Proposed Wind Farm at Bullington Cross

Review of Applicant's Environmental Information – Noise

Supplementary Report

April 2014

Report No: **RD/04/13/BDBC/TVBC/WCC/01**

For:

Winchester City Council
Test Valley Borough Council
Basingstoke and Deane Borough Council

Pre***pared by:***

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***Date*:** April 2014

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1 Introduction

1.1 EDF Energy have submitted a planning application to three Councils (Basingstoke and Deane, Test Valley and Winchester City) to erect 14 wind turbines on land at Bullington Cross in Hampshire. I have been instructed jointly by the Councils to advise on the noise issues in connection with the application.

1.2 The planning application was supported by a noise impact assessment (reference R4162-1 Rev 4) carried out by 24 Acoustics Limited. I submitted a preliminary report to the Councils in October 2013. I concluded that the assessment was generally competent and exhaustive, but there were some deficiencies and omissions that I recommended should be addressed.

1.3 Some of these arose from the difficulties experienced by 24 Acoustics in gaining access to land close to dwellings to carry out baseline noise measurements, making it necessary to make these measurements at 'proxy' locations some distance from the dwellings in question. Other points included the need to adequately define background noise levels in different wind directions, and to take account of good practice guidance issued by the Institute of Acoustics (the 'IoA GPG' – Reference 2) in May 2013 (post-dating the initial noise assessment.

1.4 I recommended (at 7.4) that the following further work should be carried out, and additional information supplied, to resolve the outstanding issues associated with the noise assessment:

a) Further noise surveys should be carried out at Tufton Warren (at the agreed proxy location) and at Upper Norton Farm. The surveys should be of sufficient duration to provide an adequate dataset with wind directions in the eastern sector to enable average background noise levels to be reliably determined (and therefore noise limits derived) for these wind directions.

b) Comparisons should be made between the data measured at Cranbourne House and the Cranbourne House 'proxy' locations, for the same range of wind directions, to derive corrections to enable the proxy data to be corrected to take account of the observed differences between the proxy location and the house itself. Applying corrections to measured background noise data is not recommended practice. However, provided that there is a high degree of certainty that the 'corrected' levels are lower than would be measured at the house itself, which would lead to lower (more restrictive) noise limits then I believe that this is a justifiable course of action in this case, where it has not been possible to obtain adequate data at the actual property.

c) Revised noise predictions should be provided for the candidate wind turbine, using input values of Sound Power Level based on manufacturer's data and with allowances for uncertainty in accordance with the IoA GPG.

(d) An annual wind rose for the site and an analysis of the distribution of wind speeds and directions during the noise survey periods.

(e) An updated noise assessment report incorporating this additional and revised data.

1.5 24 Acoustics have now submitted an Addendum report (R4162-5 Rev 4) which provides an updated noise assessment based on the following additional or revised information:

- The results of additional background noise measurements made during the period October-December 2013) at Upper Norton Farmhouse and Tufton Warren (proxy location) to provide further information on the effect of wind direction on background noise levels.

- The results of additional background noise measurements at New Barn Farm (October-November 2013). The previous measurements for this location were made at a proxy location not close to dwellings: although from site inspection the proxy location was considered to be representative (Preliminary Report Appendix 1). The resident subsequently gave permission for measurements to be made close to the dwelling and these measurements were therefore made to eliminate the uncertainty associated with proxy measurements.

- Further analysis of background noise measurements made previously at Cranbourne House and an associated proxy location.

- Revisions to the Sound Power Level assumed for the candidate wind turbines, in accordance with the IoA GPG.

- Information on the annual distribution of wind direction at the site to assist in the evaluation of the directional analysis of the background noise data.

1.6 I have had discussions with 24 Acoustics whilst this additional work was being planned or was in progress and I have generally agreed with the content and scope of the work, which appeared to address the queries raised in my Preliminary Report.

1.7 I have reviewed the 2014 Addendum Report. This report presents my observations and recommendations, which should be read in conjunction with my Preliminary Report of October 2013.

2 Review of Addendum Noise Impact Assessment

(Unless stated, section, paragraph and figure numbers in italics refer to the 24 Acoustics Addendum Report dated March 2014)

2.1 *Additional Measurement Surveys*

Details of the further surveys (dates, locations, instrumentation etc) are given in *Section 5.* The information provided is adequate and the equipment used and procedure adopted are in accordance with good practice.

2.2 *Additional Measurements – New Barn Farm*

The measurements at New Barn Farm are shown on *Figures 11 and 12*. The measurements covered an adequate range of wind speeds and the derived 'best fit' lines shown on these figures provides a robust basis for setting the ETSU-R-97 (Reference 1) noise limits for the houses at this location and are preferred to the measurements made in 2012 at a proxy location.

2.3 *Additional measurements – Tufton Warren and Upper Norton*

2.3.1 As explained in 4.26 of my Preliminary Report, these locations will experience the predicted levels of wind turbine noise when the wind directions are such that the dwellings are downwind of the wind turbines. 'Downwind' (in terms of noise propagation) covers a range of wind directions within a sector of about 150 degrees. These locations are to the NW and SW of the proposed wind farm and would therefore experience the highest noise levels when winds are in the E/NE sectors. However, in these wind directions background noise levels at Upper Norton and Tufton Warren would be expected to be relatively low, because they would be upwind of the main roads which in SW winds (which are the prevailing winds) are a significant component of the background noise.

2.3.2 In contrast New Barn Farm (for example) would experience the highest wind farm noise levels when winds are from the SW sector, when background noise at this location from the A303 and A34 will also be at or close to their maximum levels.

2.3.3 For locations such as Upper Norton it is often necessary to 'directionally filter' the background noise data, so that the noise limits derived from this data are based only on the measurements made in wind directions when the wind farm noise levels would be at or close to their maximum values whilst typical background noise levels would be closer to their typical 'low' values. This provides an appropriate 'like for like' comparison. Although winds from the E/NE sector are relatively infrequent, they can persist for extended periods at some times of the year. The Addendum Report provides information (as requested) in *Figures 18 and 19* on the typical annual distribution of wind speeds and directions at this site, using data from the Met Office.

2.3.4 24 Acoustics have applied directional filtering to the background noise data for Upper Norton and Tufton Warren; the range of wind directions included in the filtered dataset was 45-135 degrees for Tufton Warren and 340-80 degrees for Upper Norton. These are the (approximate) ranges of wind directions for which these locations would be effectively downwind of the wind farm but upwind of the A34 and A303 (the typical 'worst case' situation). These data are shown on *Figures 6/7 and 10/11* and on the Table in *Appendix E*. One purpose of the additional noise surveys in late 2013 was to collect additional data for these wind directions, since the data collected in the 2012 survey was inadequate and directional filtering was carried out only for Tufton Warren. Although the further surveys provided additional data, this is still relatively sparse, particularly at higher wind speeds. This is very evident from examination of the filtered data for Tufton Warren (*Figures 10 and 11*). Winds from the relevant sector (45 and 135 degrees) are relatively infrequent and wind speeds for this wind direction tend to be low. 'Capturing' a significant body of noise data in these conditions is therefore problematic. However, the filtered data does clearly indicate that background noise levels at low wind speeds are very significantly dependent on wind direction: the values derived from the 'filtered' data being typically 4-5dB lower than the values derived from the unfiltered (all wind directions) data, which is dominated by the measurements made during the more-usual SW winds.

2.3.5 In my opinion the noise assessment for Tufton Warren and Upper Norton should be based on noise limits derived using the background noise data filtered for the 'worst case' range of wind directions, even though these occur for a relatively small proportion of the time. It is clear that the effect of wind direction is very significant at these locations, with the predicted (highest) wind farm noise levels occurring when background noise levels are significantly lower than the average levels for all wind directions.

2.3.6 Because the data filtered for the appropriate wind directions is sparse (*Figures 6/7 and 10/11*) some extrapolation of the data will be required to reach appropriate values for noise limits. Although it is not standard practice to use extrapolated data I am satisfied that in this case it is justified, and will result in noise limits that are conservative (i.e. do not disadvantage residents) whilst not unreasonably compromising the operation of the wind farm if planning permission is granted. The issue of noise limits and noise conditions is addressed below in 3.5 – 3.8.

2.4 ***Additional Background Noise Data Analysis – Cranbourne House***

2.4.1 The amended assessment relies on the background noise measurements made in 2012. At that time, measurements were made in the garden of the house for five days only: further measurements were made at a proxy position to the north of the A303, this position being a similar distance from the A303 as the first measurement position. However, it was agreed following a site visit that the proxy position would not provide representative background noise levels for Cranbourne House because the house and garden are significantly screened from, the A303 by earth bunds.

2.4.2 Although the 2012 quiet daytime measurements at Cranbourne House itself were of short duration, they covered a wide range of wind speeds and showed very little scatter (*Figure 16)* and therefore can reasonably be used to derive a typical relationship between background noise level and wind speed. However, their night-time data (Figure 16 in the noise assessment in the ES) was sparse, with considerable scatter and with little data for wind speeds above 6 m/s.

2.4.3 However, it is reasonable to assume that the difference between average quiet daytime and night time noise levels will be very similar at both the house and the proxy location, since the background noise climate at both locations is dominated by the same noise sources – A303 traffic and movement of vegetation in wind. Therefore it is reasonable, in my view, to derive a night time background noise level at Cranbourne House by correcting the quiet daytime levels by a factor corresponding to the quiet daytime/night time difference at the proxy location. This procedure was adopted (*paragraph 7.4*) and results in the night time background noise levels on *Figure 17*.

2.4.4 Examination of the Tables in *Appendix E* indicates that the difference between quiet daytime and (calculated) night time noise levels (determined by applying this calculation) is greater than the differences measured at the other survey locations, suggesting that the correction is almost certainly conservative (i.e. that the calculated night time levels are actually lower than the 'true' levels) and therefore biased towards lower (more restrictive) night time noise limits.

2.4.5 Further, the wind direction during the measurements at Cranbourne House were predominantly from the SW sector, which would place the house upwind of the A303 and therefore would result in background noise levels close to the minimum values likely to be experienced at Cranbourne House and Cottages. However, they would experience the predicted wind farm noise levels in northerly winds, when noise from the A303 would also be higher. Therefore setting noise limits for Cranbourne House and Cottages on the basis of the measurements in SW winds provides a further measure of conservatism.

2.4.6 Therefore although the background noise measurements at Cranbourne House and the associated proxy location fall short of meeting the requirements set out in the IoA GPG, I consider that they can be interpreted to provide conservative ('safe', from the residents' point of view) values of background noise levels and noise limits. Therefore I do not consider that the deficiencies in these measurements are a matter of significant concern.

2.5 ***Updated Wind Farm Noise Predictions***

The procedure adopted for updating the noise predictions for operating wind turbines is set out in *Section 6*. The noise predictions have been revised to take account of recommendations in the IoA GPG about the way in which manufacturer's noise data should be interpreted. As a result, predicted noise levels at receptors for the

candidate REPower MM92 wind turbine are higher, by 1dB, than the levels predicted in the first report in the ES.

3 Discussion and Conclusions

3.1 The further measurements at New Barn Farm in Autumn 2013 were carried out at an appropriate position close to dwellings and can be taken as representative noise levels for this location, replacing the proxy measurements made in 2012.

3.2 The further measurements at Tufton Warren and Upper Norton, and the additional analysis of the 2012 measurements by Cranbourne House and the associated proxy location, although deficient in some respects, are adequate to provide a robust basis for noise assessment.

3.3 The noise predictions for the operating wind farm have been updated in accordance with current good practice and can be taken to be realistic estimates of the levels likely to result (at dwellings) during operation of the candidate wind turbines when the dwelling is downwind of the wind farm (the 'worst case' condition).

3.4 The assessment demonstrates that the proposed wind farm can comply with maximum noise limits defined using the ETSU-R-97 procedure, which is endorsed in Government planning guidance. Compliance with the ETSU-R-97 noise limits does not mean that turbine noise would not sometimes be audible at dwellings or that residents would not suffer some loss of amenity as a result of increased ambient noise levels when wind turbines are operating. In a few cases, wind farm planning applications have been refused on noise grounds (at appeal) even when it has been demonstrated that the ETSU noise limits could be complied with, in cases where the sites concerned were located in quiet areas and the noise change resulting from the introduction of the wind farm would have been large (of the order of 10dB or more). In this casa the area is subject to relatively high background noise levels because of its proximity to the A303 and A34. Predicted noise levels do not exceed the existing background noise levels by large margins (see *Figures 4-17).* From the data available the only significant excess of wind farm noise over background noise (about 7dB) would occur at Tufton Warren at night (*Figure 11)* in a relatively infrequent range of wind directions.

3.5 Therefore I conclude that although the proposed wind farm would have some noise impact on local residents, the magnitude of the impact would not justify refusal of planning permission on noise grounds. Experience of previous appeal decisions demonstrates that provided that a wind farm can be shown to operated within the ETSU-R-97 noise limits then a refusal on noise grounds can only be sustained at appeal in particular circumstances (including conspicuously low background noise levels) that are not present in this case.

3.6 It is standard practice to impose specific noise conditions, including values of noise limits not-to-be exceeded at specified dwellings, on any wind farm planning

permission. There is a form of wording for wind farm noise conditions that is applied almost universally. The values assigned to noise limits are obviously site-specific. Appropriate values for noise limits in this case require further consideration because of the need to interpret the directionally-filtered data (see 2.3.6 above). Recommendations for values of noise limits will be submitted in a further document if required.

3.7 As explained in my Preliminary Report at 6.2 – 6.5, wind turbine noise may exhibit a distinctive characteristic termed amplitude modulation (AM), a regular variation ('pulsing') in noise level. If audible at dwellings, this may result in turbine noise being more intrusive than the actual measured noise level (which would 'average out' this variation). In my preliminary report I suggested that the risk of AM occurring at Bullington Cross could reasonably be disregarded because wind farm noise would not often be audible at dwellings. Also, it was not common practice to impose a condition to address AM.

3.8 However, the approach to AM has changed during the last 6 months: further evidence on the occurrence of AM has emerged, and RenewableUK (formerly The British Wind Energy Association, BWEA) have published the results of a research programme (Reference 3) and have drafted a proposed planning condition to address AM. It is generally accepted that the RUK draft condition requires validation and modification, but that it provides a basis for a robust condition. Two recent wind farm appeals have been allowed (References 4 and 5), one a decision by the Secretary of State, where an AM condition of the 'scheme to be agreed' type has been imposed. This form of condition relies on the assumption that a robust method of assessing AM will shortly be available. Because of this changed situation, and because it appears from the new data that wind turbine noise was likely to be more audible at Tufton Warren than previously predicted (although in only a restricted range on wind directions) I now consider that an AM condition of the 'scheme to be agreed' type should be applied here, if planning permission is granted.

4 Summary of Conclusions

4.1 The Addendum Noise Impact Assessment Report (R4162-5 Rev 4) prepared by 24 Acoustics, in conjunction with the information submitted in the ES, provides an adequate basis for assessing the noise impact of the proposed Bullington Cross Wind Farm.

4.2 The reports confirm that the wind farm could be operated within limits that are endorsed by government policy as being 'acceptable'. Although compliance with such limits can still allow substantial adverse noise impacts because the introduction of the wind farm results in large increases in ambient noise levels, particularly at night, the background noise levels in this area are relatively high because of the location close to major roads. Therefore in my opinion the noise impact here would not be such that a refusal on noise grounds would be justified.

4.3 If planning permission were granted it should be subject to noise conditions. These would include specific noise limits for dwellings and a condition to address amplitude modulation, should this be experienced. Draft conditions will be put forward, if required, in a further document.

5 References

1. *The Assessment and Rating of Noise from Wind Farms.* Report ETSU-R-97. Energy Technology Support Unit (ETSU). 1996.

2. *Good Practice Guide to the Application of ETSU-R-97 for Assessment and Rating if Wind Turbine Noise.* Institute of Acoustics. May 2013

3 *RenewableUK research into Amplitude Modulation* (December 2013) http://www.renewableuk.com/en/publications/reports.cfm/year/2013/

4 Wind Farm Appeal Decision – Turncole (APP/X1545/A/12/2174982, APP/X1545/A/12/2179484 & APP/X1545/A/12/2179225)

5 Wind Farm Appeal Decision – Dunsland Cross (APP/W1145/A/13/2194484)

Proposed Wind Farm at Bullington Cross

Preliminary Review of Applicant's Environmental Information - Noise

October 2013

Report No: **RD/1013/BDBC/TVBC/WCC/01**

For:

Winchester City Council
Test Valley Borough Council
Basingstoke and Deane Borough Council

Pre***pared by:***

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Date**:** October 2013

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R A Davis - **Qualifications and Experience**

I hold the degree of Bachelor of Science in Engineering from the University of Southampton, and I am a member of the Institute of Acoustics. I have worked in the fields of acoustics and noise control since 1968, and as an acoustics consultant since 1971. I have carried out assessments of environmental noise from existing and proposed industrial sites at numerous locations throughout the UK, and I have presented evidence on these matters in Court and at Public Inquiries.

From 1990-2001 I was Technical Manager of ISVR Consultancy Services (now ISVR Consulting), a consultancy unit within the Institute of Sound and Vibration Research at Southampton University. The Institute is recognised internationally as a centre for teaching, research and consultancy in most aspects of acoustics, noise and vibration. I represented the Institute on British Standards Committees concerned with the measurement and assessment of noise. I left the Institute in 2001 to set up my own practice. I also continue to work with ISVR as an Associate Consultant.

I have experience of the prediction and assessment of noise from wind farms through involvement in research programmes carried out by ISVR and from the assessment of the noise impact of proposed wind farms on specific sites. I have advised local authorities and residents' groups on the prediction and assessment of noise from approximately 40 proposed UK wind turbine installations and I have presented technical evidence on noise at a number of Public Inquiries relating to wind farm planning applications.

I was a member of the Noise Working Group assembled by the DTI in 2006 to review the results of recent research into the causes of complaints from wind farm neighbours about low-frequency noise effects. I was also a member of a team of consultants and Universities commissioned by Renewable UK (formerly the British Wind Energy Association) in 2010 to carry out research to investigate amplitude modulation of noise from wind turbines during 2010-12.

I am currently a member of the Working Group formed by the Institute of Acoustics, at the request of the Department of Energy and Climate Change, which has produced a 'Good Practice Guide' (now endorsed by the DECC) for the application of the ETSU-R-97 procedures to the assessment of wind turbine noise.

1 Introduction

1.1 EDF Energy have submitted a planning application to three Councils (Basingstoke and Deane, Test Valley and Winchester City) to erect 14 wind turbines on land at Bullington Cross in Hampshire. I have been instructed jointly by the Councils to advise on the noise issues in connection with the application. This Report presents my observations and recommendations.

1.2 I refer to the following documents:

- Appendix 10.1 to the Environmental Statement (ES) comprising a noise impact assessment carried out by 24 Acoustics Limited (their reference R4162-1 Rev 4).

- Relevant planning guidance, standards and technical literature including the recently-published May 2013) Institute of Acoustics 'Good Practice' document (the 'IoA GPG'), which has now been endorsed by the Department of Energy and Climate Change and the Department for Communities and Local Government, .

1.3 I am generally familiar with the site location. I have visited the area in the vicinity of the site, observed the locations of dwellings, and have reviewed the locations where background noise measurements were made, either by direct inspection (where this was possible without entering premises) or making use of publicly-available (via the internet) aerial photographs.

2 Description of the development

2.1 The proposed site is on farmland at Upper Norton Farm, Bullington Cross, near Sutton Scotney. To the south and west the area around the site is bounded by the A303 and the A34: dwellings within 1 km of any proposed wind turbine are within about 3 km of one or both of these major roads ***(Figure 1 in ES Appendix 10.1).***

2.2 The scheme as proposed would comprise 14 wind turbines, each with a rated output of 2-3 MW and a maximum tip height of 127 metres.

3 Approach to Noise Assessment - General

3.1 Noise affecting the local area will be generated by the use of plant and machinery and by vehicle movements during the construction and decommissioning of a wind farm, and by the wind turbines themselves when they are operating.

3.2 ES Appendix 10.1 provides an assessment of construction noise (at **Section 8**). In my view construction (and decommissioning) noise can be controlled to acceptable levels by means of measures such as a requirement to adhere to an approved Construction Management Plan, and therefore noise during these phases should not

present an obstacle to granting planning permission. This Report is therefore concerned only with operational noise – noise from working wind turbines.

3.3 For modern wind turbines, the main source of noise is the interaction of the air with the surfaces of the rotating blades. Noise is radiated from the turbine in all directions, although at the distances we are concerned with here the highest noise levels are created downwind of the turbine. Noise levels vary with wind speed: for modern turbines of the type proposed here, noise levels increase as wind speed increases, before 'levelling off' at high wind speeds.

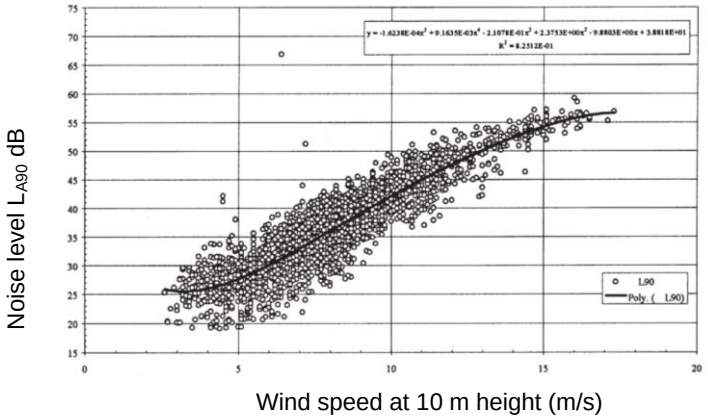
3.4 The standard approach to the assessment of noise from a proposed wind turbine installation follows the procedures set out in ETSU-R-97 (Reference 1). The use of ETSU-R-97 is endorsed in EN-3 (*National Policy Statement for Renewable Energy Infrastructure*) and in recently-published DCLG Guidance.

3.5 The ETSU assessment procedure is as follows:

- Noise-sensitive properties (most often, but not exclusively, dwellings) in the vicinity of the site, including the dwellings closest to any proposed turbine location, are identified.

- Noise surveys are carried out to establish the typical existing background noise levels, over a range of wind speeds, at the identified receptors. These measurements are made using unattended equipment located at representative locations around the site, ideally close to dwellings, for a period of not less than one week (and usually 2-6 weeks). Noise levels in successive 10 minute intervals are recorded and correlated with a wind speed measured at or close to the wind turbine site.

- A typical dataset is shown in the figure below (from ETSU-R-97). Each data point on the graph is a single 10-minute noise measurement, plotted against the average wind speed during the same interval. A 'best fit' line is derived using regression analysis to produce a curve (defined by the equation) that can be viewed as the average relationship between background noise level and wind speed and serves as the 'baseline' for the noise assessment. Background noise levels are determined separately for the night time (23.00 – 07.00) and 'quiet daytime' or 'amenity hours' (evening and weekend) periods.



- The wind speed at 10 metres height (the 'x-axis' values on the above graph) may be either the wind speed actually measured at a height of 10 metres above the ground, or a so called 'standardised' wind speed at 10 metres height calculated from measurements at greater heights. The second method is recommended in current good practice guidance (Reference 3).

- The results of the background noise surveys are used to derive noise limits at dwellings. The noise limits proposed in ETSU-R-97 are set at:

  5 dB above the 'mean' background level at any wind speed
  or
  a fixed level in the range 35-40 dB during the day or 43 dB at night
  whichever is higher.

  All noise levels are expressed in terms of the L_{A90} index – the noise level (in A-weighted decibels) exceeded for 90% of the time

- Since the lowest noise limit that would apply at any site using the above procedure would be 35 dB L_{A90}, irrespective of the background noise level, ETSU recommends (logically) that background noise surveys are not required for sites where it can be demonstrated that wind turbine noise would not exceed a level of 35dB at any dwelling.

- Calculations are performed to predict the noise levels, for a range of wind speeds, that will be created at the representative dwellings when all the wind turbines are operating.

- Predicted wind farm noise levels are compared with the derived noise limits. Provided that the predicted noise levels do not exceed the ETSU-R-97 derived limits, noise levels are judged to be 'ETSU compliant'.

3.6 The use of ETSU-R-97 is endorsed by government and most decisions on wind farm planning applications, by local authorities or at Appeal, adopt ETSU limits as the appropriate criteria. If planning permission is given, it is usual practice to impose conditions restricting noise levels to the ETSU limits, although sometimes lower noise limits are applied

3.7 Although it is standard practice for wind farm noise assessments put forward by applicants to rely solely on ETSU-R-97, it should be emphasised that compliance with the ETSU noise limits does not imply that noise will not be audible at dwellings, or that it will not adversely affect residential amenity. The ETSU noise limits are set at levels judged (by the Working Party that proposed them) to provide 'reasonable protection' to wind farm neighbours without placing unreasonable restrictions on wind farm development. This is discussed further in Section 4 below.

3.8 The noise assessment in the ES is based on the use of the REPower MM92, which has a rated power output of 2.05 MW, although this is a 'candidate' turbine for the

purposes of the assessment and may not be the type installed if planning permission is granted: any type of turbine in the 2-3 MW range could be used, subject to the planning conditions (including noise limits) being complied with.

4 Review of the Noise Assessment in the ES

*(Unless stated, paragraph, Figure and page numbers refer to the corresponding numbers in Appendix 10.1 to the ES and are shown in **bold italics**).*

Identification of Receptors - Information in the ES

4.1 In ***Table 2*** the ES lists receptor locations (dwellings) in the vicinity of the site and their map references; the locations are shown on ***Figure 1***.

Identification of receptors – comments

4.2 19 receptors are listed, although at some locations there are multiple dwellings: for example, the EIA Scoping Report submitted to the Councils provided, at Table 7.1, a list of 17 dwellings within 1 km of any wind turbine location and records 5 dwellings at Tufton Warren Cottages. Also, I believe that there are a number of separate dwellings at New Barn Farm. The actual number of dwellings likely to be affected by noise from the wind farm, potentially those within 1 km of a wind turbine, therefore appears to be between 20 and 25 but is subject to confirmation.

Survey equipment – information in the ES

4.3 Noise measurements were made using Class 1 sound level meters ***(5.5)*** , with the microphones protected using the windshields (Rion WS-03) described in ***5.7***. Calibration certificates for the meters are attached in ***Appendix C***.

4.4 Wind speeds were monitored simultaneously using a Triton SODAR (Sonic Detection and Ranging) device installed by Dulas Limited. (***5.8 and Appendix D***).

4.5 A rain gauge was installed at Upper Norton Farm House to detect rainfall to enable rain-affected noise measurements to be discarded. (***5.8***)

Survey equipment – comments

4.6 The equipment used for noise measurements was fit for purpose and, from the information provided, correctly operated.

4.7 The use of SODAR, a ground-based device for measuring wind speed (and direction), rather than conventional (typically rotating-cup) anemometers carried on a tall mast, is a relatively recent development. Studies which compare measurements made using both methods on the same site have demonstrated good agreement. SODAR measurements can be compromised by factors such as the presence of

obstructions (buildings or trees) and experience is required in selecting an appropriate location for the equipment, and in filtering the measured data to remove anomalies. In this case the equipment was installed by Dulas Limited: the installation report is attached as ***Appendix D***. I would expect the wind data collected by this system to be reliable and of adequate precision.

Baseline Survey Locations - Information in the ES

4.8 Baseline (background) noise measurements were carried out between 22 June and 20 July 2012 at five locations, identified in the ES ***(Table 5)*** as follows. However, as explained in ***Table 5*** and 4.9 below, only at Upper Norton Farmhouse was the equipment located in the immediate vicinity of the named property.

Upper Norton Farmhouse/Upper Norton Cottages
Tufton Warren
New Barn Farm
Poacher's Lodge
Cranbourne House

Table T4.8 Background noise monitoring locations

4.9 Because it was not found possible to place equipment within the curtilage of three of the named properties (Tufton Warren, New Barn Farm, Poacher's Lodge), measurements were made at other locations ('proxy locations') on land owned by the applicant. These were stated ***(5.2)*** to be 'the closest and most equivalent positions'. Also, the equipment initially located at Cranbourne House was relocated during the survey to a proxy location to the north of the A303. The four proxy locations were between approximately 500 and 875 metres from the named dwellings ***(Table 5)*** and are shown on ***Figure 2***. ***Figure 3*** shows photographs of the measurement locations.

Baseline Survey Locations - Comments

4.10 The survey locations are distributed around the site and on preliminary judgment might be expected to provide adequately representative background noise data. However, except at Upper Norton Farm and the first location at Cranbourne House (which was active for only 5 days) the proxy background noise survey locations were in open fields some distance from the dwellings with which they are associated. ETSU-R-97 recommends that background noise measurements are made in the vicinity of dwellings, at positions used for rest and recreation. The IoA Good Practice Guide (Reference 3, para. 2.2.5) accepts that it may be necessary to make use of proxy measurement locations some distance from dwellings, and this is satisfactory provided that selection of these locations is justified (i.e. it is explained why these locations would be expected to experience similar background noise levels to those in amenity areas close to the dwellings in question). The ES provides no such justification, other than to assert that the proxy locations were the 'closest and most equivalent positions' to the named properties.

4.11 Except for the position at Upper Norton Farm and the first position at Cranbourne House, measurement locations were clearly not typical of amenity areas within gardens. It is possible that noise generated by the wind disturbing crops and local vegetation close to the microphones may be higher than would be experienced in a garden, although obviously this depends on the nature and locations (relative to the measurement location of vegetation in the garden. At lower wind speeds, background noise is most influenced by traffic noise from the A303 and A34, and noise from this source will be dependent mainly on distance from these roads, on the wind direction, and the presence of any screening (by topography and buildings) between the road and the location. The Tufton Warren proxy location is further from the A34 than the houses at Tufton Warren, and might therefore be expected to experience rather lower levels of traffic noise. The New Barn Farm and Poacher's Lodge proxy locations are closer to the A303 than the respective dwellings, and therefore would be expected to experience slightly higher noise from this source. These factors - the measurement environment being untypical of a garden, and the relative distances from major roads - introduce uncertainties into the derivation of 'typical' background noise levels assigned to dwellings and also therefore to the ETSU noise limits derived from these background noise levels.

4.12 If the background noise levels at proxy locations are higher than levels prevailing at the dwellings themselves, this would generally result in the ETSU-R-97 noise limits (based on the background noise levels) being set to too-high levels, with the result that the noise impact of the development at dwellings would be under-stated. Therefore it is essential that background noise levels at dwellings are robustly defined.

4.13 The uncertainties associated with the background noise survey data were acknowledged in the ES (at ***para. 7.5)*** and the use of proxy locations was discussed with WCC and BDBC (***Appendix B, page 53****)* after survey completion. It was observed (and agreed) that there was in all cases significant 'headroom' between predicted wind farm noise levels and the ETSU limits derived from the background noise data. It was concluded that even if surveys had been carried out close to the actual properties (or if additional surveys were carried out at these properties) then it was unlikely that the background noise levels would be found to be significantly lower than those at the proxy locations, and therefore unlikely that the noise limits would be reduced to the extent that the predicted noise levels would exceed these limits. Therefore the outcome of the assessment – that the ETSU noise limits would not be exceeded – would be unchanged.

4.14 I agree that there is reasonable certainty that further background noise surveys carried out in the vicinity of dwellings would not change the overall outcome of the assessment (which is that if the candidate MM92 turbines were installed the ETSU noise limits would be complied with). However, the uncertainties in defining typical background noise level do have other implications. In particular, if planning permission were to be granted it is standard practice to impose a condition specifying noise limits: this is necessary in any event since turbines other than the 'candidate' types may be used. Without robust background noise data such limits cannot be properly derived.

4.15 In an attempt to resolve these issues, I visited the area around the site on 18 September 2013, with R Peckham and D Coles (24 Acoustics), D Ingram (Winchester CC) and R Gilbert (Basingstoke and Deane BC). We visited the actual noise measurement locations, and also viewed (as far as possible without entering private property without permission) the immediate surroundings of the dwellings for which proxy locations had been adopted. Notes made following the site visit are attached as Appendix 1.

4.16 It was concluded from the site visit that there were robust grounds for accepting the background noise levels measured at the proxy locations for Tufton Warren, Old Barn Farm and Poacher's Lodge as being representative of the levels at the properties themselves. However, the proxy location for Cranbourne House was not considered to be representative: it was to the north of the A303, and therefore more often downwind of this road (in the prevailing SW winds) than Cranbourne House (and Cranbourne Cottages) which lie to the south of the A303. Also, Cranbourne House receives some screening from the A303 by the earth bund between the house and the road, whereas the proxy location was on rising ground with the A303 being clearly visible. This is discussed further in 4.29 – 4.31 below.

Analysis of Background Noise Levels- Information in the ES

4.17 The background noise data is analysed as described in ***7.1 – 7.2***. Time histories of noise level and wind speed are shown in ***Appendix G***, which identifies discarded data points, including data measured during recorded rainfall and 'a period after rainfall ceased'. Noise data measured in the early mornings when the 'dawn chorus' was judged to be a significant contributor and noise during other 'spurious events' was also discarded.

4.18 After 'filtering' to remove non-typical data the data is analysed to derive 'best fit' lines representing the variation in average background noise level with wind speed as shown on ***Charts 5-18***. There are separate charts for daytime amenity hours and night hours. Noise levels are correlated with a calculated ('standardised)' wind speed at 10 metres height derived from measurements of wind speed at the hub height of the candidate turbine (80 metres).

4.19 Background noise levels at the Tufton Warren location are analysed in two ways (***Figures 7/8 and 9/10***). It is noted that Tufton Warren would experience the highest wind farm noise levels when winds were in the NE sector, whereas in these conditions Tufton Warren (and houses nearby) would be upwind of the A34 and A303 and background noise levels therefore lower than in SW winds, which are stated to be 'prevailing'. In the ES, the background noise data has been 'filtered' to include only data measured in easterly winds (0-180°) to produce the alternative 'best fit' lines shown on ***Figures 9 and 10***. Background levels are shown to be typically 5dB lower at 4 m/s wind speed during the quiet daytime period (compare ***Figures 7 and 9***) if the 'easterly wind' data is compared with the 'all wind directions' data, although no significant difference is apparent from the filtered night-time data. At other

locations the best fit lines of background noise are based on data collected over the full range of wind directions experienced during the surveys.

4.20 Noise limits derived using the ETSU procedure, set at 5dB above the derived 'average' background noise levels but subject to a lower limit of 35dB during the daytime or 43dB at night, are shown on ***Figures 5-18***. The limit curves are 'flattened off' at higher wind speeds.

Analysis of Data – Comments

4.21 As shown on ***Figures 5-18***, there were few valid data points recorded at wind speeds above about 8m/s during the quiet daytime hours or above 9m/s during amenity hours or 8m/s at night. ETSU-R-97 recommends that data is obtained for wind speeds up to 12m/s. However, this is not a significant deficiency: modern pitch-controlled turbines of the type proposed here reach their rated power output (and highest Sound Power Levels) at wind speeds of around 8m/s, and acquisition of background noise data for higher wind speeds is therefore not a critical requirement.

4.22 In this case the assumption is made, in deriving the ETSU noise limits, that the background noise does not increase further as wind speeds increase above the speeds for which measured data, resulting in the noise limit curves in ***Figures 5-18*** being 'flattened-off' at higher wind speeds. This is a conservative ('safe') assumption and is in accordance with the IoA GPG (Reference 3, para. 3.1.20).

4.24 The exclusion of night time noise data judged to be influenced by the dawn chorus is accepted good practice (IoA GPG para. 3.1.7), since this noise is seasonal and therefore not typical of conditions prevailing over the course of a full year. This data has been excluded here.

4.25 Even allowing for any uncertainties attached to the measured background noise data, background noise levels in this area are clearly relatively high, compared with many rural sites, because of the proximity to the A34 and A303 which are relatively heavily-trafficked during the early morning (which falls into the ETSU-R-97 'night' period of 23:00-07:00) and throughout the day. From the data provided, average background noise levels at most dwellings are higher than 35dB L_{A90} during the quiet daytime periods and 30dB at night, even at the lowest wind speeds, and at Cranbourne House, close to the A303, minimum levels are over 50 dB and 40 dB respectively.

4.26 I agree that it is appropriate to consider the effect of wind direction on background noise levels at properties such as those at Tufton Warren, and also at Upper Norton Farm: at both locations the highest wind farm noise level would be expected to be experienced at times when background noise levels from the A303 and A34 would be expected to be close to their lowest levels (when winds are from the NE sector). The use of 'directional filtering' of background noise data for sites and receptors close to existing noise sources such as main roads is referred to in 3.1.22 – 3.1.24 of the IoA GPG. However, the dataset of directionally-filtered noise levels on ***Figures 9 and 10*** is inadequate to allow any firm conclusions to be drawn about the effects of wind direction at Tufton Warren: there are few data points, no data for wind speeds

above about 6m/s, and the data exhibits wide scatter. In my view the 'best fit' lines constructed from this data cannot be taken to be reliable. No wind-direction–filtered data is provided for Upper Norton Farm.

4.27 The paucity of data for easterly winds illustrates that winds in the 0-180º sector rarely occurred during the survey period. An extended survey period would have been required to capture more data during easterly winds and would have been desirable. The importance of this factor depends strongly on the proportion of time that easterly winds occur and for what ranges of wind speeds. The ES states at ***paragraph 7.4*** that the prevailing winds are from the SW, but no evidence is presented to support this assertion. I recommend that the applicant should be asked to provide an annual wind rose to show the percentage of time that winds from different sectors occur, so that the Councils can form a view on whether the incidence of easterly winds, and the resulting lower background noise levels at Tufton Warren in particular, are important factors here. It would also be helpful if 24Acoustics could provide data illustrating the range of wind directions and speeds experienced during the survey period, to allow some judgement to be made of whether the range of wind directions during the survey was typical of the annual pattern.

4.28 I recommend that further surveys should be carried out at Tufton Warren and also at Upper Norton Farm to obtain adequate data to allow the effects of wind direction on background noise levels at these properties to be properly assessed.

4.29 During discussions with 24 Acoustics on 27 September, the limited data measured at Cranbourne House itself (for 5 days only) was examined to assess whether it provided an adequate basis for defining the background noise levels at the house. It was agreed that the night-time data (***ES Figure 16***) was inadequate, since there was only sparse data and this exhibited wide scatter such that the 'best fit' line generated from it could not be considered to be reliable. However, the quiet daytime data **(*Figure 15)*** showed little scatter. Although the number of data points does not comply with the recommendations in the IoA, a reduced number of data points is acceptable provided that data points are tightly grouped (IoA GPG para. 2.9.5). In my view the data on ES Figure 15 can therefore reasonably be used to represent the quiet daytime background noise levels at Cranbourne House.

4.30 Also, subject to further analysis (see 7.6 below) this data can be used to calculate a 'correction factor' between the Cranbourne House location and the proxy location, by comparing the data shown on ***Figures 15 and 17*** in the ES. This correction could then be applied to the night time data for the proxy location, shown on ***Figure 18***. It can be assumed that correction factor between the house and proxy locations will be the same for both day and night, since the main noise source during both periods is traffic on the A303. This matter is discussed further in 7.4, where recommendations for further necessary work are presented.

4.31 Although 'adjusting' background noise data in the way proposed is not good practice, in this case the proposed correction procedure is likely to lead to conservative values of noise limits (i.e. in favour of residents). This is because the wind direction during the survey was predominantly from the SW sector and therefore the background

noise levels assigned to Cranbourne House will be biased toward this wind direction. However, the predicted wind turbine noise levels would only occur at Cranbourne House during northerly winds, when background noise levels at the house would be at their maximum, and higher than the average levels recorded. This inherent conservatism in setting noise limits for Cranbourne House (and Cranbourne Cottages) would, in my view, more than compensate for any uncertainty resulting from the necessity to derive the night-time background noise levels by making corrections to measured data.

Prediction of Wind Farm Noise Levels - Information in the ES

4.32 Noise levels from operating wind turbines are predicted using the methodology of ISO 9613-2 (Reference 2) using proprietary software (IMMI 2011-1), with the input parameters set out in ***6.2 – 6.5***. The predictions are based on the use of candidate turbines, the REPower MM92 operating in their standard (i.e. not 'noise-reduced') mode. The 'at source' noise levels (Sound Power Levels) applied as input to the predictions are tabulated at ***Table 6*** (but subject to a 1dB addition for 'measurement accuracy'). These values are supported by documents published by the manufacturer attached as ***Appendix E***.

4.33 The predictions apply to the 'worst case' wind direction when the receptor is downwind of the wind farm. 'Downwind' in this context can be taken (typically) to mean that the wind direction is blowing from a direction up to around 75 degrees either side of a line drawn between any turbine and the receptor.

4.34 Predicted wind turbine operating noise levels at wind speeds from 7m/s upwards (the wind speed at which noise levels reach their maxima) are shown on ***Table 7***: maximum predicted noise levels at the identified dwellings are in the range 29.3 – 40.4dB L_{A90}. These levels are represented on the noise contour plot on ***Figure 4***. Curves of predicted noise levels over the wind speed range 4-10m/s are shown on the Tables in ***Appendix F*** and plotted on ***Figures 5-18***, which illustrate the relative values of predicted wind farm noise levels, existing background noise levels (as derived) and the corresponding ETSU-R-97 limits.

4.35 In all cases predicted noise levels are shown to be lower than the derived ETSU-R-97 limits by significant margins, generally in excess of 5dB.

Comments – Noise Predictions

4.36 The predictions are carried out using an appropriate method (ISO 9613-2). From sample checks I believe that the predictions are mathematically correct using the input data adopted.

4.37 The values of Sound Power Level for the MM92 wind turbine (***Table 6***) are extracted from the REPower data sheet. Although the values in ***Table 6*** are stated (***at 6.2***) as being warranted by REPower, the status of any 'warranty' is unclear: there is (presumably) no contractual agreement between the applicant and REPower, and

the REPower document places qualifications on the 'guarantee' in terms of terrain, inlet turbulence and vertical wind shear. Therefore the 'guarantee' is generic and does not refer to this specific site. The IoA GPG recommends (at 4.3.6) that where wind turbine manufacturer's statement of Sound Power Levels is not supported by a test report stating an uncertainty factor, then a correction of +2dB should be added to the manufacturer's values. 24Acoustics have applied a +1dB correction to allow for 'measurement accuracy'. If the recommendations in the GPG are followed, predicted levels would be 1dB higher than those stated in the ES.

4.38 Noise prediction is not an 'exact science' and levels may, in practice exceed the predicted levels. However, the margin of uncertainty is likely to be of the order of perhaps 2dB (including the potential 1dB under-prediction referred to in 4.37 above). This would only be critical if predicted noise levels were close to the ETSU R-97 limits: in this case it is likely that there will be significant 'headroom' between noise levels and noise limits. Therefore the consequences of a minor under-prediction of wind farm noise levels at dwellings are not likely to be important here, but in the interests of complying with good practice the predictions should be revised.

5 Assessment of Noise Impact – Limitations of ETSU-R-97

5.1 The noise assessment in the ES is based solely on a comparison between predicted noise levels and limit derived using the ETSU-R-97 procedure. The presumption (although not specifically stated) is that if the ETSU noise limits are not exceeded then wind turbine noise are 'acceptable' and not a matter that should influence the planning decision.

5.2 Compliance with the ETSU limits does not necessarily mean that residential amenity would not be impaired by wind farm noise. The ETSU noise limits represent a compromise between the interests of local residents and the perceived need to develop more sources of renewable energy. In some respects they are 'generous' to wind farm developers, because their application as 'targets' can result in higher (less-restrictive) noise acceptability criteria being adopted for wind farms than would normally be applied to other types of industrial development.

5.3 The ETSU procedure provides no means of establishing the significance of noise impact; it merely proposes a method of establishing noise limits that are at the upper bounds of acceptability. This approach is at odds with the protocol for assessing other environmental effects, which rate impacts on a semantic scale (using terms such as "negligible-low-medium-high-very high"). To put it simply, ETSU provides only a 'pass/fail' approach. Clearly noise levels do not change from being 'of no consequence' to 'unacceptable' as a threshold is reached and passed. It follows that there must be an adverse noise impact (even if this is judged 'acceptable') at noise levels that are lower than the ETSU limits. If there are such impacts they should be taken into account in the balancing exercise.

5.4 Because of the structure of the ETSU limits, which apply lower 'fixed values of 35-40dB in the daytime and 43dB at night, application of the limits can permit very

significant increases in noise levels in rural areas where background noise levels are currently low, particularly at night, which means that turbine noise will often be audible both inside and outside dwellings in some wind conditions.

5.5 A number of Inspectors at recent Inquiries have questioned or rejected the premise that the ETSU noise limits should be applied in the inflexible manner implied in the ES. Inspectors have also expressed concerns about a number of noise-related issues, even in situations where a noise assessment reliably demonstrates that noise levels would not exceed the ETSU limits. The issues included: uncertainties associated with the predicted noise levels, the reliance on a 'candidate' turbine in the assessment, and the likelihood of loss of amenity in tranquil locations where existing background noise levels are very low. Inspectors have also expressed concerns about the possibility of amplitude modulation, and about the effectiveness of conditions in constraining noise levels within prescribed limits. These considerations have not in all cases affected the outcome of an Appeal, but they have been taken into account in the balancing exercise.

5.6 In this case these concerns are of limited relevance, because the existing background noise levels are relatively high because of the proximity of two major roads. Examination of ***Figures 5-18*** shows that predicted noise levels do not in most cases exceed the existing background noise levels (although it is recognised that in some cases the background noise levels are subject to uncertainty, and wind farm noise levels are marginally under-predicted).

5.7 My opinion is that although further assessment work is required to confirm the situation, at this stage there is reasonable certainty that the wind farm as proposed would be able to comply with noise limits properly-derived using the ETSU-R-97 procedure. Noise levels would not exceed existing background noise levels by significant margins, and there would be no more than minimal disturbance to local residents by way of noise.

6 Other Noise Issues

Infrasound, low-frequency noise and vibration from wind turbines

6.1 There has been widespread publicity in the press and on internet sites concerning the risk of adverse health effects resulting from infrasound, low-frequency noise and ground-borne vibration from wind turbines. These factors are referred to in ***7.10*** and ***7.11***. My view of the available evidence is that the levels of vibration, low-frequency noise and infrasound from wind turbines, at the distances we are concerned with here, are extremely low and generally significantly lower than human levels of perception, and that there is no convincing evidence that adverse health effect could result from these emissions. Evidence on such effects has been put forward at a number of wind farm Appeals in the UK and to my knowledge no Inspector has attached any weight to such evidence. In my view the Local Planning Authority could not justify refusing a wind farm planning application on these grounds.

Amplitude Modulation

6.2 There is a risk that wind turbine noise will exhibit high levels of amplitude modulation ('AM' - a rhythmic 'swish' or 'thump') in some weather conditions. Although some AM is a characteristic of noise from all wind turbines, in most cases the characteristic is not noticeable at typical 'residential' distances in excess of 500 metres. In a few cases it has been found that amplitude modulation is enhanced and is clearly detectable inside and outside dwellings. If the phenomenon occurs, the potential for disturbance due to noise is considerably greater than if the noise is steady in level. The causes of excessive amplitude modulation are not fully understood.

6.3 The noise assessment addresses AM at ***7.6 - 7.8***. This refers to the 2007 'Salford Report' and to a subsequent government statement. This response is presumably intended to dismiss concerns about AM on the grounds that the UK government has decided not to pursue further research into the phenomenon.

6.4 AM is a matter of concern to the UK wind energy industry, and RenewableUK (previously the British Wind Energy Association) have funded a research programme to investigate the causes of 'greater than average' AM and to establish the typical annoyance responses to amplitude-modulated noise. The results of the RenewableUK research have not yet been published.

6.5 In the current state of knowledge it is not possible to quantify the risk of AM occurring at this site. Neither is it possible to construct a specific condition that would address AM should it occur. 'AM conditions' of various forms have been imposed by Inspectors in some appeal decisions (Den Brook, Swinford) and by some Local Planning Authorities, though either their effectiveness or their validity (in terms of Circular 11/95) has been questioned. The results of the RenewableUK research (in which I have participated), when published, may assist in formulating an effective condition to address AM.

6.6 All that can be said at this time is that the occurrence of significant AM has so far been limited to relatively few UK wind farm sites and the risk of its occurring at Bullington Cross is statistically small. Further, even if wind farm noise were audible at dwellings (which it may be on occasions), noise levels are likely to be below or very close to existing background noise levels, which are elevated because of the proximity of major roads. Therefore even if amplitude-modulation is present I would not expect it to be detectable at dwellings at a significant level. Therefore in my opinion the risk of amplitude modulation effects occurring here is not a matter that should significantly influence the planning decision.

7 Preliminary Conclusions

7.1 Although in most respects the noise assessment is exhaustive and competent, uncertainties are identified concerning the background noise data, arising from the use of proxy measurement locations. Therefore the ETSU-R-97 noise limits derived from them, on which the noise assessment is based, could be questioned. However, following the joint site inspection (see 4.15 above) it is my opinion that the proxy noise measurements can provide an adequate basis for noise assessment, with appropriate corrections in the case of the night-time Cranbourne House data.

7.2 The noise levels resulting from operation of the 'candidate' wind turbines are marginally under-predicted because the allowance made for data uncertainty does not comply with recommendations in the IoA Good Practice Guide.

7.3 The potential noise impacts at Tufton Warren and at Upper Norton Farm have not been adequately assessed: wind farm noise levels at these locations will be highest when winds are from the east, when background levels are likely to be at a minimum because of the locations of these receptors relative to the A303 and A34. The ES does provide an assessment for Tufton Warren, based on background noise data 'filtered' for easterly winds, but the assessment cannot be considered to be robust because it relies on very sparse data with a high degree of scatter (**ES *Figures 9 and 10).***

7.4 It is recommended that the following further information is requested: in some cases this will involve additional survey and analysis work: This information should satisfactorily resolve the outstanding issues associated with the noise assessment:

a) The results of further noise surveys at Tufton Warren (at the proxy location) and Upper Norton Farm. The surveys should be of sufficient duration to provide an adequate dataset with wind directions in the eastern sector to enable average background noise levels to be reliably determined (and therefore noise limits derived) for these wind directions.

b) Comparisons between the data measured at Cranbourne House and the Cranbourne House 'proxy' locations, for the same range of wind directions, to derive corrections to enable the proxy data to be corrected to take account of the observed differences between the proxy location and the house itself. (Applying corrections to measured background noise data is not recommended practice. However, provided that there is a high degree of certainty that the 'corrected' levels are lower than would be measured at the house itself, which would lead to lower (more restrictive) noise limits then I believe that this is a justifiable course of action in this case, where it has not been possible to obtain adequate data at the actual property).

c) Revised noise predictions for the candidate wind turbine, using input values of Sound Power Level based on manufacturer's data and with allowances for uncertainty in accordance with the IoA Good Practice Guide.

(d) An annual wind rose for the site (or for a representative local site) and an analysis of the distribution of wind speeds and directions during the noise survey periods.

(e) An updated noise assessment report incorporating this additional and revised data.

7.5 At the date of this report, my understanding is that EDF have agreed to the following actions:

i. 24 Acoustics have been instructed to carry out additional measurements at or near Tufton Warren and at Upper Norton Farm ((a) above) and these have commenced. A SODAR device has been deployed to provide wind speed data to support these measurements.

ii. EDF have written again to local residents to request permission to locate equipment within the property curtilages. If such permission is granted further measurements would be carried out to reduce the dependence on 'proxy' locations where possible (although as noted in this report such further measurements are not considered to be essential, although they would be useful, particularly at Cranbourne House, to provide additional validation of the proxy data).

7.6 Also, further analysis by 24 Acoustics (not yet formally submitted) demonstrates that, subject to further details being provided in the final report, representative background noise levels and noise limits for Cranbourne House can be derived by applying corrections to the measurements at the Cranbourne House proxy location.

7.7 I consider that the submission of an updated report as (e) above would enable the noise impact of the development to be assessed in sufficient detail to inform the Councils in reaching their decisions on the application.

9 References

1 *The Assessment and Rating of Noise from Wind Farms.* Report ETSU-R-97. Energy Technology Support Unit (ETSU). 1996.

2 ISO 9613: 1966*. Acoustics – Attenuation of sound during propagation outdoors. Part 2: General method of calculation.*

3 *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise.* Institute of Acoustics. May 2013.

Proposed Bullington Cross Wind Farm
Adequacy of Background Noise data presented in the Environmental Statement
Note on Site Visits - Wednesday 18 September.

Present:

D Ingram (WCC), R Gilbert (BDBC), R Peckham & D Coles (24 Acoustics), R. Davis

Objectives

- To inspect the noise monitoring locations used for the background noise surveys for the proposed Bullington Cross wind farm (24Acoustics' Report R4162-4 dated 17 January 2013). Positions were identified on-site by RP/DC and confirmed from photographs in the ES.

- To judge whether the 'proxy' noise measurement locations (i.e. all locations except Upper Norton Farm) were representative (in terms of background noise levels) of locations in the vicinity of the houses with which they were associated.

- To inform decisions about the need for further data analysis or additional background noise measurements.

General

The weather was fine. Winds were variable, generally from the NW and 1-4m/s. It was recognised that noise propagation from the A34 and A303 would be wind-direction dependent and that observations about the level of traffic noise at any location were therefore specific to these wind conditions.

Observations on dwellings and measurement locations as follows:

Upper Norton Farm

Main house (financially-involved) + 2 cottages
Traffic noise audible, moderate belt of trees to N of cottages, approximately equidistant main house-cottages-measurement position. The measurement location (not a proxy location) was judged to be well-selected and representative of these dwellings.

Background noise levels would be expected to be lower when winds are from the E sector, corresponding with highest (as-predicted) wind farm noise. Directional analysis of background noise is therefore recommended to establish appropriate noise limits.

Cranbourne House/Cottages

2 Cottages (near A303) + main house/concert hall (partly screened by earth bund).

Main house - relatively high levels of noise from A303 were evident, subjectively from NW direction (presumably because the earth bund does not extend far in this direction).
Significant noise from wind in row of trees (birch?) to western boundary.
The proxy location - N of A303, similar distance from A303 as Cranbourne House to the S, in open field with view of A303, traffic clearly audible. Crops in field (vine-type – peas?) at time of survey, now harvested - judged unlikely to generate significant noise in wind.

However, background noise levels at proxy position unlikely to be representative of levels at Cranbourne House (even ignoring effects of wind direction) because of the protective bund between Cranbourne House and the A303.

Tufton Warren

4 cottages + house + wedding venue. A34 clearly audible near houses (NW wind). Proxy position in field to east, close to hedgerow and with growing crops (as at Cranbourne proxy location). Traffic noise was clearly audible at proxy location although subjectively lower (estimate 3dB?) than near the houses.

Significant tree cover near houses and corresponding wind-generated noise.

The proxy location and the houses at Tufton Warren are a similar distance from A303: the proxy location is further from the A34. Overall, it was judged that background noise levels at the proxy location are unlikely to be higher than at the houses in any wind direction, and are almost certainly lower. Therefore the levels at the proxy location can safely be taken to be representative of levels at houses.

Background noise levels at both houses and proxy location are likely to be lower when winds from the easterly direction, corresponding with highest (as-predicted) wind farm noise. Directional analysis is therefore desirable (as for Upper Norton Farm).

Poachers Lodge

House is a bungalow with significant local tree cover, background noise dominated by wind in trees.
Proxy position in field to south, about 50m from hedge/tree bank to N. Crops (unidentified - a grain crop) was growing at time of survey, now harvested. Traffic noise (A303) just audible (although NW wind would reduce level compared with more-usual SW wind). The proxy position was closer to A303 than Poachers Lodge.

It was judged that the measurements at the proxy position would be adequately representative of Poachers Lodge, perhaps in combination with measurement data from the New Barn Farm proxy location (see below).

New Barn Farm

3 houses, including converted barn. Significant local tree cover generating noise in wind.

Proxy location about 750 m to the south, in centre of field. Crops (grain) in field at time of survey, now harvested.

It was judged that background noise levels in the vicinity of houses would not be lower than at measurement location, and that the proxy measurements were adequately representative. Measured noise levels were very similar to those measured at the Poacher's Lodge proxy location: it would be reasonable to combine these measurements (taking the lower level at any wind speed) to define noise limits for both of these properties and others in the vicinity.

R A Davis/19-09-13