Noel Tuohy MCC,
Anfield House,
Summerhill Lane,
Portlaoise,
Co Laois

Date: 24th August, 2017

Re: Laois County Development Plan 2017-2023- Draft Ministerial Direction

A Chara,

I acknowledge your submission received on the 14th August in relation to the Laois County Development Plan 2017-2023- Draft Ministerial Direction.

Please be advised that the contents will be noted in the Chief Executives Report to the Minister in this regard.

Mise le Meas,

Angela McEvoy
Senior Planner
Planning Section

Submission No 7

Anfield House,
Summerhill Lane,
Portlaoise,
Co Laois
14th August 2017

Submission of Noel Tuohy MCC to the Laois County Development Plan 2017-2023 – Draft Ministerial direction

Dear Sir/Madam,

I wish to make a submission on the Laois County Development Plan 2017-2023 – Draft Ministerial Direction on the matter of Section 31 of the Planning and Development Act 2000 (as amended by S.21 of the Planning and Development (amended) Act 2010) Laois County Development Plan Direction 2010.

The Minister has stated:

> ***WHEREAS*** *the Minister, for the reasons set out in the Statement of Reasons hereto, is of the Opinion that*
> *(i) Laois County Council in making the Laois County Development Plan 2017-2023 has ignored or has not taken sufficient account of the submissions made by the Minister in November 2016 and in May 2017,*
>
> *and*
> *(ii) the Laois County Development Plan 2017-2023 is not in compliance with the requirements of s.10(2)(n), s.10(5) and s.10(5A), s.28 (1B)(b) and s.31(1)(c) of the Planning and Development Act 2000 (as amended).*

I strongly refute the accusations that we have ignored or have not taken sufficient account of the submissions made by the Minister in November 2016 and in May 2017 as part of the Laois CDP 2017. This is simply not true. The CDP documents including the various County Manager Reports and the Minutes of Council Meetings show clearly that the submissions made by the Minister were taken fully into account, ample evidence was available to support the decisions taken and therefore the Laois County Development Plan 2017-2023 is in compliance with the requirements of the Planning and Development Act 2000 (as amended).

The Minister must also be aware that achieving sustainable development involves balancing the competing requirements of many different plans and needs and also involves the consideration of submissions received by the public. I respectfully suggest that your focus here is too narrow and does not take account of the broad range of issues that were considered. The elected representatives took these competing interests fully into consideration and the result is the variation that you are now challenging.

The Minister has directed that:

> *(i) The text in Policy EN7 is to be deleted as shown below:*
> *Ensure a setback distance of 1.5 km of Wind turbines from schools, dwellings, community centres and all public roads in all areas open for consideration for wind farm development*
>
> *(ii) The text in Section 6.1 of Appendix 5- Wind Energy Strategy is to be deleted as shown below:*
>
> *'Ensure a setback distance of 1.5 kms of wind turbines from schools, dwellings, community centres and all public roads in all areas open for consideration for wind-farm development.'*
>
> *(iii) The Map 1.6.5 – Wind Energy as adopted is to be removed. For ease of reference a copy of the said map is attached as Appendix 1 to this direction.*
> *And*

The Map 1.6.5 – Wind Energy as included in the Draft Laois County Development Plan 2017-2023 is to be included. For ease of reference a copy of the said map is attached as Appendix 2 to this direction.

The Minister claims in his 'Statement of Reasons' that

1. The Laois County Development Plan 2017 – 2023 is not consistent with relevant guidelines to planning authorities issued by me under Section 28 of the Planning Development & Act 2000 (as amended) specifically the Wind Energy Guidelines 2006 and insufficient grounds have been stated for such departures as required under Section 28(1B)(b) of the Planning & Development Act 2000 (as amended). The plan is therefore in breach of Section 31(1)(c) of the Planning & Development Act 2000 (as amended)."

The relevant sections of the Planning and Development Act 2000 (as amended) state that

***28.**—(1) The Minister may, at any time, issue guidelines to planning authorities regarding any of their functions under this Act and planning authorities shall have regard to those guidelines in the performance of their functions.*
F101[(1A) Without prejudice to the generality of subsection (1) and for the purposes of that subsection a planning authority in having regard to the guidelines issued by the Minister under that subsection, shall—
(a) consider the policies and objectives of the Minister contained in the guidelines when preparing and making the draft development plan and the development plan, and
(b) append a statement to the draft development plan and the development plan which shall include the information referred to in subsection (1B).

*(1B) The statement which the planning authority shall append to the draft development plan and the development plan under subsection (1A)**shall include information which demonstrates**—*
(a) how the planning authority has implemented the policies and objectives of the Minister contained in the guidelines when considering their application to the area or part of the area of the draft development plan and the development plan, or
(b) if applicable, that the planning authority has formed the opinion that it is not possible, because of the nature and characteristics of the area or part of the area of the development plan, to implement certain policies and objectives of the Minister contained in the guidelines when considering the application of those policies in the area or part of the area of the draft development plan or the development plan and shall give reasons for the forming of the opinion and why the policies and objectives of the Minister have not been so implemented.]

*F105[**31.**— (1) Where the Minister is of the opinion that—*
(a) a planning authority, in making a development plan, a variation of a development plan, or a local area plan (in this section referred to as a 'plan') has ignored, or has not taken sufficient account of submissions or observations made by the Minister to the planning authority under section 12, 13 or 20,
(b) in the case of a plan, the plan fails to set out an overall strategy for the proper planning and sustainable development of the area,
(c) the plan is not in compliance with the requirements of this Act, or
(d) if applicable, having received a submission prepared under section 31C or 31D (inserted by section 95 of the Act of 2008) that a plan of a planning authority in the Greater Dublin Area (GDA) is not consistent with the transport strategy of the National Transport Authority,

the Minister may in accordance with this section, for stated reasons, direct a planning authority to take such specified measures as he or she may require in relation to that plan.

I refute the Minister's point that 'insufficient grounds' have been stated for our departure from the 2006 Wind Energy Guidelines. The Planning and Development Act (as amended) states at section 28(1B)(b) that reasons must be given for departing from policy guidelines. You will note that the written statements

supporting the new County Development Plan provide these reasons. I have set out a few samples in response to your points 1-7 below. As this information is clearly present as required by the Act, it is simply not reasonable to suggest that 'insufficient grounds' have been stated:

1. The Minister states that

(a) The Laois County Development Plan 2017-2023 does not meet with the requirements of Section 10(2)(n) of the Planning and Development Act 2000 (as amended), as the effect of Policy EN7, Section 6.1 (Appendix 5) and revised wind energy map 1.6.5, is to severely undermine and negate practical measures to adapt to climate change and reduce reliance on fossil fuels and;

(b) The Environmental Report does not include information on "any measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing" Policy EN7, even though it will effectively run contrary to Policy EN1 and Aim 13 in the Development Plan, as adopted.

Consequentially, the plan is not in compliance with the requirements of Sub sections 10(5) and (5A) of the Planning and Development Act 2000 (as amended) due to the fact that the environmental report which is required to accompany the plan (and without which the plan would be in breach of Directive 2001/42/EC) does not include information on mitigation to offset any significant adverse effects on the environment of implementing PolicyEN7.
The plan is therefore in breach of Section 31(1)(c) of the Planning & Development Act 2000 (as amended).

The PDA 2000 (as amended) states that

***10.**—(1) A development plan shall set out an overall strategy for the proper planning and sustainable development of the area of the development plan and shall consist of a written statement and a plan or plans indicating the development objectives for the area in question.*
F40[(1A) The written statement referred to in subsection (1) shall include a core strategy which shows that the development objectives in the development plan are consistent, as far as practicable, with national and regional development objectives
set out in the National Spatial Strategy and F41[the regional spatial and economic strategy].

(2) Without prejudice to the generality of subsection (1), a development plan shall include objectives for—
(n) the promotion of sustainable settlement and transportation strategies in urban and rural areas including the promotion of measures to—
(i) reduce energy demand in response to the likelihood of increases in energy and other costs due to long-term decline in non-renewable resources,
(ii) reduce anthropogenic greenhouse gas emissions, and
(iii) address the necessity of adaptation to climate change;
in particular, having regard to location, layout and design of new development;

F51 [(5) The Minister may, for the purposes of giving effect to Directive 2001/42/EC of the European Parliament and Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (No. 2001/42/EC, O.J.
No. L 197, 21 July 2001 P. 0030-0037), by regulations make provision in relation to consideration of the likely significant effects on the environment of implementing a development plan.]
F40 [(5A) Where required, a strategic environmental assessment or an appropriate assessment of a draft development plan shall be carried out.]

Laois CDP - AIM 13:
Ensure that development is promoted, supported or facilitated by the Laois County Development Plan, provides for climate change including for the increased risk of flooding and the promotion of renewable energy where possible.;

Laois CDP - EN1:
Encourage and favorably consider proposals for renewable energy developments and ancillary facilities subject to compliance with normal planning and environmental criteria; in order to meet national, regional and county renewable energy targets and to facilitate a reduction in CO2 emissions and the promotion of a low carbon economy, and in compliance with Article 6 of the Habitats Directive;

I refute the Minister's assertion that Policy EN7, Section 6.1 (Appendix 5) and revised wind energy map 1.6.5, 'severely undermine and negate practical measures to adapt to climate change and reduce reliance on fossil fuels"...The requirement to adapt to climate change and reduce reliance on fossil fuels has been taken very seriously in the CDP process, you will note that:

- Laois has already facilitated significant commercial wind-farm projects i.e. "with an energy output equivalent of c 82 MW which by industry norms would supply the energy consumption requirements of c. 114,000 no. households which is well in excess of the population of County Laois. " (ref Chief Executive's response to submission no 69 submission by Department of Housing, Planning, Community & Local Government, Stage 2 Consultations - Chief Executive's Report on Review of the CDP 2017-2023)

- An evidence-based assessment of the county involving the SEAI Wind Atlas to identify areas deemed 'eminently suitable for wind-farm development' established that "It is considered that there are no such areas in County Laois" (ref. page 22, Appendix 5: Wind Energy Strategy, Laois County development Plan 2017-2023). This means that any potential locations for wind-farms would be in sub-optimal locations at best which would be contrary to sustainable development.

- It is denied that implementing policy EN7 will result in *'significant adverse effects on the environment'*. Actually, it seems more likely that significant adverse effects will occur if it is not implemented as per your draft direction. Regarding this, please see the reference to a submission from the Irish Doctors Environmental Association-point 5 below.

- Laois also fully intends on developing other mechanisms to support commitments to reduce reliance on fossil fuels i.e. *"Laois County Council is committed to the preparation of a holistic Local Authority Renewable Energy Strategy [LARES] during the lifetime of the new County Development Plan 2017-2023."* (ref. Energy and Communications Objective OBJ1, Volume 1-Written Statement, Laois County Development Plan 2017-2023). This is also mentioned in the Chief Executive's response directly to submission no 69 submission by your Department of Housing, Planning, Community & Local Government, Stage 2 Consultations.

As you can see, in the context of the items set out above, the issues to which you refer are not in conflict with either AIM 13 or EN1.

- Laois CDP - AIM 13 refers to "*the promotion of renewable energy where possible*". As you can see from the previous references above, renewable energy has been and continues to be promoted

- Laois CDP - EN1 refers to encouraging renewable energy developments "*subject to compliance with normal planning and environmental criteria*";

2. The Minister states that

The planning authority was advised in a submission made on 5th May 2017 under section 12 of the Planning & Development Act 2000 (as amended) of my opinion.

I note you will see from the responses below that these submissions were before the elected representatives during the County Development Plan process.

3. The Minister states that

The inclusion of a wind turbine set-back stipulation in Policy EN7 and in Section 6.1 of Appendix 5, coupled with the requirements of Map 1.6.5 of the Laois County Development Plan 2017-2013, results in the introduction of an arbitrary and mandatory exclusion or setback distance of a minimum of 1.5 kilometres from schools, dwellings, community centres and all public roads in all areas open for consideration for windfarm development and effectively designates the vast bulk of the County as not open for considering wind energy proposals.

These requirements are in clear breach of Sections 5.6 and 5.12 of the Wind Energy Guidelines 2006 in that they remove the capability for a case by case assessment of wind energy applications based on objective analysis of their impact on the specified property types. Furthermore in practical terms the setback requirement introduces a setback distance considerably in excess of the non-mandatory guidance setback referred to in the statutory guidelines.

As the minister rightly points out, the existing Wind Energy Guidelines 2006 contain non-mandatory guidance. This guidance was discussed and considered as part of the County Development Plan process. As such and for the reasons set out in points 4 and 5 below you will see that the County Development Plan has introduced these restrictions in a considered manner that is in keeping with the need to achieve sustainable development.

4. The Minister states that

The mandatory and arbitrary exclusion zones introduced by Policy EN7 and Section 6.1 of Appendix 5, coupled with the requirements of revised Map 1.6.5 are in breach of the planning policy guidance contained in the Wind Energy Guidelines 2006, as they do not maximise wind energy potential in the county and are in direct conflict with the requirements of Section 3.4 of the guidelines 'to secure the maximum potential from wind energy resources of the planning authority's area commensurate with supporting development that is consistent with the proper planning and sustainable development.'

The effect of the mandatory setback requirement and the requirements of Map 1.6.5 is to significantly restrict the potential for wind energy development in the county which is contrary to national energy policy supporting development of renewable energy resources including wind energy infrastructure.

I refute the Minister's statement. The exclusion zones proposed are not arbitrary but were to achieve a balance with the other needs within the county including to protect human health and amenity. As per the explanation given directly in response to the issues raised by your department *"The intention of the Elected Members, in incorporating this revised Wind Energy Map, was to avoid centres of population within the county, where there is potential for conflict with wind farm developments in the future. "* (ref. Chief Executive's Report, Public Consultation of Proposed Material Alterations/Amendments, 26th May 2017).

An evidence-based assessment of the county involving the SEAI Wind Atlas to identify areas deemed eminently suitable for wind-farm development established that "It is considered that there are no such areas in County Laois" (ref. page 22, Appendix 5: Wind Energy Strategy, Laois County development Plan 2017-2023). This means that any potential locations for wind-farms would be in sub-optimal locations at best which would clearly be contrary to proper planning and sustainable development.

While the impact may be to restrict further suboptimal development of wind-farms in Laois, this should be taken in context i.e.

- Laois has already facilitated significant commercial wind-farm projects i.e. *"with an energy output equivalent of c 82 MW which by industry norms would supply the energy consumption requirements of c. 114,000 no. households which is well in excess of the population of County Laois. "* (ref Chief Executive's response to submission no 69 submission by Department of Housing, Planning, Community & Local Government, Stage 2 Consultations - Chief Executive's Report on Review of the CDP 2017-2023) and

- fully intends on developing other mechanisms to support these commitments i.e. *"Laois County Council is committed to the preparation of a holistic Local Authority Renewable Energy Strategy [LARES] during the lifetime of the new County Development Plan 2017-2023."* (ref. Energy and Communications Objective OBJ1, Volume 1-Written Statement, Laois County Development Plan 2017-2023)

5. The Minister states that
   The planning authority has not demonstrated sufficient and evidentially based reasoning, relating to the nature and characteristics of Laois, for the above significant policy departures from the guidelines on wind energy and has therefore failed to comply with the provisions of Section 28(1) and Section 28(1B)(b) and Section 31(1)(c) of the Act.

I refute this point. The planning authority clearly had more than sufficient evidence before it to support the requirement for a 1.5km setback in line with the precautionary principle. This is broadly equivalent to a 10xturbine height setback for the now common turbines in the height ranges 150-175m.

You will also see that a supplementary submission from the Irish Doctors Environmental Association raised serious issues regarding the adequacy and completeness of the existing Wind Energy Guidelines (see complete submission 74). The written statement includes a response from the chief executive explaining *"there is no express reference to human health or quality of life in Section 4.5 of the current [2006] Wind Energy Guidelines"*. (ref Chief Executive's response to submission no 74, page 219, Stage 2 Consultations - Chief Executive's Report on Review of the CDP 2017-2023) and as such this issue had to be addressed.

Additionally, it was widely publicised at that time that a number of families in Cork were forced to move out of their homes on the basis of wind Turbine noise nuisance. The High Court case 2011-9955-P where Enercon Wind Farm Services Ireland Ltd. admitted liability was settled in April 2017. The homes involved were situated within 1km of the wind-farm demonstrating that the current Wind energy Guidelines were inadequate to prevent this situation. It would have been negligent to ignore this relevant information, which was in the public domain at the time.

We also draw your attention to the explanation given directly in response to the issues raised by your department *"The intention of the Elected Members, in incorporating this revised Wind Energy Map, was to avoid centres of population within the county, where there is potential for conflict with wind farm developments in the future. "* (ref. Chief Executive's Report, Public Consultation of Proposed Material Alterations/Amendments, 26th May 2017).

6. The Minister states that
   This deficiency in the evidential basis of the policy is contrary to the guidelines above which are intended to ensure a consistency of approach throughout the country in the identification of suitable locations for wind energy development and the securing of the maximum potential from the wind energy resources of the planning authority's area and to underpin wider Government policy in relation to meeting binding international legal obligations with regard to renewable energy production and tackling the drivers of climate change.

I strongly refute this point. There is clearly no deficiency in the evidential basis of the County Development Plan. As the minister has already pointed out, the Wind Energy Guidelines 2006 are non-mandatory and thus deviation from these is allowable. The CDP process takes full account of the requirements for renewable energy production and tackling the drivers of climate change, this is evidenced in the relevant CDP documents and I would reference you to the responses to your other points to see where these issues have been addressed. You will also note that suitable locations for wind energy in the county have been identified (ref Chief Executive's response to Submission no 69 by Department of Housing, Planning, Community & Local Government, Stage 2 Consultations - Chief Executive's Report on Review of the CDP 2017-2023). Laois has already facilitated significant commercial wind-farm projects i.e. "with an energy output equivalent of c 82 MW which by industry norms would supply the energy consumption requirements of c. 114,000 no. households which is well in excess of the population of County Laois. "

7. The Minister states that

Such a requirement on future wind energy projects would seriously restrict the potential for the development of wind energy infrastructure in County Laois. The changes would be significantly in conflict with national and regional policy objectives to support the development of wind energy as a crucial component of meeting Ireland's commitments to reducing greenhouse gas emissions and increasing renewable energy resources.

I refute this point. The Minister will be aware that Laois is a small inland county which equates to only 2.4% of the national landmass (ref 1.3 County Profile, Volume 1-Written Statement, Laois County Development Plan 2017-2023). To suggest that changes to wind-farm setback distances in Laois will have a significant impact on meeting's Ireland's emissions/renewable energy commitment's seems to be an unreasonable statement.

Particularly so in the context that:

- An evidence-based assessment of the county involving the SEAI Wind Atlas to identify areas deemed eminently suitable for wind-farm development established that "It is considered that there are no such areas in County Laois" (ref. page 22, Appendix 5: Wind Energy Strategy, Laois County development Plan 2017-2023). This means that any potential locations for wind-farms would be in sub-optimal locations at best which would be contrary to sustainable development.

- Laois has already facilitated significant commercial wind-farm projects i.e. *"with an energy output equivalent of c 82 MW which by industry norms would supply the energy consumption requirements of c. 114,000 no. households which is well in excess of the population of County Laois. " (ref Chief Executive's response to submission no 69 submission by Department of Housing, Planning, Community & Local Government, Stage 2 Consultations - Chief Executive's Report on Review of the CDP 2017-2023)* and

- fully intends on developing other mechanisms to support these commitments i.e. *"Laois County Council is committed to the preparation of a holistic Local Authority Renewable Energy Strategy [LARES] during the lifetime of the new County Development Plan 2017-2023."* (ref. Energy and Communications Objective OBJ1, Volume 1-Written Statement, Laois County Development Plan 2017-2023)

As such, it is totally refuted that these changes would be significantly in conflict with Ireland's commitments to reducing greenhouse gas emissions and increasing renewable energy resources.

Finally, I note that the 2006 Wind Energy Guidelines have never been subject to Strategic Environmental Assessment. This is in clear contradiction of your recent Planning Circular Letter Circular PL 5/2017 which states that:

"In line with requirements under Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment, a Strategic Environmental Assessment (SEA) ***will be carried out*** *on the proposed revisions to the Guidelines, incorporating the preferred draft approach outlined above, prior to*

their adoption. The SEA process ensures that environmental considerations and public participation are fully integrated in the preparation of plans and programmes which provide a framework for development consent or planning permission."

How is it that these amended guidelines must be subject to SEA when the 2006 guidelines were not?

How is it that the Minister with responsibility for planning matters is Directing a Local Authority to comply with any Wind Energy Guidelines **before** they have been subject to the required SEA process that the Minister has identified as being necessary?

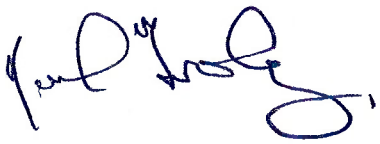
This would appear to be in direct conflict with the SEA Directive. Article 4(1) of the SEA Directive states that "*The environmental assessment referred to in Article 3 shall be carried out during the preparation of a plan or programme and **before its adoption** or submission to the legislative procedure.*"

As such, I cannot see how the guidelines have any standing either legally or as guidance to County Councils.

I must seriously question whether the Minister is attempting to direct the Local Authority to adopt a plan (the wind energy guidelines in any form) in breach of the SEA Directive? If that is the case then this would appear to nullify your draft direction.

Yours faithfully,

Cllr. Noel Tuohy



References:

LCC CDP 2017-2023 - Draft ministerial Direction http://www.laois.ie/wp-content/uploads/Draft-Ministerial-Direction-July-2017.pdf

Chief Executive's Report on Review of the CDP 2017-2023 http://www.laois.ie/wp-content/uploads/Chief-Executive-Report-January-2017.pdf

Wind Energy Strategy, Laois County Development Plan 2017-2023
http://www.laois.ie/wp-content/uploads/Appendix-5-Wind-Energy-Strategy-2017-2023.pdf

Laois County Development Plan 2017-2020 http://www.laois.ie/wp-content/uploads/VOLUME-1-2017-2023.pdf

3rd Chief Executive's report - Public Consultation of Proposed Material Alterations/Amendments **26th May 2017** http://www.laois.ie/wp-content/uploads/3rd-CE-Report-May-2017-Final.pdf

Chief Executive's Report on Review of the CDP 2017-2023
http://www.laois.ie/wp-content/uploads/Chief-Executive-Report-January-2017.pdf

MINUTES OF THE MEETING OF LAOIS COUNTY COUNCIL HELD IN ARAS AN CHONTAE, PORTLAOISE, ON THE 20TH OF MARCH 2017 TO CONSIDER THE DRAFT LAOIS COUNTY DEVELOPMENT PLAN 2017-2-23 AND THE CHIEF EXECUTIVE'S REPORT http://www.laois.ie/wp-content/uploads/MinutesCountyDevelopmentPlanMeeting20032017-Web.pdf

DIRECTIVE 2001/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment. (The SEA Directive)
http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001L0042&from=EN

Ms Paula Byrne,
Cullenagh,
Portlaoise,
Co Laois

Date: 9th August, 2017

Re: Laois County Development Plan 2017-2023- Draft Ministerial Direction

A Chara,

I acknowledge your submission received on the 9th August in relation to the Laois County Development Plan 2017-2023- Draft Ministerial Direction.

Please be advised that the contents will be noted in the Chief Executives Report to the Minister in this regard.

Mise le Meas,

Donal Kiely

Donal Kiely
Acting Senior Planner
Planning Section

Submission No. 2

Cullenagh,

Co. Laois

6th August 2017

Dear Sir/Madam,

I wish to make a submission on the Laois County Development Plan 2017-2023 – Draft Ministerial Direction.

- The minister can issue such a direction if a draft county development plan fails to set out an overall strategy for the proper planning and sustainable development of the area of a planning authority or otherwise significantly fails to comply with the Planning and Development Act 2000 (as amended) (PDA). The variation complies with proper and sustainable development of the area. It also complies with the PDA.
- Neither the 2006 wind energy guidelines nor our current Wind Energy Policy (NREAP) have been subjected to a Strategic Environmental Assessment and so do not comply with Planning and Development (Strategic Environmental Assessment) Regulations. Therefore, neither the policy nor the guidelines have any legal standing under the PDA.
- The Department have not undertaken an Environmental Impact Assessment (EIA) or a SEA of the Laois County Development plan and the wind turbine set back distances so have no evidential basis for determining a lower set back.
- On 6th October 2016 the Minister for Communications, Climate Action and Environment (Deputy Denis Naughten) responded to a question on the revised wind energy guidelines with the following statement:

  "When I was on the Deputy's side of the House, I raised this question as well. I am as anxious as anybody else to have these new guidelines put in place as the current guidelines are not fit for purpose. Along with the Minister for Housing, Planning, Community and Local Government, Deputy Coveney, my officials and I are actively engaged with this at the moment. There is a commitment in the programme for Government to present the new guidelines to the Government within six months, and we intend to do that. I hope we will have those finalised by next month."

  In other words, the Minister Naughten has clearly stated on the record that the current guidelines are "not fit for purpose" however the Minister Murphy still wants Laois County Council to change its County development plan to comply with these not fit for purpose and illegal guidelines.

http://oireachtasdebates.oireachtas.ie/debates%20authoring/debateswebpack.nsf/takes/dail2016100600012?opendocument

- The Department of the Environment commissioned RPS consultants to undertake a study on the setback distance for wind turbines as part of the revision of the 2006 guidelines. the report shows that an estimated setback distance of **1209m (i.e. 1.2 km)** would be the absolute minimum distance necessary to meet the 40dB absolute noise limit proposed in the draft revision of the Wind Guidelines. I have been advised by experts in this area that a 40dB limit is still not enough to ensure there is no distress caused to people in their homes. This fact is reinforced by the case of a number of families in Banteer Co Cork who successfully sued a wind farm operator due to noise nuisance. The families were located within 1.5km of the wind turbines. Although, the settlement figures have not been released, we understand that this has run into several millions. By imposing a lower set back distance based on guideline that have been openly acknowledged as not fit for

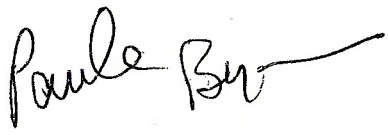
purpose, the department and possibly Laois County Council would potential be liable for any future legal action of this kind. Amendments to the EIA directive, are applicable from 17th May 2017 introduced under Directive 2014/15/EU. These amendments compel the competent planning authority to prepare an EIAR and to consider impacts on population and human health, as well as taking into account 'current knowledge' and 'methods of assessments'.

http://www.irishexaminer.com/breakingnews/ireland/cork-village-families-settle-action-against-wind-turbine-operators-793550.html

- A similar ministerial direction issued to Donegal Co Co was quashed in court following judicial review and the variation to the CDP upheld. Therefore Donegal have a setback distance in its County Development plan of 10 times turbine height. With many turbines now in the region of 150m – 175m tall, this is an effective set back distance of 1.5km – 1.75km. similarly, Westmeath Co Co adopted a variation to their County development plan implementing a tiered setback distance. By attempting to block the variation in CDP, the minister is inconsistent by allowing differing set-backs in different counties, and putting the citizens of Laois at a disadvantage to those in other counties.
- The minister is incorrect in stating that wind developments in Laois will make a significant impact on the reduction of CO_2, thereby contributing to national mitigation policies. We save between 2.6 to 4% of our overall CO_2 emissions from the deployment of wind energy in Ireland. This from approximately 1,400 wind turbines and assuming SEAI figures are correct. However, analysts have shown that the reduction in CO2 does not have a linear relationship with increased wind energy on the electricity grid. This is due to the fact that conventional generation of electricity must always be available to back up wind power, as electricity from wind cannot be stored and so must be used as generated or dumped. Also the capacity factor of wind (the % of it's theoretical maximum power output) is approximately 30%. The potential reduction in CO_2 from wind farms in Laois would make no meaningful difference to overall emissions and as full cost benefit analysis of deployment of wind on Ireland's electricity grid has never been undertaken, no claims can be made otherwise. Ireland (and the EU) have not completed a SEA, as stated, nor a regulatory impact analysis (RIA) as required before EU Directives before they are agreed. In summary, both the EU and Ireland broke all their legally binding procedures, subverted their citizens' rights, inflicted a financial, social and environmental burdens on Ireland which have not been justified.

Yours faithfully,

Paula Byrne



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Seamus Fingleton,
People Over Wind,

Date: 9th August, 2017

Re: Laois County Development Plan 2017-2023- Draft Ministerial Direction

A Chara,

I acknowledge your submission received on the 1st August in relation to the Laois County Development Plan 2017-2023- Draft Ministerial Direction.

Please be advised that the contents will be noted in the Chief Executives Report to the Minister in this regard.

Mise le Meas,

Donal Kiely
Acting Senior Planner
Planning Section

Submission No. 1

McEvoy Angela

From: Seamus Fingleton [seamusfingleton@hotmail.com]
Sent: 01 August 2017 20:44
To: Forward Planning
Subject: Laois County Development Plan 2017-2023 – Draft Ministerial Direction
Attachments: Westmeant variation number 2.docx; rps-group-report-on-wind-turbine-noise-modeling-11-may-2015.pdf; Variation No 2 (Wind Energy) to the Co Development Plan 2012-2018 (As Varied).pdf

Dear Sir/Madam,

I wish to make a submission on behalf of People Over Wind on the Laois County Development Plan 2017-2023 – Draft Ministerial Direction. We are a NGO community group made up of families in County Laois.

Legal Basis

Sec 31 of the Planning and Development Act 2000 (as amended) (PDA) states that the ministerial direction can be issued where the Minister considers that any draft development plan fails to set out an overall strategy for the proper planning and sustainable development of the area of a planning authority or otherwise significantly fails to comply with the Act.

This variation clearly complies with proper and sustainable development of the area. It also complies with the PDA.

However, the variation does not comply with the 2016 Wind energy guidelines or our current Wind Energy Policy. However, Neither of these have been subjected to a Strategic Environmental Assessment and so do not comply with PLANNING AND DEVELOPMENT (STRATEGIC ENVIRONMENTAL ASSESSMENT) REGULATIONS 2004. Therefore, neither the policy nor the guidelines have any legal standing under the PDA.

The Department have not undertaken an EIA or a SEA of the Laois County Development plan and the wind turbine set back distances so have no evidential basis for determining a lower set back.

In addition, on 6th October 2016 the Minister for Communications, Climate Action and Environment (Deputy Denis Naughten) responded to a question on the revised wind energy guidelines with the following statement "*When I was on the Deputy's side of the House, I raised this question as well. I am as anxious as anybody else to have these new guidelines put in place as the current guidelines are not fit for purpose. Along with the Minister for Housing, Planning, Community and Local Government, Deputy Coveney, my officials and I are actively engaged with this at the moment. There is a commitment in the programme for Government to present the new guidelines to the Government within six months, and we intend to do that. I hope we will have those finalised by next month.*"

http://oireachtasdebates.oireachtas.ie/debates%20authoring/debateswebpack.nsf/takes/dail2016100600012?opendocument

So the Senior Minister in the Department has clearly stated on the record that the current guidelines are "not fit for purpose" however the junior minister still wants Laois County Council to change its County development plan to comply with these not fit for purpose and illegal guidelines.

Setback Distances

Notwithstanding the above, the Department of the Environment commissioned RPS consultants to undertake a study on the setback distance for wind turbines as part of the revision of the 2006 guidelines. I have attached a copy of this report.

Table 3.2 of the report shows that an estimated setback distance of **1209m (i.e. 1.2 km)** would be the absolute minimum distance necessary to meet the 40dB absolute noise limit proposed in the draft revision of the Wind Guidelines.

Our group firmly believe and have been advised by experts in this area that a 40dB limit is still not enough to ensure there is no distress caused to people in their homes.

Banteer Legal Action

A number of families in Banteer co Cork, successfully sued a wind farm operator due to noise nuisance. The families were located within 1.5km of the wind turbines. Although, the settlement figures have not been released, we understand that this has run into several millions.
http://www.irishexaminer.com/breakingnews/ireland/cork-village-families-settle-action-against-wind-turbine-operators-793550.html

By imposing a lower set back distance based on guideline that have been openly acknowledged as not fit for purpose, the department would potential be liable for any future legal action of this kind.

Donegal variation to the County Development Plan
At the meeting of Donegal County Council on 30th June 2014, the Members decided to make a Variation (No. 2) to the County Donegal Development Plan 2012-2018 (As Varied) as provided for in Section 13 of the Planning and Development Act 2000-2016. The Variation relates to Chapters 7 & 10 of the CDP 2012-2018 (As Varied) regarding wind energy.

On 6th October 2016 the Minister notified Donegal County Council of his decision pursuant to Section 31(16)(a) of the Act to issue a Direction omitting those amendments that were made through Variation No.2 at the meeting of Donegal County Council on 30th June 2014. However, following judicial review proceedings and the making of a Consent Order by the High Court on 14th March 2017, inclusive of a term that the Minister's Direction "be quashed without further Order", the Council was required to restore Variation No. 2 and thus make the County Development Plan conform to the Court Order. I attach a copy of Donegal variation (No. 2)

In summary, Donegal County Council had included a setback distance in its County Development plan of 10 times turbine height. With most turbines now in the region of 150m – 175m, this is an effective set back distance of 1.5km – 1.75km.

Westmeath variation to County Development Plan
On 24th April 2017, Westmeath County Council adopted a variation to their County development plan and adopted the following set back distances

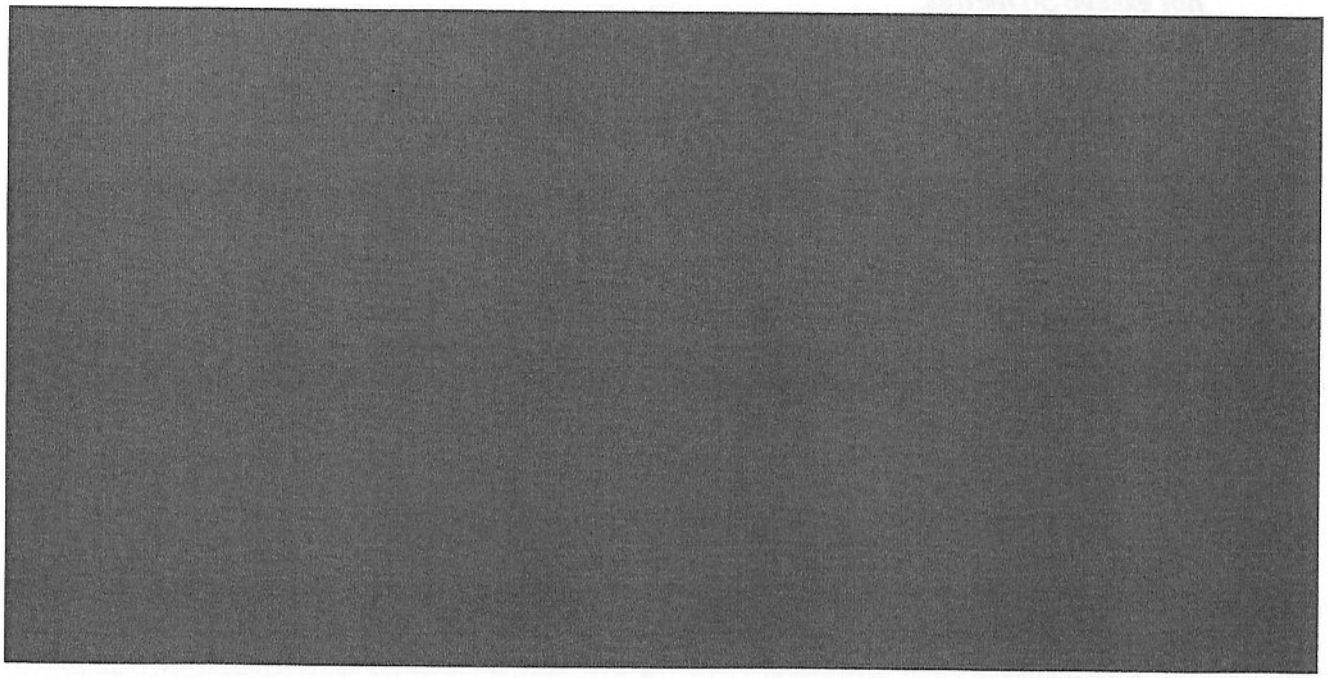
- ***500 metres**, where height of the wind turbine generator is greater than 25 metres but does not exceed 50 metres.*
- ***1000 metres**, where the height of the wind turbine generator is greater than 50 metres but does not exceed 100 metres.*
- ***1500 metres**, where the height of the wind turbine generator is greater than 100 metres but does not exceed 150 metres.*
- ***More than 2000 metres**, where the height of the wind turbine generator is greater than 150 metres.*

Based on the adopted Donegal and Westmeath variations, the ministerial direction should be revised to tweak the 1.5km absolute limit adopted by Laois County Council to be either 10 time turbine height as per Donegal or the tiered setback distance adopted by Westmeath County Council. Removal of this set back limit completely would mean that Laois is being treated inconsistently with other counties and without without any reasons.

Yours sincerely

Seamus Fingleton
For and on behalf of People Over Wind

VARIATION NO. 2 TO THE WESTMEATH COUNTY DEVELOPMENT PLAN 2014-2020



Forward Planning Department

Adopted 24th April 2017

WESTMEATH COUNTY COUNCIL
Comhairle Chontae na hIarmhí

Variation (No.2) relates to amendments to existing wind energy policy contained in Chapter 10 of Volume 1 of the Westmeath County Development Plan 2014-2020 and concerns the introduction of new standards for separation distances between wind turbines and residential dwellings. It provides for the insertion of a new planning policy P-WIN 6 in Section 10.6 of Volume 1 of the Westmeath County Development Plan 2014-2020 as follows:

P-WIN 6

To provide the following separation distances between wind turbines and residential dwellings

- ***500 metres,*** *where height of the wind turbine generator is greater than 25 metres but does not exceed 50 metres.*
- ***1000 metres,*** *where the height of the wind turbine generator is greater than 50 metres but does not exceed 100 metres.*
- ***1500 metres,*** *where the height of the wind turbine generator is greater than 100 metres but does not exceed 150 metres.*
- ***More than 2000 metres,*** *where the height of the wind turbine generator is greater than 150 metres.*

Comhairle Contae
Dhún na nGall
Donegal County Council

Variation No. 2 (Wind Energy) to the County Donegal Development Plan 2012-2018 (as varied)

Variation No. 2 (Wind Energy) to the County Donegal Development Plan 2012-2018 (As Varied)

Introduction

At the meeting of Donegal County Council on 30th June 2014, the Members decided to make Variation No.2 (Wind Energy) to the County Donegal Development Plan 2012- 2018 (as varied). The content of the Variation is set out on the following pages.

(Note: Deletions of text are shown in black ~~strikethrough~~; insertions of text are shown in blue lettering).

Amendment No. 1:

Amend the text at Chapter 7, section 7.2.1, page 108 of the Core Document, in relation to area identified as 'Not Favoured' so that it reads as follows (NB: New text in blue):

Not Favoured – Areas where wind energy proposals will not be favoured have been identified due to the significant environmental, heritage and landscape constraints. These include; SAC and SPA (Natura 2000) Sites, NHAs, unspoiled areas of EHSAs, Areas of Fresh Water Pearl Mussel including the catchments identified in the Sub-Basin Management Plans for Clady Eske, Glaskeelin, Leannan, Owencarrow and Owenea (as listed in S.I. 296 of 2009), important views and prospects. It is considered that these areas have little or no capacity for wind energy development.

Map 9 Wind energy highlights the 'Area Open to Consideration' and the 'Not Favoured areas'.

The Council recognise the opportunities arising from the use of more efficient turbines on established windfarms, as they generate much higher energy yields per turbine, thereby reducing the need for additional turbines. In most cases the infrastructure, roads, hardstand, turbines, sub station and fences have already been established, so there should be limited additional impact.

To reflect the increasingly complex interaction of the issues involved in considering wind energy proposals the Council is committed to further developing the Renewable Energy Strategy that recognises the potential role of the county in energy generation in the context of the proper planning and sustainable development of the area. The wind energy policies herein must be considered in the context of the development and technical standards relating to wind energy set out in Chapter 10 and in the context of all other relevant objectives and policies set out in this Plan.

Amendment No. 2

Insert a new objective at Chapter 7, section 7.2.2, page 109 of the Core Document so as to state (NB: New text in blue):

E-O-6: To ensure that wind energy developments do not adversely impact upon the existing residential amenities of residential properties, and other centres of human habitation (as defined at 10.6.7) in Chapter 10 Development and Technical Standards.

Amendment No. 3

Amend Map 9, 'Wind Energy' to show the addition of 6 Sub-Basin Catchments of SAC populations listed in S.I. 296 of 2009 (First Schedule) for the Fresh Water Pearl Mussel as 'Not Favoured for Wind Energy Developments' as shown in accordance with the Appendix 1 of this document.

Amendment No. 4

Amend the text at Chapter 10, section 10.6.5 of the Core Document so as to read as follows (new text shown in blue; text for deletion shown in ~~strikethrough~~).

10.6.5 Wind turbines must meet the requirements and standards set out in the DEHLG Wind Energy Development Guidelines 2006, or any subsequent related Guidelines and in addition must not be located within:

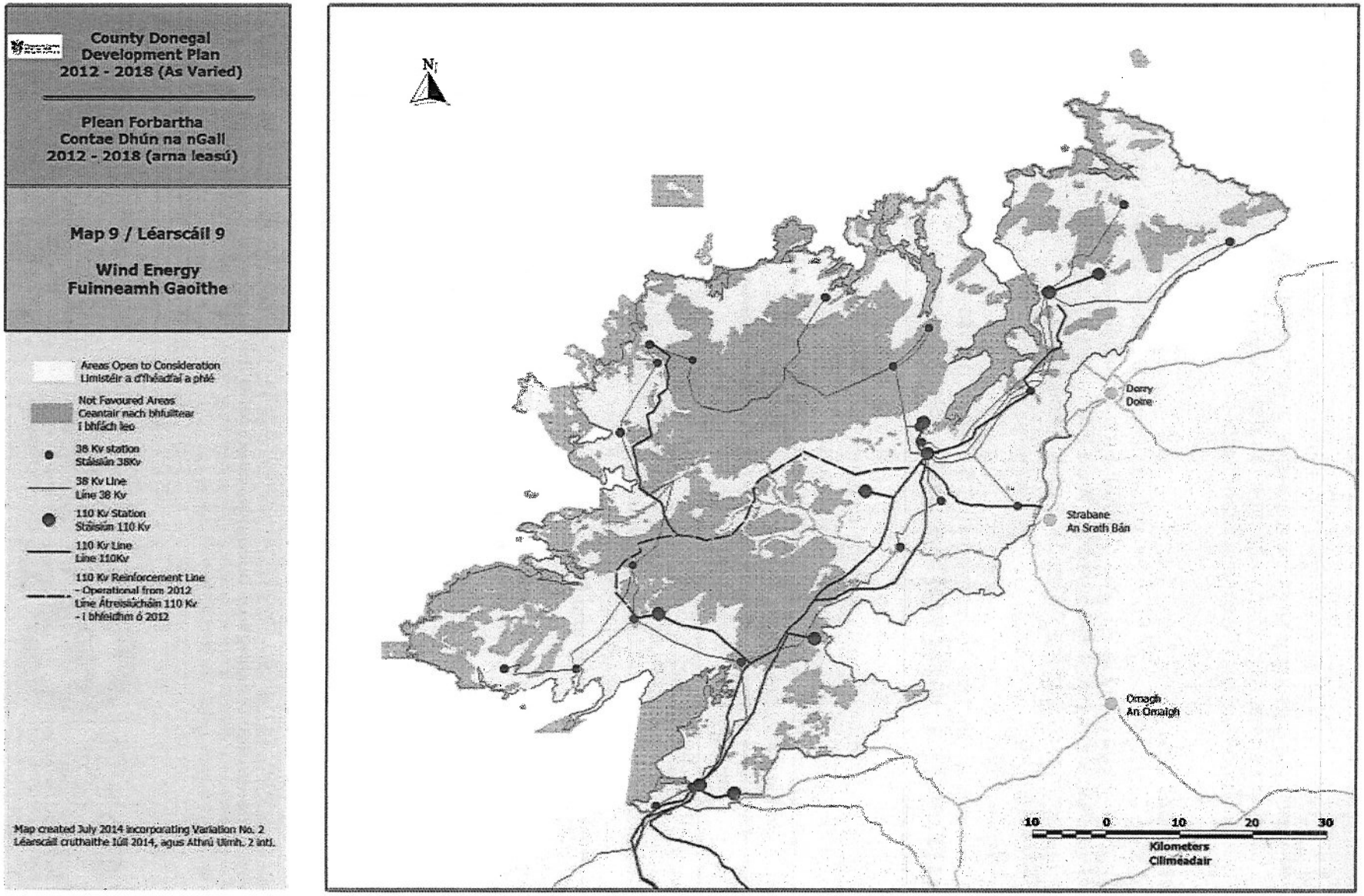
(a) The zone of visual influence (ZVI) of the Glenveagh National Park
(b) The zone of influence/ flight path at Donegal Airport.
(c) The 6 Fresh Water Pearl Mussel (S.I. 296 of 2009) catchments contained in the Freshwater Pearl Mussel Sub-Basin Management Plans for Clady, Eske, Glaskeelin, Leannan, Owencarrow and Owenea.
(d) A set back distance of ten times the tip height of proposed turbines from residential properties and other centres of human habitation.

Amendment No. 5

Insert new text into the Core Strategy at Chapter 10 as section 10.6.7 so as to state as follows (New text shown in blue):

10.6.7 Centres of Human Habitation
Definition:-
'Centre of Human Habitation' includes schools, hospitals, churches, residential buildings or buildings used for public assembly'.

Appendix 1: Map 9; Wind Energy.



Source: Donegal County Council
Foinse: Comhairle Chontae Dún na nGall

RPS

SEAI

Report on Wind Turbine Noise Modelling

Document Control Sheet

Client:	Sustainable Energy Authority of Ireland
Project Title:	SEAI Wind Turbine Noise
Document Title:	Report on Wind Turbine Noise Modelling
Document No:	MDE1178RP0001

Text Pages:	40	Appendices:	1

Rev.	Status	Date	Author(s)	Reviewed By	Approved By
A01	Client Approval	11th March 2015	E McK	S K	J G
A02	Client Approval	11th May 2015	EMcK SK	DP	JG

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EXECUTIVE SUMMARY

This report has been prepared in order to inform a decision on the impact of potential noise limits on the available wind energy capacity in Ireland. There are a number of simplifying assumptions that have been made in compiling this report, including the size of turbine chosen for the study. The turbine choice was determined from discussions with wind turbine manufacturers and wind farm developers as a 3-3.S MW turbine with a tip height of 150-175m.

An acoustic model with the following iterations was prepared:

- Turbine type x 3
- Turbine hub height x 3
- Wind speed x 7
- Ground factor x 2
- Terrain contours x 7

Noise predictions were calculated in 10 metre steps out to a distance of 1 kilometre using the ISO 9613-2 methodology and following the Institute of Acoustics *"Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise"*. This yielded statistically robust distance/noise level data which was then analysed to determine appropriate separation distances for each 1 dBA band in the range 38 dBA to 45 dBA.

From the calculated separation distances a GIS model was prepared with the separation distance applied to:

- Sensitive Receptors listed in the GeoDirectory
- Ecological constraints
- Cultural Heritage sites
- Geological exclusion area
- Topographical and land cover constraints

Based on turbine tip height appropriate wind speed zones/areas were determined and a calculation of the available land and potential wind farm development capacity was determined.

The potential capacity for wind farm development is impacted significantly by the selection of a fixed noise limit level. The reduction from the current daytime limit of 45 dBA to the proposed limit of 40 dBA will result in a loss of capacity of 13,797 GWh or a 52% loss of capacity. Similarly a reduction from the current night time limit of 43 dBA will result in a 29% loss in capacity.

1 PROJECT BRIEF

The Department of Communications, Energy and Natural Resources (DCENR) is currently conducting a targeted review of the Wind Energy Development Guidelines 2006 (WEDG06). The review is a targeted review in relation to noise, proximity and shadow flicker.

RPS have been commissioned by the Sustainable Energy Authority of Ireland (SEAI) for the provision of a desk study to assess the impact of a range of noise limits on the location and scale of wind turbine development in Ireland. This desk study will inform the DCENR of the appropriateness of applying an absolute noise limit value in the range of 38 – 45 dB by assessing the potential impact of each of the 8 proposed absolute noise limits with respect to the identification of potential areas for future wind project development.

1.1 SCOPE OF WORK

A revised methodology was developed to meet the revised timeframe issued by SEAI to ensure that the desk study informs the DCENR of the potential impact and appropriateness of the absolute noise limit values prior to the development of the revised guidance. The scope of this acoustic modelling and GIS mapping exercise is to provide a preliminary desk analysis of noise emissions from large wind turbines in 'typical' conditions in Ireland.

This report is based on the specification in Appendix 1 of the SEAI Request for Tenders Document:

- Identification of potential areas available for future wind project development having regard to a given range (38 – 45dB) of noise limits;
- Delivery of a GIS application that will, take consideration of the location of dwellings & other noise sensitive properties, identify viable areas for wind turbine placement with a given set of inputs;
- A GIS application output, a map layer of the viable wind turbines sites under the range of noise limits (from 38 – 45dB).

The methodology to complete this work is outlined in Section 2 of this report.

2 MODEL METHODOLOGY

The acoustic models produced in this study are based on the identification of potential viable areas for wind turbine placement with regard to the use of an absolute noise limit (38 – 45 dB expressed as L_{A90}) as an appropriate means to control noise impact.

The process starts with a simplified acoustic model for a single candidate turbine in a generic setting. This turbine is modelled using an industry standard acoustic modelling software package to obtain the separation distances associated with different fixed limit noise levels. From this single turbine, parameters likely to influence noise emissions from turbines are modelled to determine a range of distances over which specific noise levels will occur.

This table is then used in combination with the geo-directory to prepare maps of the country. The geo-directory is used to identify all the exclusion zones set out in Section 4 of this report. From the distances determined from the acoustic model, an exclusion zone based on the required separation distance to achieve a particular noise limit value is plotted. This identifies the 'residual' areas where a wind turbine can be located without the noise level arising from the turbine exceeding the threshold value.

Using GIS, the maps are used to calculate the 'residual' areas which are in turn used to prepare a table of available area suitable for wind farm development, subject to the particular noise thresholds.

2.1 ACOUSTIC MODEL

The acoustic model is based on a single candidate turbine on different terrain types. The sound emission levels have been calculated to a distance of 1 kilometre, in accordance with ISO 9613-2, using the industry standard Cadna noise (Version 4.3) modelling software. The single candidate turbine was then factored up to a multiple turbine scenario. The parameters of the model are set out in Section 3 of this report.

An acoustic model was prepared using candidate turbine noise data for typical 2.3 to 4.5 MW turbines. The predicted noise level at any point was then calculated for terrain and meteorological factors to determine an estimated operating noise level from a theoretical wind farm. This provides a table of the required separation distances from a sensitive receptor location to a turbine.

2.2 GIS MODEL

ESRI ArcGIS 10.2 is used for data collation and building the GIS process model. The An Post GeoDirectory is used for identification of the sensitive receptors. The GeoDirectory classifies each building as being either residential, commercial, both (residential and commercial) or unknown. The data comes as point database where each building is located to within a metre with pinpoint accuracy. GeoDirectory also gives further breakdowns of information such as townland, electoral and county divisions. Euclidean distance raster is generated from the GeoDirectory points with the exclusion of commercial point locations. Other technical, environmental, cultural heritage and archaeological exclusions are also applied to the distance raster.

The output from the acoustic model and the matching wind speed thresholds are incorporated into the GIS model to calculate the available areas. A detailed parameters and process flow is given in Section 4 of this report.

3 ACOUSTIC MODEL

The scope of this acoustic model is to provide a preliminary analysis of noise emissions from large wind turbines in 'typical' conditions in Ireland. The study is designed to cater for the largest range of conditions possible while retaining realistic, rather than extreme modelling scenarios.

3.1 ACOUSTIC MODEL ASSUMPTIONS

Wind farm design and layout is a highly complex task requiring the consideration of shadow flicker, visual impact, setback distances, wind conditions, turbine clearance/separation and ecological requirements, in addition to acoustics. In order for this study to provide a realistic wind farm model scenario, a number of simplifying assumptions have been made regarding the type, layout and location of wind turbines:

1. Turbines will not be located on a water body (lake or river of more than 700m in extent),
2. There are no non-acoustic restrictions on turbine location,
3. All turbines are 'typical' turbines as set out in Section 3.2,
4. All turbines experience the same meteorological conditions, and
5. Cumulative impacts of multiple turbines equate to a 3 dB increase in received noise level (wind farm factor – see section 3.2.1).

3.2 ACOUSTIC MODEL CALCULATION PARAMETERS

The acoustic model has been prepared using the parameters set out in Section 4 of the *"Institute of Acoustics Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise"*, Cand et al (2013). These parameters represent current best practice for modelling wind farm noise. The main points set out in the methodology are as follows:

- Model calculations are carried out using *ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2 General Method of Calculation for Propagation Modelling*,
- Wind turbine sound power (source) to be based on manufacturer warranted values or 'standard' values measured using IEC 614100-11 plus 2 dB to allow for measurement uncertainty,
- Reported wind speeds are normalised to a height of 10m,
- Ground factor, G = 0.5 or G = 0.0 (Hard ground or propagation over water).
- Wind turbine noise predictions are based on octave band data,
- L_{90} values are determined by subtracting 2 dB from L_{eq} levels,
- Receiver height of 4 metres, and
- Atmospheric conditions of 10°C and 70% humidity.

In addition to the noise model calculations, certain assumptions are made regarding the siting and configuration of wind turbines in wind farms.

3.2.1 Single Turbine Model v Wind Farm Model

The basis of the model is that of a single turbine. In order to cater for the likelihood that turbines will arise in clusters, a correction for the proximity of additional turbines is required.

Wind farm layouts are planned to optimise the electrical output when all the other constraints have been taken into consideration. In order to achieve maximum electrical output it is necessary to separate the turbines to avoid turbulence from one turbine interfering with another. The separation distance is normally measured in terms of rotor diameter and is generally site specific. The common range of separation distances is from 6 to 12 rotor diameters, which in the case of large turbines means something greater than 500m.

With a single turbine impacting on a sensitive location, the acoustic model predicts a noise level in dB. Due to turbine separation it is likely that the next nearest turbine will be at least 1.4 times the distance of the first turbine away, if the turbines are close to the sensitive receptor location. This would have the effect of adding 2 dB to the single turbine noise level. At greater separation distances the cumulative impact would be less than this at the sensitive location.

In order to estimate the potential of additional turbines (more than 2) a correction factor of 3 dB has been adopted for the purpose of the acoustic model.

3.2.2 Terrain

In order to provide a representative selection of terrain types, candidate turbines were modelled on the following terrain;

- Flat terrain with ground factors of 0.0 and 0.5
- 20 degree inclines with ground factors of 0.0 and 0.5 for cross-slope, up-slope and down-slope conditions
- 40 degree inclines with ground factors of 0.0 and 0.5 for cross-slope, up-slope and down-slope conditions

This range of terrain types provides a broad range of situations where turbines could be located in either undulating or flat terrain. The terrain slope is based on the terrain between the source and receiver positions in order to replicate propagation across complex terrain, in particular across valleys.

3.2.3 Turbine Hub Height/Tip Height

The acoustic model is based on the available information from three specimen turbines. From discussions with manufacturers' representatives and wind farm designers, the maximum hub height likely to be chosen in Ireland is in the order of 100m. Hub heights of 120m are possible in low wind sites on continental Europe but unlikely in Ireland. For the purpose of this study, noise models were prepared on the basis of three turbine hub heights; 75m, 92m and 110m. This covers the likely range of hub heights to be encountered in Ireland.

The current design of 3-3.5MW turbines has a range of rotor diameters from 100m to 140m, the larger diameter rotors being used on low wind sites. If we combine the highest possible hub height (120m) with the largest rotor diameter (140m); this yields a maximum tip height of 190m. In order to estimate the available land resource tip heights of 125m, 150m, 175m and 200m were used in the setback calculations. For practical purposes in Ireland, tip heights of 150m to 175m are likely to form the design envelope in the medium term. Turbine tip heights of 125m to 166m have been modelled acoustically for this report. This constraint was based on available sound power data.

3.3 TURBINE CHOICE

A review of 68 sample large wind farms that have been granted planning permission indicates that 43 sites are proposing wind turbines of less than 2.5 MW capacity, 18 sites are proposing turbines with a rated capacity of between 2.5 MW and 2.75 MW and 7 sites are proposing to use turbines of 3 MW capacity. This reflects international practice where the maximum turbine size appears to be stabilising at around 3 to 3.5 MW for onshore wind farms, with larger units being designed for offshore use.

In order to determine the type of turbines likely to be used on wind farms in Ireland, and the corresponding noise emissions, a desk study of candidate turbines was undertaken. This included turbines in the range 2.3 to 4.5 MW from the following manufacturers:

- Enercon
- Gamesa
- General Electric
- Nordex
- Siemens
- Vestas

Consultations took place with manufacturers, wind farm designers and developers to determine the likely scope of design briefs over the next 10 years. As some of the data was provided on a commercially sensitive basis, candidate turbines are not named in this report.

The consensus view is that the current generation of 3 to 3.5MW turbines is likely to be the largest common candidate turbine type in the medium term. This is based on manufacturers' development programmes and the tendency to locate larger wind turbines offshore. Noise emissions from turbines are the focus of considerable design effort on the part of manufacturers. The result is that the noise levels of current turbine designs have not increased in proportion to the increase in power output.

A report prepared for the Danish Energy Authority (Delta, 2008) provided sound power level data for 37 wind turbines from 75 kW to 2000 kW. This data was combined with manufacturers' data to produce **Error! Reference source not found.**. This figure demonstrates that while there has been a 60 fold increase in power output, the sound power output has increased by 16 dB, a 3 to 4 fold increase in relative terms.

A trend line has been constructed in Error! Reference source not found. and the three candidate turbines used for this study are at or above this trend line in terms of sound power.

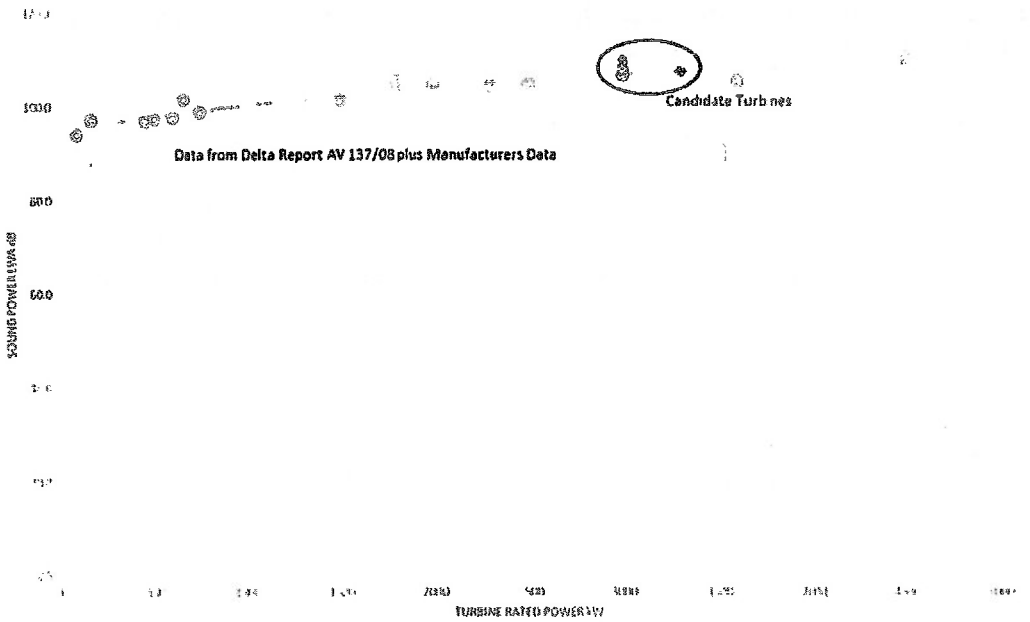

Figure 3.1: Turbine Sound Power vs Turbine Electrical Power Output

It is reasonable to assume that a range of capacities will continue to be used onshore as site specific considerations will limit turbine height and scale. For the purposes of this study, a 3 to 3.5 MW turbine size has been chosen. Three typical turbine configurations (A, B and C), based on manufacturers' specifications (+2 dB for measurement uncertainty), are shown in Table 3.1.

Table 3.1: Typical turbine configurations

	Rating (MW)	Blade Diameter (m)	L_{WA} (dB) @ 10m/s wind speed
Turbine A	3.0	112	108.7
Turbine B	3.0	101	110
Turbine C	3.3	100	107.6

The hub heights shown in Table 3.1 have been taken as the heights for typical sites. On higher wind speed sites the hub heights may decrease to 70m. The blade diameter is unlikely to get much larger as noise emissions are related to blade tip speed and rotor diameter is one of the primary limiting controls in this regard.

3.3.1 Wind Turbine Noise Data

Wind turbine noise emission data is now reported in accordance with IEC 61400-11 using 'standardised' wind speeds. DECLG (2013) proposes an absolute noise limit, which is independent of wind speed. At lower wind speeds, and lower power outputs, noise emissions from turbines are reduced. With modern pitch controlled turbines; as the wind speed increases, the noise level from the turbines increases until it reaches a plateau at around 8m/s. The modelling for this survey was

based on octave band sound power output levels for a range of wind speeds from 4m/s to 10m/s in 1m/s intervals, i.e. 7 separate wind speed bands.

3.4 ISO 9613-2 MODEL PARAMETERS

The standard is designed to enable the calculation of L_{eq} values from sound power levels (L_w) under 'average' meteorological conditions which are favourable to propagation. The standard considers downwind and temperature inversion conditions as using these conditions as a baseline tends to predict worst-case (highest) noise levels.

In the case of a generic model for the whole country, it is not physically possible for sensitive locations to be downwind in worst-case conditions all of the time. One of the overall assumptions is that turbines are equally distributed in all directions from a sensitive location. The model is therefore conservative in that a downwind situation is unlikely to arise all of the time.

3.4.1 Directivity

Directivity arises in two contexts; the directivity of the source and the directivity of the model. For the purposes of this study wind turbine sources are considered omnidirectional. ISO 9613-2 however does introduce a significant directionality in noise levels as the standard is based on downwind propagation or inversion conditions. This is illustrated in Figure 3.2 and Figure 3.3 where ISO 9613-2 is considered as 'average conditions for downwind propagation'.

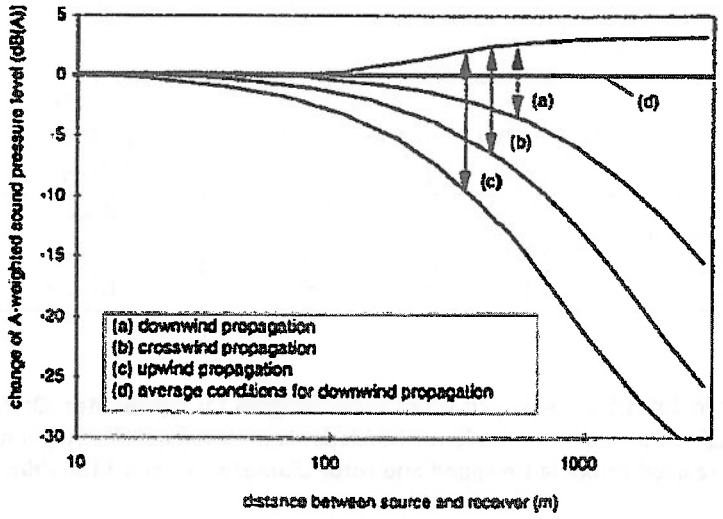

Figure 3.2: Weather Effects from Wagner et al (1996)

Figure 3.2 shows the possible change of A-weighted sound pressure level due to weather effects compared to propagation including only spherical spreading and air absorption. At 1,000m the difference between upwind and 'average' conditions is approximately 20 dB.

Figure 6 (b) of Cand et al (2013) also indicates that there is a significant difference between downwind, crosswind and upwind propagation. The difference between downwind and upwind propagation in complex terrain is indicated as being up to 8 dB.

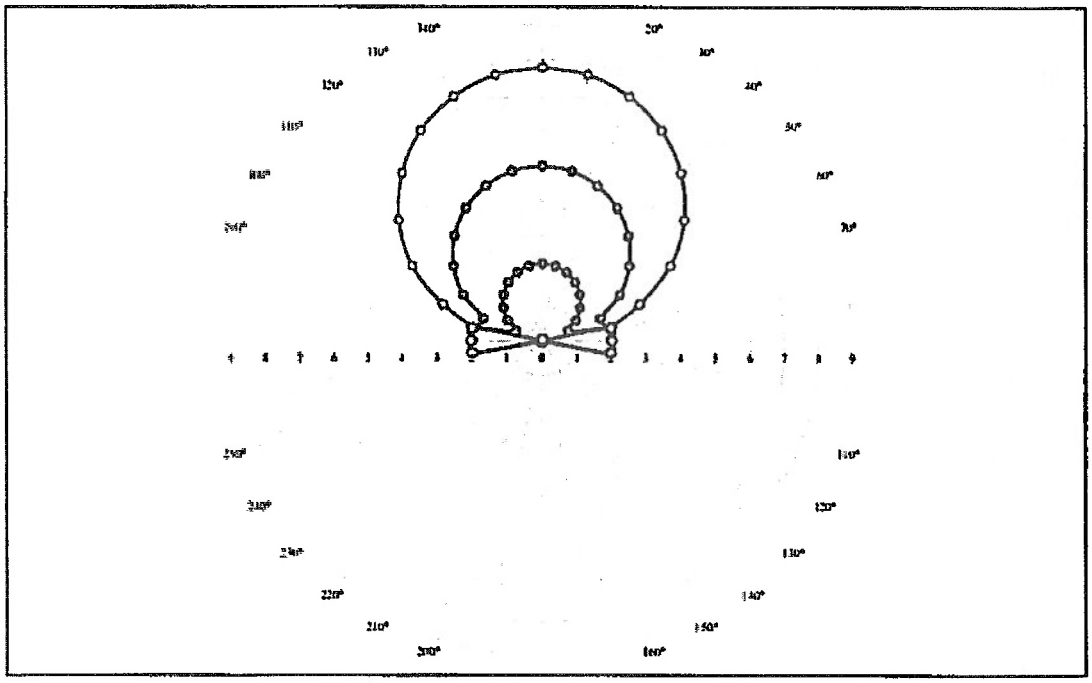

Figure 3.3: Weather Effects from Cand et al (2013)

Figure 3.3 shows the estimated change in noise levels with wind direction. 180° refers to a receptor downwind of the wind turbine in complex landscapes (refer to Figure 6(b), Cand et al (2013). Black corresponds to close to the source, expanding outward to Red which equals 18 times the tip height).

ISO 9613-2 does not have the capability of modelling specific wind directions. Figure 3.2 would indicate attenuation changes of up to 20 dB between upwind and downwind propagation, while Figure 3.3 is more conservative.

No wind direction correction is applied to the models for the purposes of this report. The separation distances are based on downwind propagation/inversion which is not the case on a continuous basis. This provides a conservative estimate of the separation distance required.

3.4.2 Attenuation

Attenuation usually refers to a decrease in intensity of sound as a result of the absorption of energy and scattering out of the path of a detector. Attenuation can arise from a number of factors and ISO 9613-2 sets out the total attenuation to be taken into consideration as follows:

$$\text{Attenuation} \quad A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc} \qquad (2)$$

Where:

A_{div} = attenuation due to geometrical spreading

A_{atm} = attenuation due to atmospheric absorption

A_{gr} = attenuation due to ground effect

A_{bar} = attenuation due to barriers

A_{misc} = attenuation due to miscellaneous other effects

3.4.3 Geometric Spreading

ISO 9613-2 calculates geometric spreading according to the formula:

$$A_{geometric} = 20 \log10 (d/d_o) + 11 \quad (3)$$

Where:

d is the source-receiver distance and d_o = 1m is a reference distance.

There will be a certain ambiguity in the region near the source which is not evident in far field conditions. In the case of wind turbine noise at neighbouring properties, we are generally dealing with far field conditions. For any given site the variation in this parameter does not alter. Standard spherical propagation as set out in ISO 9613-2 is used.

3.4.4 Atmospheric Absorption

The atmospheric attenuation depends on the frequency of the sound and the ambient temperature and relative humidity of the air. Atmospheric pressure has a very weak influence and can be ignored. Cand et al (2013) suggests that for wind turbine noise prediction, the ambient temperature and the relative humidity should be standardised at 10°C and 70% respectively. This has the effect of reducing uncertainty due to atmospheric absorption to within the overall tolerance bands of ISO 9613-2.

There is no site specific correction required for atmospheric absorption. No additional correction is therefore proposed for atmospheric absorption.

3.4.5 Ground Factor Effects

The acoustic properties of ground attenuation are considered by applying an appropriate ground factor. A ground factor varies between 0 and 1, 0 being hard ground, paving, water or hard surfaces and 1 being soft ground, grassland, trees, vegetation or farm land. Cand et al (2013) and the *IOA Good Practice Guide* (IOA 2013) suggest that for wind farms, a ground factor of 0.5 should be used in all cases except large bodies of water or urban areas.

Given that we are considering large turbines (~3 MW), urban areas are not being considered. For the purpose of this study, the instance in which this would be a consideration comprises a relatively narrow body of water (up to 700m wide) with a wind turbine on one side and a sensitive location on the other. This is similar to a situation where noise propagates across a valley.

Significant research has been carried out on noise propagation over undulating ground. This can be a particular problem when wind turbines are located on elevated ground on one side of a valley and a sensitive location is on the other. The Ground Factor of 0.5 complies with the scenario recommended in the *IOA Good Practice Guide* (IOA 2013). All terrains are also calculated with a Ground Factor of 0.0 to replicate a worst case scenario where hard ground or transmission over water bodies is encountered.

3.4.6 Wind and Temperature Effects

The wind speed closer to the ground is lower than that at height. The temperature profile of the lower atmosphere depends on the time of day and the effect of solar heating. These factors combine to create a vertical gradient of sound speed. Sound will be refracted in the direction of higher sound speeds to lower sound speeds. This leads to sound being diffracted either upwards or downwards.

Under stable atmospheric conditions, downward propagation can occur during temperature inversions. This leads to increased sound levels at distance from the source. When the sound speed decreases with height, sound rays are bent upwards away from the ground, leading to reduced levels at distance from the source.

The modelling used in this report is based on downwind propagation or inversion conditions, i.e. worst case.

3.4.7 Atmospheric Turbulence Effects

The wind speed and temperature profile are not constant but generally tend to vary around mean values over relatively short periods (minutes). The effect of turbulence is to create variations in received sound level around a mean value. In extreme cases this can lead to changes in the order of 10 dB but this is relatively extreme and the typical variation is in the order of 5 dB.

No correction for atmospheric turbulence has been applied to the models in this report.

3.4.8 Barrier and Terrain Effects

Topographic screening effects are considered in section 7.4 of *ISO 9613-2 – Screening*. The standard includes for calculations, including significant screening. In the context of wind turbines in open countryside however, the effect of screening is limited. Cand et al (2013) recommend that the maximum screening effect should be limited to 2 dB "and then only if there is no direct line of sight between the highest point on the turbine rotor and the receiver location".

For the purpose of this study no additional correction for screening is applied.

3.5 ACOUSTIC MODELLING RESULTS

The acoustic model for the candidate turbines were created with variations in turbine hub heights, terrain contours, ground factor and wind speed. The noise level for each combination was calculated in 100m intervals out to a distance of 1km. This yielded over 113,000 individual model scenarios with

each scenario representing one iteration of the outlined variables at different distances from the turbine.

The model scenarios were sorted into 1 dB 'bins', each of which had several thousand combinations that resulted in a received level in the range, cross referenced with the distance from the source at which it ocurred. The mean and standard deviation distance for each 1 dB bin were calculated using an Excel spreadsheet.

Plots of the data for each 1 dBA band are provided in Figure 3.4 to Figure 3.11.

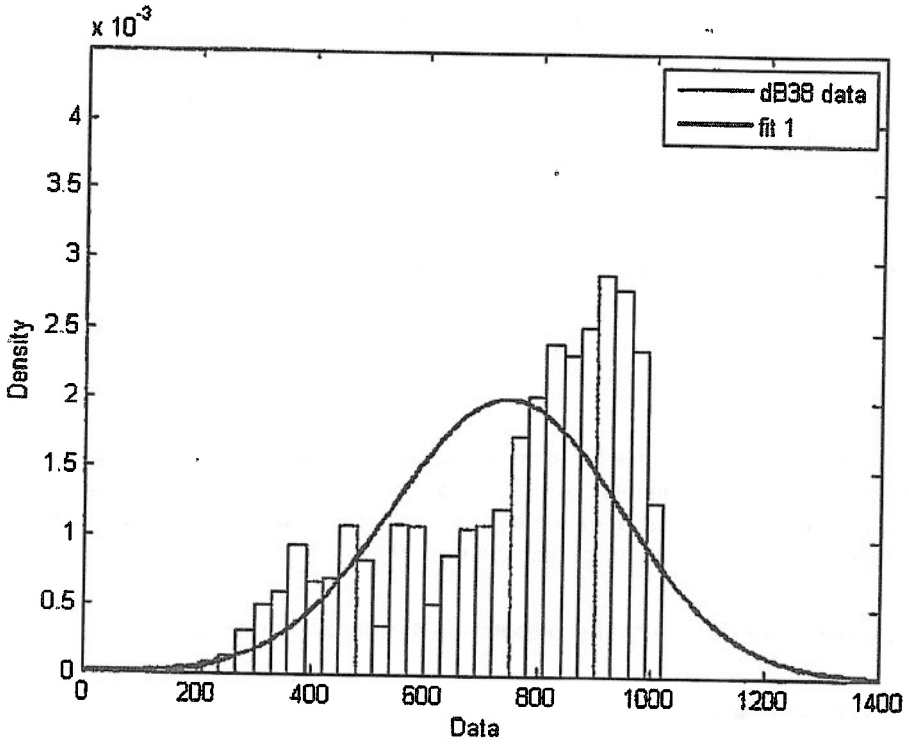

Figure 3.4: Probability Density Function for 38 dB (n=5592)

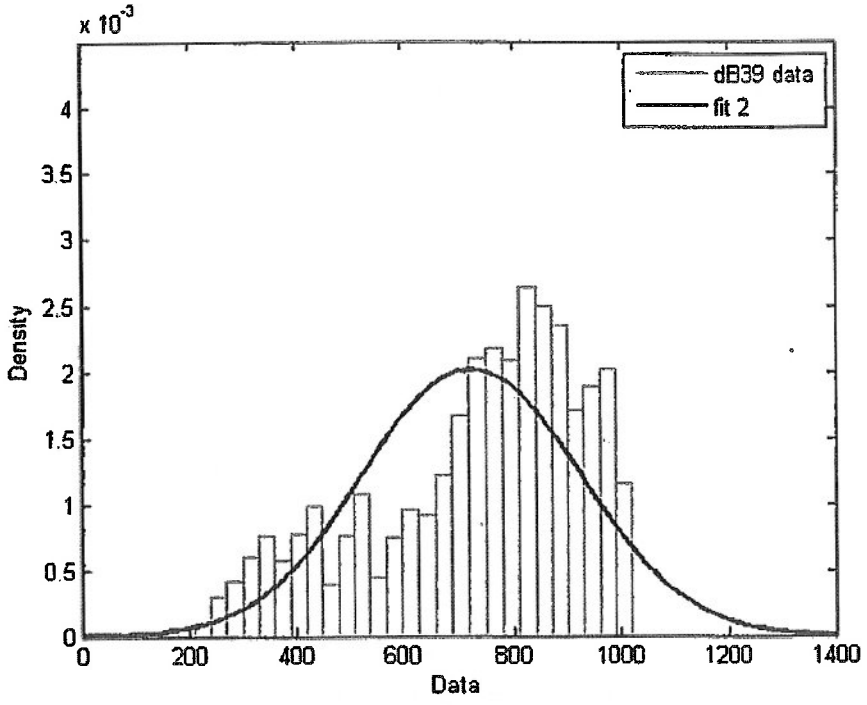

Figure 3.5: Probability Density Function for 39 dB (n=6186)

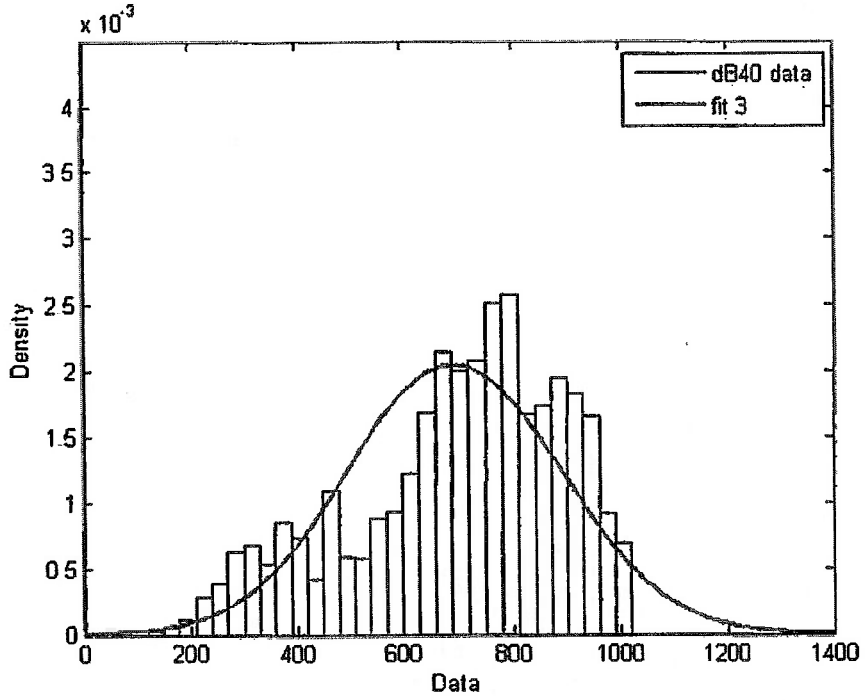

Figure 3.6: Probability Density Function for 40 dB (n=6431)

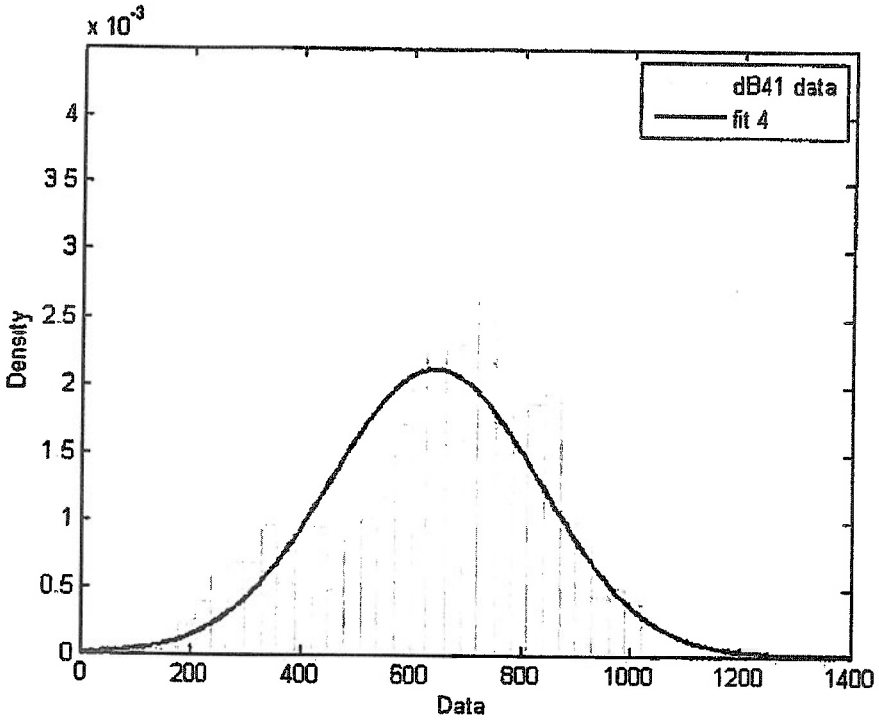

Figure 3.7: Probability Density Function for 41 dB (n=6272)

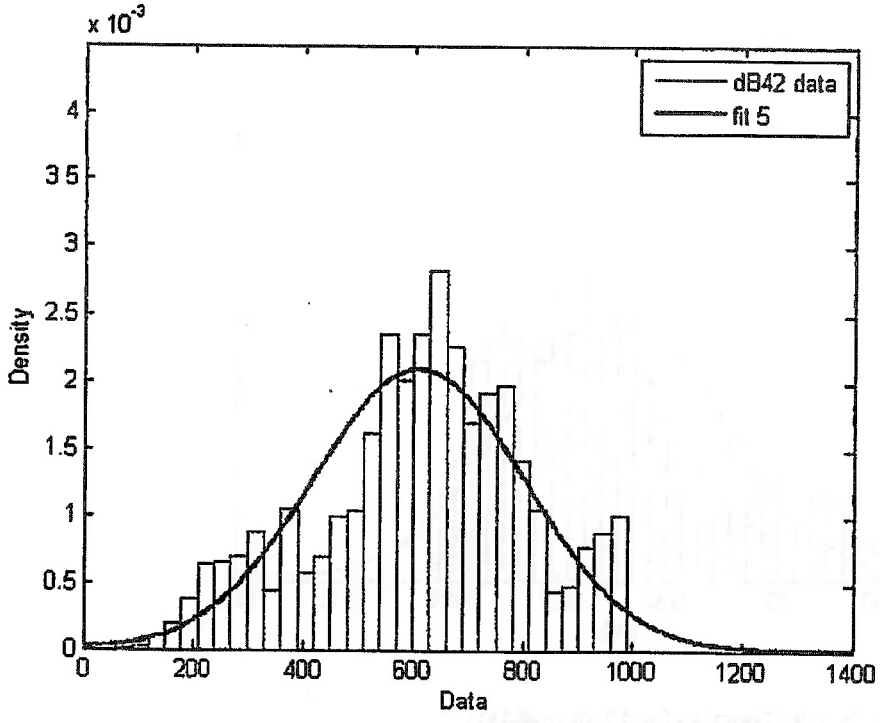

Figure 3.8: Probability Density Function for 42 dB (n=6133)

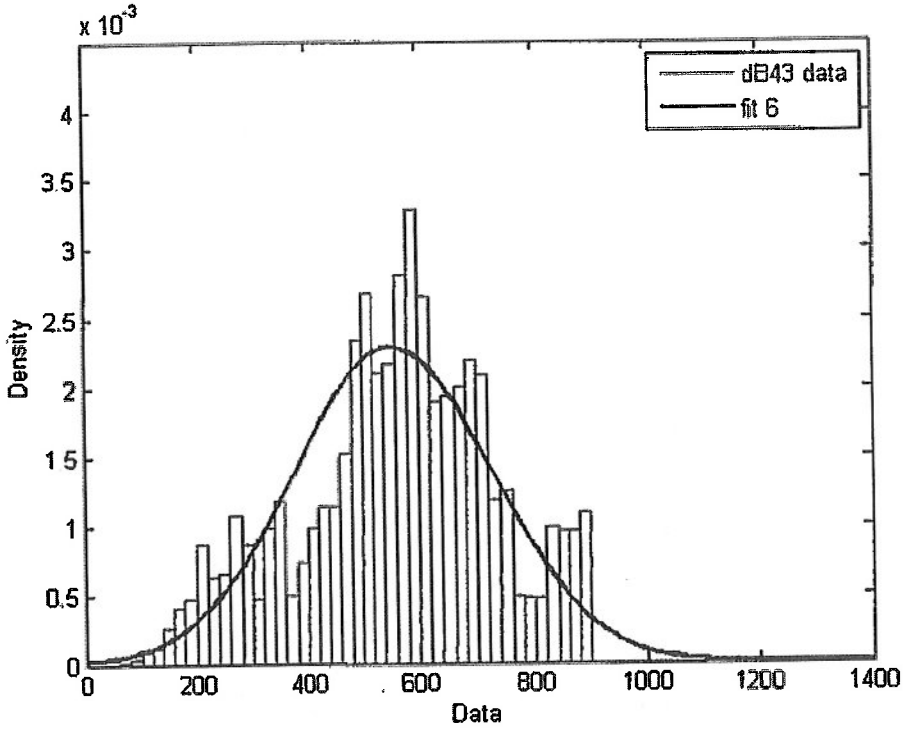

Figure 3.9: Probability Density Function for 43 dB (n=5645)

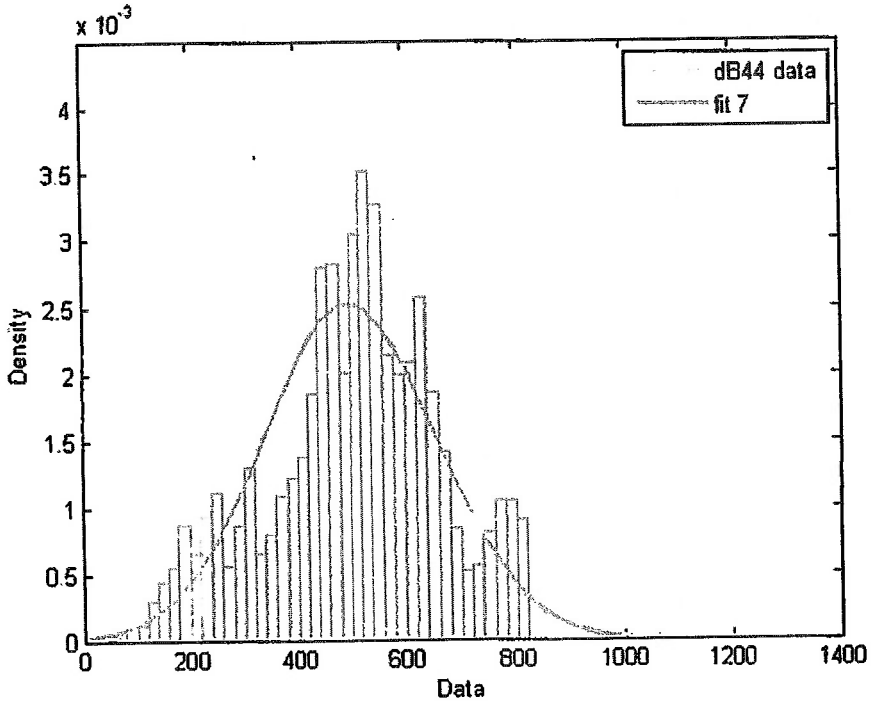

Figure 3.10: Probability Density Function for 44 dB (n=5197)

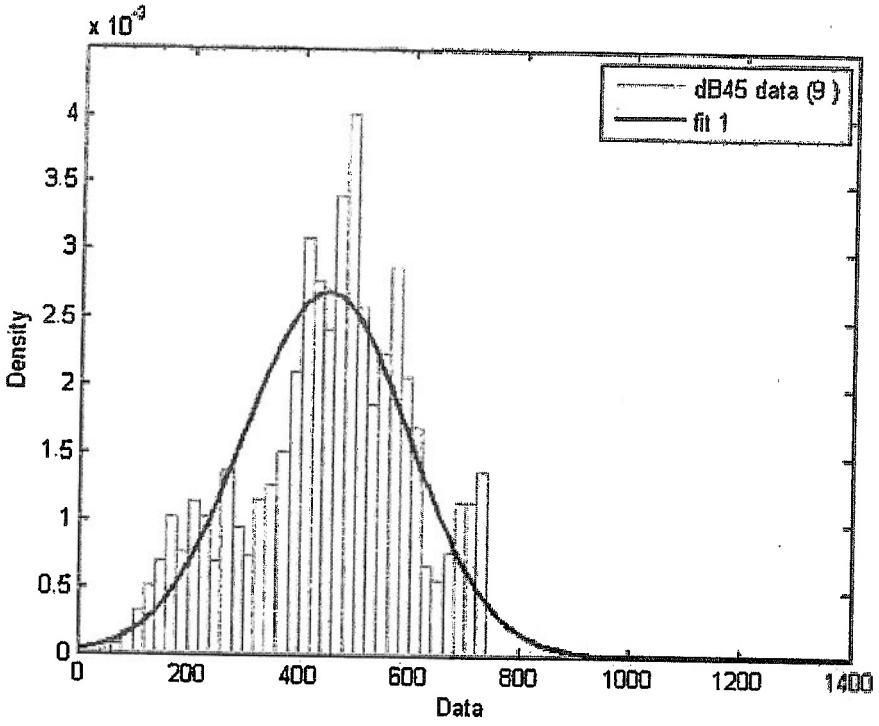

Figure 3.11: Probability Density Function for 45 dB (n=4757)

The mean and standard deviation distances were combined to provide a 99th percentile distance which was then input to the GIS model. The 99th percentile is based on the 'three-sigma' rule whereby Wheeler & Chambers (1992) demonstrated that 99% of data falls below mean plus three times the standard deviation, even for non-normal data.

3.6 ESTIMATED SETBACK DISTANCES

The estimated setback distances, as dervided from the acoustic model, are set out in Table 3.2.

Table 3.2: Acoustic Model Setback Distances

Absolute Noise Limit dBA	Statistical Mean Distance metres	Distance Standard deviation metres	99%ile Distance metres
38	725	198	1319
39	692	196	1280
40	643	189	1209
41	610	191	1183
42	551	175	1075
43	497	158	972
44	448	148	893
45	383	133	782

4 GIS MODEL

4.1 SENSITIVE RECEPTORS DATABASE

The GeoAddress Locator from the An Post's GeoDirectory is used for the identification of sensitive receptors. GeoDirectory provides a complete database of all of the buildings in the Republic of Ireland and their geolocation details. It is the only reliable and up-to-date information on address location based on the Ordnance Survey Ireland (OSI) large scale data and backed by An Post. The data is updated quarterly.

For this study the buildings data from the GeoDirectory which holds the grid coordinates in both Irish Grid and Irish Transvers Mercator, associated unique ID, building use and several other important attributes is used. The building use column classifies all points into residential (R), commercial (C), both residential and commercial (B) or unknown (U).

The GeoDirectory is a comprehensive Building and Address Point database and therefore it is assumed that all sensitive receptors are spatially represented as a point in the database. The following building use categories are used as sensitive receptors for this study.

- R - Residential
- B - Both Residential & Commercial
- U - Unknown

4.2 DISTANCE MODEL

Euclidean, or straight-line, distance raster is created using the sensitive receptors as source. The source identifies the location of the objects of interest which in this case are the residential, both residential and commercial and unknown point locations from the GeoDirectory. The source locations are transformed into a raster and assigned with 0 values.

The Euclidean distance output raster contains the measured distance from every cell to the nearest source. The distances are measured as the crow flies (Euclidean distance) in the projection units of the raster, in this case meters, and are computed from cell centre to cell centre.

The raster is created at cell size of 20m resolution and is used as the basis for all analysis in the GIS model.

4.3 EXCLUSION ZONES

The following datasets were used as exclusion zones and removed from the distance model created in the previous step.

4.3.1 Biodiversity and Ecology

- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)
- National Parks
- Ramsar Sites
- Lakes
- Fresh Water Pearl Mussel catchments (designated under si296 only)
- Annex 1 Habitats (extracted from CORINE 2006)*
- Shellfish Areas
- Natural Heritage Areas (NHA)
- Proposed Natural Heritage Areas (pNHA)
- Salmonid Rivers (Salmonid rivers are available as line features therefore total length of salmonid rivers within each setback and height scenario are calculated and presented in the matrix)
- Important Bird Areas (the data is available as point dataset therefore total counts within each setback and height scenario are presented in the matrix.

*The following CORINE 2006 codes are used to extract areas of un-confirmed Annex 1 habitats.

Table 4.1: CORINE 2006 Classes considered for Annex 1 habitats

CORINE Level 3 Code	Level 3 Description
311	Broad-leaved forests
321	Natural grassland
322	Moors and heathlands
331	Beaches, dunes, sand
412	Peat bogs
421	Salt marshes
423	Intertidal flats
521	Coastal lagoons
522	Estuaries

4.3.2 Population

- Settlements and Built-up areas (CSO Dataset)
- Zoned Land (MyPlan.ie Data)
  - Current Development Plans
  - Current Local Area Plans
  - Other Current Plans
- Airports/Aerodromes (1km buffer applied for this study)

4.3.3 Cultural Heritage and Architectural Conservation

- World Heritage Sites (UNESCO Sites)
- Record of Monuments and Places
- National Inventory of Architectural Heritage

The cultural heritage and architectural conservation datasets are available as point layer. Therefore the counts per setback areas are presented in the matrix.

4.3.4 Soils, Geological and Hydrogeology Exclusion Areas

- Geological Heritage Areas
- Landslide Susceptibility Areas [not excluded as per GSI advise]
- Quaternary Data 2014 [not excluded as per GSI advise]

4.3.5 Topography, Landcover and Landuse Exclusion Areas

- Military Lands
- Slopes greater than 10 degrees (17.6%)
- Walking and Cycling Trails (polyline dataset therefore are represented as total length within the setback and height scenarios).

4.4 MINIMUM AREA REQUIREMENT

Minimum area is calculated on assumption of single turbine and based on the manufacturers' models of the various tip heights. The clearance distance from boundary of a wind farm is assumed at 2.5 x rotor diameter. The circle area is calculated using the following formula.

$$A=\pi r^2$$

Table 4.2 shows the minimum area requires per height scenario.

Table 4.2: Minimum Area Calculation

Tip Height	Rotor Diameter	Clearance Distance (2.5 x rotor diameter)	Minimum Area Required in m^2	Minimum Area Required in km^2
125m	90m	225m	159,043	0.159
150m	105m	262.5m	216,475	0.216
175m	112m	280m	246,300	0.246
200m	126m	315m	311,724	0.311

4.5 WIND SPEED AREA CALCULATIONS

The wind speed areas are calculated from the Wind Atlas 2013 data. The Wind Atlas 2013 displays wind speeds at 20, 30, 40, 50, 75, 100, 125 and 150 metres above ground level (agl), at a horizontal resolution of 100m, SEAI(2013).

The data from the Wind Atlas 2013 was made available in the GIS format as rasters with 100m cell size and in the Irish Transverse Mercator (ITM) coordinate system. Figure 4.1 is an example from the Wind Atlas Report.

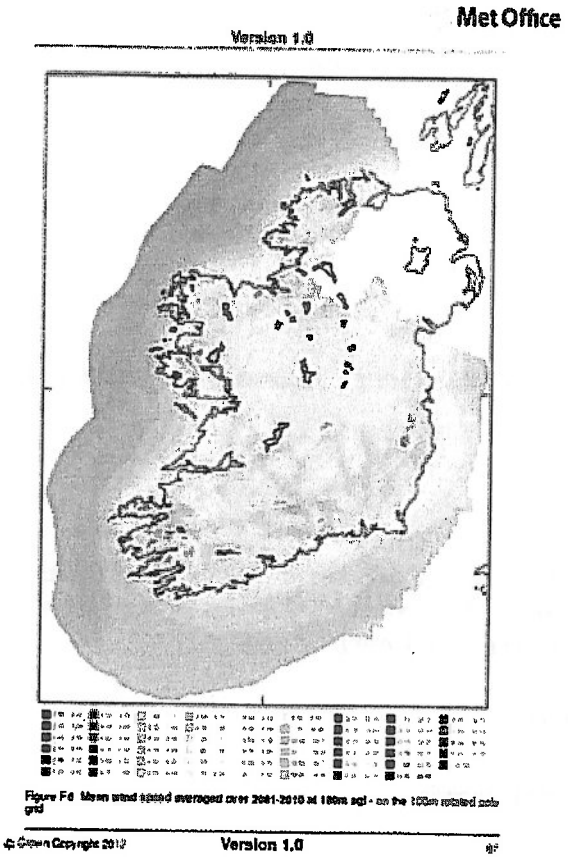

Figure 4.1: Mean wind speed averaged over 2001 – 2010 at 100m agl (Wind Atlas 2013)

For each area, the wind speed rasters were classified into the following classes and the areas were calculated using each set of setback distance polygons created in the earlier steps.

Areas that have windspeeds lower than those shown in the Table 4.3 are excluded. The tip height alongside each 'minimum' wind speed is aligned with the typical wind turbine size required to make sites with that average wind speed viable.

Table 4.3: Matching Wind Speed

Tip Height of Interest	Matching Minimum Wind Speed at Tip Height (m/s) 100m*
200m	7.50
175m	7.60
150m	7.75
125m	8.00

*Assumptions provided by SEAI through discussions with industry sources

4.6 POTENTIAL WIND ENERGY CAPACITY (MW)

The potential wind energy capacity (MW) was calculated for each scenario by multiplying the land cover available to wind energy developments (in km2) by an assumed wind energy capacity intensity of 10MW per Km2. This assumption was provided by SEAI based previous research and on industry reports, for example The Bellona Foundation- Strangeland, A. (2007). The Potential and Barriers for Renewable Energy).

4.7 POTENTIAL WIND ENERGY OUTPUT (GWH)

The potential wind energy output (GWh) was calculated assuming:

- The assumed capacity factors (CF) was broken down relating to tip heights. These assumptions are higher than the typical existing annual capacity factors, taken from EirGrid data, but are significantly less than the capacity factors taken from manufacturers and other independent sources and models.
  - 125m (30% CF),
  - 150m (33.33% CF),
  - 175m (36.66% CF),
  - 200m (40% CF).
- Losses of 15% (Assumption received from SEAI)

4.8 ARCGIS MODEL

All spatial datasets are collated, harmonised into one coordinate system (Irish Transverse Mercator) and added to the project's File GeoDatabase in ESRI ArcCatalog. For the spatial analysis a series of models were built in the ArcMap Model Builder. Figure 4.2 shows the process flow of the ArcGIS model.

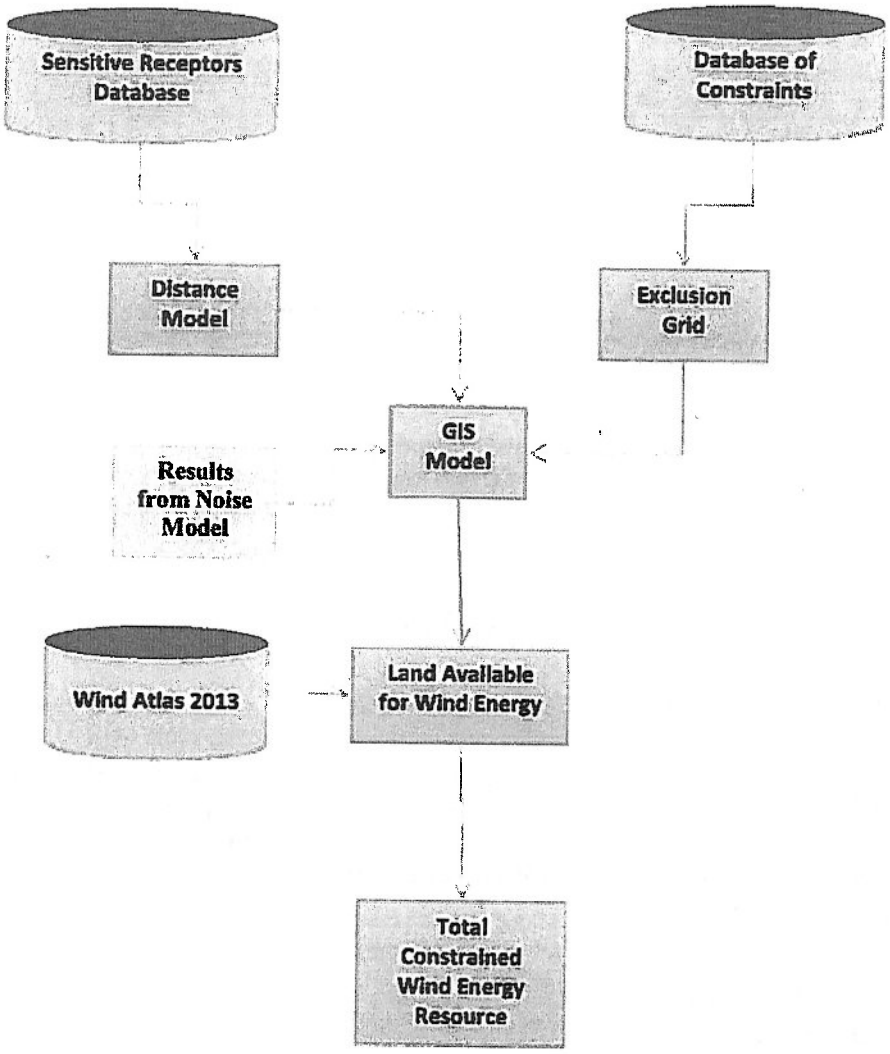

Figure 4.2: Process Model of the spatial analysis

5 OVERVIEW OF MODELLING RESULTS

The estimated set back distances, as outlined in Table 3.2, provide details on the statistical propagation from a wind farm to a sensitive receptor which provides a representative statistical distance within which noise limits could be reached. The separation distance is based on a 99th percentile, i.e. three sigma distance from the source, as set out in Section 3.S. The estimated set back distances which were derived from the acoustic model were inputted into the GIS Software package (ArcGIS) for post processing and mapping.

Table S.1 represents the potential area available for wind development in Ireland resulting from a number of putative noise limit scenarios. These scenarios are based on an absolute noise limit value in the range of 38 - 4SdB (expressed as L_{A90}). Each zone is based on a potential dB noise level and a range of assumed tip heights (defining the minimum parcel of land required for a single turbine, and removing parcels below this size).

An available capacity was developed to determine the potential turbine output for the available land. Table 5.1 outlines the Capacity Output Potential for each noise level limit.

5.1.1 Caveats

Given the high level nature of the exercise, a number of core assumptions were used to develop a basic model in order to complete these calculations. These assumptions were as follows:

- Setbacks are taken from the An Post GeoDirectory dataset, using datapoint locations identified as residential and commercial.
- Turbine output capacity was assumed to be 3-3.5 MW, given current trends in the industry. Three turbines, from the most popular wind turbine manufacturers represented in Ireland, were taken from within this range and the model was based on the manufacturers' noise data for these turbines.
- A wind farm factor was applied to the separation distances to replicate multi-turbine emissions. Tip heights and assumed rotor diameter were used to exclude unconstrained land parcels of a size below which a single turbine could not be erected. Exclusion zones were also used including geographical features such as lakes and certain designated areas, given the likelihood of planning being applied for and granted in these areas. These areas include SAC's, SPA's, National Parks, Ramsar sites, certain Freshwater Pearl Mussel catchments designated under SI296, Annex 1 Habitats, Military Areas and Natural and Geological Heritage Areas.

Table 5.1: Potential area available for wind development in Ireland

Absolute Noise Limit	Tip Height (m)	Rotor Diameter (m)	Clearance Distance (m)	Min Area Required (sq m)	Available Area (sq km)	Percent of ROI land area
38 dB	200	126	315	311	411	0.585%
	175	112	280	246	398	0.567%
	150	105	262.5	216	325	0.463%
	125	90	225	159	164	0.234%
39 dB	200	126	315	311	432	0.615%
	175	112	280	246	418	0.595%
	150	105	262.5	216	340	0.483%
	125	90	225	159	172	0.244%
40 dB	200	126	315	311	477	0.679%
	175	112	280	246	459	0.653%
	150	105	262.5	216	370	0.527%
	125	90	225	159	185	0.263%
41 dB	200	126	315	311	494	0.702%
	175	112	280	246	475	0.676%
	150	105	262.5	216	382	0.543%
	125	90	225	159	189	0.269%
42 dB	200	126	315	311	574	0.817%
	175	112	280	246	554	0.789%
	150	105	262.5	216	439	0.624%
	125	90	225	159	210	0.299%
43 dB	200	126	315	311	679	0.967%
	175	112	280	246	649	0.923%
	150	105	262.5	216	502	0.714%
	125	90	225	159	234	0.332%
44 dB	200	126	315	311	789	1.123%
	175	112	280	246	753	1.071%
	150	105	262.5	216	570	0.811%
	125	90	225	159	254	0.362%
45 dB	200	126	315	311	1,018	1.449%
	175	112	280	246	964	1.372%
	150	105	262.5	216	708	1.008%
	125	90	225	159	288	0.410%

The following key points have also been considered, given that they would further reduce the amount of viable sites from the capacity figures produced in this high level analysis:

- The analysis considered a range of scenarios for the turbines relating to wind speed, noise attenuation, atmospheric and other effects to provide a representative statistical distance within which noise limits could be reached.
- The analysis completed, defined a zone where the separation between turbine and receptor is statistically (99th percentile) greater than the cumulative correction setback distance and within which turbines are likely to operate without acoustic restrictions.
- The model, by its nature, cannot take account of site-specific engineering and other technical constraints, including site specific wind quality. It is probable that a proportion of the available land, and capacity indicated would prove not to be technically or economically viable due to site specific constraints.
- The model cannot take account of site specific environmental designations, nor can it assume the cumulative effects of wind being concentrated into a significantly reduced national landbank. It is probable that a proportion of the available land and capacity indicated would not be successful within a planning process, given these local factors.

The potential viable areas for wind turbine placement with regard to the use of an absolute noise limit (expressed as L_{A90}) as an appropriate means to control noise impact are presented in Figure 6.1 to Figure 6.8.

Given the above, SEAI have used their planning database to outline a number of scenarios where the above factors would impact on deliverability. These take the basic RPS Results of available capacity for development and use historic planning and grid data to determine likely development levels. SEAI scenarios have been determined at 10%, 16% and 30%, and are outlined overleaf.

6 SEAI SCENARIO ANALYSIS

									SEAI Scenario Analysis					
Absolute Noise Limit	Tip Height of Interest	Area Available (km²) Before the minimum Wind Speed at Tip Height	Matching Minimum Wind Speed at Tip Height (m/s) 100m	Area Available (km²) Matching Minimum Wind Speed	Percent of ROI land area	Capacity Available (MW)	Assumed Capacity Factor for Tip Heights	Capacity Output Potential (GWh)	Capacity Available (MW) Scenario 1 (10%)	Capacity Available (MW) Scenario 2 (16%)	Capacity Available (MW) Scenario 3 (30%)	Capacity Output Potential (GWh) Scenario 1 (10%)	Capacity Output Potential (GWh) Scenario 2 (16%)	Capacity Output Potential (GWh) Scenario 3 (30%)
38dB	200m	416	7.5	411	0.585%	4,109	40.00%	12,239	411	657	1,233	1,224	1,958	3,672
	175m	424	7.6	398	0.567%	3,983	36.66%	10,872	398	637	1,195	1,087	1,740	3,262
	150m	427	7.75	325	0.463%	3,253	33.33%	8,073	325	520	976	807	1,292	2,422
	125m	433	8	164	0.234%	1,641	30.00%	3,666	164	263	492	367	586	1,100
39dB	200m	437	7.5	432	0.615%	4,322	40.00%	12,874	432	692	1,297	1,287	2,060	3,862
	175m	446	7.6	418	0.595%	4,182	36.66%	11,415	418	669	1,254	1,141	1,826	3,424
	150m	450	7.75	340	0.483%	3,396	33.33%	8,428	340	543	1,019	843	1,348	2,528
	125m	456	8	172	0.244%	1,715	30.00%	3,832	172	274	515	383	613	1,150
40dB	200m	484	7.5	477	0.679%	4,772	40.00%	14,214	477	764	1,432	1,421	2,274	4,264
	175m	493	7.6	459	0.653%	4,590	36.66%	12,530	459	734	1,377	1,253	2,005	3,759
	150m	497	7.75	370	0.527%	3,704	33.33%	9,191	370	593	1,111	919	1,471	2,757
	125m	505	8	185	0.263%	1,846	30.00%	4,123	185	295	554	412	660	1,237
41dB	200m	501	7.5	494	0.702%	4,936	40.00%	14,702	494	790	1,481	1,470	2,352	4,411
	175m	511	7.6	475	0.676%	4,749	36.66%	12,963	475	760	1,425	1,296	2,074	3,889
	150m	515	7.75	382	0.543%	3,818	33.33%	9,476	382	611	1,145	948	1,516	2,843
	125m	524	8	189	0.269%	1,889	30.00%	4,220	189	302	567	422	675	1,266
42dB	200m	585	7.5	574	0.817%	5,743	40.00%	17,106	574	919	1,723	1,711	2,737	5,132
	175m	601	7.6	554	0.789%	5,542	36.66%	15,128	554	887	1,663	1,513	2,420	4,538
	150m	608	7.75	439	0.624%	4,388	33.33%	10,890	439	702	1,316	1,089	1,742	3,267
	125m	616	8	210	0.299%	2,103	30.00%	4,697	210	336	631	470	752	1,409
43dB	200m	695	7.5	679	0.967%	6,793	40.00%	20,234	679	1,087	2,038	2,023	3,237	6,070
	175m	710	7.6	649	0.923%	6,489	36.66%	17,713	649	1,038	1,947	1,771	2,834	5,314
	150m	717	7.75	502	0.714%	5,018	33.33%	12,453	502	803	1,505	1,245	1,992	3,736
	125m	735	8	234	0.332%	2,336	30.00%	5,217	234	374	701	522	835	1,565
44dB	200m	810	7.5	789	1.123%	7,889	40.00%	23,495	789	1,262	2,367	2,350	3,759	7,049
	175m	834	7.6	753	1.071%	7,529	36.66%	20,551	753	1,205	2,259	2,055	3,288	6,165
	150m	842	7.75	570	0.811%	5,699	33.33%	14,144	570	912	1,710	1,414	2,263	4,243
	125m	862	8	254	0.362%	2,541	30.00%	5,676	254	407	762	568	908	1,703
45dB	200m	1,051	7.5	1,018	1.449%	10,183	40.00%	30,329	1,018	1,629	3,055	3,033	4,853	9,099
	175m	1,090	7.6	964	1.372%	9,639	36.66%	26,311	964	1,542	2,892	2,631	4,210	7,893
	150m	1,103	7.75	708	1.008%	7,084	33.33%	17,582	708	1,134	2,125	1,758	2,813	5,275
	125m	1,137	8	288	0.410%	2,881	30.00%	6,436	288	461	864	644	1,030	1,931

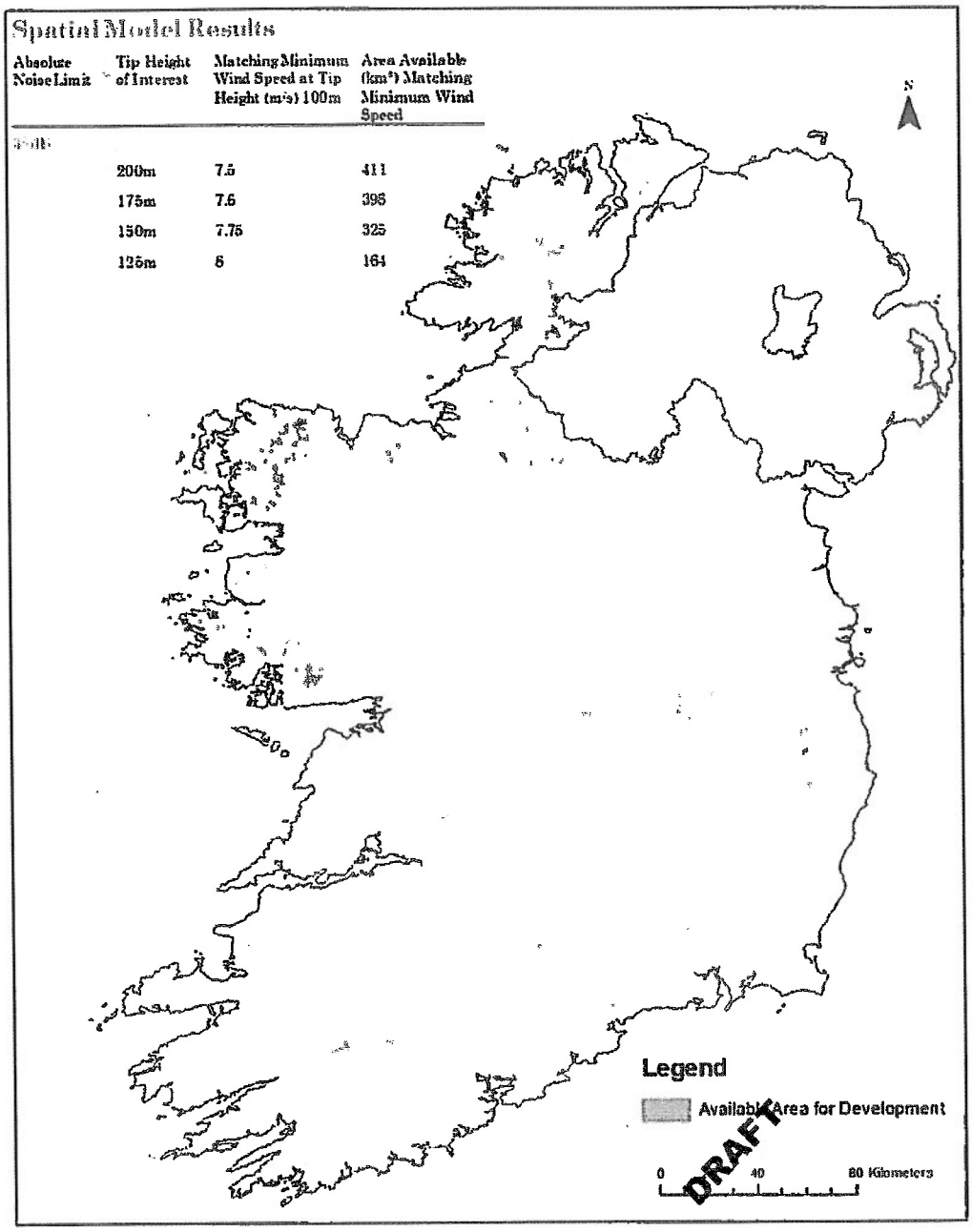

Figure 6.1: Absolute Noise Limit 38dB

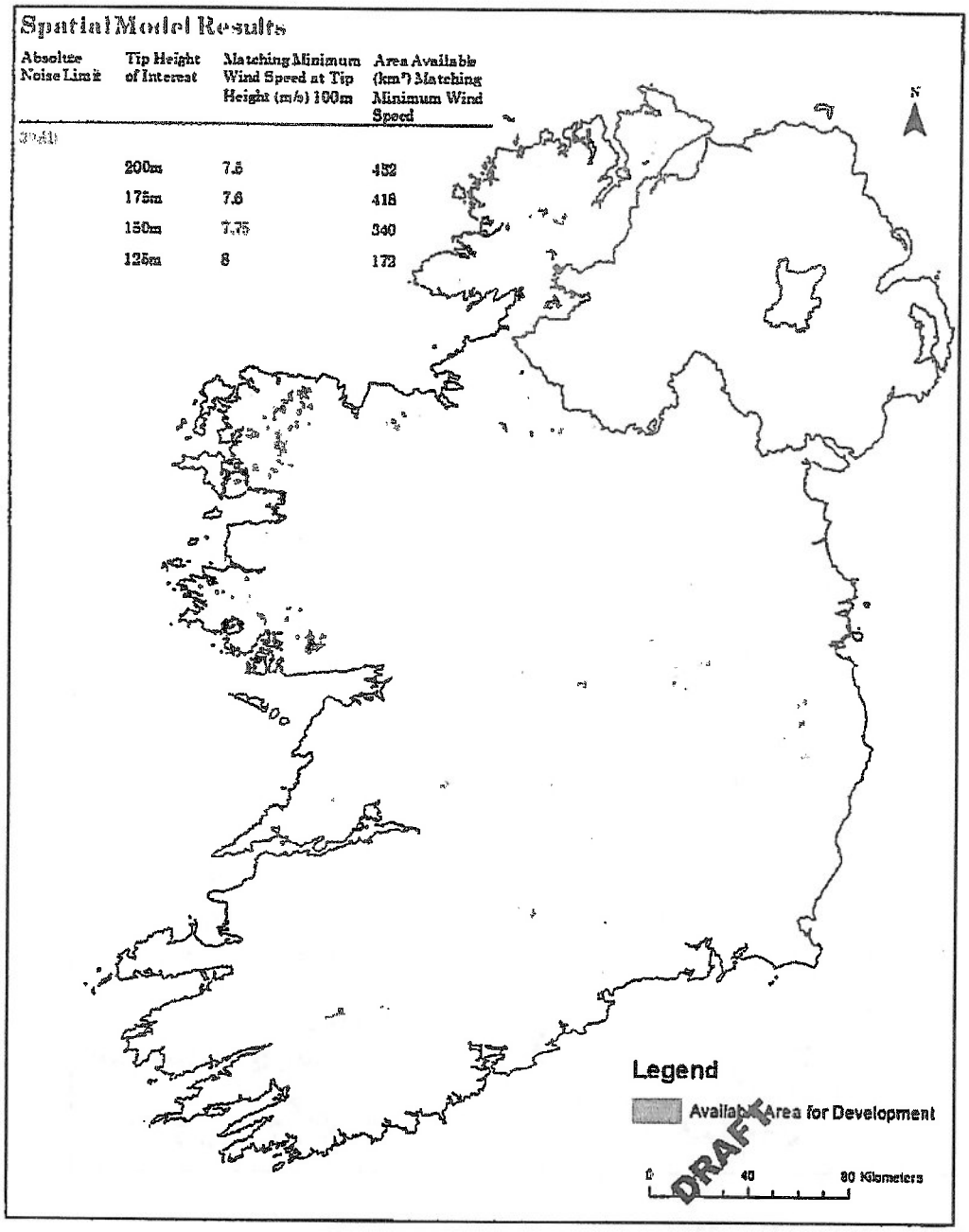

Figure 6.2: Absolute Noise Limit 39dB

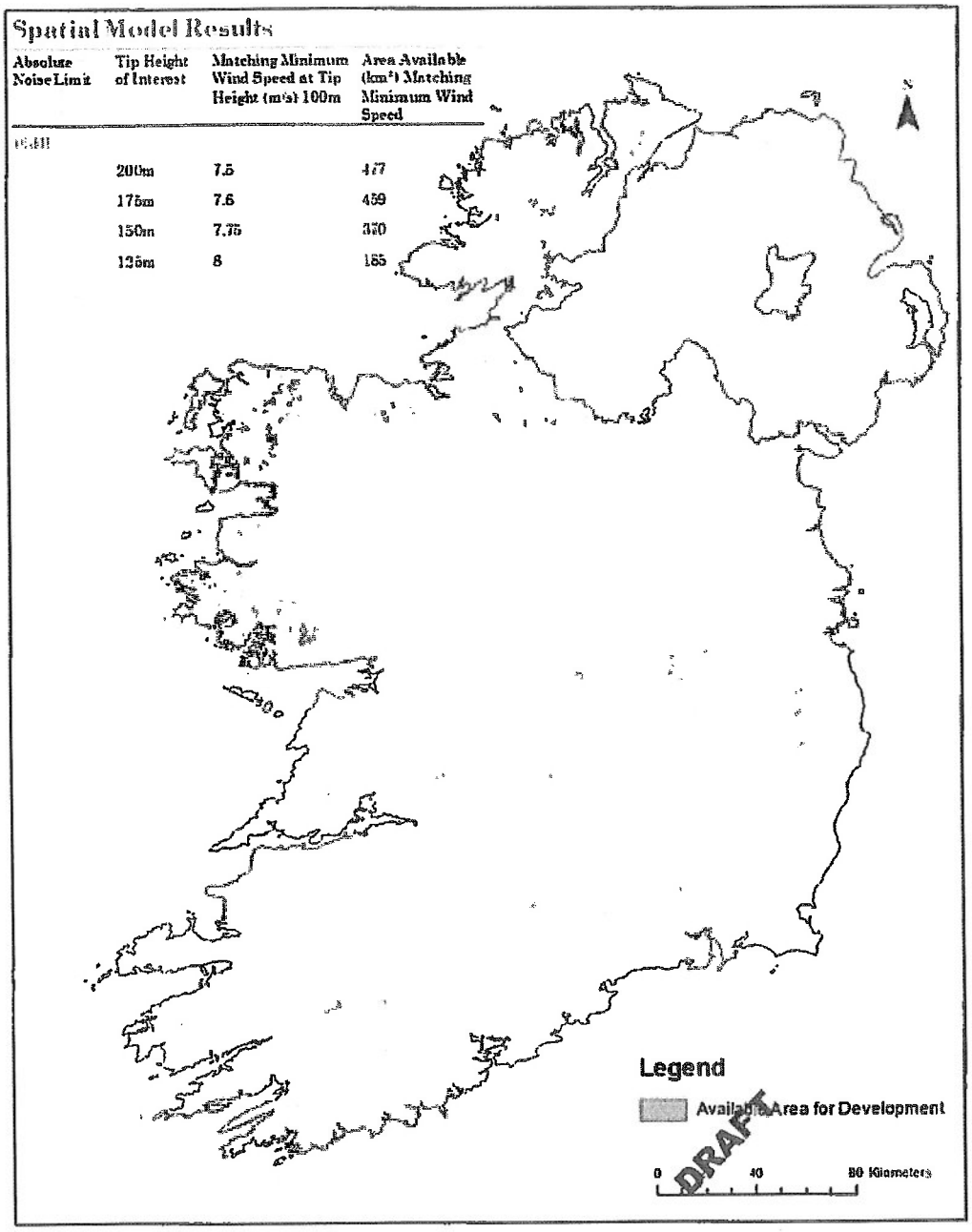

Figure 6.3: Absolute Noise Limit 40dB

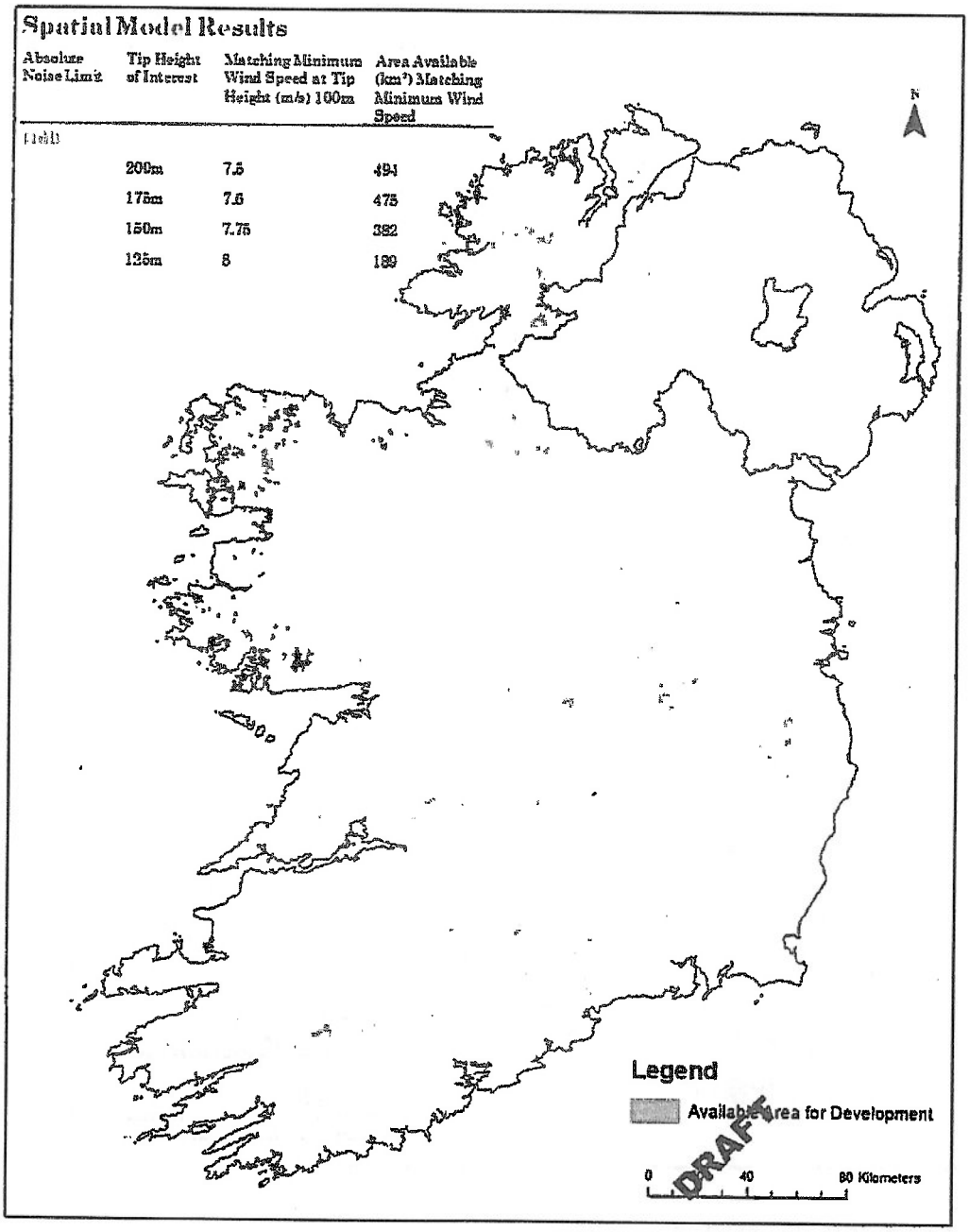

Figure 6.4: Absolute Noise Limit 41dB

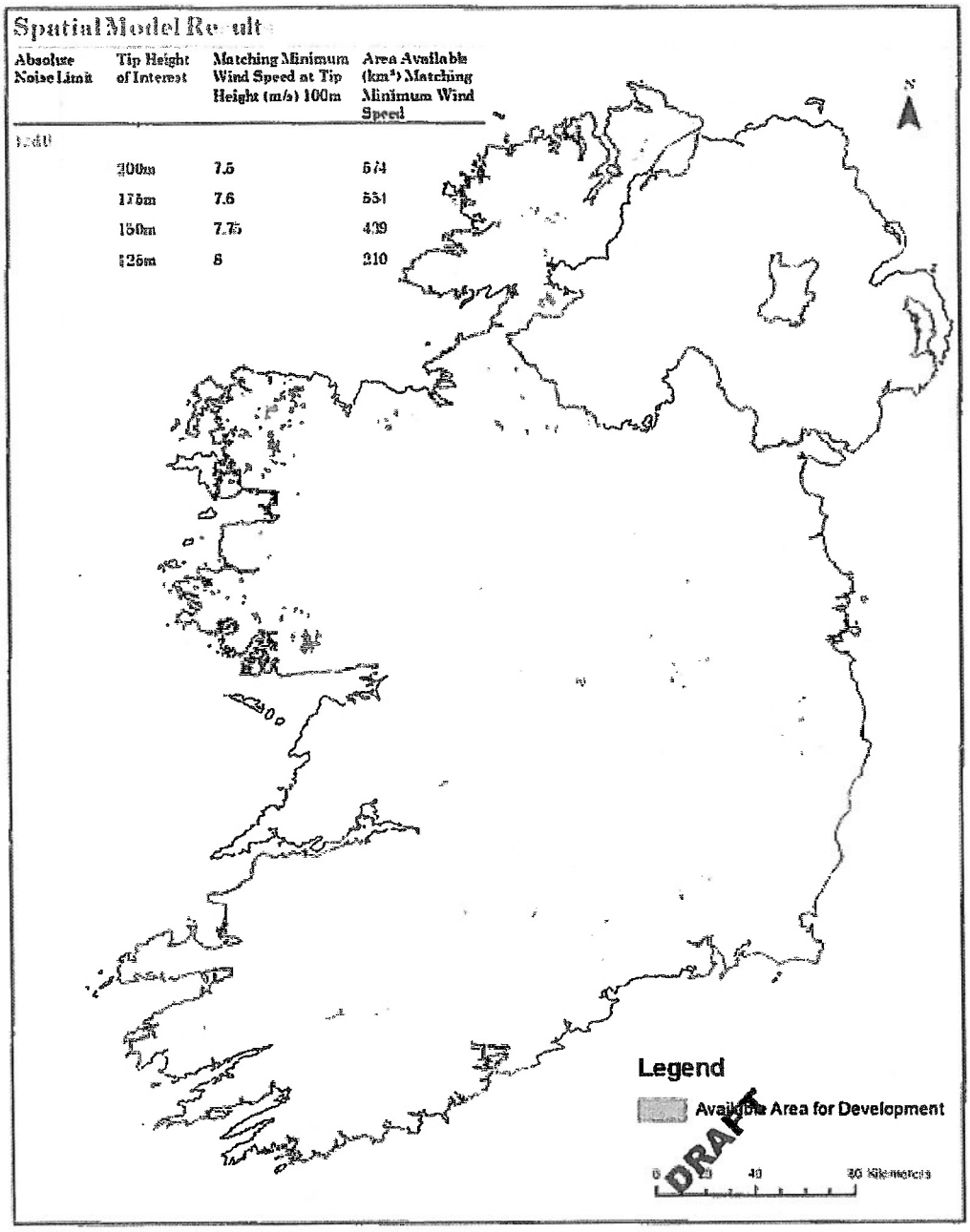

Figure 6.5: Absolute Noise Limit 42dB

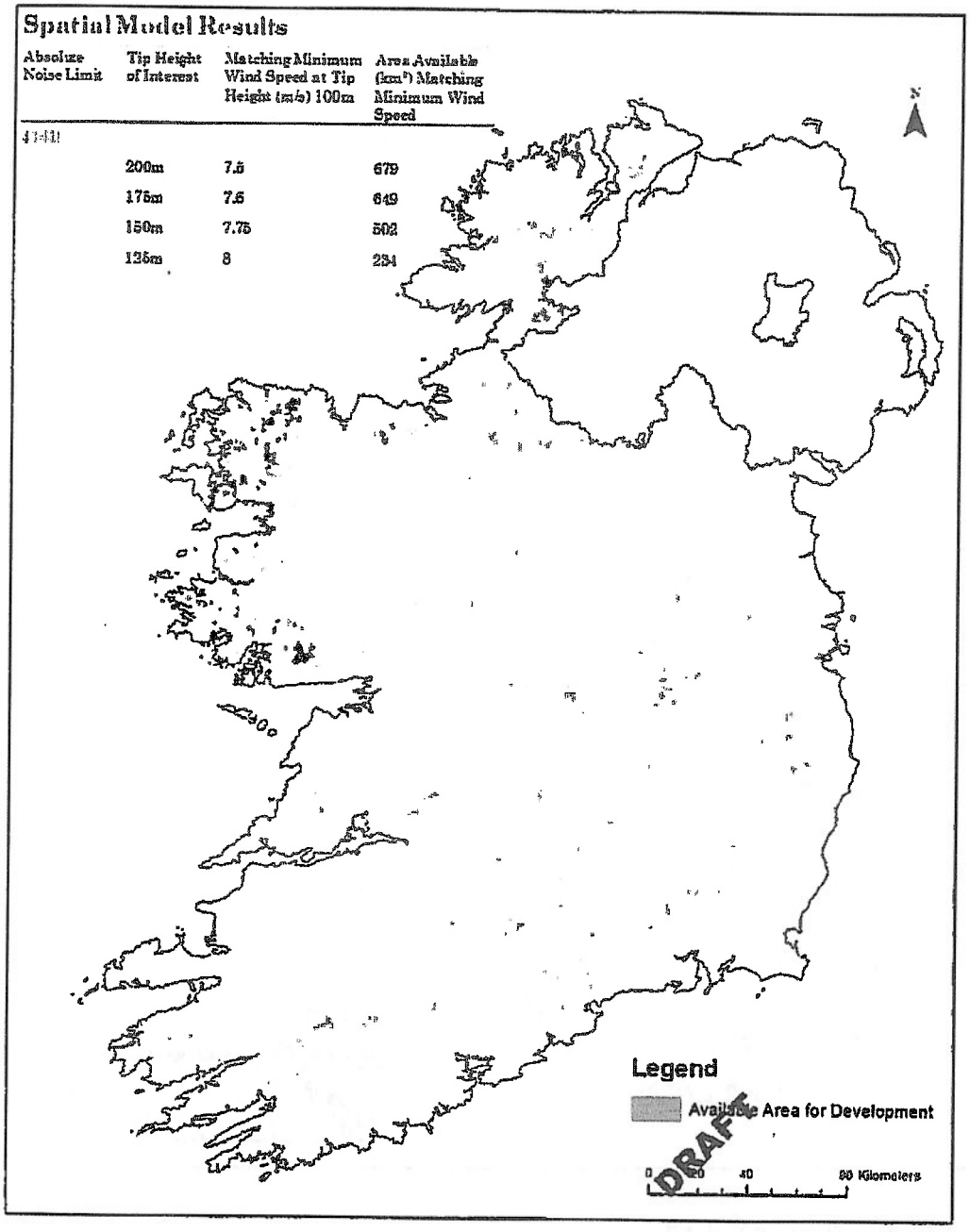

Figure 6.6: Absolute Noise Limit 43dB

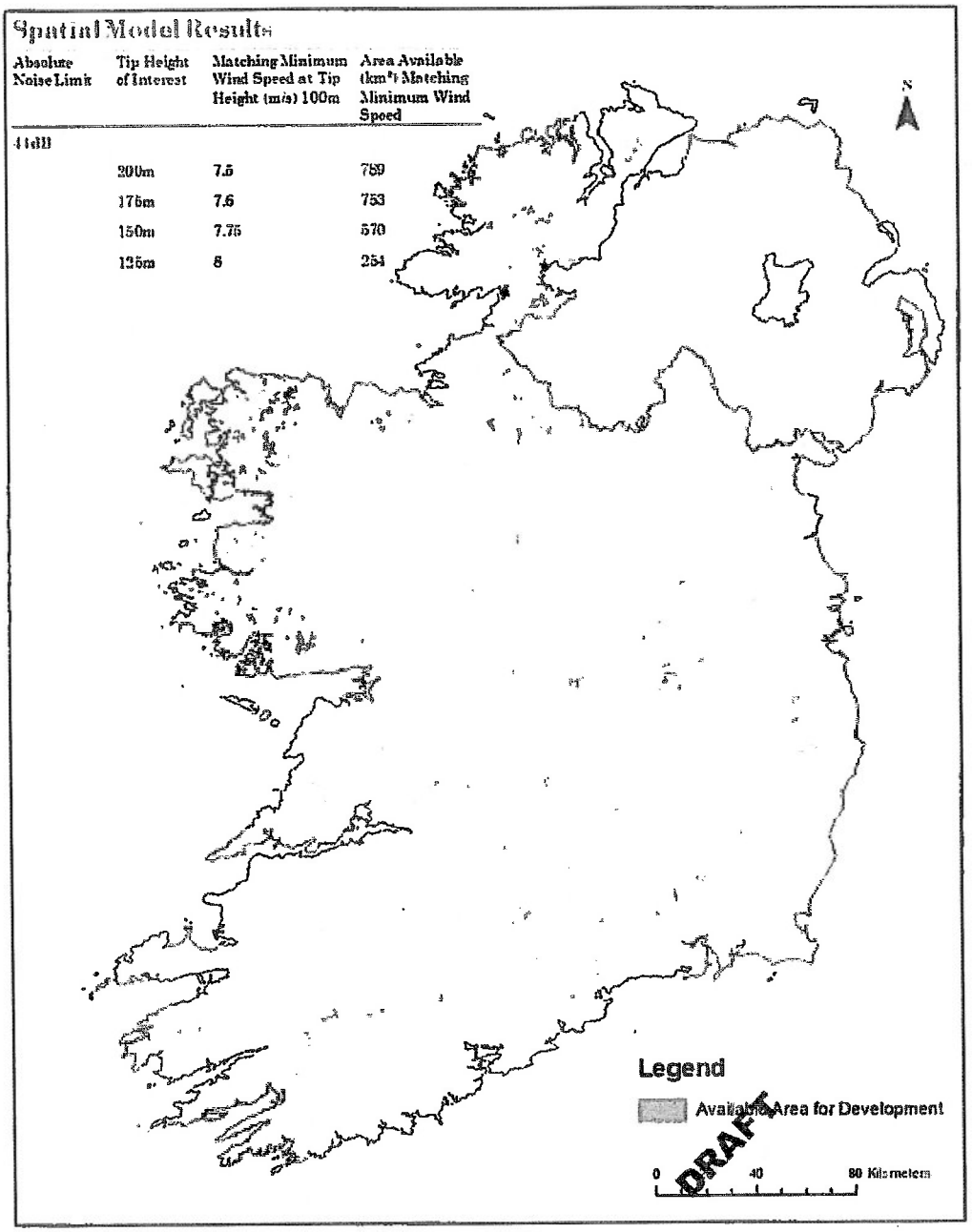

Figure 6.7: Absolute Noise Limit 44dB

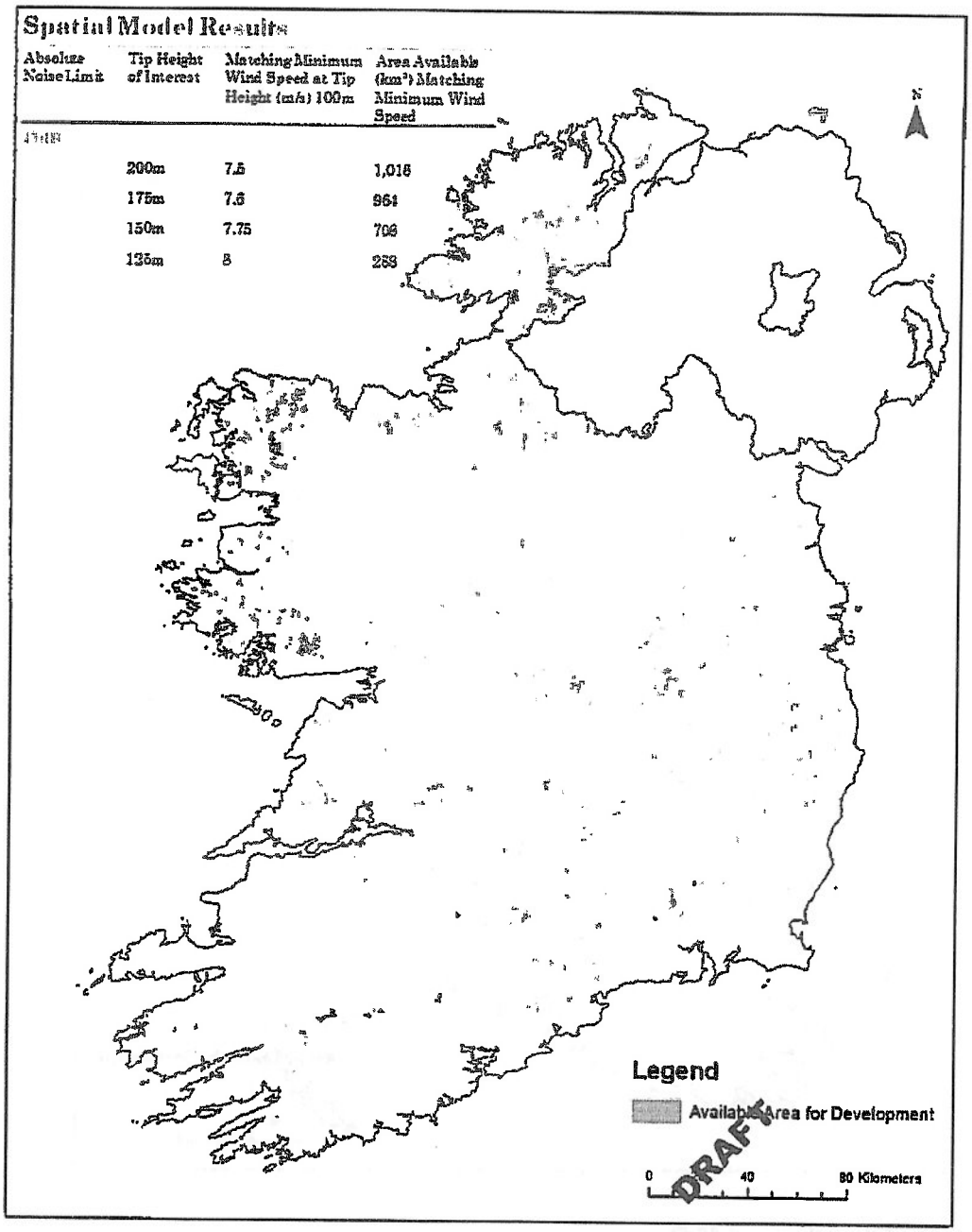

Figure 6.8: Absolute Noise Limit 45dB

7 DISCUSSION

The acoustic model results are presented in Section 3.5. The modelling results which resulted in each 1 dB noise limit band were collated and a Probability Distribution Function plot of the data is presented. The plots show that for lower noise levels (38 dBA to 40 dBA) the data is not normally distributed. The data is shewed to the higher end of the distance spectrum. For noise levels of 41 dBA to 45 dBA the data shows a reasonable approximation to a normal distribution.

The acoustic model provided data for over 113,000 individual 'models' comprising of a combination of the parameters outlined in Sections 3.2 to 3.4. The number of individual 'models' in each of the 1 dBA 'bins' ranged from 4757 to 6431, giving a robust statistical basis to the calculated result. The bands show that the proposed noise limit is inversely proportional to the acoustic setback distance as expected.

The GIS model provides the context where increasing setback distances result in significant reductions in available land area and potential wind capacity in Ireland. Table 5.1 sets out the available capacity which has a range of 248% from a low potential noise limit of 38 dBA to the existing daytime level of 45 dBA. With the site specific factors outlined in Section 5.1.1, this could result in a three to one reduction in potential capacity if adopted.

The potential viable areas for wind turbine placement with regard to the use of an absolute noise limit (expressed as L_{A90}) as an appropriate means to control noise impact have been presented in Figures 5.1 to 5.8. The potential capacity is directly related to the maximum tip height and absolute noise limit level.

7.1 POTENTIAL AREA AVAILABLE FOR WIND DEVELOPMENT IN IRELAND

The potential capacity for wind energy development in Ireland for the range of proposed noise limit levels and turbine tip height is shown in Figure 7.1.

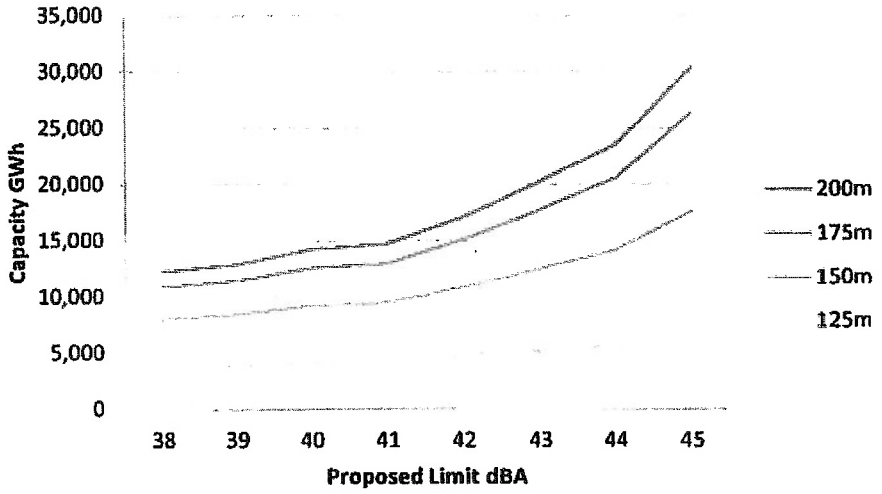

Figure 7.1: Wind Energy Capacity v Absolute Noise Level

Future large scale wind farm development is likely to use tip heights in the range 150m to 175m. 200m hub heights may be a requirement on some low wind sites but not the norm. Focussing on the impact of proposed fixed noise limit values in this band indicates that a wind energy output of 10,000 GWh is feasible with 175m tip heights but a challenge with a limit of 150m on tip heights.

Taking the 175m curve, the output decreases from 26,311 GWh at the current daytime limit of 45 dBA to 10,872 GWh at a potential limit of 38 dBA. The 175m data is shown in Table 7.1.

Table 7.1: Potential Capacity GWhr for wind development in Ireland

Capacity GWhr at 175m tip height							
38 dBA	39 dBA	40 dBA	41 dBA	42 dBA	43 dBA	44 dBA	45 dBA
10,872	11,415	12,530	12,963	15,128	17,713	20,551	26,311

8 CONCLUSIONS

The potential capacity for wind farm development is impacted significantly by the selection of a fixed noise limit level. The reduction from the current daytime limit of 45 dBA to the proposed limit of 40 dBA will result in a loss of capacity of 13,797 GWh or a 52% loss of capacity. Similarly a reduction from the current night time limit of 43 dBA will result in a 29% loss in capacity.

Changing the noise limit to a fixed level 3 or 5 dBA below the currently permitted levels will result in a significant loss in potential wind energy capacity.

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APPENDIX A

GLOSSARY OF TERMINOLOGY

Ambient / Background Noise	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. The $L_{Aeq,\ 10min}$ is the parameter that is used to define the background noise level in this instance. L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.
A-weighting	The A-weighting approximates the response of the human ear, particularly for sounds of moderate and low levels
C-weighting	The C-weighting approximates the response of the human ear, particularly for sounds at high noise levels (typically greater than 100 dB).
dB	Decibel. The unit of sound level. A measurement of sound level expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr =20 µPa i.e. $dB = 20 \times \log(P/P_r)$
dB(A)	An 'A-weighted decibel' – a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. A-weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
HH	Hub Height.
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
L_{Aeq}	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.
L_{A90}	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
MW	1×10^6 Watts
Octave Band	Sound, which can occur over a range of frequencies, may be divided into octave bands for analysis. For environmental noise assessments, sound is commonly divided into 8 octave bands. The octave band frequencies are 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz and 8kHz.
Sound Pressure Level (L_p)	A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 µPa RMS) and expressed in decibels
Sound Power Level (L_W)	The level of total sound power radiated by a sound source. A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} Watts and expressed in decibels.