



# Internal Memo

**To:** Paul Sexton  
Principal Planning Officer  
**Dept:** Planning & New Communities

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**From:** Greg Kearney  
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**Phone:** X3145

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**Date:** 24<sup>th</sup> January 2014

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**Subject:** Land at Highfield Farm, West of Royston Road, Litlington  
  
Highfield Wind Farm  
  
Installation of five wind turbines of maximum height to tip of 100m; a single 60m lattice tower meteorological mast; on-site substation; access tracks; hard standing areas; external transformers; temporary construction compound and associated ancillary infrastructure.

**Our Ref:** Job No: WK207503

**Your Ref:** S/0439/12/FL

This application is for the installation 5 wind turbines situated on farmland, approximately 1.5km South-west from the centre of the village of Litlington.

A Highfield Wind Farm Environmental Statement (ES) comprised of Volumes 1 to 4 dated February 2012, prepared by Engena UK Ltd (an independent renewable energy consultancy) on behalf of the applicant, Highfield Wind Energy Limited, forms part of the application.

The ES is comprised of the following Volumes 1 to 4:

- Volume 1: Non-Technical Summary
- Volume 2: Written Statement including Volume 2: Appendices
- Volume 3: Figures
- Volume 4: Visualisations

The ES reports on the findings of an Environmental Impact Assessment (EIA), undertaken by Eugena Ltd (principle project managers for the EIA) and a team of specialist consultants to identify the potential significant effects / impacts of the proposals upon the existing baseline environment and consideration of mitigation, as necessary.

For the purpose of the EIA and the ES assessment of impacts have been based upon a candidate turbine, the Nordex N80 2.5MW wind turbine which has a hub-height of 60m and a rotor diameter of 80m, with an overall height to tip of 100m.

## **1.0 Summary**

The application documents and Environmental Impact Assessment (EIA) with associated Environment Statement (ES) / Appendices are technically complex and detailed in many respects.

The following environmental health issues need to be considered and addressed effectively in order to minimise potential adverse impacts on existing residents and which are paramount in facilitating sustainable development and safeguarding amenity and a healthy living environment:

- **Noise Impact**
  - Construction Noise & Vibration
  - Wind Farm Operational Noise
  
- **Shadow Flicker**

## **2.0 The Wind Farm Location**

The proposed wind farm site is to be sited on open arable farmland within the ownership of Highfield Farm. The farmland is approximately 1.5km South-west from the centre of the village of Litlington.

The location of the 5 turbines on the application site is illustrated in Figure 3- Site Layout within Volume 3 – Figures and in Plate 3.5- Final Site Layout within Volume 2- Written Statement, of the ES.

The ES states that the residential properties Stretlands (Ashwell St / Track), Fairview, Bonfield and Turnberry all addressed as Royston Road on the south west edge of the village of Litlington are approximately 860 to 890 metres from the nearest proposed turbine 4.

The closest dwellings within 1km to the proposal and their approximate distance and direction from the nearest proposed turbines are those listed in Table 1- below (recreated from Table 4.1 – *Nearest Dwellings to the Proposal* (listed out to 1km) on page 59 of the ES - Volume 2: Written Statement.

**Table 1 –Nearest Dwellings to the Proposed Turbines**

<b>Closest Dwellings to the Proposal (up to 1km)</b>	<b>Private or Wind Farm Landowner Owned</b>	<b>Distance from Nearest Turbine (approximate to nearest 5m)</b>	<b>Direction From Turbine</b>	<b>Turbine No.</b>
<b>Highfield House</b> Highfield Farm, Royston Rd, Litlington, SG8 9NJ	Landowner	500m	SSE	5
<b>Highfield Farm</b>	Landowner	560m	SE	5

<b>Cottages ( semi-detached cottages, 1 &amp; 2)</b> Royston Rd, Litlington, SG8 9NJ				
<b>Highfield Farm</b> Royston Rd, Litlington, SG8 9NJ	Landowner	585m	SSE	5
<b>Brick Cottages (also known as The Cottages or Morden Grange Farm Cottages), (semi-detached cottages)</b> Baldock Rd (Ashwell St), Steeple Morden, SG8 9NR	Private	600m	SW	2
<b>Limlow</b> (Residential House) Royston Rd, Litlington, SB8 0RS	Private	640m	NNE	4
<b>White Cottages (No 3 &amp; 4 semi-detached cottages)</b> Ashwell St, Steeple Morden, SG8 9NR	Private	650m	WSW	2
<b>Morden Grange Farm House</b> Baldock Rd (Ashwell St), Steeple Morden, SG8 0NT	Private	715m	WSW	2
<b>Fairview</b> Royston Road	Private	860m	N	4

### **3.0 Chapter 13- Noise**

Hayes McKenzie Partnership Ltd (HMP) have undertaken an assessment of the potential noise impact of the proposed Highfield Wind Farm scheme upon the surrounding area and in particular upon the nearest noise sensitive premises / any nearby dwellings, in accordance with the document 'The Assessment and Rating of Noise from Wind Farms' (commonly known as ETSU-R-97 or ETSU).

Reference is made to Planning Policy Statement (PPS) 22: Renewable Energy and the Companion Guide to PPS22- Planning for Renewable Energy both of which recommend that the document ETSU should be used to assess and rate noise from wind energy development.

ETSU in its introduction states that it:

*“describes a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities. The suggested noise limits and their reasonableness have been evaluated with regard to regulating the development of wind energy in the public interest. They have been presented in a manner*

*that makes them a suitable basis for noise-related planning conditions or covenants within an agreement between a developer of a wind farm and the local authority”.*

It is important to note that in recent years, members of the acoustic fraternity and various academic research papers have challenged the reliance on ETSU in assessing the noise impact of all wind farm planning applications. ETSU was based on the design and operation of turbines up to a height of approximately 60 metres and there is concern about whether it adequately assesses different noise issues associated with larger turbines like those proposed at Highfield Wind Farm.

The relevance of ETSU has been discussed at numerous recent wind farm planning appeals and inspectors have acknowledged that there are inherent problems with certain aspects of ETSU in assessing noise impact.

Notwithstanding these concerns, ETSU remains the governments best practice guidance on the assessment of noise impact but may be supplemented with additional assessment considerations and procedures if fully justified.

It is noted that the noise assessment is effectively based on a candidate type wind turbine. Subject to planning approval, it will necessary to warrant sound power levels for the turbines to ensure that the actual wind turbines installed will meet noise immisions that have been or will be used in any acceptable noise impact assessment.

The ES noise assessment generally follows and is in accordance with the four stage process recommended in ETSU:

- i. Undertake a baseline noise survey of the prevailing representative background noise levels during quiet day and night time periods at noise sensitive premises (NSP) (effectively establishes existing noise environment in the absence of the proposed wind farm operating)
- ii. Use the background noise levels to generate maximum permissible day and night time noise levels having regard to ETSU guidance, which then generally form the basis of any planning noise limit conditions.
- iii. The prediction of likely noise imissions from the turbines to each of the representative NSPs, to assess if maximum permissible day and night time noise criterion will be complied with. Consider amending turbine proposals if potential noise limits exceedances.
- iv. Drafting of planning conditions requiring that the relevant maximum permissible noise levels are not breached and action to be taken in the event of a justified complaint.

It is also noted that Appendix 13- Noise of ES *Volume 2 - Appendices* includes the following additional relevant information regarding noise:

- Appendix 13.1 – Background Noise Histograms (Time History Figures of Measured Background Noise and Wind Speed Data)
- Appendix 13.2 – Nordex N80 Noise Levels

### **3.1 Operational Noise Planning Guidance - Paragraphs 13.13 to 13.35**

Planning Policy Statement (PPS) 22: Renewable Energy and the Companion Guide to PPS22- Planning for Renewable Energy both promote renewable energy resources, “*subject to appropriate environmental safeguards.*” with paragraph PPS 22 requiring that: “*Local*

*planning authorities should ensure that renewable energy developments have been located and designed in such a way to minimise increases in ambient noise levels."*

The Companion Guide to PPS 22 also requires in paragraph 41 that: *"Well-specified and well-designed wind farms should be located so that increases in ambient noise levels around noise-sensitive developments are kept to acceptable levels with relation to existing background noise."*

These planning policies documents were probably relevant when the application was originally compiled but it is noted that the National Planning Policy Framework (NPPF), March 2012, was published and became effective on the 27<sup>th</sup> March 2011.

### **3.2 National Planning Policy Framework (NPPF) / ETSU-R-97 and Noise**

The NPPF effectively replaced numerous PPSs and PPGs including PPS 22 and PPG 24: Planning & Noise.

Amongst other aims and with specific reference to noise pollution, the NPPF under section 11 and the heading *"Conserving and enhancing the natural environment"*, paragraph 109, states:

*The planning system should contribute to and enhance the natural and local environment by:*

- *preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability;*

Paragraph 120 states that:

*To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account.*

*With respect to noise aims, the NPPF is less prescriptive compared to previous policy / guidance and paragraph 123 states that planning policies and decisions should aim to:*

- *avoid noise from giving rise to significant adverse impacts<sup>27</sup> on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts<sup>27</sup> on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established;<sup>28</sup>*
- *and identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

<sup>27</sup> See Explanatory Note to the Noise Policy Statement for England (Department for the Environment, Food and Rural Affairs).

With regard to renewable energy schemes the NPPF at footnote 17 states:

*"In assessing the likely impacts of potential wind energy development when identifying suitable areas, and in determining planning applications for such development, **planning authorities should follow the approach set out in the National Policy Statement for Renewable Energy Infrastructure** (read with the relevant sections of the Overarching National Policy Statement for Energy Infrastructure, including that on aviation impacts). Where plans identify areas as suitable for renewable and low-carbon energy development, they should make clear what criteria have determined their selection, including for what size of development the areas are considered suitable"*

On the issue of noise from wind farms, the National Policy Statement for Renewable Energy Infrastructure (EN-3), DECC, July 2011 under the section "Onshore Wind Farm Impacts – Noise and vibration", states:

*2.7.54 The ES should include a noise assessment as set out in Section 5.11 of EN-1. However, the noise created by wind turbines in operation is related to wind speed and is different to general industrial noise and an additional assessment of this noise should be made.*

*2.7.55 The method of assessing the impact of noise from a wind farm on nearby residents is described in the report, 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) 32. This was produced by the Working Group on Noise from Wind Turbines Final Report, September 1996 and the report recommends noise limits that seek to protect the amenity of wind farm neighbours. The noise levels recommended by ETSU-R-97 are determined by a combination of absolute noise limits and noise limits relative to the existing background noise levels around the site at different wind speeds. Therefore noise limits will often influence the separation of wind turbines from residential properties.*

*2.7.56 The applicant's assessment of noise from the operation of the wind turbines should use ETSU-R-97, taking account of the latest industry good practice. This should include any guidance on best practice that the Government may from time to time publish.*

The policy section of the ES Chapter 13 Noise also makes reference to a number of noise guidance documents which reflect best practice in undertaking significance of impact assessment for certain noise sources and characteristics typically associated with wind turbine construction and operation.

### **3.3 Construction and Decommissioning Noise**

Paragraphs 13.36 to 13.46 consider construction and decommissioning noise. The methodology used to assess the impact of noise associated with any construction / decommissioning on site and indirect offsite construction related traffic noise on local roads and access tracks, is acceptable and due regard has been given to BS 5228: 2009 - Code of Practice for Noise and Vibration on Construction and Open Sites- Part 1- Noise.

Construction noise will be audible from time to time at nearby dwellings it will be temporary / passing in nature. Providing the best practical means are used to mitigate impact in accordance with BS 5228, including controls over permitted construction hours of working, an unacceptable adverse impact is unlikely.

However, further detailed information will be required prior to commencement of development. Therefore construction noise and vibration impact should be controlled and mitigated by the imposition of conditions restricting the hours of construction work and requiring finalised construction details / noise impact assessments to be submitted for approval including noise mitigation and monitoring, as necessary.

This could be secured as part of a suitably worded overarching Construction / Decommissioning Environmental Management Plan / Programme (CDEMP) condition or similar, following consultation with this service.

### **3.4 Operational Noise Impact Assessment – Additional Information**

Following review of Chapter 13 noise assessment and associated appendices submitted as part of the original ES, under cover of a memo dated the 11<sup>th</sup> September 2012 this service requested further additional information, clarifications and or justification on the following noise related issues:

- Baseline Noise Measurements- Paragraphs 13.47 to 13.63 (Assessment of Existing Noise Environment / Locations)
- Measurement Positions- Paragraphs 13.50 to 13.49
- Instrumentation- Paragraphs 13.48 to 13.49
- Measurement Procedure- Paragraphs 13.56 to 13.61
- Data Removed from Analysis & Results of Noise Measurements - Paragraph 13.62 to 13.63
- Data Removed from Analysis & Results of Noise Measurements - Paragraph 13.62 to 13.63
- Operational Noise Impact Assessment – Paragraphs 13.78 to 13.85
- Infrasound and Low Frequency Noise
- Blade Swish/ Thump or Excess Amplitude / Aerodynamic Modulation (EAM) - Paragraphs 13.28 to 13.29

In response to this request the following additional responses and information have been submitted:

- *“Highfield Farm, Response to Objection Document (section 7 of Stop Litlington Wind Farm Action Group Objection, June 2012) with appendices A & B”, Hayes McKenzie Partnership Ltd, 9<sup>th</sup> August 2012 (ref HM: 2086\_C\_L1\_RAW)*
- *“Highfield Wind Farm, Response to SCDC Health & Environmental Services with appendices A to F - calibration certificates etc”, Hayes McKenzie Partnership Ltd, 4<sup>th</sup> October 2012*
- Engena email of the 31<sup>st</sup> January 2013, *“Subject: Requested further information”, including the following:*
  - Draft wording for a condition for Excess Amplitude Modulation
  - Hayes McKenzie Partnership Ltd Percentage (%) Spread of Wind Conditions During (Noise) Survey 12/03/2009 – 03/04/2009 Historic Spread of Wind Conditions, October 2008 – June 2012 (%),
  - Historic Yearly Average (Wind) Shear 2009
  - Average (Wind) Shear During Survey Period (12/03/2009 – 03/04/2009)

- "Highfield Wind Farm, Response to SCDC Health & Environmental Services, Additional Comment on Measurement Position at Morden Grange Farm", Hayes McKenzie Partnership Ltd, 1<sup>st</sup> February 2013
- Hayes McKenzie Partnership Ltd letter dated 22nd May 2013 titled "Proposed Highfield Wind Farm, Planning Application S/0439/12/FL Additional Noise Monitoring" (ref HM: 2086\_C\_L1\_RAW)
- "Highfield Wind Farm, Planning Application S/0439/12/FL, Additional Noise Monitoring with appendices A to D", Hayes McKenzie Partnership Ltd, 17<sup>th</sup> July 2013
- Engena email of the 13 November 2013, "Subject: Highfield Wind farm – Suggested Noise Conditions".

I have also had an opportunity the representation submitted the Stop Litlington Wind Farm Action Group titled, "Highfield Wind Farm, Litlington, South Cambridgeshire, An Updated Objection by Stop Litlington Wind Farm Action Group Local Planning Authority Reference: S/0439/12/FL, June 2012 (Original submission) March 2013 (Updated submission)".

### 3.5 Additional Noise Impact Assessment

It is important to note that following concerns expressed about how the representativeness of the baseline / background noise monitoring undertaken, following a methodology agreed with this service, additional baseline noise monitoring has been undertaken at two location 4 White Cottages (to the North of Morden grange farm) and 1 / 2 Ashwell Street, Litlington respectively. The results of additional monitoring and noise impact assessment are provided in the HMP submission / report titled "Highfield Wind Farm, Planning Application S/0439/12/FL, Additional Noise Monitoring with appendices A to D", Hayes McKenzie Partnership Ltd, dated the 17<sup>th</sup> July 2013.

Table 2, below details the nearest noise sensitive residential properties, at which baseline / background noise monitoring have been undertaken.

**Table2: Background Monitoring Locations Relative to the Nearest Turbine**

Background Monitoring Locations	Private or Wind Farm Landowner Owned	Distance to Nearest Turbine (approximate to nearest 5m)	Direction From Turbine	Turbine No.
<b>Limlow</b> (Residential House) Royston Rd, Litlington, SB8 0RS	Private	640m	NNE	4
<b>Highfield House</b> Highfield Farm, Royston Road, Litlington, SG8 9NJ	Landowner	500m	SSE	5
<b>Highfield Farm</b>	Landowner	560m	SE	5



<b>Cottages (1 &amp; 2)</b>  Royston Rd, Litlington, SG8 9NJ				
<b>Morden Grange Farm</b>  Baldock Rd (Ashwell St), Steeple Morden	Private	715m	WSW	2
<b>4 White Cottages</b>  Baldock Road, Steeple Morden, SG8 9NR	Private	645	SW	2
<b>1 / 2 Ashwell Street</b>  Royston Rd, Litlington, SB8 0RS	Private	840m	Nrth	4

The locations are considered in the ES to be representative of the nearest dwellings to the proposed development.

Hayes McKenzie Partnership Ltd in their Additional Noise Monitoring Report dated the 17<sup>th</sup> July 2013, state that the noise impact assessment that has been undertaken complies with ETSU-R-97, the IoA Bulletin (2009) and also the Institute of Acoustics (IOA) document titled "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, May 2013" and any supplementary guidance notes published to date (most currently consultations). This includes the noise impact assessment undertaken prior to May 2013.

The May 2013 IOA Good Practice Guide is effectively a technical supplement to ETSU- R-97 and whilst research / review was not undertaken by Government, it came about from an invitation by the Department of Energy & Climate Change (DECC) to the IOA to set up a working group to take forward the relevant recommendations of the HMP report on "Analysis of How Noise Impacts are considered in the Determination of Wind Farm Planning Applications", as referred to in footnote 34 to NPS EN-3. The aim of the IOA working group was to review the available evidence and to produce good practice on wind turbine noise assessment.

The IOA Good Practice Guide has not been published by Government but it is important to note that DEEC accept that it represents current industry good practice and endorse it as a supplement to ETSU.

As stated, national planning guidance supports the use of ETSU-R-97 as the test of the acceptability of wind farm noise. In England, the National Policy Statement for Renewable Energy Infrastructure (NPS EN-3) includes specific guidance on noise impact assessment for onshore wind farm developments.

NPS EN-3 advises that the ETSU-R-97 methodology, in accordance with the latest industry good practice (which should reflect any updated guidance issued in relation to ETSU-R-97 and accepted by Government i.e. the IOA Good Practice Guide May 2013) should be used to assess and rate noise from wind farms.

Therefore, the assessment of significant operational noise effects is based upon compliance with the ETSU-R-97 guidelines. Meeting noise limits is judged a 'not significant effect', whereas an excess over the noise limits is considered a 'significant effect'. It is acknowledged that the ETSU approach does not directly aim to determine significance in an EIA context, rather it represents a balance between the need for wind energy and the need to protect residential amenities.

The key national guidance documents, which provided guidelines on the assessment of noise in England, are the NPPF and the Noise Policy Statement for England (NPSE).

NPPF outlines general aims for planning policy with regard to noise: avoiding significant impacts and minimising other impacts arising from new development, protecting identified areas of tranquillity, recognising that this should be balanced against the need for business to operate without unreasonable restrictions being imposed. This is consistent with the general Government policy on noise as set out in the NPSE.

### **3.6 Noise Impact Assessment**

The noise assessment involves the setting of maximum permissible operational noise limit levels at various nearest receptors and ES follows the recommended approach in ETSU-R-97.

ETSU states that noise from the wind farm should be limited to 5dB(A) above background for both day and night-time (with the exception of the lower limits), remembering that the background level of each period may be different.

In low noise environments the day-time level of the LA90, 10min of the wind farm noise should be limited to an absolute level within the range of 35-40dB(A). The actual value chosen within this range should depend upon a number of factors:

- the number of dwellings in the neighbourhood of the wind farm
- the effect of noise limits on the number of kWh generated
- the duration and level of exposure.

A fixed limit for night-time is 43dB(A) is recommended.

For all properties with a financially involved occupier, an higher limit of 45 dB may be warranted.

### **3.7 Blade Swish/ Thump or Other or Excess Amplitude / Aerodynamic Modulation (O/EAM)**

Wind turbine noise is not always a steady sound and can include an aerodynamic noise known as amplitude modulation (AM) at times, in the form a relatively constant modulated or fluctuating beat or swish / thump which occurs at the same rate as the turbine blades rotate.

At the time of the preparation and publication of ETSU-R-97 the phenomenon of AM was acknowledged appreciated but the understanding of its potential effect on the prediction of noise from wind turbines in the UK was limited.

The ETSU report does identify the inherent potential for AM in the order of 3 dBA peak to trough, meaning that the noise level increases and decreases by 3 dBA variation from a broadband constant level with every rotation of the turbine / blade passing frequency. In the majority of cases ETSU regards the modulation as acceptable and specifically excludes applying any noise penalty for the character of AM noise.

Recently however research indicates that in stable atmospheric conditions, the effect of wind shear at altitudes in which modern wind turbines operate can be underestimated and results in considerable AM of up to 9.5dBA.

Such an effect has the potential to have a more pronounced and noticeable adverse noise impact giving rise to more annoyance and has become commonly known as or referred to as enhanced amplitude modulation (EAM).

An article in the July / August 2009 edition of the IOA Acoustics Bulletin Vol33 No 4, by Bowdler presented a review of the evidence and information regarding amplitude modulation, in order to attempt to better characterise and identify possible causes of the phenomenon. Bowdler concluded that:

*"It seems probable that there are two distinct mechanisms in operation to create amplitude modulation. The first is swish, which is a function of the observer's position relative to the turbine. The second is thump which is due to turbine blades passing through uneven air velocities as they rotate. In the second case the uneven air may be due to the interaction of other turbines, excessive wind shear or topography. These two mechanisms are entirely separate though it is possible that they interact. If this is the case there is little that can be done about swish but further research into thump would help to avoid excessive amplitude modulation in future developments."*

Bowdler also described 'swish' earlier in the article as a 'relatively benign' feature of the noise, so it would be reasonable to conclude that concerns are mainly associated with 'thump'.

While the understanding of EAM generation is limited and its onset and severity is not totally predictable, it is recognised by professional acousticians that EAM is more likely to occur under the following mechanisms (most of which result in uneven air flow) as possible sources of thump:

- Interactions between turbines (inadequate spacing or linear array = rotor / wake effects);
- Excessive wind shear / stable atmosphere;
- High turbulence; and
- Topography
- Local Blade Stall

It is acknowledged that the appropriate spacing for turbines is strongly dependent on the nature of the terrain and the wind rose for a site. Whilst spacing may be mainly associated with energy loss it is our view that if turbines are spaced closer than 6 rotor diameters in a frequent prevailing wind direction and 4 rotor diameters across / perpendicular the prevailing wind direction, it is likely that unacceptable high wake and turbulence induced noise may occur and may result in a greater potential for EAM to occur.

However it should be noted that on the 16<sup>th</sup> December 2013, after 3 to 5 years of research Renewable UK (The voice of the wind and marine energy- the wind industry trade association), published detailed new scientific research on wind energy acoustics. The study was carried out to investigate the causes of and solutions to, the occurrence of an acoustic characteristic known as "Other Amplitude Modulation" (OAM).

The report explains the differences between "Normal Amplitude Modulation" (NAM), which is the common swishing sound made by turbine blades as they pass through the air, and OAM, which in their view is an *"infrequent and uncommon sound which typically lasts only for a few minutes"*. As a result of the research, acoustics professionals and the wind industry should have a clear understanding of the characteristics of OAM, as well as how to address it if it should occur.

They report that the wind industry has identified solutions to the AM issue such as software adjustments which change the angle of the turbine blades at certain times when OAM could occur.

It also states that *"the industry has also worked with members of the Institute of Acoustics on the development of a planning condition which can be used by local authorities. This means that when wind farm developers apply to build projects, they will be required to resolve any instances of OAM in accordance with the planning permission."*

However the Institute of Acoustics has cautiously welcomed the publication by RenewableUK of the research and a proposed planning condition to deal with the issue of amplitude modulation (AM) of noise from wind turbines.

The Chairman of the IOA Noise Working Group has stated said: *"This research is a significant step forward in understanding what causes amplitude modulation from a wind turbine, and how people react to it. The proposed planning condition, though, needs a period of testing and validation before it can be considered to be good practice. The IOA understands that RenewableUK will shortly be making the analysis tool publicly available on their website so that all interested parties can test the proposed condition, and the IOA will review the results later in the year. Until that time, the IOA cautions the use of the proposed planning condition."*

### **3.8 EAM Planning Condition and or a s106 Planning Obligation / Agreement**

Whilst the probability and frequency of EAM occurrence may be uncertain, due to the moderate to severe significance adverse impact that local residents may experience should it arise and the potential onerous requirements the investigation of EAM would place on SCDC, we wish to pursue a precautionary approach and wish to see the imposition of a EAM planning condition and or a s106 planning obligation agreement defining what would be considered EAM, requiring the applicant to investigate any justified complaints regarding EAM and mitigation if substantiated.

Following Renewable UK research publication it appears that the wind farm industry have endorsed the need the need of some form of planning condition to address AM noise.

Engena (the agent for the applicant) have confirmed that such an EAM condition approach is agreeable in principle subject to final wording that is acceptable to all parties. They have sent this service a draft EAM condition for consideration and it is hopeful that an agreement on a suitable worded condition can be reached.

### **3.9 Operational Noise Conclusions**

Whilst we have some concerns about the directional analysis of prevailing background noise levels that has been undertaken in filtering background noise measurements it is our view that the road traffic noise from the A505 to the South is not a dominant noise source at the majority of the monitoring locations noise.

A revised noise assessment has been carried out for the proposed Wind Farm in accordance with ETSU-R-97 taking into account the points of clarification raised this service. The design of the proposed Highfield Wind Farm is such that using a commercially available candidate turbine, the operational noise levels from the wind farm are likely to fall within the ETSU guidance noise limits derived from measurements taken at the surrounding receptors.

On balance we therefore conclude that the necessary noise assessment for the wind farm has been carried out in accordance with government / industry best practice including the requirements of ETSU-R-97, the "Prediction and assessment of wind turbine noise" IOA bulletin March/April 2009 and the May 2013 IOA Good Practice Guide.

It has been demonstrated following a robust analysis of the supporting baseline monitoring data and assessment approach that the proposed Wind Farm should not exceed the limits recommended by ETSU and therefore would result in no significant effects at the residential receptors identified in relation to noise.

The impact assessment predicts that collective operational turbine noise levels for all the closest residential receptor locations fall within the relevant levels of acceptability (meeting the ETSU guidance derived noise limits), at all wind speeds and directions.

Having reviewed the additional background noise monitoring undertaken and information provided by HMP, based on the ES submitted we have no objection in principle providing we can agree with the applicant / agent noise related conditions for and based on the following:

- **Construction Env Management Plan** or similar - covering hours of work/construction, noise predictions etc in accordance with BS 5228:2009,
- **Operational Noise:**
  - maximum permitted noise levels at specified properties having regard to ES and ETSU limit guidance / IOA Good Practice Guidance, May 2013;
  - provision of noise and met data as requested;
  - compliance checking if complaints received etc;
  - Other or Excess Amplitude / Aerodynamic Modulation (O/EAM) noise occurrence greater than that envisaged or inherent in ETSU should complaints arise ;
  - post commissioning noise compliance checking for a period of time

#### **4.0 Potential for Shadow Flicker Effects, - Chapter 9 - Paragraphs 9.284 to 9.316**

It should be noted that environmental health are not experts on shadow flicker and indeed have no additional duty or remit to investigate or deal with should complaints about the phenomenon arise when the wind farm is operational. It is therefore paramount that protection is provide by planning condition or similar. However we offer the following comments:

The potential for shadow flicker effects is considered in the ES Volume 2- Written Statement, Chapter 9- Landscape and Visual Impact Assessment under the section heading Potential for Shadow Flicker Effects, Paragraphs 9.284 to 9.316. Appendix 9.4 reports the Shadow Flicker Model Outputs for various turbines and potential for impact at certain receptors.

Under certain combinations of geographical position, time of day and year, the sun may pass behind the rotor of a wind turbine and cast a long shadow. When the sun is in a certain position in the sky at a specific time of day and alignment with an intervening turbine and the window of a neighbouring dwelling, as the blades rotate shadows can pass a narrow window. A person within that room may perceive that the shadow, effectively a drop in light levels

which comes and goes with each pass of a blade, appearing to flick on and off. This effect is known as shadow flicker. It can have health and amenity effects.

Planning Policy Statement (PPS) 22 states that shadow flicker only occurs within 10 rotor diameters of the turbines at 130 degrees either side of north relative to the turbines.

The Department of Energy and Climate Change (DECC) document *"Update of UK Shadow Flicker Evidence Base - Final Report"* published 2011 endorsed the use of 10 rotor diameters and 130 degrees either side of north from each turbine, as the areas where shadow flicker is most likely to occur.

However these conditions should not be viewed as an absolute and at distances beyond 10 rotor diameters there is a low risk that shadow flicker may occur.

The National Policy Statement for Renewable Energy Infrastructure (EN-3), DECC, July 2011 under the section *"Onshore Wind Farm Impacts – Shadow Flicker"*, states:

*"Research and computer modelling on flicker effects has demonstrated that there is unlikely to be a significant impact at distances greater than ten rotor diameters from a turbine. Therefore if the turbine has 80m diameter blades, the potentially significant shadow flicker effect could be observed up to 800m from a turbine"*.

A REsoft WindFarm computer software model has been used to model and calculate the time and extent of shadows / shadow flickers when the wind farm is operational. It considers the location of each of the turbine, the surrounding terrain, property locations, property orientation, window placement and the path and height of the sun as it rises, crosses the sky and sets at various times of the year. The model considers predictions as worst case scenario conducive for shadow flicker, such as a clear sky and visibility at all times every day, bare terrain (no intervening screening such as trees, buildings) and a specific wind direction that always results in turbine blades rotating in a plane perpendicular to a potential receptor dwelling.

This assessment methodology is acceptable and precise prediction is possible.

The assessment is comprehensive and the study area is well defined and it is possible to calculate the number of hours per year that shadow flicker may occur at a particular dwelling.

Seven dwellings with the potential to experience shadow flicker effects have been identified (eg with 10 rotor diameters-800metres and 130 degrees either side of north from each turbine) and table 3, below displays the results of the worst case shadow flicker assessment grouped by property and frequency of occurrence.

**Table 3 – Shadow Flicker data grouped by property**

Dwellings within 800m of proposed Turbines	Number of Potential Days Per Year Events Occur Per Turbine	Max. Time events Occur Per Day Per Turbine (Hours)	Mean Time Per Day an event Occurs (Hrs)	Total Theoretical Max. Time Per Year (Hrs)
<b>Highfield House</b> Highfield Farm, Royston Rd, Litlington, SG8 9NJ	T3	61	0.57	29.4

<b>Highfield Farm Cottages ( semi-detached cottages, 1 &amp; 2)</b> Royston Rd, Litlington, SG8 9NJ	T3	52	0.46	0.36	18.9
<b>Highfield Farm</b> Royston Rd, Litlington, SG8 9NJ	T3	57	0.50	0.42	23.9
<b>Brick Cottages (also known as The Cottages or Morden Grange Farm Cottages), (semi-detached cottages)</b> Baldock Rd (Ashwell St), Steeple Morden, SG8 9NR	-	0	0.00	0.00	0.0
<b>Limlow</b> (Residential House) Royston Rd, Litlington, SB8 0RS	-	0	0.00	0.00	0.0
<b>White Cottages (No 3 &amp; 4 semi-detached cottages)</b> Ashwell St, Steeple Morden, SG8 9NR	T2	53	0.53	0.41	22.0
<b>Morden Grange Farm House</b> Baldock Rd (Ashwell St), Steeple Morden, SG8 0NT	T2	80	0.51	0.41	36.1

It is concluded that theoretically that there 5 potential receptor properties within study area that could be exposed to shadow flicker although for very short periods.

Apart from Highfield House the worst affected property is Morden Grange Farm House which could experience 80 shadow days per annum for a maximum of up to 51 minutes on each day, a total of 36.1 shadow hours per annum.

In response to a request for additional information Engena have provided some additional information by email on the 4<sup>th</sup> October 2012, "*Subject: Highfield Wind Farm – 04/10/2012: Clarifications on Shadow Flicker*". Some additional clarifications are provided and a draft planning condition is proposed.

We agree that such as a shadow flicker related mitigation condition is necessary and reasonable in the interests of the amenities of nearby residents subject to agreement on the final wording.

## **5.0 Overall Conclusions**

The purpose of an ES is to provide all the necessary information in a readily understandable format for public scrutiny to allow an informed decision to be made on whether planning permission should be granted.

The following environmental health issues need to be considered and addressed effectively in order to minimise potential adverse impacts on existing residents, and which are paramount in facilitating sustainable development and safeguarding amenity and a healthy living environment:

- **Noise Impact**
  - Construction Noise & Vibration
  - Wind Farm Operational Noise
- **Shadow Flicker**

We have therefore considered the effect of the proposed development on living conditions at residential dwellings in the surrounding area, including its impact on quality of life / amenity in terms of operational noise including Other or Excess Amplitude / Aerodynamic Modulation (O/EAM) and shadow flicker impacts.

As far as the living conditions of the wind farm neighbours are concerned, having reviewed the additional background noise monitoring undertaken and information provided we conclude that robust noise and shadow flicker impact assessments have been undertaken and reported within the ES. The assessments have been undertaken in accordance with current government / industry standards and best practice guidance.

In particular, the necessary noise assessment for the wind farm has been carried out in accordance with government / industry best practice including the requirements of ETSU-R-97, the "Prediction and assessment of wind turbine noise" IOA bulletin March/April 2009 and the May 2013 IOA Good Practice Guide.

It has been demonstrated following a robust analysis of the supporting baseline monitoring data and assessment approach that the proposed Wind Farm should not exceed the limits recommended by ETSU and therefore would result in no significant effects at the residential receptors identified in relation to noise.

The impact assessment predicts that collective operational turbine noise levels for all the closest residential receptor locations fall within the relevant levels of acceptability (meeting the ETSU guidance derived noise limits), at all wind speeds and directions.

On balance we have no objection principle as it is our view that the proposals should not give rise to significant adverse impacts on health and quality of life as a result of noise and shadow flicker subject to mitigation control / regulation by appropriately worded conditions that provide an adequate level of protection.

The following conditions have been agreed in principle with the applicant / agent and their respective consultants but are subject to ongoing negotiations on final detailed precise wording (and subject to planning condition circular tests):

- **Construction Env Management Plan or similar** - covering hours of work/construction noise predictions etc in accordance with BS 5228:2009,
- **Operational Noise:**
  - maximum permitted noise levels at specified properties having regard to ES and ETSU limit guidance / IOA Good Practice Guidance, May 2013;
  - provision of noise and met data as requested;
  - compliance checking if complaints received etc;



- Other or Excess Amplitude / Aerodynamic Modulation (O/EAM) noise occurrence greater than that envisaged or inherent in ETSU should complaints arise ;
- post commissioning noise compliance checking for a period of time
- Shadow Flicker Complaint / Mitigation Protocol / Matt finish to blades (whilst not specifically Env Health Issues I assume planning will impose as an impact on living conditions)

We are confident that agreement can be reached on final detailed precise wording of these conditions and depending on the member's decision, if they were minded to approve the final wording of any conditions could be delegated to officers or brought back to committee for approval.

If you require any further advice or clarification please do not hesitate to contact me.

Regards

**Greg Kearney & Russell Watkins**  
**Environmental Health Officers**  
**Health & Environmental Services**