Marine Advice Memo

To: Seran Davies - Marine Licensing Team

From: Adam Cooper - Marine Area Management and Advice Team

Date: 13 December 2020

Response to email from Seran Davies dated 22 November 2022

Consultation: Project Erebus Further Information

Application Reference: ORML2170

Applicant: Blue Gem Wind Limited

NRW advisors consultation record

NRW Advisor	Job title/Team	Technical advice provided
Joanna Ibrahim	Specialist Advisor, Physical Processes (Marine All Wales Advice Team)	Marine and Coastal Physical Processes
Eleanor Howlett	Specialist Advisor, Marine Water Quality (Marine All Wales Advice Team)	Marine Water Quality
Lucie Haines	Development Planning Team Leader	(Marine and Transitional) WFD
Leyre Nieva	Specialist Advisor, Benthic Ecology (Marine and Coastal Ecosystems Team)	Benthic Ecology
Nick Martin	Specialist Advisor, Marine Mammals (Marine and Coastal Ecosystems Team)	Marine Mammals
Mike Bailey	Specialist Advisor, Marine Ornithology (Marine and Coastal Ecosystems Team)	Marine Ornithology
Ida Nielsen	Specialist Advisor, fish and fisheries (Marine and Coastal Ecosystems Team)	Marine and Estuarine Fish
Louise Edwards	Senior Advisor (DPAS SW)	Onshore Receptors
Olwen Maidment	Lead Specialist Advisor, Landscape (DPAS Mid)	Seascape, Landscape and Visual impact Assessment (SLVIA)

NRW Advisory comments:

Overarching Comments

This memo should be read alongside “ORML2170 Project Erebus Technical and General Consultation Responses_SEI Response_Further Clarifications v2.0 NRW response” spreadsheet. Where all responses for a receptor could fit in the spreadsheet this has been done. This memo details key issues, and also detailed comments that were too long to include in the spreadsheet.

The further clarifications provided have allowed us to agree with more of the overall conclusions of the applicants assessments (though not all – see below). As with our response to the previous consultation, for some receptors while we can agree the overall conclusions we do not agree with the methods/approaches undertaken, or we would have liked to see certain further information provided.

Marine Water Quality

Key Issues

No major concerns.

Detailed Comments

All responses are in the spreadsheet.

Water Framework Directive (WFD) Assessment

Key Issues

No major concerns

Detailed Comments

All responses are in the spreadsheet.

Marine and Transitional Water Framework Directive

Key Issues

Our issues regarding WFD hydromorphology and biological elements have now been resolved

Detailed Comments

All responses are in the spreadsheet

Coastal Processes

Key Issues

NRW have no further issues.

Detailed Comments

Please see comments in the spreadsheet and below:

Potential Impact of Cable Protection on Sediment Transport Affecting Turbot Bank

Comment 1

NRW welcome the efforts undertaken to further understand the sand wave migration rates of Turbot Bank using overlapping bathymetry data of three sand wave features (Greenlink 2018 and CCW 2012) on the northern margin of the bank system. The analysis of these sand wave features clearly indicate that the sand waves on the northern side of Turbot bank are highly mobile and are migrating at a rate of 10-13 m/y towards the ESE (Additional Bathymetric Analysis Report, Figure 2 section 2.2 Findings). The modelled sediment transport rates (ES Volume 1 Chapter 6, Graphic 6.16) also confirms and agrees with the observations that this area is highly mobile, showing a general west to east movement of sediment to the north of the Turbot Bank system. On this basis, we can agree that the additional bathymetric data presented, provides NRW with the reassurance that the tide only numerical model is robust and fit for purpose in the prediction of net sediment transport rates for the study area.

Comment 2

We agree that the modelled patterns of net sediment transport as a result of tidal currents and the observed asymmetry of the sandwave features (CCW and Greenlink bathymetry of Turbot Bank) indicate a clockwise circulation of sediment via active bedform migration around Turbot Bank (ES Vol.1 Chapter 6 Graphic 6.16 and Project Erebus Further Clarifications, Figure 2.2). However, we note that there are distinct differences between the measured and modelled directions of the individual sand wave features, particularly over the shallow regions of the bank.

When comparing the CCW multibeam geophysics transect profiles with the modelled directions of net sediment transport (ES Vol. 2 figure 6.9a and figure 6.9b), the symmetry or asymmetry of the sand waves which defines the direction of transport, in some cases were opposite to what the tidal model predicted. TB1 closest to the ECC showed NW transport but model showed Easterly movement. TB2 on NW flank of bank showed no obvious direction but model showed flow towards ENE. TB3 showed agreement with tidal model movement of sand waves towards WNW. TB4 showed NE transport but tidal model

shows transport was N and directed off the bank but also agrees to NE. TB5 showed symmetric pattern which suggests stable crest formation and no obvious direction. TB6 showed opposite crest alignment to East but model shows flow to West. TB7 showed a slight asymmetry to NW but was not well defined. Further, the three sand wave features used to determine the migration rates for the northern flank of Turbot Bank (Additional Bathymetric Analysis Report, Figure 2), showed a NW to SE direction of travel, whereas the model predicted a general West to East transport. The differences in the model output were raised in the ES for the CCW transects (ES Vol. 2 Figure 6.9b) and noted the discrepancies were due to wave coupling:

Extracted from Volume 1 Chapter 6 Marine and Coastal Processes ES

"The modelled net transport direction (due to tidal currents only) on the crest of the bank is to the northwest, but appears to be different in practice (based on the bedform orientation and shape) if the long term effect of waves (predominantly from the southwest) are also factored in; and

Large bedform asymmetry in some areas is not very clearly defined, suggesting a spatially variable response to the balance of short-term sediment transport (orientated to the local tidal axis), and long-term net transport (spatially variable directions, from aligned to perpendicular to the tidal axis). The same balance appears to also affect the resulting final crest alignment, which may be intermediate between the short- and long-term directions".

Unfortunately, these slight differences in the migratory direction of the sand waves reduced the confidence in relying on the model predictions (in the absence of high-resolution bathymetry) to describe the finer detail of sediment transport pathways and linkages in the wider area, particularly from the North West where understanding the sediment transport pathways and any linkage to the Turbot Sand Bank System is important to the assessment of impact potentially caused by the presence of the cable protection between KP5 – KP7.

Cable Protection North and South of the Turbot Bank System

Comment 4

The ES assessment concluded that the external cable protection rock berms north or south of the Turbot Bank, fundamentally have little to no potential to block or otherwise change the magnitude or direction of long-term sediment transport locally, or regionally elsewhere, indirectly through changes to patterns of currents or waves. Whilst we agreed that the cable protection will not affect the wider changes to patterns of current flow or waves as they are in deep water, it is the physical obstruction to the bed load sediment transport migration which we have raised concerns about, as the alignment of the cable protection is almost perpendicular to the sediment transport direction. The physical obstruction to the sediment pathways could potentially restrict the source of sediment to Turbot Bank and affect the form and function of the Turbot sand bank system over time. No observational evidence was presented for the north west area (bathymetric surveys) to describe the sediment mobility and rates of sediment transport apart from the modelled outputs which suggests high sediment transport rates.

The ES assessment assumed that there is very little bedload sediment transport to the North West of the sand bank system as it assumed the area is composed mainly of

bedrock (depicted by the shaded areas overlaying the model as Annex 1 Reef ES Vol. 1 Chapter 6, Graphic 6.15 and 6.16) and suggests that the area is tidally swept and that sediment is transported mainly in suspension. Using this argument, the ES concluded that there is no direct link from the NW as the area is bedrock. However, the EUNIS classification of habitats defines the Annex 1 Reef Area (shown by the shaded areas in Graphic 6.16) as circalittoral subtidal sediment made up of sand and gravel (Geophysical & Environmental Final Survey Report, figure 21). Grab samples taken along the ECC at location no.18, 19 and 20 in the vicinity of the cable protection NW of Turbot Bank, further defined the seabed being composed of a high percentage of sand and a small percentage of gravel (Geophysical & Environmental Final Survey Report figure 39). The depth of this sand layer across the wider area and the presence of sand wave features is however unknown due to lack of bathymetric data and it could not be ruled out there is a potential for bedload sediment migration towards the Turbot bank from the northwest which would be obstructed by the presence of the 2km long cable protection berm.

However, we agree that if the seabed sediments are in fact stable (already tidally swept) and not actively mobile, the presence of the cable protection will not cause significant blockage of sediment and will not have any measurable impact on the sediment supply which could affect the form and function of the Turbot Bank system, particularly as we acknowledge that there is a sediment supply from the south and southeast of the Bank which feeds into the clockwise circulation of the sand wave features around the sand bank, contributing to form and function of the Turbot Bank system (ES Vol 1 Chapter 6 Graphic 6.16).

Comment 5

After reviewing the further clarifications submitted along with the additional bathymetry information of Turbot Bank, NRW are encouraged that the external cable protection will not likely be continuous along the route and acknowledge that the final extent will be informed by further geotechnical surveys. We also welcome the potential for reducing the actual height of the cable protection rock berm from 2.0m to 1.5m for those sections of cable protection to the north and south of Turbot Bank (Project Erebus Further Clarifications section 2.2.1.3). Both these measures will reduce the impact on the interruption to the bedload sediment transport caused by the cable protection. The gaps in the cable protection will facilitate sediment to freely move as bedload, and the reduction in berm height will be a lower barrier to the passage of sediment over the berm.

NRW have noted that the applicant in the further clarification report has considered that sediment is potentially mobile along the cable protection which is evidenced by their attempt to theoretically deduce the amount of sediment that could be trapped by the cable protection to the north west and south west of the Turbot Bank (section 2.4.1.1). We accept their assumption that sediment will accumulate in the rock voids and acknowledge their attempt to calculate the total volume of potential sediment accumulation based on a volume of 20% of the total cross-sectional space within the berm. Their approximation deduces that the total volume of sediment that will accumulate for all four sections of the berm between KP 4.4. and KP 20 will be approximately 21500m^3. They further assume that the sediment transport direction will not be altered by the berm and sediment will naturally flow over the berm once these voids have been filled. We agree that sediment will flow over the berm, given that the angle of repose of the berm is less than the angle of repose of the sediment which is based on a theoretical value for sand grains. We are encouraged that the potential total volume of trapped sediment would represent a

maximum of approximately 0.03% of the Turbot Bank volume. What has not been determined however, is the time frame over which the sediment will take to move over the berm and migrate downstream uninterrupted (once the interstices have been filled). However, if we assume that the seabed is mobile and the sediment from the NW potentially feeds into the Turbot Bank sand wave system, a small volume loss of 0.03% sediment loss will not likely affect the form or function of the bank, particularly given that the sediment is fed into the system from the south and south east as well.

To address the uncertainty in the time frame for the sediment to infill and form a naturally stable sediment slope and surface, on which the sediment can migrate over the berm under natural ambient conditions, NRW welcome that the applicant (BGW) has committed to undertaking pre and post installation multibeam bathymetric surveys as detailed in the Outline Environmental Monitoring Plan (OEMP) to provide further data to address the uncertainties in the baseline evidence and validate the predictions of the ES assessment. We acknowledge the commitment to include the section of the ECC that passes close to Turbot Bank. We advise that the Multibeam surveys should cover the entire area of Turbot Bank, which will provide validation of ES predictions and a more robust understanding of the form and function of the sand bank feature. The OEMP currently propose to conduct the multibeam surveys pre-constrution and post-construction (1, 5 and 10 years after commissioning of the project. The sand wave migratory rates surrounding Turbot Bank are currently unknown. We advise that the pre-construction and post construction validation monitoring should be carried out 1, 3 and 5 years after commissioning of the project and a detailed morphological assessment carried out at year 5, which will allow validation of predictions relating to any alteration to the sand wave migratory pathways or alteration to the form of the Turbot Sand bank Annex 1 feature. The assessment will inform the requirement and time frame for any further monitoring.

Cable Protection to the South of Turbot Bank

Comment 6

We are in agreement that the alignment of the cable protection to the south of Turbot Bank will not interfere with the bedload transport direction as it is aligned in the direction of sediment transport pathways which is from south to north and as a result will have minimal influence on obstructing the bedload sediment transport from the south.

Low confidence in Rate of Recovery of Seabed Morphodynamics following Sand Wave Levelling

Comment 7

NRW have since been presented with further evidence to show that three sand waves to the northern flank of the Turbot Bank system is migrating at a rate of 10-13m/y towards the SE indicating that the migration of sand waves is very active. From the additional bathymetric evidence presented and the sand wave migration rates calculated from limited bathymetry overlay for other sections of the ECC (ES Vol2 Figure 6.12), NRW are satisfied that the sediment regime is mobile along the ECC and are satisfied that the

seabed will recover over a period of time to the west of the Turbot Sand bank which will require sand wave levelling (KP 8.1) Sediment coming in from the South and South East should adequately recover the seabed in this area. The rate at which the seabed will recover following sand wave levelling will depend on how mobile the sediment is and whether the sand waves are actively migrating.

NRW welcome that the applicant (BGW) has committed to undertaking pre and post installation multibeam bathymetric surveys as detailed in the Outline Environmental Monitoring Plan (OEMP) to provide further data to validate the predictions of the ES by assessing the changes in bathymetry within the offshore consent boundary including sand waves along the ECC that may be subject to levelling prior to the installation of the export cable. We recommend surveys be carried out in all areas where sand wave levelling takes place along the ECC and in the Array site. We advise that the pre-construction and post construction monitoring should be carried out 1, 3 and 5 years after commissioning of the project and a detailed morphological assessment carried out at year 5, which will identify the recovery rate of the sand waves. The assessment will inform whether further monitoring is required or not.

Benthic Ecology

Key Issues

Issues resolved.

Detailed Comments

See spreadsheet and below:

Potential impacts to Annex I Sandbank feature

NRW had outstanding concerns that reasonable scientific doubt remained over the potential impacts from the cable protection north and south of Turbot Bank combined with the cable protection required for the Greenlink interconnector crossing on the conservaton objectives for the Annex I Sandbank feature of the Pembrokeshire Marine SAC. This uncertainty was based on a lack of baseline understanding of the sandwave migration rates for Turbot Bank which would require historical survey data, and a reliance on the model predictions (in the absence of high-resolution bathymetry) to define the finer detail of sediment transport pathways and linkages in the wider area.

The applicant has now provided and assessed additional bathymetry information for Turbot Bank (allowing an assessment of sandwave mobility over a 10-year period to be estimated by comparing data from the Greenlink interconnector bathymetric surveys to previously collected CCW data) which has now sufficiently filled some of the bathymetric evidence gaps highlighted above. This further information has given NRW reassurance that the tide only model provided by the applicant is fit for purpose in the prediction of sediment transport rates for the study area.

In the clarification report the applicant has further considered that the sediment along the cable protection could be mobile, and this is supported by their attempt to theoretically deduce the amount of sediment that could be trapped by the cable protection to the north west and south west of the Turbot Bank. In this assessment the applicant assumes that the sediment transport direction will not be altered by the berm and sediment will naturally flow over the berm once these voids have been filled.The NRW Physical Process Specialist agrees with the applicant that sediment will flow over the berm (see response from specialist).

In this further clarification, the applicant has also made an attempt to deduce the amount of sediment that could be trapped by the cable protection to the north west and south west of Turbot Bank, and a small volume loss of 0.03% has been predicted. Uncertainty however remains over the time frame over which the sediment will take to move over the berm and migrate downstream uninterrupted (once the interstices have been filled). However, as noted in the NRW Physical Process comments, if we assume that the seabed is mobile and the sediment from the NW potentially feeds into the Turbot Bank sand wave system, a small volume loss of 0.03% sediment loss is unlikely to affect the form or function of the bank (See specialist response for further details).

The applicant has also clarified the external cable protection will not likely be continuous along the route and that there is the potential to reduce the height of the cable protection berm from 2.0m to 1.5m for those sections of the cable route. Both of these measures are welcome and will reduce the impact on the interruption to the bedload sediment transport caused by the cable protection and therefore, to the form and function of the bank.

All of the above additional information that has been provided by the applicant in this latest clarification exercise, has allowed NRW to resolve the uncertainty in relation to sediment supply from the north west potentially feeding into the Turbot Bank sandbank system which due to the blockage effects of the bed load sediment transport could have an impact on the form and function of the Annex I Sandbank feature of the Pembrokeshire Marine SAC.

NRW now agree the cable protection north and south of Turbot Bank combined with the the cable protection required for the Greenlink interconnector crossing will not undermine the conservaton objectives of the Annex I Sandbank feature of the Pembrokeshire Marine SAC, as the physical, biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat will be maintained.

It must be noted, however, that some uncertainty remains over the time frame over which the sediment will take to move over the berm (See above and also NRW Physical Process Specialist comments). The applicant has therefore committed to undertaking pre- and post-installation monitoring to validate the predictions made in the ES and in the HRA.

Potential impacts Maerl bed:

NRW understand following the recent clarification provided by the applicant the impact of the restrictions proposed to the HDD operations and the limitations of the technology. It is understood that this could result in additional risks to the successful operation of the HDD.

As discussed, Maerl is highly sensitivie to even low levels of sediment deposition. Experimental burial studies by Wilson *et al*. (2004), reported that burial by a shallow layer (0.25 or 2 cm) of muddy sand containing hydrogen sulphide was quickly detrimental (damage recorded within 1 week) and all maerl was dead by 2 weeks. Even Maerl lying on the surface of this muddy sediment was dead within two weeks (Wilson *et al*., 2004). Chapman and Fletcher (2002) found that even a 1 mm layer of sediment high in hydrogen sulphide was highly toxic to Fucous embryos even when the overlying water was oxygenated. The Maerl bed in Milford Haven has declined by approximately 90% since 2004 and is at high risk of further decline if pressures on this habitat are maintained or increased.

The additional assessment produced by applicant predicted level of sediment deposition <1mm (<20 g/m²) for HDD at landfall. This level is very small and could be minimal when considering the background levels of suspended sediments in the estuary. Nevertheless, there is an impact pathway to the Maerl from the release of the bentonite and a small risk that even this small amount could have an impact. We have considered the duration of the impact, the small amount of sediment deposition predicted and the concerns raised by the applicant and we are no longer proposing to restrict the HDD to neap tides. We however would appreciate any efforts that could be made by the applicant to limit any exposure of the Maerl to even very small amount of suspended sediments to minimise any further risks of decline.

References

Wilson, S., Blake, C., Berges, J.A. and Maggs, C.A. 2004. Environmental tolerances of free living coralline algae (maërl): implications for European marine conservation. Biological Conservation, 120: 279–289.

Chapman, A.S., Fletcher, R.L. 2002. Differential effects of sediments on survival and growth of Fucus serratus embryos (Fucales, Phaeophyceae). Journal of Phycology 38: 894–903

Marine and Estuarine Fish

Key Issues

Issues resolved.

Detailed Comments

See Spreadsheet

Seascape Landscape and Visual Impact Assessment (SLVIA)

Key Issues

The applicant's clarifications have not changed our conclusions, our original concerns remain and NRW consider the proposals would have numerous and extensive adverse effects on seascape and visual receptors within the National Park. NRW are concerned that the assessment has under-estimated some seascape and visual effects on some receptors within the National Park

Detailed Comments

See spreadsheet and below:

Paragraph 5.1.1.8 of the Further Clarifications document refers to East Anglia TWO setting a precedent. NRW does not consider that it sets a precedent as each case should be decided on its own merits. There are clear differences between the proposals and the designations, notably that the Suffolk Coasts and Heaths AONB is already affected by offshore wind farms.

Onshore Receptors

Key Issues

No significant Issues

Detailed Comments

All response in spreadsheet.

Marine Ornithology

Key Issues

As per our response to the last consultation, although concerns remain regarding the methods undertaken and the lack of certain information (see below for details), we are able to state that we can agree with the overall assessment conclusions.

Detailed Comments

We welcome the further Population Viability Analyses (PVAs) for auks at Skomer, Skokholm and Seas off Pembrokeshire (SSSP) SPA undertaken by Erebus in the further clarification document. We welcome that the Applicant has now considered 70% displacement and 10% mortality rates for each of the auk species to ensure the full range of worst-case scenarios is assessed, and that these models have been run using 5000 simulations. All the other methodological issues with the PVA parameterisation we noted in our previous response to the Supplementary Environmental Information (SEI) document (provision of parameter log files generated by the PVA tool, use of stable age structures) have not been addressed. However, we again note that this does not alter our agreement with the conclusions of no adverse effect on integrity (AEoI) for puffin, razorbill or guillemot from the SSSP SPA for displacement from Erebus alone or in-combination. However, these methodological issues should be taken into account for any future PVAs undertaken by any offshore wind application in the future.

With respect to Chapter 6 Post-Consent Requirements, we acknowledge the reference to the OEMP (Ornithology) outline plan and look forward to engaging with the Applicant on resolving post-consent issues via a working group including SNCBs and environmental non-governmental organisations.

Marine Mammals

Key Issues

As per our response to the last consultation, although concerns remain regarding the methods undertaken and the lack of certain information (see below for details), we are able to state that we can agree with the overall assessment conclusions.

Detailed Comments

All responses in spreadsheet.

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