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Wave Model Clarification Note

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1. INTRODUCTION

This note provides a response to comments from NRW on the worst case scenario for wave modelling for the Marine Licence Application ORML1938 – Morlais Tidal Array.

In the NRW response Menter Mon dated 16/04/20, NRW commented as follows:

"We note that the wave modelling has assumed a worst case of 60 surface emergent devices (MOR/HRW/DOC/0001 HR Wallingford Coastal processes modelling report); however, within the project description (Chapter 4 of ES), a figure of 130 surface emergent devices is put forward as a realistic worst case. Please could you clarify this discrepancy with due consideration to our comments on Project Design envelope."

Note that in further comments in response to FEI submitted under the TWAO, NRW commented:

"A.6 The worst-case wave modelling scenario has considered 60 floating devices in the southern permissible section of the array, which have an increased blockage effect on waves, 310 seabed-mounted devices and associated infrastructure. As advised in previous Technical Working Group (TWG) meetings with the applicant, this will constrain the project's design as this is the worst case that has been assessed for this topic.

A.7 Section 4.3.3, paragraph 100 of the updated ES Chapter 4 Project Description states that the worst-case scenario for surface emergent devices is up to a maximum of 130 devices; this number is contradictory to the wave modelling assessment provided (see paragraph A.6). In the PDE matrix spreadsheet, the worst-case generators and device type for 'Impact 2: Changes to the wave regime due to the presence of structures in the Project' is also noted as an envelope covering 240 no. 1 MW devices to 620 no. smaller (0.3-0.5 MW) devices rather than the surface emergent device type. Clarification is therefore required on these discrepancies."

2. MENTER MON RESPONSE

As stated in an email to NRW Advisory on 13th Feb 2020, the worst case scenario for the wave model is the floating area of the MDZ being filled with 60 x 2MW floating devices = 120MW total, the maximum number of the largest type of surface device permitted in this area of the zone (as shown green in Figure 4-1).

The use of 60 devices to represent the worst case impact as opposed to using the 130 maximum floating devices permissible is not a discrepancy but a function of the way that the physical characteristics of devices and different PDE limits function together to limit deployment.

The worst case wave impact is primarily a function of total array hull length as opposed to device number, and hence the scenario used has been chosen to give the maximum hull length permissible rather than the maximum number of devices.

Thus the 60 device scenario used is assessed to have a greater potential impact than a 130 device scenario as through analysis of the various technologies, any permissible combination of 130 devices would have a lower total hull length and hence a lesser wave impact.

2.1. FURTHER DETAIL ON DETERMINATION OF WORST CASE

To determine a suitable configuration to represent the realistic worst case layout for the wave impact modelling, a comparison of the different technology types is undertaken. Owing to the relatively deep position of submerged devices in the water column (8m+ below LAT), away from the wave energy zone, it is considered that floating devices will create the greatest impact (Note that it is subsequently confirmed in the modelling that seabed mounted devices have a negligible impact).

An assessment of the different floating technology types is therefore undertaken to consider their relative potential to cause wave regime impacts. Given that it is the hull structure that presents the greatest hydrodynamic area to the wave in the high energy wave zone at the surface, it is determined that the hull length is the primary driver in determining wave impact.

Given that the exact layout and combination of devices is yet to be determined it is considered that the simplest and most effective layout to be modelled should use a single device type so as to give a uniform geographic impact as far as possible to aid with interpretation of the impact. In particular, this removes the possibility of local variations confusing the overall picture of the impact.

The different technology types were therefore assessed in terms of hull length per MW to determine the type that would have the greatest impact on waves. The result is shown in Table 1.

Device type	(Indicative manufacturer)	MW per device	Hull length (m)	Length/MW
Large Dual TEC tidal devices	Orbital	2	73	36.5
Large Dual TEC tidal devices	Magallanes	1.5	45	30
Large spar buoy devices	Aquantis	1	3.8	3.8
Multiple vertical axis devices	Instream	0.2	22	110
Multiple TEC tidal devices	Tocardo	1.5	9	6

TABLE 1. HULL LENGTH PER MW FOR EACH DEVICE TYPE

FIGURE 1. INDICATIVE TECHNOLOGY TYPES

As shown in Table 1, the Multiple vertical axis devices (Instream) have the greatest hull length per MW. However, on further consideration, another PDE limit comes in to play which means they do not give the worst case wave impact. Owing to their small scale, a deployment of solely this technology would reach the 130 device limit with a total hull length of just 2,806m as shown in Table 2.

For this reason, the Large Dual TEC tidal device (Orbital) is used to represent the worst case scenario, as up to 60 of these can be deployed prior to reaching the 30MW limit of the four approximated subzones in the floating area shown green in Figure 4-1. This presents the greatest total array hull length totalling 4,380m as shown in Table 3. Note that in reality, owing to the 30MW limit on any particular technology the Large Dual TEC tidal device (Orbital) would not be installed in more than a 30MW array, and hence a number of less impacting devices would necessarily be installed instead of some of the Orbital devices. This means that the scenario is conservative.

Technology type	MW per device	Hull length (m)	Length / MW	No.	MW	Total hull length (m)
Multiple vertical axis devices	0.2	22	110	130	26	2,860

TABLE 2. TOTAL HULL LENGTH FOR 130 MULTIPLE VERTICAL AXIS DEVICES

Technology type	MW per device	Hull length (m)	Length / MW	No.	MW	Total hull length (m)
Large Dual TEC devices (Orb)	2	73	36.5	60	120	4,380

TABLE 4. TOTAL HULL LENGTH FOR REPRESENTATIVE WORST CASE SCENARIO

In conclusion, the analysis undertaken showed that the 60 Large Dual TEC devices (Orbital) gave a worst case hull length value significantly in excess of any other technology type despite having fewer than 130 devices. As the Orbital device has a greater hull length per MW than any other technology, the overall hull length is larger than for any mixed technology scenario. Accordingly this was used as the representative worst case for the model.

It is therefore considered that the PDE governing the worst case wave impact is already specified by the existing PDE definitions and no further constraint on numbers of floating devices is necessary.

The PDE Matrix document has also been updated to reflect this.