Technical Note

Clarification of collision risk impact assessment approach for the European Offshore Wind Deployment Centre – Updated approach following changes to the Rochdale envelope.

July 2012

GENESIS

deeper understanding

Clarification of collision risk impact assessment approach for the European Offshore Wind Deployment Centre – Updated approach following changes to the Rochdale envelope.

Project/Job Title: **Aberdeen Windfarm**
Genesis Job Number: **J-90008/A**

Prepared for:
AOWFL

Prepared by Genesis:
6 Albyn Place, Aberdeen, AB10 1YH, UK
Tel: +44 (0)1224 615100 Fax: +44 (0)1224 615111
www.genesisoilandgas.com

Rev	Date	Description	Issued by	Checked by	Approved by	Client Approval
A1	16/05/2012	Internal Review	CB	PB	CB	N/A
B1	17/05/2012	First Draft for Client	CB	PB	CB	NS
G4	03/07/2012	Final	IS	NM	IS	

Contents

Figures & Tables

1 Introduction

Aberdeen Offshore Windfarm Ltd (AOWFL) wish to advise of a change in the Rochdale envelope for the proposed European Offshore Wind Deployment Centre (EOWDC) and this technical note will explain the implications this will have on the collision risk assessment and the approach taken.

In keeping with the concept of a demonstrator site, AOWFL have been engaging with global turbine suppliers who wish to demonstrate their next generation turbine technology at the EOWDC site. Similarly there has been consultation with foundation manufacturers in order to further refine the options for the site.

Whilst the foundation options will not be finalised until offshore geotechnical works and more details on ground conditions are available, AOWFL have commenced a formal commercial process to identify and refine the turbine supply options for the site. This process is at an early and confidential stage, whereby the manufacturers have provided turbine specifications but have not supplied commercial terms.

At the time of defining the Rochdale envelope (as submitted August 2011) the project engineers undertook consultation with the supply chain to understand their ambitions and likely details of their turbines which were at an early stage of development. The results of this initial consultation were inevitably a reflection of the supply chain at the time and the stated ambitions of manufacturers at the time. Consequently, a Rochdale envelope allowing for turbine tip heights of up to 195 m, rotor radius of 75 m and hub heights of 120 m informed the project description (as submitted).

The overarching objective of the EU grant is to deploy new equipment, systems, processes and initiate R&D to improve the competitiveness of Offshore Wind Energy Production, whilst generating environmentally sound marketable electricity and to increase the supply chain capabilities in Scotland, the wider UK and Europe.

The commercial evaluation of prospective turbine suppliers who can meet the EU requirements has revealed that a number of manufacturer's turbines marginally exceed the Rochdale envelope parameters (as submitted). These turbines would require an adjustment to the tip height from 195 m to 198.5 m, and rotor radius from 75 m to 86 m (Table 1).

Table 1 Dimensions of the Rochdale envelope and changes to the Rochdale envelope

Parameter	Rochdale Envelope as submitted	Rochdale envelope (as requested)	Differential
Tip Ht (aLAT)	up to 195m	up to 198.5	3.5m
Hub Ht (aLAT)	up to 120m	up to 120m	Nil (likely reduction
Rotor radius (diameter)	up to 75m (150m)	up to 86m (172m)	11m (22m)

- *Please note that these dimensions are only applicable to part of the scheme and do not represent wholesale adjustments to all 11 turbine locations.*

At this stage it is not possible to anticipate the likely final outcome of commercial negotiations, however, given the strategic importance of the project with respect to future Round 3 and Scottish Territorial Waters projects it is crucial that the project maximises the demonstration opportunities both in terms of technologies and regulatory and consultee learning.

As is the case with commercial offshore wind farm schemes, it is not possible to finalise the exact scheme details during the pre-consent stage. In addition, the innovative and demonstrator nature of this scheme demands flexibility of approach compared to the more typical 'of the shelf' supply of foundations and turbines.

Thus it is not possible to confirm the turbines and foundations will be present at each of the 11 locations until commercial contract award stage, though the course aim is to refine the options going forward with a view to short listing manufacturers.

Following on from a meeting on the 8th February 2012 at the Marine Scotland marine laboratory AOWFL sought the views of both Scottish Natural Heritage (SNH) and the Royal Society for the Protection of Birds (RSPB) on the collision risk approach.

SNH and RSPB provided comments on the proposed approach. This technical note seeks to address comments made on the original collision risk methodology and also provide an update on changes made to the Rochdale used in the collision risk model. It should be stressed that the only change to the collision risk modelling is the turbine parameters modelled with all other aspects of the methodology and approach being unchanged from those outlined in the previous collision risk methodology approach submitted for comment (AOWFL, 2012).

2 Input parameters used in the collision risk model

The input parameters to be used within the new collision risk assessment spreadsheet are discussed below. The collision risk assessment has been run for two sets of turbine parameters; the original Rochdale and an updated Rochdale and thus two sets of results are available to illustrate what effects changing the Rochdale has caused.

2.1 Turbine parameters for the collision risk model – Original Rochdale envelope.

The turbine parameters in the original Rochdale envelope were based on the information available from commercially available turbines at the time, with many of the parameters being derived from the upper limits (worst case) of the realistic criteria, for example the mean revolutions per minute. The parameters used for the original Rochdale are presented in Table 2 and have been applied in the original collision risk assessment.

Table 2 Turbine parameters applied in the collision risk model – Rochdale envelope

	Value	Comments
Rotor diameter	75 m	Expected to be <75m
Mean revolutions per minute (rpm)	7.4 rpm	Derived from indicative wind profiles and wind cut out points as per SOSS methodology
Sea clearance rotor tip to sea level	~25 m	-
Max chord diameter	6.5 m	-
Pitch	30 degrees	Expected to be <30 degrees
Monthly operating time	85%	90%.

2.2 Turbine and windfarm parameters for the collision risk model – updated Rochdale

Since the original Rochdale was submitted, a number of turbines are being evaluated both commercially and in terms of innovation content, and this has necessitated a change in some of the input parameters modelled. Consequently, AOWFL carried out an evaluation exercise which ranked the turbines in terms of their collision risk. The input parameters for the turbines were assessed on the basis of their sensitivity to influence the collision risk outputs. All the turbines were modelled to determine which turbine should be taken forward as the worst case turbine to model (produced the highest number of collisions given a density of flying birds). Due to the non-disclosure agreements which are in place with the turbine manufacturers it is not possible to present the results of the ranking exercise as this would reveal sensitive commercial information such as power curves, rotation speed and rotor dimensions.

The outcome of this evaluation exercise was that the turbine identified as having the highest potential collision risk was selected as the turbine to be modelled. It should be recognised that this turbine did not have the largest diameter of swept area, but due to a combination of factors such as its higher rotational speed it was considered to result in the largest theoretical collision risk.

The EOWDC concept is to deploy a number of different turbines throughout the lease area, yet for the purpose of the collision risk assessment it will be assumed that the same turbine will be installed at all 11 locations. This approach is favoured for a number reasons, firstly it will allow for uncertainty in the configuration of turbines to be factored in and also continue to build a degree of precaution into the collision risk assessment.

Specific changes to the parameters modelled in the updated Rochdale include an increase in rotor diameter, decrease in max chord length, decrease in mean rotations per minute and inclusion of monthly time operational (Table 3).

The rotor diameter has increased to 167 m from the value considered in the original Rochdale envelope. This is less than the maximum value supplied in the updated Rochdale (172 m) but corresponds with the other parameters which result in the turbine causing the highest collision risk.

A pitch of 15 degrees is estimated as an average when the turbine is operating at around its mean rotational speed, and this is used throughout the CRM. The variation of pitch along the length of the blades is not provided by manufacturers, nor is data available for the pitch at different wind speeds. It was considered the previous value of 30 degrees was excessive given the expected pitch values form turbines considered. Indeed, the value of 15 degrees is also conservative when consideration is given to the fact that the blades will have near zero pitch angle up until rated speed. Once rated speed is achieved, the blades will begin to pitch in from near zero to their max value (typically 20-25 degrees). Once the max wind speed is observed, the turbine will shut down and cease rotating. As the wind turbine will spend the majority of it's time operating below the rated wind speed (typically 80% of the time) the average pitch will be far less than the maximum value.

A max chord length of 5.4 m has been used, this has been derived from a manufactures specification from a 7MW wind turbine, it should be worth noting the max chord length is expected to be less than this and is a precautionary value. The proportion of time operational has been derived from an estimate of the time available and the proportion of time above/below cut-in/cut-out speed of the turbine.

Table 3 Turbine parameters applied in the collision risk model – updated parameters

7MW turbines	Value	Comments
Rotor diameter	167 m	Derived from manufacturers specifications.
Mean revolutions per minute (rpm)	6.05 rpm	Derived from indicative wind profiles and wind cut out points as per SOSS methodology
Sea clearance rotor tip to sea level	~25 m	-
Max chord	5.4 m	Derived from manufacturers specifications, precautionary value.
Pitch	15 degrees	Our calculations suggest that <10 degree is a more accurate figures, but we have retained a parameter of 15 to include further conservatism in the model

3 Addressing specific comments/issues Scottish Natural Heritage raised in response to the original collision risk approach:

This section provides a response to the comments made by Scottish Natural Heritage (SNH) and the Royal Society for the Protection of Birds (RSPB). The comments made by the consultees have been responded to in italics below.

Scottish Natural Heritage comments:

1. The model described in Band 2011 is the most appropriate model to use and should be applied here. If the Strategic Ornithological Support Services (SOSS) do provide future iterations of the model we agree that it will not be necessary to use this updated model. This will be at the discretion of the developer.

***AOWFL response**: Accept comment; as of 16th May 2012 there does not appear to be an updated version of the model therefore it is the intention to proceed with the latest version available.*

2. We agree that the areas recommended for inclusion in the CRM for years one and two seem broadly similar and suitable to use. The overall mean is the most appropriate estimate for density as the survey method wasn't designed to be used to more finely or precisely define areas of higher and lower density and given the scale of the area surveyed.

***AOWFL response**: Accept comment and this is the approach taken in the report.*

3. It should be recognized that the method used for snapshot counts is likely to be an underestimate of the true density of birds in flight as it does not account for likely declines in detectability with increasing distance from the observer. The snapshot count methodology used is still the correct one to use and is unlikely to provide an overly unrealistic conclusion to the collision risk modelling, particularly as the assessment should be made using precautionary avoidance rates.

***AOWFL response**: Agreed that snapshot counts may result in an underestimate of birds, and this is especially the case for a relatively small survey area (small number of snapshots taken) where birds naturally present in low densities could be missed during the actual snapshots. AOWFL recognise these limitations but are also constrained with using snapshots within collision risk assessments as this appears to be the current approach method.*

4. Flight height data collected during surveys should be compared with generic flight height information collated and analysed by SOSS. Where there are important differences between these values, the reason for the differences should be examined. If these differences are likely due to data issues (small sample size) we recommend using the flight height information with the largest sample size as this is likely to be the most representative. Where important differences cannot be attributed to data issues, site specific differences should be considered and explained. If it is thought that site specific flight heights are more appropriate, this should be thoroughly

explained and well reasoned. If this is not possible the more precautionary flight height information of the two should be used.

***AOWFL response**: Agree with SNH comment and this has been the approach taken in the assessment. Two sources of data have been used for proportion at flight height. In the collision risk assessment, site specific data collected during EOWDC boat based surveys and also generic flight height data has been used. .*

5. Assessment of collision mortality to common terns will need to consider what affect the proposed development may have should the tern population at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA return to the citation population level. An appropriate assessment will need to demonstrate that the proposed development would not prevent the recovery of this colony to citation levels. It will therefore be necessary to estimate what the density of flying terns within the proposed development footprint may be if the SPA was recovered and then assess whether the predicted collision mortality would result in an adverse effect on the recovered population. This will require assumptions on how the pattern of density may change within the development footprint if the SPA tern population were to return to citation levels. There is likely to be a substantial level of uncertainty in these assumptions, making it difficult to assess impacts to the SPA with confidence. Therefore it may be helpful to examine a presumed range of densities in the footprint relative to theoretical populations in the SPA to help explain the level of risk to different population sizes. For example, densities could be explored relative to the current population size, 100 pairs, citation population and 500 pairs. This recognises that 500 pairs represents an unrealistic scenario, so if predicted collision mortality is not important it would suggest that the risk due to uncertainty at citation levels is very low.

***AOWFL response**: AOWFL have given consideration to this request and devised an approach to address this comment.*

Common terns were not captured in significant numbers within the snapshot counts to undertake collision risk modelling. To generate densities of birds in flight two different approaches to calculate the density were used.

- *The range-independent approach assumed that common terns were evenly distributed across their maximum foraging range.*
- *The range-dependent approach assigned a proportion of common terns into distance bands from the colony according to their known foraging habitats.*

In both approaches the collision risk assessment was carried out using the Band (2011) model.

For each approach the density of birds in flight was calculated for population size of 10 to 1000 individuals. The input parameters to the Band model were tailored for the common tern with other input parameters representing the turbines both in the Rochdale and the updated Rochdale . Monthly flight densities were derived for the two scenarios and inputted into the model for the months where common terns are expected to be present at the Ythan estuary SPA, this was April through to

September. Further details of this approach and the results are presented in the update bird impact assessment.

RSPB comments

1. Boat-based surveys are stated (page 5, line 6) to have been carried out in October 2011 and December 2011 (but Table 1 shows a November 2011 but no December 2011 survey, Table 2 provides confirmation that there is no December 2011 survey) and will be used in revised CRA. This should be clarified. Jan 2012 survey was carried out but (by implication) is not going to be used although Table 1 indicates only that Feb-May 2012 surveys are not going to be used. We accept that the data acquisition process has to stop somewhere and the assembled data now effectively meets the "2 full years" recommended for analysis. We note that surveys will continue to May but will not be used in ES or decision-making.

***AOWFL response**: A mistake was made in the text. Boat based surveys due to a period of bad weather it was not possible to undertake a December 2011 survey. Two surveys were actually carried out in January 2012. However, only one of these the survey which occurred in 8th-9th January was included, the other survey towards the end of the month experienced very poor survey conditions and was only partially completed.*

The distribution of the monthly boat based surveys in Phase 1 and Phase 2 are given in Table 4 and no surveys carried out later than 9th January were included in the analysis. .

Table 4 Monthly boat based surveys conducted for the European Offshore Wind Deployment Centre (EOWDC),

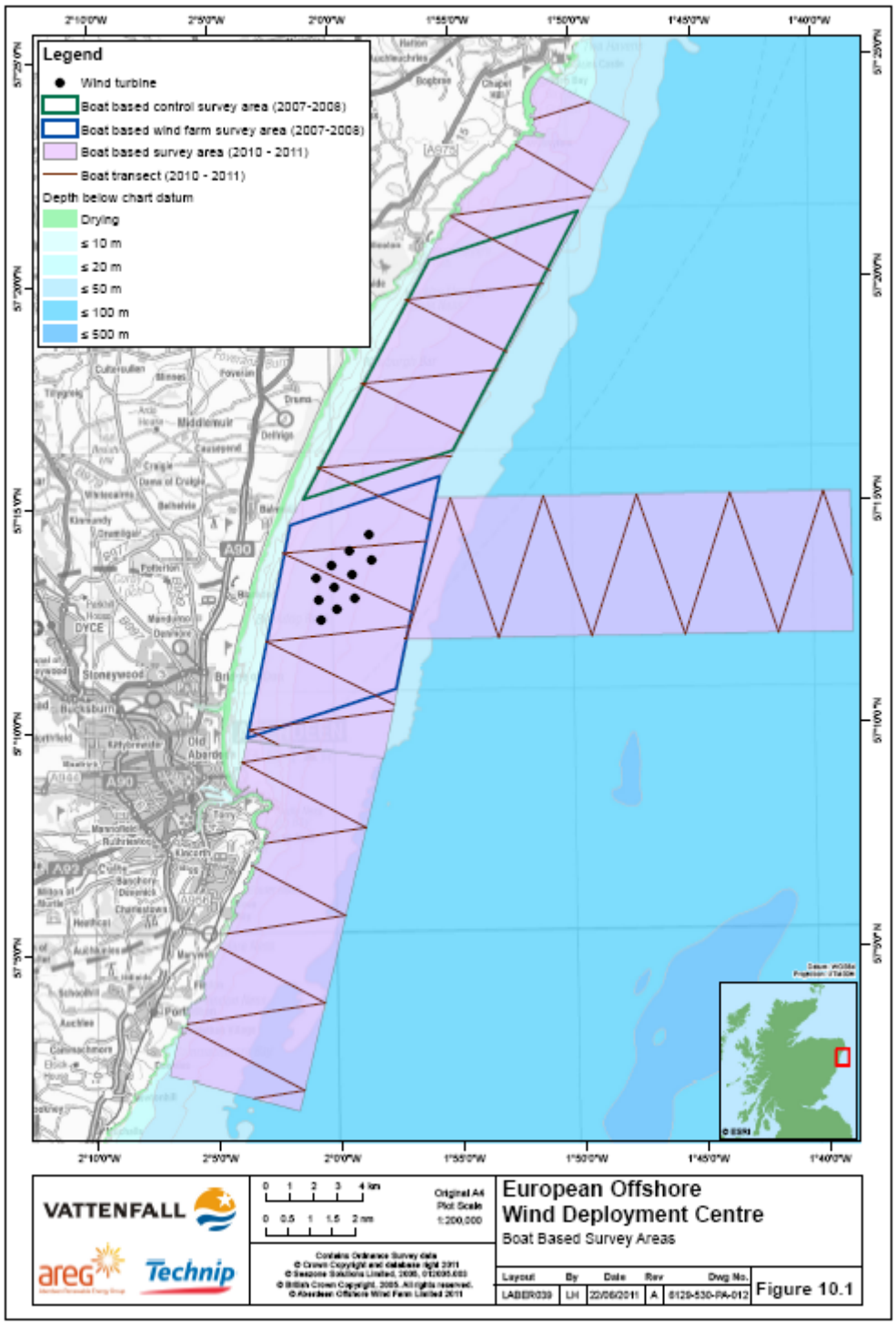
		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Phase 1 n=15	2007	-											
	2008			-	*x 2*	-	-	-	-	-	-	-	-
Phase 2 n= 15	2010	-	-	-	-	-	-	-			-		-
	2011					-	*x 2*	*x 2*		-			-
	2012	x 2	Ongoing surveys not used in analysis →										

- blue illustrates successful survey, April 2008, June 2011, July 2011 and January 2012 have two surveys.

2. We take from the text that the reason why Year 2 data from only the "Northern" Transect area will be used is to make it more comparable with Year 1 data. The different scales of Figs 1 and 2 make it difficult to judge whether Year 1 and Year 2 data extend equally far north and we recommend that these scales be equalised in the ES addendum.

***AOWFL response**: Figure 1 illustrates the areas covered in during the two phases of AOWFL boat surveys. The survey area for the later boat based surveys extends marginally further north than the 2007-2008 surveys, but the majority of the survey area is comparable.*

Figure 1 The survey areas covered by the AOWFL during 2007-2008 and 2010-2012 (reproduced from the Environmental Statement)



3. The parameters to be used in the CRA are acceptable but “Max rotor diam” should read “max blade width”.

***AOWFL response**: Accept comment, ‘max chord width’ has been used this is the same as max blade width.*

4. If birds are flushed by passage of survey boat this will inflate numbers of birds in flight. If they are flushed at a range greater than 300m, this may decrease the recorded number in flight. Any assumptions should be spelled out fully.

***AOWFL response**: The approach taken throughout the boat based surveys is based on the agreed recommended approach for boat-based surveys, If birds are flushed by vessels then this may cause an increase in the numbers recorded in flight, particularly if its within 300 m of the vessel and recorded within the snap-shot period. The consequence of this may be to inflate the number of birds assessed at risk of collision and consequently make the assessment more precautionary.*

5. There is a missing flight band here 25-50 m. This is presumably just an error. Using site specific flight height data (where sufficient) should be preferable to generic data provided that the sample size is adequate but again, this is subject to the proviso that a moving survey boat has no effect.

***AOWFL response**: The omission of flight band of 25-50 m was an error. As stated in response to SNH comment above AOWFL have used two sets of data to determine the proportion at flight height. A moving survey boat is expected to influence the local distribution and behaviour of birds and for certain species may increase, or decrease the proportions in flight. Quantifying the influence of a moving vessel is particularly challenging and we would not expect the vessel to have no effect on bird local bird populations.*

6. Determining the appropriate avoidance criteria is an important point yet to be agreed. We welcome sight of the interim collision risk results prior to ES Addendum submission. The underpinning raw data should also be provided, as we previously requested, to us to enable verification of collision risk predictions. The provision of this information will allow us to assess properly the likely impacts of the turbines and thus to re-evaluate RSPB Scotland's view of the EOWDC proposal.

***AOWFL response**:* A range of avoidance rates have been assessed from 98% to 99.5% based on SNH and COWRIE guidance. Where evidence exists that the avoidance rate may be greater then 98%, then this has been used within the assessment. Where there is a paucity of evidence to select a higher avoidance rate then a default 98% avoidance rate has been used in the assessment as recommended by SNH. AOWFL do not expect that there will be sufficient time to allow consultees to have an opportunity to see the draft collision risk outputs, that said the review of the addendum will allow another chance for comment.

References

AOWFL 2012. Collision risk assessment approach for the European Offshore Wind Deployment Centre, technical note for discussion. Prepared for Genesis consultants for Aberdeen Offshore Wind Farm Limited.

Band 2011. Band Collision Risk Model. Final. Version 02.

Band, B. 2011. Using a Collision Risk Model to Assess Bird Collisions Risks for Offshore Windfarms. Final September 2011.

Camphuysen, K. J., Fox, A. D., Leopold, M. F. and Petersen, I. K. (2004) *Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K.: a comparison of ship and aerial sampling methods for marine birds, and their applicability to offshore wind farm assessments* (PDF, 2.7 mb), NIOZ report to COWRIE (BAM – 02-2002), Texel, 37pp.

Strategic Ornithological Support Services (SOSS). Using a collision risk model to assess bird collision risks for offshore windfarms. Draft Worked Example. December 2011