- Consideration of prominent landcover and structures, or features to which a wind energy development can provide a visual counterbalance;

- Management of visual exposure from viewing locations in respect of the sectional profile, striving in so far as is practicable; to achieve full turbine exposure from sensitive key viewpoints, as the perception of complete turbines is more aesthetically pleasing than stunted turbines;

- Taking advantage of the possibility of a relationship between a wind energy development and, say, an urban settlement; and

- Avoiding the creation of visual confusion and spatial dominance where landscapes are already cluttered, but take advantage of a moderate amount of visual absorption that might be provided by existing structures and/or infrastructure.

6.3.2 Topographic Profile

A wind energy development should be located so as to optimise the aesthetic qualities of the surrounding landscape and those of the wind energy development itself. It should, therefore, respond to topographic profile, achieving visual balance and accentuation of landform.

Fig 1: Wind energy development located on a peak

Fig 2: Wind energy development located in saddle between peaks – framing and, thus, accentuation achieved.

6.3.3 Sectional Profile

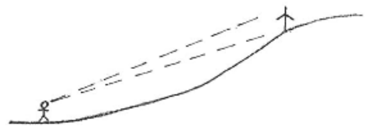

Fig 3: Wind energy development located above a concave slope, providing full visual exposure.

Fig 4: Wind energy development located above & behind convex slope, partially screening turbines from view.

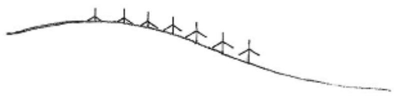

Fig 5: Wind energy development partially screened behind crest where screening visually stunts towers.

6.3.4 Composite Relationships

Large entities contiguous to a wind energy development may or may not result in visual balance. In diagram below, a forest stands in profile, creating a visual counterbalance to the wind energy development. This assumes the typical practice of replanting commercial plantations after harvesting.

Fig 6: Wind energy development in visual harmony with forest.

Large entities such as power lines and towers, agricultural buildings, houses and roads may create a context that visually absorbs a wind energy development, especially in farmland (visual absorption capacity), though in more sensitive upland situations this could result in visual confusion. However, visual complexity as well as image and / or thematic association with industrial structures, for example, can help to assimilate a wind energy development where it becomes just one more element in the landscape.

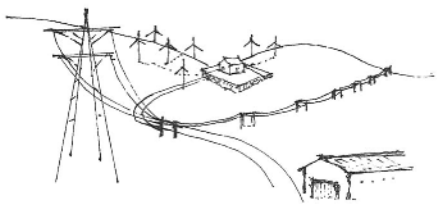

Fig 7: Wind energy development located in a landscape of complex visual composition resulting in visual confusion.

Where the wind energy development is relatively close and above a small urban node, it should respect the scale of its setting and avoid spatial dominance.

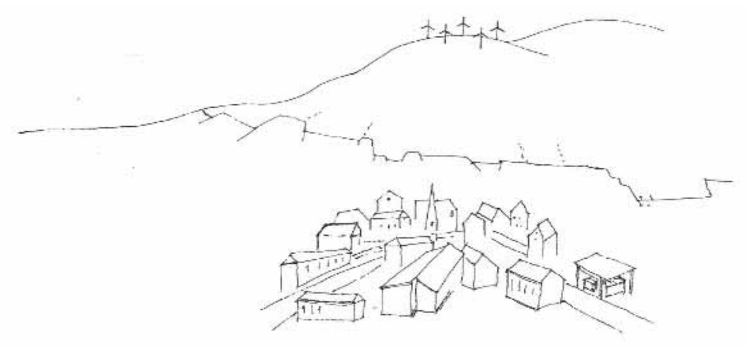

Fig 8: Wind energy development located contiguous to an urban centre.

6.4 Spatial Extent and Scale

Spatial extent is the area covered by a wind energy development, reflecting the number of turbines involved and their spacing.

The spatial extent of a wind energy development should be balanced and in scale with its landscape context. This involves consideration of the perceived size (extent and height) of landform, landcover and structures relative to the wind energy development.

Many turbines viewed at close proximity in a spatially enclosed area, such as hilly mountain moorland or farmland area will be large while a few turbines on open moorland will be regarded as small.[13]

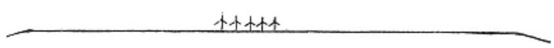

Fig 9: Wind energy development is too limited in spatial extent relative to the scale of its panoramic setting.

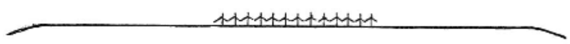

Fig 10: Spatial extent of wind energy development is more appropriate regarding the scale of its panoramic setting.

13 The term 'size' is deliberately avoided here as it is usually used within the industry to indicate the capacity of turbines to generate electricity (measured in megawatts).

Fig 11: Wind farm is too spatially extensive relative to the scale of the hill.

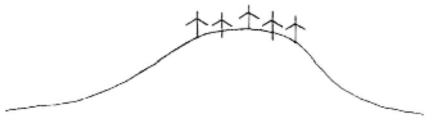

Fig. 12: Spatial extent of wind farm is more appropriate relative to the scale of the hill.

6.5 Cumulative Effect

Cumulative effect is the perceived effect on the landscape of two or more wind energy developments visible from any one place.

- A landscape of complex landform and landcover provides a greater possibility of screening for more than one wind energy development.

- Similarity in the siting and design approach is preferred where a number of wind energy developments are located in the same landscape character area, particularly within the same viewshed. However, an alternative approach where a particular aesthetic effect is sought may be acceptable.

- Different wind energy developments can appear as a single collective unit if located near each other.

- It is preferable to avoid locating turbines where they can be seen one behind another, when viewed from highly sensitive key view points (for example, viewing points along walking or scenic routes, or from designated views or prospects), as this results in visual stacking and, thus, confusion. This may not be critical, however, where the wind energy development to the rear is in the distant background.

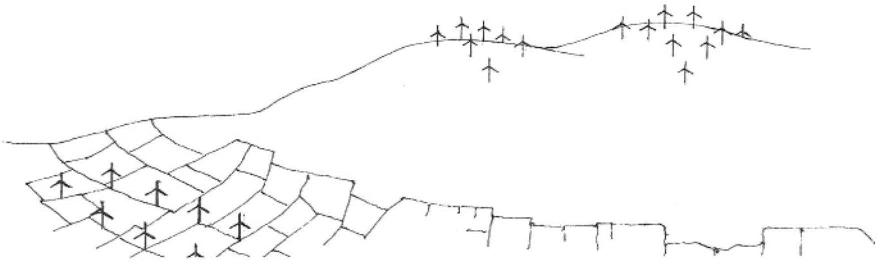

Fig 13: Wind energy developments dissimilar in terms of spatial extent, spacing and layout in different landscape types but within the same viewshed.

Wind energy developments within relatively close proximity to one another, while in different landscape character contexts, may be so close as to be within the same visual unit and, therefore, should involve the same siting and design approach.

6.6 Spacing

Spacing concerns the position of turbines relative to one another and the gaps between turbines.

- Regular spacing is more appropriate for wind energy developments in landscapes of clear and orderly landcover pattern or unenclosed flat landscapes.

- Irregular spacing is more appropriate in landscapes of varied landcover pattern or hilly and / or rugged landscapes.

- Graduated spacing of turbines is acceptable for wind energy developments where accentuation of a landscape feature or the creation of a sense of climax is sought.

- Generally, spacing should be of a uniform type in any given wind energy development, rather than a mixture.

- Some flexibility in spacing should be integral to a planning permission to allow for necessary on-site fine-tune adjustment of turbine placing due to such considerations as geological support for foundation or archaeological remains, etc (see paragraph 7.3 and 7.4).

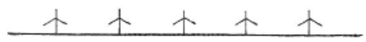

Fig 14: Wind energy development with regular spacing of turbines – a simple and obvious rhythm.

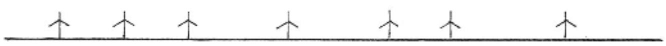

Fig 15: Wind energy development with irregular spacing of turbines – no obvious rhythm, i.e. non-repetitive.

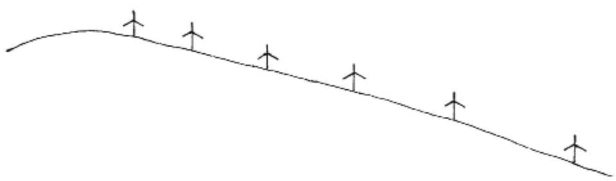

Fig 16: Wind energy development with graduated spacing on a hillside - attractive in terms of accentuation of ascent and sense of climax.

6.7 Layout

Layout concerns the position of turbines, providing the overall form or configuration of the wind energy development and its perceived density or complexity.

- Generally, layout should be of a uniform type, whether a single line, staggered line, splayed line, random or grid, rather than a mixture;
- The creation of a "visual stacking" effect from a sensitive viewpoint should be avoided;
- A circular / oval cluster or linear layout would be appropriate on hilltops;
- A linear or staggered linear layout would be appropriate close to a road or other such linear features; and

- A random or grid layout would be appropriate on a vast open landscape.

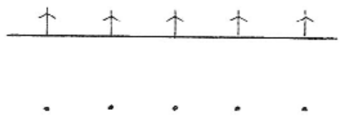

Fig 17: Plan and view of single line layout.

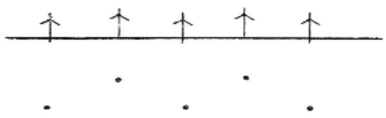

Fig 18: Plan and view of staggered line layout.

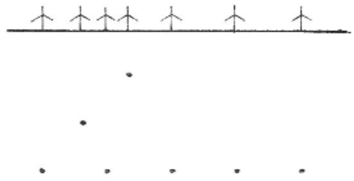

Fig 19: Plan and view of splayed linear layout.

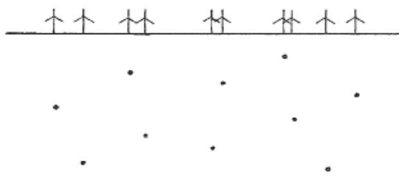

Fig 20: Plan and view of random layout

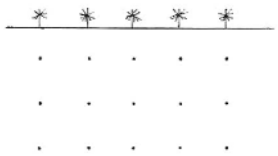

Fig 21: Plan and view of grid layout.

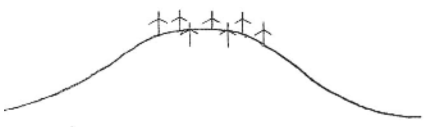

Fig 22: View of linear layout on a peak.

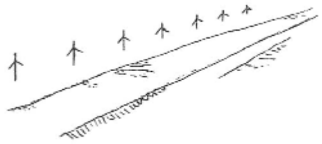

Fig 23: View of linear layout in response to a road, shoreline or cliff.

6.8 Height

Height relates to the full extent of turbines, comprising tower, nacelle and maximum blade length in an upright position. Height involves both the actual height and / or perceived height relative to topography. It includes the profile of the wind energy development as a whole, whether even or uneven. Different possibilities are acceptable, depending on context.

- Turbine height is critical in landscapes of relatively small scale, or comprising features and structures such as houses, and must be carefully considered so as to achieve visual balance and not to visually dominate.

- A wind energy development comprising two distinct turbine heights may be acceptable provided the resulting composition is carefully considered, so as to achieve an aesthetic effect. This situation may result from the combination of an old and a new wind energy development or where certain turbines would be critically visible from a sensitive viewpoint. Other than the height difference, the wind energy developments in the same viewshed should relate with regard to their main design features and colour.

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- Where possible, the perception from more sensitive viewpoints, of turbine blade sets cutting the horizon should be avoided.

- A skewed profile where one or more turbines are perceived to run at an angle relative to the horizon is acceptable in landscapes which are not of high sensitivity or where some aesthetic effect can be demonstrated.

Fig 24: Turbines are too high relative to the scale of the hill - this results in spatial dominance.

Fig 25: Turbines are too short (squat) relative to the scale of the hill - this results in visual irritation

Fig 26: Height of turbines is appropriate.

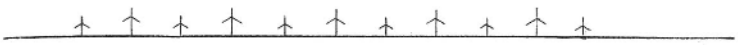

Fig 27: Wind energy development comprising turbines of two distinct heights used to aesthetic effect - careful spacing and simplicity of layout achieve a successful solution. Alternative sequences and rhythms may also be appropriate.

6.9 Landscape Character Types as a Basis for Guidelines

Landscape character types provide a useful basis for practical application of siting and design guidelines in relation to wind energy development and can be incorporated into the plan-led approach discussed in Chapter 3.

Six landscape character types have been selected to represent most situations:

- Mountain moorland
- Hilly and flat farmland
- Flat peatland

- Transitional marginal land
- Urban / industrial
- Coast

It is, however, common that a wind energy development is located in one landscape character type but is visible from another, for example, where the site comprises an unenclosed moorland ridge standing above a broad flat farmland. In such an instance, the entire visual unit should be taken into consideration. It will be necessary to decide whether the moorland ridge or the farmland might more strongly influence the approach.

The guidance on the siting and design possibilities in each of the landscape character types is proactively indicative of how wind energy developments best fit different landscapes and is necessarily independent of the issue of sensitivity, that is, of whether wind energy developments are appropriate in a given location. Thus, one might ably demonstrate how a proposed wind energy development could fit aesthetically into the landscape while recognising its inappropriateness due, for instance, to a critical heritage designation.

It should also be emphasised that actual realisation of preferred solutions as depicted in these guidelines is not always feasible due to the variations of a particular landscape type and the different viewing possibilities for each.

6.9.1 Mountain Moorland

Key characteristics of this landscape are:

- Peaked, ridged or rolling mountains and upland with steep sides or gently formed valleys;
- Generally unenclosed;
- Landcover comprising blanket bog, a mottling of heather, wild grasses and some rush in wet flushes; and
- A landscape type of relative remoteness and often comprising pristine, unspoilt and remote landscapes.

Given exposure and smoothness of terrain, these landscapes are often sought for wind energy development. The exposure of mountains and the preference for wind energy developments to be located at high elevations result in high visibility.

Mountain moorland may be inappropriate for wind energy development for reasons of natural heritage and the fact that some of these landscapes are of rare scenic quality and / or support some of the last wilderness areas of relatively pristine, unspoilt and remote landscapes.

However, many examples of these landscapes should be open for consideration subject to appropriate design and landscape siting to minimise adverse impact and optimise aesthetic effect.

Siting and design guidance for mountain moorland

Location

It may be acceptable to locate wind energy developments on ridges and peaks. They may also be appropriate, in certain instances, in a saddle between two peaks where they will be partially contained or "framed". A third acceptable location is lower down on sweeping mountainsides.

Spatial extent

Given the typical extensive areas of continuous unenclosed ground, larger wind energy developments can generally be accommodated because they correspond in terms of scale. However the spatial extent of a wind energy development would need to be reduced where a suggestion of smaller scale is provided by nearby landscape features.

1(a) Large wind energy development with random layout, irregular spacing and high turbines - this siting and design option is appropriate given the scale of this landscape

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1(b) Wind energy development with many turbines of medium height – this can be inappropriate. The spatial extent of a wind energy development can be reduced by using taller turbines. This may be a preferable solution in some situations.

1(c) Wind energy development with relatively few and tall turbines.

Spacing

All spacing options are usually acceptable. Where a wind energy development is clearly visible on a crest or ridge there is considerable scope to vary the rhythm, though on simple ridges, regular spacing may be more appropriate. On sweeping and continuously even areas of mountain moorland or upland plateaux regular spacing may be most desirable.

Layout

All layout options are usually acceptable. However, the best solutions would either be a random layout, and clustered where located on hills and ridges (fig 1(a)), or a grid layout on sweeping and continuously even areas of moorland or plateaux (fig 1(b)). Where a wind energy development is close to a linear element, such as a river, road or long escarpment, a corresponding linear layout or staggered line might be most desirable.

1(d) *A wind energy development with a grid layout with tall turbines – the rhythmic grid layout is appropriate to the open expanse of moorland, especially when it relates to the geometric blocks of conifers.*

Height

There would generally be no height restrictions on mountain moorlands as the scale of landscape is so great. However, shorter turbines may be more appropriate where they are located on small peaks and outcrops in order to maintain an appropriate scale. Profile, whether even or uneven, is dependent on topography: the more rugged and undulating (e.g., knolls and crags) the more uneven it will be. The profile of the wind energy development should not necessarily run in parallel to that of the topography.

1(e) Cumulative effect involving two wind energy developments – this situation would possibly be acceptable due to the similar siting and design approach adopted for each wind energy development

Cumulative effect

The open expanse of such landscapes can absorb a number of wind energy developments, depending on their proximity. The cumulative impact will also depend on the actual visual complexity of landform, whether steeply rolling, undulating or gently sweeping. The more varied and undulating an area is topographically, the greater its ability to absorb and screen wind energy developments. The aesthetic effect of wind energy developments in these landscapes is acceptable where each one is discrete, standing in relative isolation.

6.9.2 Hilly and Flat Farmland

Key characteristics of this landscape are:

- Intensively managed farmland, whether flat, undulating or hilly;
- A patchwork of fields delineated by hedgerows varying in size;
- Farmsteads and houses are scattered throughout, as well as occasional villages and towns;
- Roads, and telegraph and power lines and poles are significant components; and
- A working and inhabited landscape type.

The essential key here is one of rational order and simplicity, as well as respect for scale and human activities. The predominance of field pattern introduces an organised patchwork landcover structure that not only prompts a similar response in the siting and design of wind energy developments, but also provides a spatial structure and rhythm. Although hilly and flat farmland type is usually not highly sensitive in terms of scenery, due regard must be given to houses, farmsteads and centres of population.

Siting and design guidance for hilly and flat farmland

Location

Location on ridges and plateaux is preferred, not only to maximise exposure, but also to ensure a reasonable distance from dwellings. Sufficient distance should be maintained from farmsteads, houses and centres of population in order to ensure that wind energy developments do not visually dominate them. Elevated locations are also more likely to achieve optimum aesthetic effect. Turbines perceived as being in close proximity to, or overlapping other landscape elements, such as buildings, roads and power or telegraph poles and lines may result in visual clutter and confusion. While in practice this can be tolerated, in highly sensitive landscapes every attempt should be made to avoid it.

Spatial extent

This can be expected to be quite limited in response to the scale of fields and such topographic features as hills and knolls. Sufficient distance from buildings, most likely to be critical at lower elevations, must be established in order to avoid dominance by the wind energy development.

2(a) *Wind energy development of large spatial extent – this example is inappropriate given the scale of this landscape.*

2(b) *Wind energy development of small spatial extent – this example is appropriate given the scale of this landscape.*

2(c) *Wind energy development with random layout - this response is inappropriate given the patchwork field pattern of this landscape.*

2(d) *Wind energy development with grid layout - this response involving any form of linear layout and regular spacing is appropriate given the patchwork field pattern of this landscape.*

2(e) *Small wind energy development with regular linear layout - the rhythmic order is more appropriate to this landscape due to the order created by the field pattern.*

Spacing

The optimum spacing pattern is likely to be regular, responding to the underlying pattern field pattern. The fields comprising the site might provide the structure for spacing of turbines. However, this may not always be the case and a balance will have to be struck between adequate spacing to achieve operability and a correspondence to field pattern.

Layout

The optimum layout is linear, and staggered linear on ridges (which are elongated) and hilltops (which are peaked), but a clustered layout would also be appropriate on a hilltop. Where a wind energy development is functionally possible on a flat landscape a grid layout would be aesthetically acceptable.

Height

Turbines should relate in terms of scale to landscape elements and will therefore tend not to be tall. However, an exception to this would be where they are on a high ridge or hilltop of relatively large scale. The more undulating the topography the greater the acceptability of an uneven profile, provided it does not result in significant visual confusion and conflict.

2(f) *Small wind energy development located close to modern farm buildings - a thematic association is established involving modern materials and construction. Careful consideration needs to be given to tall turbines in this landscape given the potential proximity of houses.*

Cumulative effect

It is important that wind energy development development is never perceived to visually dominate. However, given that these landscapes comprise hedgerows and often hills, and that views across the landscape will likely be intermittent and partially obscured, visibility of two or more wind energy developments is usually acceptable.

2(g) *Cumulative effect caused by two wind energy developments - although similar in siting and design, the open and full exposure of both developments might be excessive given the fact that it involves an inhabited landscape.*

6.9.3 Flat Peatland

Key characteristics of this landscape are:

- Landscapes of this type comprise a vast planar extent of peatland and have significant potential for future wind energy development;
- In their relatively undisturbed and naturalistic state the wet bogs comprise a landcover mostly of heather, wild grasses and bog cotton, as well as patches of coniferous plantation;
- Some of these bogs have been harvested for peat and may comprise long parallel ridges of stacked milled peat and deep drains.;
- Evidence of human habitation is sparse;
- Roads tend to run in straight lines over considerable distances, followed by electricity and / or telephone lines; and
- This landscape type is horizontal, open, extensive and also characterised by a sense of remoteness.

The preferred approach here is one of large-scale response. The vast visual openness with few, if any, dominant geometric elements provides a certain freedom in the siting and design of wind energy developments.

Siting and design guidance for flat peatland

Location

Wind energy developments can be placed almost anywhere in these landscapes from an aesthetic point of view. They are probably best located away from roadsides allowing a reasonable sense of separation. However, the possibility of driving through a wind energy development closely straddling a road could prove an exciting experience.

3(a) *Random layout - the random spacing is not entirely appropriate to the simplicity of this landscape.*

3(b) *Staggered linear layout - the rhythmic spacing and layout as well as even profile of turbines create a composition appropriate to the simplicity of this landscape and corresponding to the peat harvesting ridges.*

3(c) *Grid layout - the rhythmic and regular layout create a composition appropriate to the simplicity of this landscape.*

Spatial extent

The vast scale of this landscape type allows for a correspondingly large spatial extent for wind energy developments.

Spacing

Regular spacing is generally preferred, especially in areas of mechanically harvested peat ridges.

Layout

In open expanses, a wind energy development layout with depth, preferably comprising a grid, is more appropriate than a simple linear layout. However, where a wind energy development is located close to feature such as a river, road or escarpment, a linear or staggered linear layout would also be appropriate.

Height

Aesthetically, tall turbines would be most appropriate. In any case, in terms of viability they are likely to be necessary given the relatively low wind speeds available. An even profile would be preferred.

Cumulative effect

The openness of vista across these landscapes will result in a clear visibility of other wind energy developments in the area. Given that the wind energy developments are likely to be extensive and high, it is important that they are not perceived to crowd and dominate the flat landscape. More than one wind energy development might be acceptable in the distant background provided it was only faintly visible under normal atmospheric conditions.

Further details in relation to Best Practice for Wind Energy Development in Peatlands are outlined in Appendix 4.

3(d) *Cumulative effect of two wind energy developments - this is acceptable where the wind energy developments are limited in spatial extent and are located at great distance apart.*

6.9.4 Transitional Marginal Landscapes

Key characteristics of this landscape are:

- Comprises something of both mountain moorland and farmland, thus involving a mix of small fields, tight hedgerows and shelterbelts;
- May include relatively rugged and rocky terrain, and thus a reasonable degree of spatial enclosure;
- Higher ground tends to be wet and boggy. Lower areas are usually cultivated and managed as fields;
- Houses and farmsteads are usually fairly common; and
- This landscape type bridges the organised and intensively managed farmland and the more naturalistic moorland;

The essential key here is one of respect for scale and human activities. These landscapes are often relatively small-scale due to spatial enclosure provided by hills and wind energy developments should respond sensitively to this intimacy. These landscapes are also visually complex due to diverse landform and landcover, as well as houses and power and telegraph poles and lines. Wind energy developments should avoid adding to such complexity due to the risk of creating visual confusion and conflict.

Siting and design guidance for transitional marginal landscapes

Location

As wind energy developments, for reasons of commercial viability, will typically be located on ridges and peaks, a clear visual separation will be achieved from the complexity of lower ground. However, wind energy developments might also be located at lower levels in extensive areas of this landscape type, where they will be perceived against a relatively complex backdrop. In these situations it is important to minimise visual confusion such as the crossing by blade sets of skylines, buildings, utility lines and varied landcover.

Spatial extent

Wind energy developments in these landscapes should be relatively small in terms of spatial extent. It is important that they do not dominate but achieve a balance with their surrounds, especially considering that small fields and houses are prevalent.

4(a) *Wind energy development with regular spacing and linear layout - may not be appropriate due to the undulation of land form as well as limited field pattern.*

4(b) *Wind energy development with irregular spacing and random layout - is more appropriate given the relative undulation of the setting.*

4(c) *Large wind energy development straddling two landscape character types within the same visual unit - this creates a visual ambivalence and, thus, negative tension between the two character types involved.*

Spacing

All options are possible, depending on the actual landscape characteristics. However, irregular spacing is likely to be most appropriate, given the complexity of landform and land cover typical of these landscapes, and the absence of extensive swaths of fields of regular and rectilinear pattern.

Layout

The likely location of wind energy developments on ridges suggests a linear or staggered linear layout whereas on broader hilltops they could be linear or clustered. Grid layouts are less likely to succeed aesthetically unless there is an open continuity of similar landcover.

Height

In small-scaled enclosed areas, short turbines are preferred in order to avoid their spatial dominance and to ensure visual balance. However where the upper ground is relatively open and visually extensive, taller turbines may be more appropriate. In terms of perceived height, the profile can be even or uneven, depending on the profile and visual complexity of the terrain involved. The more rugged and undulating, the greater the acceptability of an uneven profile provided it does not result in significant visual confusion and conflict.

Cumulative effect

This would have to be evaluated on a case-by-case basis, but great caution should be exercised. The spatial enclosure often found in transitional marginal landscapes is likely to preclude the possibility of seeing another wind energy development. However, should two or more wind energy developments be visible within a confined setting a critically adverse effect might result, depending on turbine height and wind energy development extent and proximity.

6.9.5 Urban and Industrial

Key characteristics of this landscape are:

- a predominance of urban complexity, industrial buildings, infrastructure or a combination of these; and
- that it is intensively altered and dominated by structures.

The essential key here is one of rational order and simplicity. Wind energy developments can thematically complement the contemporary technology expression of these landscapes and visually relate to their functional nature.

Siting and design guidance for urban and industrial areas

Location

A wind energy development can be placed sufficiently close to the structures concerned in order to establish a visual relationship but sufficiently distant to ensure a certain autonomy. The wind energy development should appear as a distinct and discrete entity.

Spatial extent

This should be determined by the spatial extent and height of the existing structures making up the urban and / or industrial context. Generally, therefore, it is likely to be relatively limited.

5(a) *Large wind energy development with random layout contiguous to town that can be inappropriate - although an association is achieved between the wind energy development and urban structures as well as infrastructural elements; the wind energy development spatially dominates the hill and town.*

5(b) *Small wind energy development with regular layout contiguous to town. Regarding its spatial extent, this wind energy development is appropriate to the scale of the hill and town and a thematic association is created with the existing telecommunication towers in terms of technological image.*

5(c) *Wind energy development contiguous to industrial buildings with random layout - visual disharmony is created.*

5(d) *Wind energy development with staggered linear layout contiguous to industrial buildings – rhythmic spacing is appropriate to the industrial and technological image of the context.*

Spacing

Regular spacing will usually provide the greatest possibility of visual integration. A graded spacing, however, could be used to aesthetic effect, depending on how it was composed in relation to the built context.

Layout

In order to achieve simplicity, a single line or staggered line will most likely be the preferred approach. In the case of an extensive urban and / or industrial complex a slightly deeper plan might be acceptable.

Height

Where only a very small wind energy development is involved, tall turbines could create a dramatic contrast with existing structures. Otherwise, turbines should be selected so as not to visually overpower existing structures. An even profile would typically be preferred in order to ensure simplicity and reduce the likelihood of visual confusion, but an uneven profile may be acceptable depending on contextual relationships.

Cumulative effect

In urban areas there is little or no tolerance of more than one wind energy development due to the likely sense of clutter and possible feeling of dominance.

5(e) *Wind energy development located in harmonious visual relationship to a town and rural buildings - white turbines relate to the colour of the buildings of the urban centre as well as to the houses and farmsteads scattered across the countryside.*

6.9.6 Coastal Zone

Key characteristics of this landscape are:

- Beaches, dunes, rocks, promontories and / or cliffs;
- High rocky crags may have scrub, heather, bracken and gorse as land cover, whereas flatter areas are more likely to comprise farmland;
- Seashores can also include harbours, hamlets, villages and towns and some of these may have developed into seaside holiday resorts; and
- This landscape type involves openness, nature and recreation and thus may be sensitive. Coastal landscapes identified through sensitivity analysis, as being of rare scenic quality may not be appropriate for wind energy development.

The essential key here is one of simplicity and rational order. The juncture of land and sea is extremely attractive to the eye. Its linearity or, perhaps more likely, curvilinearity creates a strong aesthetic contrast with the planar quality of the sea in geometric terms. Both are, nevertheless, essentially simple and elemental. Rather than inhibiting the introduction of a wind energy development, the associations and symbolism of the seashore challenge the wind energy development design to achieve aesthetic excellence. The simplicity of many coastlines prompts a corresponding simplicity regarding the introduction of wind energy developments.

Siting and design guidance for coastal areas

Location

Wind energy developments should be set back from the sea and clearly located on solid ground. They are suited to low beach shorelines as well as rocky promontories.

Spatial extent

This depends on the length of shoreline. In order to achieve simplicity, a wind energy development should not extend beyond one particular kind of shore. Accordingly, it should physically relate to a beach or a rocky promontory but not bridge the two.

Spacing

Regular turbine spacing would be most appropriate in order to achieve a serenity and composure that reflect those of the sea. A promontory could be used to achieve a dramatic aesthetic effect using graded spacing with the gradual tightening occurring seawards.

6(a) *Wind energy development with irregular spacing and linear layout on coastal promontory - visual disorder is created by variation in spacing and hub height (wind energy development profile) which is inappropriate to the simplicity of the landscape / seascape context.*

6(b) *Wind energy development with regular spacing and linear layout on coastal promontory - the simplicity and rhythm created by rhythmic spacing and level profile are appropriate to the simplicity of the landscape / seascape context.*

Layout

Wind energy developments should reflect the linearity of the shore by a corresponding linear or staggered linear layout. However, on a headland with a peak or hill, a clustered layout might be used to crown and thus accentuate the feature.

6(c) Wind energy development with the irregularity of spacing is disjointed and creates visual disharmony on this simple curving coastline.

6(d) Wind energy development with simplicity involving regular spacing, a linear layout and level profile is usually preferable.

6(e) *Graduated spacing and linear layout on coastal promontory - the increasingly closer spacing of turbines draws emphasis to the tip of the promontory and its connection to the sea.*

6(f) *Clustered layout on end of promontory - this layout too accentuates and celebrates the end of the promontory and its interface with the sea.*

Height

Turbines can generally be tall, especially close to and parallel to beaches. More caution might be necessary in regard to promontories where the scale of the projecting land mass should be considered. The profile should be even in response to the flatness of the sea.

Cumulative effect

Generally along any length of shoreline one wind energy development can be visible in the fore or middle ground. A second one may be acceptable in the far distant background, provided it is only dimly visible under normal atmospheric conditions in order to preserve the spatial, scenic and thematic integrity of the shore. The principle objective is to ensure that multiple wind energy developments are not visible in close proximity from any one seaside location due to their generally sensitive nature.

6.10 Landscape Impact of Wind Energy Development Construction

The process of construction can result in adverse landscape and visual impact due to, for example, temporary structures and materials on site, alterations to drainage, dust, ground compaction, excavation, road construction, soil erosion and mineral leaching, as well as traffic movement. To help alleviate these impacts, the following practices should be adhered to as closely as possible:

- Site offices, workers' hut and toilets, materials and site compound should ideally be sited so as to minimise visual exposure, bearing in mind operational effectiveness from a construction and site management perspective, and landscape conditions. They should be removed when the wind energy development is constructed;

- Construction traffic and machinery movement should be confined as much as is practicable to the roads and tracks that are part of the long-term development in order to minimise unnecessary compaction;

- Where temporary earth works are required, ground and vegetation should be reinstated as soon as possible;

- The site should be kept tidy and construction rubbish should be neatly contained;

- Cement trucks should not be washed on site where there is a risk of run-off and damage to flora and watercourses;

- The spread of dust on surrounding vegetation should be minimised - where heavy and visible in sensitive landscapes it should be removed by spraying with water after construction is complete;

- The dispensing of fuel and oil tanks should be confined to one bounded location in order to minimise the risk of damage by spillage; and

- Where possible, after construction is completed, vegetation should be reinstated on banks and margins of roads that are constructed to accommodate the passage of construction machinery and trucks. This is especially critical where cut and fill has been required.

6.11 Landscape Impacts of Associated Development

The elements associated with wind energy developments other than turbines include the roads and tracks, power poles and lines, the control building, the wind measuring mast and the compound. Individually and collectively, these elements should be considered, located and designed to respect the character of surrounding landscape.

6.11.1 Control Building and Substation Compound

- A high standard of design should be applied to all structures associated with the substation, and should not only take account of its function but also of its aesthetic quality, in order to minimise any sense of intrusion.

- The development should incorporate colour harmony and adequate screening of the control building and substation compound. Should the surrounding landscape include trees and / or shrubs, such material can be used for screening. In sensitive landscapes, consideration should be given to screening the control buildings and compound by earth berms as well as re-sodding with local vegetation in order to mitigate their visual impact.

- The control building, where practicable, should be located in a dip or a hollow but away from ecologically sensitive areas or features. In the case of coastal locations it should not be located on promontories, unless comprising a special design appropriate to the setting.

- Control buildings should be designed to respect the character of buildings typically found in the surrounding landscape.

- Urban / industrial contexts could also accommodate building design, which corresponds more specifically to the contiguous building(s).

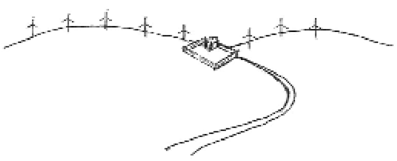

Fig 28: Visually exposed control building and angular compound draw attention to the wind energy development while creating visual disharmony.

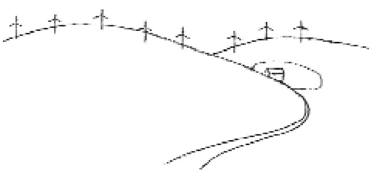

Fig 29: Screened/partially screened control building and rounded shape of compound is more sympathetic to the landscape.

6.11.2 Fencing

- Fencing should be limited to the substation compound area.

- Chain link is preferred over palisade fencing as it is more transparent.

- Fencing should not encompass the entire wind energy development, as this would unnecessarily compromise access to the countryside as well as the sense of simplicity intrinsic to the aesthetic quality of turbines. Extensive areas of fenced ground would also limit grazing which could result in variations in the colour of vegetation.

- Temporary fencing (e.g., electric fencing) may be required to keep grazing animals off bare soils while vegetation cover re-establishes or scraghs root in.

- Consideration should be given on Mountain Moorland hilltops to creating a curvilinear shape for the compound as defined by fencing, as the more conventional rectilinear shape may jar with the openness and sense of the open natural setting.

6.11.3 Connection to Electricity Providers

- Power line connections between turbines and from turbines to the control building should be underground.

- Power lines should be interred alongside turbine access roads in order to minimise spatial extent of soil / hydrological and vegetation damage / disturbance.

- The cost of underground connection from the compound to the national grid is generally prohibitive. This connection can thus be above ground in all but the most sensitive landscapes.

- In certain landscapes, such as highly sensitive Mountain Moorland, consideration should be given to burying the cables until such a distance as the poles and cables would be visually acceptable, for example, where other power lines exist.

- In order to reduce visual impact, connections should preferably be carried on wooden poles rather than lattice towers, except where necessary for changes in direction and within the compound.

- Power line connections to the grid should, where possible, avoid running perpendicular to contours, especially on Mountain Moorland slopes. Where practicable, it should not cross the horizon at ridge level unless a line already exists. Where passing through a forest, power line connections should follow existing firebreaks or roads. In landscape types where human presence and rectilinear landscape patterns are typical, power line layout can be more flexible.

6.11.4 Roads/Tracks

The impact of access routes on landscape can be minimised by sensitive routing and design.

- The number and extent of roads / tracks serving the site should be kept to a minimum. Access routes should utilise existing roads where possible.

- Access roads / tracks should relate to key characteristics of landscape, e.g., the roads should not follow a straight line up a Mountain Moorland slope directly to the wind energy development, but rather a diagonal line following the contours. Sensitive areas such as archaeological sites should be avoided as far as possible while important features such as streams should be properly bridged or culverted.

- The colour of road material should be such as to minimise contrast with the surrounding landcover. Crushed stone sourced locally is preferable.

- Access tracks should be properly landscaped immediately following completion of works and damage to existing hedgerows from transporting the turbines should be made good.

- Cut and fill required for road construction should be roughly balanced in order to minimise the need for soil removal from the site. Surfaces resulting from cut and fill should consist of material that is conducive to the successful re-establishment of local vegetation.

- Disturbed soil, whether cut banks or deposited soil, should be re-seeded or re-sodded to match surrounding conditions in sensitive landscapes. Re-sodding is essential on upland and lowland peatlands, and all other upland sites, as re-seeding is likely to be unsuccessful and exposed peat is liable to erode. Non-development site vegetation should not be introduced on semi-natural sites such as peatlands.

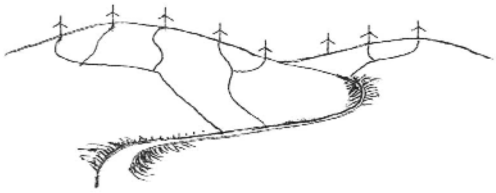

Fig 30: Unnecessary tracks create visual confusion in Mountain Moorland. Deep cutting and high banks of fill for roads have a scarring effect on mountainsides, and act as drainage channels thus resulting in hydrological impacts on adjacent areas/habitats and possibly initiating erosion due to concentrating water flows.

6.12 Turbine Colour

The colour and surface finish of wind turbines influences the visual impact of a wind energy development. In most Irish landscapes, white, off-white or light grey are generally the most appropriate colours, but other natural colouring may be acceptable depending on the circumstances. For example, two-tone colouring, with a natural colour at the base of the turbine surmounted by white, off-white or light grey, can be effective.

Turbines should as far as possible appear as a positive element within a landscape. Consequently, dark grey or metallic colours can appear negative or relate to industrial elements, whereas white is expressive of an image of cleanliness and efficiency associated with wind energy. Matt non-reflective finishes should be used on all turbine components.

6.13 Turbine Maintenance

Regular maintenance of turbines is important in the context of the general visual amenity of the wind energy development. In this regard:

- Rotors should be kept rotating and counter rotation of blade sets should be avoided. Any malfunctioning turbines should be repaired or removed, together with ancilliary structures or any other scrap material, ideally within a maximum six-month period.

- Nacelles and towers should be kept clear of leakage from internal fluids.

6.14 Turbine Transformers

Given that they are relatively small and their visual impact is localized, turbine transformers can be located either within the tower, partially underground or adjacent to the tower. Where exposed in more sensitive locations, screening can be provided using earth mounding and / or vegetation, as appropriate to the surrounds. Where visually exposed, transformers can be painted to suit the backdrop. Decisions regarding the location of transformers should be informed by health and safety criteria.

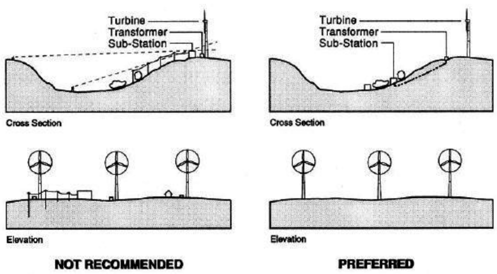

Fig 31: Visibility of turbine transformers and sub-stations.

6.15 Landscape Impact of Wind Energy Development Operation and Decommissioning

The operability of turbines should be carefully monitored electronically so as to minimise the duration of a static non-functioning blade set, as otherwise visual disharmony could result.

Decommissioning should involve the removal of all of the above-ground elements of the wind energy development and making good of the site, with the possible exception of roads and tracks where some further use can be found for them and this is approved by the planning authority. Foundation pads can be covered with local soil and left for natural re-vegetation, although they should be re-sodded in highly exposed locations.

6.16 Estimation of the Likely Degree of Impact on Landscape

Estimation of impact upon landscape is reached using both quantitative and qualitative factors. It comprises the following four parts:

- **Landscape sensitivity** (ranging from very low *sensitivity* to *very high sensitivity*) – relates to the acceptability of change to the landscape. The assessment is based on common sense, observation and professional knowledge.

- **Visual presence of the wind energy development** (ranging from *minimal presence* to *highly dominant*) – relates to how visually dominant the wind energy development is on the landscape, but is not synonymous with or indicative of adverse impact. This criteria can be assessed by examining photomontages of the proposed wind energy development, taking into account such factors as viewing distance, screening, the spatial structure of the landscape and visual absorption capacity.

- **Aesthetic impact of the wind energy development on its landscape context** (ranging from *major positive impact* to *major adverse impact*) - relates to the aesthetic relationship of the wind energy development to its context. Does the proposed wind energy development fit in well with the character of the landscape as recommended in these Guidelines, achieving an overall positive aesthetic relationship with its context?

- **Significance of the impact** (ranging from *insignificant* to *major*) – a statement used to summarise the overall impact of the wind energy development and determined by the previously assessed landscape sensitivity, visual presence and aesthetic impact. This factor is not applied where the aesthetic impact has been deemed to be positive.

TABLE 1: MATRIX SUMMARISING LANDSCAPE CHARACTER BASED RECOMMENDATIONS

	Location	Spatial Extent	Cumulative Effect	Spacing	Layout	Height
Mountain Moorland	Ridge and saddles are generally acceptable.	Tend towards large, depending on scale of actual context.	Acceptable, depending on topography as well as siting and design of wind energy developments involved.	Any spacing may be acceptable, but regular spacing may be best on a simple ridge or on broad sweeping areas.	Any layout may be acceptable, but random or clustered may be best on ridges and hilltops, respectively, and grid on broad sweeping areas.	Any height. clustered may be best on
Hills and Flat Farmland	Anywhere.	Generally limited to small wind energy developments	Acceptable depending on appropriate siting and design.	Regular.	Linear and staggered linear layout on ridges and clustered on hilltops.	Medium typically preferred but tall may be acceptable.
Flat Peatland	Anywhere.	Large.	A second wind energy development may be acceptable only at avery great distance with minimal visual presence.	Regular.	Generally a layout with depth, i.e. a grid, unless following a linear feature, where a linear or staggered linear layout may be acceptable.	Tall.
Transitional Marginal Land	Ridges and hilltops are preferred.	Generally small relative to scale of context and do not bridge two different land covers, e.g. moorland and field areas.	Generally not acceptable unless the visual presence of the second wind farm is negligible.	All options possibly acceptable.	Linear and staggered linear layout on ridges and clustered on hilltops.	Generally medium and short. A varied profile is acceptable in undulating landscape.
Urban/ Industrial	Close to but distinct from contiguous structures.	Tend towards small – relate in scale to height and spatial extent of contiguous structures.	Minimal tolerance.	Regular spacing is preferred. Graded spacing may be acceptable where composed relative to exiting structures.	Linear or staggered linear is preferred. A grid may be acceptable contiguous to larger structures.	Short enough so as not to over-power existing buildings. A few tall turbines may be successful relative to the scale of existing buildings.
Coastal Type	Set back from water.	Do not cross over between beaches and rocky promontories.	A second wind farm may be acceptable only at a very great distance with minimal visual presence.	Regular is most appropriate. Graded spacing may be acceptable on promontories.	Linear, especially along beaches. A cluster may be acceptable on promontories.	Tall may be acceptable, especially along beaches. Profile should be even.

Chapter 7
Planning Conditions

7.1 Introduction

The preparation of an adequately researched and sufficiently detailed planning application should reduce the need for an extensive list of planning conditions and any further time required for processing consequent compliance submissions. The importance of pre-application discussions between the applicant and the planning authority in advance of lodging an application cannot be overemphasised (see section 4.1).

Some planning authorities have devised standard conditions and reasons for use in relation to different types of applications. This practice is useful in the interests of consistency. The following criteria should apply to planning conditions, namely, is the condition:

- Necessary?
- Relevant to the development to be permitted?
- Precise?
- Reasonable?
- Enforceable?

In addition to establishing the suitability of planning conditions, it is important to ensure that the reason for attaching each condition is clear and unambiguous and that the developer fully understands what is required. The particular circumstances of each proposed development will need to be carefully considered in drafting conditions and deciding which conditions are necessary and appropriate.

Matters that may be appropriately dealt with by the inclusion of conditions on a planning permission for wind energy development are detailed below. The list and accompanying explanation is included for guidance only and is not exhaustive:

- Siting, design and layout
- Flexibility of turbines layout on site

- Flora, fauna and habitats
- Archaeology
- Noise
- Environmental impact and monitoring
- Construction
- Borrow pits and quarrying
- Roads and access routes
- Associated structures and equipment
- Grid connections
- Site management issues
- Shadow flicker
- Electromagnetic interference
- Aeronautical safety
- Windtake
- Financial contributions
- Wind measuring masts
- Decommissioning
- Time limits

7.2 Siting Design

Conditions which result in changes to siting, spatial extent layout, spacing, height, profile and colour of turbines need to be approached with care particularly where the wind energy application has been the subject of detailed pre planning discussion and an agreed design solution for a particular landscape proposed. The need for such conditions may arise through input from prescribed bodies or third party representations. The need to "modify" a layout will need to be balanced against the impact that that condition may have on the design of a particular wind energy project.

7.3 Flexibility in Turbine Location

As the precise location of turbines may need to be modified in the course of development due to matters such as the wind regime, ground conditions, or heritage concerns, etc. It may be helpful as referred to in paragraph 6.6 in the design of a layout and in framing conditions to allow for a degree of flexibility in the final siting of turbines. Where this flexibility is agreed upon details of final specification should be submitted to and agreed in writing with the planning authority prior to commencement of development.

7.4 Archaeology

Conditions on wind energy developments within close proximity to recorded monuments and sites may include the following:

- Funding by the applicant of archaeological assessment, geophysical survey, archaeological testing, archaeological excavation and / or monitoring within the area covered by the permission;

- Preservation of all or part of the archaeological remains (in situ or by record) in the area covered by the permission;

- Relocation of position of turbine(s) in order to minimise impact on the archaeological heritage and / or create buffer zones;

- Temporary fencing-off of archaeological monuments during construction, repairing and decommissioning in order to protect and preserve the monuments; and

- Other appropriate archaeological mitigation measures that may be deemed necessary.

7.5 Noise, including Construction Noise

Conditions relating to noise levels are attached to planning permissions for wind energy developments to protect the amenity of nearby noise sensitive locations. Conditions relating to noise should address the issues of:

- Level limits;
- Locations at which those limits apply;
- Time of day at which the limit applies;
- Parameters to be measured for control purposes; and
- Access to data generated by the monitoring programme.

If there is an issue in relation to interference with the amenities of noise sensitive properties from construction work, it may be appropriate to attach a condition to control the hours in which construction may take place rather than attach conditions to control noise from the actual construction works, which are of a temporary nature. However, in attaching such a condition, it would be important to ensure that operational matters are taken into account, for example, the transport of exceptionally long loads at night to avoid traffic congestion.

7.6 Environmental Impact: Mitigation/Compensatory Measures

Mitigation / compensatory measures specified or stipulated in the EIS are designed to limit the environmental impacts of the development. They are measures that **must be implemented** and this should be reflected in the phraseology of the EIS. If there is room for doubt over whether the EIS makes the mitigation / compensatory measure obligatory or not, this should be clarified or reinforced by a planning condition, or clarification should be sought at an earlier stage by the planning authority. A condition in relation to monitoring the implementation of mitigation measures specified in the EIS should also be considered.

7.7 Environmental Monitoring

General environmental monitoring conditions should be avoided, apart from where specific requirements in relation to environmental matters are part of the planning permission. Effective monitoring is necessary to provide evidence of compliance with environmental conditions, such as noise limits or wildlife considerations.

An agreed monitoring / management programme, funded by the developer, can provide reassurance for both the planning authority and any concerned third parties that these conditions are being observed in the day-to-day operation of the wind energy development, and that in the event of a breach, appropriate remedial action will be taken. Such a programme would be particularly relevant in the initial operating period of the development, within the first 2 years, possibly with provision for further monitoring if the problem persists. The environmental monitoring can be carried out either by agreed independent specialists, or by the planning authority at the developer's expense.

7.8 Construction phase

It may be necessary in particular circumstances to attach conditions with regard to the following matters arising during the construction stage of the wind energy project:

- Hours of construction;
- Monitoring and supervision of construction phase by qualified and experienced geo-technical engineer(s) and / or by qualified and experienced ecologist(s), where deemed necessary;
- Construction traffic movements, including vehicle types and routes in relation to removal of excavated material, and importation of materials, turbine parts and equipment,
- Ground disturbance during construction;
- Management and treatment of rock and soil excavated during construction work;
- Storage and transfer of material, including use of bounded storage areas for use during construction and operational phases to avoid any pollution of surface or ground waters;
- Impacts on surface and groundwater drainage;
- Reinstatement of the site where construction works result in ground disturbance / surface damage or erosion; and
- Removal of ancillary construction equipment including site offices, portakabins and portable toilets.

7.9 Borrow Pits and Quarrying

Conditions may be required in relation to the excavation of rock and soil, and the development and location of borrow pits associated with wind energy development proposals. Conditions may also address the issues of avoidance and remediation of land slippage, where appropriate. Where land slippage occurs the local authority should be notified and all works suspended until the matter is rectified.

7.10 Roads and Access Tracks

Conditions may be necessary in relation to design, width, surface materials, construction details, silt traps, associated earthworks (such as cutting or embankments), and routing of tracks within the site, not only to minimise visibility, but also with regard to erosion and minimising impact on habitat.

7.11 Ancillary Structures and Equipment

Ideally, matters regarding associated structures and equipment should be considered at pre-planning application stage as part of an overall design solution for the site and subsequently included in the planning application. Where that does not happen, conditions may need to address siting, design and finishes of ancillary structures including sub-stations, transformers and service buildings. In general, conditions requiring the location of transformers within turbines or outside the tower base should be informed by the landscape evaluation and the health and safety criteria. Fencing should be kept to a minimum but may be necessary in relation to storage of materials and security. Where fencing is required, conditions may be necessary to address issues regarding routing, rights of way and finish.

7.12 Connection to Electricity Distributors

Where the works required to connect the wind energy development to the national grid do not form part of the planning application, or where the connection to the grid does not constitute exempted development[14], it will be necessary to submit a separate planning application to the planning authority. It is not appropriate to attach

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[14] 14 Planning and Development Regulations, 2001, Schedule 2, Part 1 Classes 26-29 Exempted Development by Statutory Undertakers of any electricity undertaking.

conditions in regard to grid connections on land outside the ownership of the applicant as part of the permission for the wind energy development.

7.13 Site Management Issues

Appropriate conditions in relation to site management issues may address the operation and maintenance of equipment and turbines, repair / replacement / removal of non-operational turbines and overall good site maintenance and management procedures.

7.14 Shadow Flicker

Shadow flicker is not usually critical. However, in unusual circumstances, where the calculations indicate that occupied dwelling houses would be significantly affected, a condition requiring the non-operation of turbines at times when predicted shadow flicker might adversely impact on any inhabited dwelling within 500m of a turbine may be appropriate.

Conditions may also address limits on the number of hours per year or minutes per day that the shadow flicker should affect an inhabited dwelling (see paragraph 5.12).

7.15 Electromagnetic Interference

Conditions regarding measures to be taken to minimise interference with the transmission of radio and television signals, air and sea transport communications and other transmissions systems in the area may be necessary. Where electromagnetic interference is difficult to predict, conditions may require the developer to consult with the service provider concerned and undertake remedial works to rectify any interference caused.

7.16 Aeronautical Safety

Conditions regarding lighting of structures, submission of coordinates of the turbines positions, as constructed, and / or other appropriate conditions should be included, where advised by the Irish Aviation Authority.

7.17 Windtake

Conditions with regard to windtake could be included to ensure that wind turbines are located in a manner that respects the development potential of the adjoining site for a similar development. Where such conditions apply they should generally allow a distance from adjoining site boundaries of not less than two rotor blades having regard to the wind resource at the site, save with the written agreement of the adjoining landowner(s). This issue is more appropriately addressed before an application is made (see paragraph 5.13).

7.18 Development Contributions

General contributions: In general, any levy that a planning authority intends to apply to wind energy development should be clear from the Development Contribution Scheme, drawn up under section 48 of the 2000 Act. There is no appeal against a general development contribution except on the basis that the terms of the scheme were not properly applied. However, where the General Contribution Scheme contains no reference to wind energy development development, or where the costs involved in the development are not provided for in the scheme, it may be appropriate to attach a special contribution condition referred to below.

Special contributions: The additional traffic - particularly in terms of heavy goods vehicles generated during the construction phase of a wind energy development - may necessitate additional expenditure by the planning authority on the surrounding road network or local infrastructure.

Where such specific exceptional costs not covered by the general contribution scheme are incurred by the local authority in respect of public infrastructure and facilities that benefit the proposed development, a condition requiring the payment of a special development contribution may be imposed under Section 48 (2)(c) of the *Planning and Development Act, 2000*. In such a case, the planning condition should specify the particular works carried out, or proposed to be carried out, by the local authority to which the special contribution relates (Section 48). Unlike contributions levied under a general scheme, these contributions may be appealed.

7.19 Decommissioning and Reinstatement

Conditions requiring the lodgement of financial bonds have been used in the past to try to ensure that decommissioning will take place in a responsible manner. However, the use of long-term bonds to secure satisfactory reinstatement of the site upon cessation of the project puts an unreasonable burden on developers given the long time span involved in wind energy developments and is difficult to enforce. The recycling value of the turbine components, particularly copper and steel, should more than adequately cover the financial costs of the decommissioning. Accordingly, the use of a long-term bond is not recommended.

7.20 Time Limits

Having regard to the statutory provisions regarding the life of a planning permission, conditions should not require that a development be commenced or finished by a certain date.

Conditions that limit the life of a wind energy development to a particular time period have been included in the past in order to enable the planning authority to reassess the operation or re-equipping of the wind energy development in the light of circumstances prevailing at the time. This can instead be achieved by way of a condition requiring that future re-equipping be agreed in writing with the planning authority or be the subject of a separate planning application. The inclusion of a condition which limits the life span of a wind energy development should be avoided, except in exceptional circumstances.

Planning authorities may grant permission for a duration longer than 5 years if it is considered appropriate, for example, to ensure that the permission does not expire before a grid connection is granted. It is, however, the responsibility of the applicants in the first instance to request such longer durations in appropriate circumstances.

Appendix 1

Landscape Sensitivity Analysis Methodology

A number of different studies can be undertaken to classify a county's landscape according to sensitivity to wind farm development. These may involve to varying degrees the public, the local planning authority and / or the landscape consultants. An outline of a stepwise procedure that can be used is provided below:

Desk Reviews – Carry out a literature review of the most pertinent documents relating to landscape sensitivity, including the current County Development Plan (CDP).

Consultation with Planning Staff – Carry out an exercise to map landscape quality with the aid of landscape consultants, if considered appropriate.

Provide planning staff with large-scale maps of the county to map the following, using their own experience and impressions:

(a) those scenic routes which are currently designated in the CDP but which might have deteriorated over time such that they no longer warrant designation;

(b) roads currently not designated in the CDP as scenic routes but which are perceived to be of such high quality that they might warrant designation;

(c) areas of landscape that are of such high quality that they could not accommodate wind farms; and

(d) areas of landscape that could accommodate wind farm development.

Initial Field Work – Planning staff and / or landscape consultants spend time in the field examining the landscapes and identifying those locations that are deemed to be of very high quality. Areas of high quality will tend to agree with those highlighted in the mapping exercise carried out above.

Public Consultation – At least one open focus group meeting (perhaps 2 or more in larger counties) should be held in order to consult with local communities and other interested parties regarding the development of a wind energy strategy for the county. These events should be well advertised and all statutory consultees should be formally invited. Following introductory presentations by the planning staff and / or consultants, the focus group attendees can participate in a series of hard-copy mapping exercises with the aim of identifying:

(a) landscapes of exceptionally high quality;
(b) ordinary (non-remarkable) landscapes;
(c) locations where wind farm development would be unacceptable (to the consultees); and
(d) locations where wind farms could be acceptable.

Such mapping exercises are a very effective medium for classifying landscape sensitivity according to different values held by the attendees. Despite the wide ranging views held by different individuals and groups (ranging from very pro-development to highly conservative), common ground will often be found when the maps are collectively reviewed. The focus group classification of landscape sensitivity to wind farm development will often closely agree with the findings from the consultation with the planning authority, as well as with the conclusions drawn from the initial field work by the planning staff and / or landscape consultants.

Preparation of Draft Sensitivity Map – All the marked-up maps prepared by the focus groups are examined in detail and a broad classification of sensitivity can be developed using GIS. As an example, areas which are identified as being exclusion zones by both the planning authority and the focus groups and which were assessed as being of high quality might be classified as being high in sensitivity. Conversely, areas where little concern was expressed regarding wind farms, and where the consultants felt that quality was unremarkable, could be classified as being moderate, or in some cases low, sensitivity. The sensitivity classification could include areas that are:

(a) acceptable in principle;
(b) open to consideration; or
(c) not acceptable.

Further Field Work and GIS Studies – Following the public consultation, further field studies should be carried out to test the emerging draft landscape sensitivity map. The most challenging aspect of this is to define the boundaries of different zones (e.g., between an exclusion zone and an acceptable zone). Given that the focus of the study is primarily landscape, computer-based studies known as zones of theoretical visibility (ZTV) can be effectively employed to identify such boundaries. It is also critically important to consult with adjacent planning authorities to see how classifications in one county fit with that of their neighbour(s).

In cases where, for example, a no-go area flanks a preferred area along a political boundary such as a ridgeline or river, some discussion may be required between both parties to produce a classification that is logical and balanced. An “ordinary” landscape in one county might be a “special” landscape in a neighbouring county and the concerns of the latter may require the former to use a buffer zone of, say, open for consideration, to provide some level of protection.

Waterford County Council carried out this exercise in practice, with the aid of landscape consultants, in the preparation of their draft Wind Energy Strategy.

Appendix 2

Advice for Developers on Best Practice in the Pre-application Consultation Process

Providing the public with a good flow of information about a proposed wind energy development in their locality prior to formal application can avoid conflict in the future. It may be helpful to circulate information pertaining to the proposal to the immediate population whose properties are within *approx* 1km of the proposed wind energy development, and to community groups, churches and clubs within *approx* 10km radius. Suggestions in regard to what this information might include are as follows:

Formal letter to:

- Introduce the wind energy development promoters and details of the proposed development.
- Indicate the necessity of wind energy development in a context of national and international policy.
- Identify the scope of the pre-consultation (who else is being contacted).
- Invite the recipient to further public exhibitions, outlining date, times and location of the exhibitions.

It would be helpful if a project information leaflet accompanied the letter.

Project information leaflet should:

- Detail location (small map), and scale of the proposed development.
- Detail an anticipated project timetable (including public exhibitions).
- Outline the environmental and social benefits that the development will affect both locally and globally, including any planning gain for the local community.

- Identify a contact name and contact details for the promoters of the development for further information.

Posters and Advertising

Where a recipient has access to community groups or clubs (e.g., in churches, community halls, sports facilities, etc.) it is a good idea to use posters advertising and inviting attendance to the public exhibitions.

Response form

A pre-paid response form for the recipient to complete may be included with the information letter to identify:

- If the recipient would like to receive further information about the proposal;
- If the recipient can identify other people not targeted by the promotion information; and
- If the recipient does not wish to receive further related information.

Appendix 3

Landscape Impact Assessment of Wind Energy Development Proposals

- **Structure of a landscape impact assessment report**

Landscape impact assessment forms an integral part of the Environmental Impact Assessment of wind energy proposals. In line with recommendations made in the Environmental Protection Agency Guidelines on environmental impact assessment, the landscape impact assessment reports for wind energy development should include the following stages:

1. Description of proposed development, including alternatives considered during the design process;
2. Description of geographic location and landscape context;
3. Definition of study area, informed by identifying the Zone of Theoretical Influence;
4. General landscape description of the Study Area;
5. Selection of viewshed reference points from where the proposal is examined in detail;
6. Assess the sensitivity of landscape from each viewshed reference point;
7. Preparation of photomontages;
8. Estimation of the likely degree of impact on landscape;
9. Recommendation of mitigation measures.

Stages 3, 5, 7 and 8 are considered in detail below.

- **Definition of study area and Zone of Theoretical Visibility**

Zone of Theoretical Visibility (previously referred to as Zone of Visual Influence) is a computer-aided procedure, which aims to predict from where the turbines might be visible. The following recommendations are made in relation to the preparation of Zone of Theoretical Visibility maps:

- For blade tips up to 100m in height, a Zone of Theoretical Visibility radius of 15km would be adequate (this is greater than the current standard by some 50% but reflects the technical difficulty of depicting "small and medium" turbines at 20km)

- For blade tips in excess of 100m, a Zone of Theoretical Visibility radius of 20km would be adequate (this is twice conventional thresholds and reflects greater visibility of higher structures).

- In areas where landscapes of national or international renown are located within 25 km of a proposed wind energy development, the Zone of Theoretical Visibility should be extended as far (and in the direction of) that landscape. This reflects the fact that highly sensitive landscapes deserve extra special treatment by developers and planners.

- It is recommended that the Zone of Theoretical Visibility should assess the degree of visibility based on the numbers of turbines visible to half the blade length in addition to hub-height. It is not sufficient to only use the hub height in the preparation of the Zone of Theoretical Visibility maps because this would exclude potential visibility of the entire blade. Likewise, using blade tip height is not necessarily appropriate because this would identify all locations that can see literally the tip of the blade and nothing else.

- It is important to overlay the Zone of Theoretical Visibility map on the 1:50,000 series Ordnance Survey maps and print preferably at a scale of 1:50,000 or at another scale ensuring that locations theoretically exposed to viewing can be easily identified. The print quality and scale of the map(s) should be such that the underlying information such as place names and roads are clearly legible.

- Colour coding of the Zone of Theoretical Visibility map according to the number of turbines visible at any one location should be capable of being easily understood by viewers of the map. It is essential to provide a clear legend.

- The resolution of the Digital Terrain Model used to prepare the Zone of Theoretical Visibility map should be a maximum of 50 by 50 metres to ensure high resolution.

- The cumulative effects of a number of different wind energy developments should be clearly represented using Zone of Theoretical Visibility maps.

- In addition to a Zone of Theoretical Visibility being based simply on contour data, screening objects such as forestry, buildings, etc., may be introduced to a Zone of Theoretical Visibility map.

A very useful exercise at the initial design stage of preparing the wind energy development layout is to carry out a "**reverse zone of theoretical visibility**" (reverse-ZTV) from locations known to be highly sensitive and from where views of turbines should be avoided. All locations theoretically visible from the sensitive viewpoint can be identified and, if any cross over the wind energy development site, they can be eliminated from the workable area. This effectively means that the wind energy development can be designed thereafter knowing that no turbines will be exposed to viewing from the chosen location.

- **Selection of viewshed reference points/import viewpoints**

This stage involves the identification of those locations from where visibility of the proposed wind energy development might be provided. It is helpful to consult with the relevant local authority(s) in identifying and choosing viewshed reference points so that delays owing to omissions can be avoided. The following guidance should be followed in selection of viewshed reference points:

1. They should reflect local designations as might be relevant from the County Development Plan or Local Area Plan, including Views and Prospects and other scenic amenity designations.

2. They should be located at varying distances from the wind energy development and, where relevant, afford views from all directions so that a good sense of what is proposed can be observed. This might include locations outside the jurisdiction of the planning authority to which the proposal is being lodged.

3. They should always present the worst case (most open) available view from any given location.

4. It is advisable to consult with the relevant planning authority(s) in identifying and choosing viewshed reference points so that delays owing to omissions can be avoided.

- **Preparation of photomontages of the development**

Photomontages provide a graphic depiction of the view from each viewshed reference point after introduction of the turbines. The following guidance should be followed in the preparation of photomontages:

1. A camera lens focal length of 50-70mm is recommended for taking photographs for preparation of photomontages.

2. Panoramic photographs included to illustrate the context in which the development might be visible should be prepared by splicing photographs taken with a 50-70mm lens and not by inclusion of views taken with a wide-angle lens.

3. Unless specifically requested to do so by the relevant planning authority or by statutory consultees, the vast majority of photomontages should be prepared from places that do provide views of the proposed wind energy development. The Zone of Theoretical Visibility is prepared to highlight places from where views are not provided and they generally do not need to be considered further thereafter.

4. The landscape depicted in the photomontage should represent the most open view possible in the direction of the wind energy development. Care should be taken so as not to place an object such as vegetation or structures between the wind energy development site and the camera.

5. Turbines that are not visible from the viewshed reference point (resulting from intermittent screening) should not be depicted on the photomontages.

6. Related to the above, the photomontage should be accompanied by a wire frame computer generated perspective view of the landscape, or shaded-relief model, illustrating all theoretically visible turbines. These wire frame diagrams may also be used to indicate turbines that are not visible in whole or in part due to screening, simply to prove that point. Wire frames and photomontages should be at the same scale and presented in unison so that direct comparison / correlation can be made.

7. The recommended distance at which the page depicting the photomontage should be held for viewing purposes should be clearly stated (this should not be less than 30cm).

8. The print quality of the photomontages should be high-low resolution or faded colour photocopies are not acceptable.

9. A reference map should be included for orientation purposes, and the longitude and latitude national grid coordinates provided for each camera position used to take the photographs, along with the coordinates of the target point. This will enable the planning authority to test the accuracy of wire frames using their own contour data.

- **Estimation of likely degree of impact on landscape**

A structure for this critical part of the Landscape Impact Assessment is proposed below, carried out in respect of each key viewpoint.

1. Describe the landscape in general, including landform, landcover, structures and features, spatial flow / interconnection and degree of naturalness or human influence.

2. Assess the visual presence of the wind energy development, for example, how spatially dominant it is. (This does not necessarily correspond to the ultimate landscape impact).

3. Assess the aesthetic impact of the wind energy development on the landscape, referring in particular to Chapter 6 of these Guidelines and determining whether the impact might be adverse or positive.

4. Using the results of the earlier estimate of landscape sensitivity from each key viewpoint along with those of visual presence and aesthetic impact, estimate the significance of the impact on the landscape.

Appendix 4

Best Practice for Wind Energy Development in Peatlands

Development of most peatland sites (including upland and lowland bog types, fens and heaths) will generally lead to impacts on natural heritage. Notable exceptions to this would be areas of exploited peatland such as within the extensive milled peat bogs, mainly in Ireland's midlands, and those that have been converted to farmland.

Where wind energy developments are permitted on peatlands, the implementation of the following construction guidelines (along with others that are recommended in the Environmental Impact Statement) may serve to reduce impacts, including minimising habitat disturbance and loss, hydrological disruption and the risk of erosion:

1. A thorough ground investigation, including hydro-geological investigations where appropriate, and a detailed evaluation of the nature of the peat, its geotechnical properties and the associated risk of instability and habitat loss or disturbance during construction and operation of the wind energy development, is to be carried out where the depth of peat is in excess of 50cm.

2. Avoid construction, if possible, on wet areas, flushes and easily eroded soils.

3. Avoid the excavation of drains, where possible, unless it is necessary for geotechnical or hydrological reasons.

4. If drains are unavoidable, ensure that silt traps are constructed and that there is only diffuse discharge of water.

5. Avoid blocking existing drains.

6. Where blasting is being used in or near a peatland area for borrow pits, foundations etc, the possible effect on the peat stability should be assessed.

7. Avoid stock grazing on any disturbed peat until local peatland vegetation has recovered (e.g., by use of temporary electric fencing).

- **Construction of Access Tracks/Roads in Peatland Areas**

1. Construct roads to take the required vehicular loadings, having due regard to overall site stability.

2. Operate machinery and vehicles used in road construction from the road as it is constructed.

3. Make the road width the minimum compatible with sound engineering practice.

4. Use hard rock to construct the road batters.

5. Culverts should be placed under roads, where appropriate, to preserve existing surface drainage channels.

- **Construction of Foundations for Turbine Towers**

1. A geotechnical analysis must be carried out for each turbine base into the method of excavation and the location for placing and storing excavated material to ensure that these operations do not give rise to slope or site instability.

2. Each tribune base should be assessed on an individual basis for stability purposes.

3. Lay out and store surface vegetated scraghs / turves, for re-sodding bare areas, off-site and water them in dry weather.

4. If, during excavation, spoil is likely to fall onto the adjacent peatland surface, protect the surface with shuttering boards or geogrid / geotextile.

5. Carefully monitor and control any pumping of water from excavated turbine bases to ensure that water is directed into existing water courses, forestry drains or specially constructed drains, all with adequate capacity to deal with the volumes of water encountered.

- **Installation of High Voltage Cables**

1. Cables should be interred alongside the turbine access routes to minimise the degree of ecological impact on site.

2. All machinery and construction methods on-site should be selected with a view to minimising impact on habitat.

3. Specialised low-ground pressure tracked machinery on bog mats should be used if operating on the peatland surface.

4. Place vegetated peatland scraghs on shuttering or geogrid (or on the road) alongside trenches unless backfilling takes place soon after excavation.

5. Place peat spoil alongside the peatland scraghs on shuttering or geogrid or on the road

6. Carefully backfill the trenches with the peat-spoil.

7. Replace the scraghs / surface turves, vegetated side up, and firm them in with the back of the excavator bucket.

Appendix 5

Glossary

Alternatives: Description of alternative locations, alternative designs and alternative processes.

Anemometer: Equipment fixed on a mast to measure wind speed over a particular site. Anemometry masts are usually slender structures fixed to the ground with guy wires.

Ambient Noise: The average noise level over a given period of time, usually composed of sound from many sources, near and far.

Background Noise Level: A measurement of the noise level already present within the environment in the absence of wind energy development operation.

Baseline Survey: Description of the existing environment against which future changes can be measured.

Berm: An extended mound of soils, overburden or structure erected as a barrier to sight, sound or water.

Blade Swish: The modulation of broadband noise at blade passing frequency.

Borrow Pit: An area of excavation of rock and / or soil material that is used elsewhere within the site development boundaries.

Built Environment: Refers to both architectural heritage and archaeological heritage.

Commissioning: The making fully operational of a project.

Cut-in Wind Speed: The wind speed at which a turbine produces a net power output. This is usually at hub height wind speeds of 4-5 metres per second.

DAU: Development Applications Unit of the Department of Environment, Heritage and Local Government, which includes the National Parks and Wildlife Service.

dB (decibel): Measurement of sound, the scale in which sound pressure level is expressed. When measuring environmental noise, a weighting network is used which filters the frequency of sound, and is expressed as dB(A).

dBA or dB(A): An "A-weighted decibel" - a measure of the overall noise level of sound across the audible frequency range (20Hz-20kHz) with A- frequency weighting (i.e., "A" weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies. The decibel scale is logarithmic. Every 10 dB(A) increase in sound level represents a doubling of loudness. A change of 3 dB(A) is the minimum perceptible under normal circumstances.

Decommissioning: The final closing down of a development or project when it has reached the end of its operational / useful life.

Ecology: The study of relationships between living organisms and between organisms and their environment (especially animal and plant communities), their energy flows and their interactions with their surroundings.

EIA: Environmental Impact Assessment: An ordered exercise designed to enable the environmental impacts of a proposed development / project to be anticipated before the project is carried out.

EIS: Environmental Impact Statement: A statement of results from the ordered exercise which focuses on anticipating all environmental impacts of significance of a proposed development, prior to implementation or construction, and which specifies those measures which should be taken to eliminate or mitigate such impacts to an acceptable level.

Environmental Heritage: Includes natural and built, including archaeological, heritage.

Energy Yield: Describes the electrical output from a wind energy project. It is closely related to wind speed; the higher the wind speed, the greater the energy yield.

EPA: Environmental Protection Agency.

European Site: Designated European site, also known as ***Natura 2000 Sites*** and include ***Special Areas of Conservation*** (SAC) under Habitats Directive 1992 that is in the listing process, an agreed candidate or designated. **Special Protection Areas** (SPECIAL PROTECTION AREA) under Birds Directive 1985.

Flushes: Areas of vegetation that differ from surrounding vegetation and are influenced by moving ground or surface water.

Geology: Science of the earth, including the composition, structure and origin of its rocks.

Habitat: Area in which an organism or group of organisms live.

Hub height: Height of wind turbine tower from the ground to the centre-line of the turbine rotor.

Hydrology: Science concerned with the occurrence and circulation of water in all its phases and modes.

Hertz: Hz: Unit of frequency of sound, in cycles per second. Frequency determines pitch of sound.

Impact: Degree of change in an environment resulting from a development.

Key Viewpoints: Places from which a development can be viewed that are crucial and sensitive with respect to observer numbers and interest.

$L_{A90,T}$: A-weighted sound pressure level (in decibels, dB) obtained using "Fast" time-weighting that is exceeded for 90% of the given time interval (T), e.g. for background noise level. The given time interval is ten minutes for $L_{A90,10min}$.

Land Use: The activities that take place within a given area of space.

LIA : Landscape Impact Assessment.

Megawatt & Kilowatts: Used as a measurement of electrical generating capacity. A megawatt (MW) is equal to 1,000 kilowatts (kW) or 1,000,000 watts (W).

Mitigation: Measures designed to avoid, reduce, remedy or compensate for adverse environmental effects that are identified.

Monitoring: Repetitive and continued observation, measurement and evaluation of environmental data to follow changes over a period of time, to assess the efficiency of control measures.

Natura 2000 Site: Designated ***European Site***. In combination ***Special Areas of Conservation*** and ***Special Protection Areas*** will constitute Natura 2000 network of protected sites for habitats and species across the EU.

Natural heritage: Refers to habitats and species of flora and fauna.

NBP: National Biodiversity Plan (2002), prepared in response to Article 6 of the Convention on Biological Diversity.

Noise: Any sound that has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it. Described as “unwanted sound”.

Noise Sensitive Location: In the case of wind energy development, this includes any occupied dwelling house, hostel, health building or place of worship and may include areas of particular scenic quality or special recreational amenity importance.

Photomontage: Image whereby an impression of a potential development is superimposed upon an actual photograph.

RMP: Record of Monuments and Places, the county maps showing the archaeological sites and accompanying manuals.

RPS: Record of Protected Structures, a record of protected structures in the functional area of the Planning Authority and contains an identifying number and address for each protected structure and one or more maps which identifies the location of each protected structure.

SAC: Special Area of Conservation under Habitats Directive (92/43/EEC), designated for rare, vulnerable and endangered habitats and species (e.g. plants, mammals and fish), listed in Annexes I and II.

Scoping: Process of identifying the significant issues that should be addressed by a particular Environmental Impact Assessment.

Sensitivity: Potential for significant change to any element in the environment that is subject to impacts.

Shadow Flicker – Term used to describe the short-lived effect of shadows cast by rotating blades of wind turbines when the sun passes behind them, which occurs under certain combinations of geographical positions and time of day.

SPA: Special Protection Area under Birds Directive (79/409/EEC), designated for bird species listed in Annex I of the Directive, in particular internationally important concentrations of migratory and wetland birds. Designation is focused on habitats of these species.

Substation: Connects the local electricity network to the electrical system of the wind energy project through a series of automatic safety switches.

Threshold: Magnitude of a project, which if exceeded, will trigger the requirement for an Environmental Impact Assessment.

TPER: Total Primary Energy Requirement.

VAC: Visual Absorption Capacity. This attempts to measure the inherent ability of a landscape to absorb development without loss of visual integrity, i.e., still maintain its visual character. The more complex the landscape, the higher the VAC.

VPs: View points.

VRPs: Viewshed Reference Points. Those locations from where visibility of the proposed wind energy development might be provided.

Wire frame/wireline diagram: Computer generated diagrams that illustrate how development will appear upon landforms from identified viewpoints. A useful tool to illustrate visual impact, especially when used in combination with photographs from the same view.

ZVI: Zone of Visual Influence: Provides a visual representation, usually presented as a map with markings or colourings, of the area over which a site and / or a proposed development may be visible.

ZTV: Zone of Theoretical Visibility. The maps produced are *theoretical* because they estimate exposure of proposed development based upon landform data only, and take no account of intermittent screening by vegetation or structures. ZTV maps estimate *visibility* of the proposed development in the surrounding landscape and not its “visual influence”.

Appendix 6

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