Application by Sofia Offshore Wind Farm Limited under paragraph 2 of Schedule 6 to the Planning Act 2008 in accordance with the Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011 for a non-material change to The Dogger Bank Teesside A and B Offshore Wind Farm Order 2015 ("the DCO").

Statement of Common Ground between Sofia Offshore Wind Farm and the Marine Management Organisation

Dated: 20 November 2018

EcoDoc Version	Date	Details
002766144-01	16 October 2018	First draft
002766144-02	12 November 2018	Second draft
002766144-03	19 November 2018	Third draft
0027266144-04	20 November 2018	Final

This Statement of Common Ground is prepared jointly and agreed by the Marine Management Organisation and Sofia Offshore Wind Farm Limited

Signed by:

For and on behalf of Sofia Offshore Wind Farm Limited [redacted]

Name: Harriet Thomas (Consent Manager)
Dated: 20 November 2018

For and on behalf of the Marine Management Organisation [redacted]

Name: Paul Stephenson (Senior Case Manager)
Dated: 20 November 2018

1. Introduction

Purpose of this Statement of Common Ground

1.1 This Statement of Common Ground ("SoCG") has been prepared by Sofia Offshore Wind Farm Limited (SOWFL) and the Marine Management Organisation (MMO) in relation to the application (referred to as 'the Application') by SOWFL under paragraph 2 of Schedule 6 to the Planning Act 2008 in accordance with the Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011 for a non-material change to The Dogger Bank Teesside A and B Offshore Wind Farm Order 2015 ("the DCO"). For the purpose of this SoCG, SOWFL and the MMO will jointly be referred to as the "Parties".

1.2 The Dogger Bank Teesside A and B Offshore Wind Farm Order 2015 ("the DCO") (SI 2015 No. 1592) was granted on the 4 August 2015 and came into force on 26 August 2015. The Order granted development consent to two individual project companies and projects: "Bizco 2" for Dogger Bank Teesside A project ("Teesside A") and "Bizco 3" for Dogger Bank Teesside B project ("Teesside B"). The DCO grants development consent for each project (A&B) for an offshore wind farm with a maximum installed capacity of 1.2 GW comprising up to 200 wind turbine generators as well as associated onshore and offshore development.

1.3 In August 2017, the Forewind Limited consortium, owning Bizco 2 and Bizco 3, was split:

1.3.1 SSE and Statoil now own 50% each of Teesside A under a new consortium, Doggerbank Offshore Wind Farm Project 3 Projco Limited ("Project 3 Projco").

1.3.2 Innogy now owns 100% of Teesside B under a new subsidiary, the Sofia Offshore Wind Farm Limited ("SOWFL") and has renamed Teesside B to Sofia Offshore Wind Farm ("the Project").

1.4 SOWFL has applied to the Secretary of State under paragraph 2 of schedule 6 to the Planning Act 2008 for a non-material change to the DCO in order to amend certain parameters relating to the Project controlled by requirements under the DCO, comprising an increase in the consented:

1.4.1 rotor diameter from 215m to 288m;

1.4.2 to enable construction of offshore platforms using monopole foundations;

1.4.3 hammer energy during installation of monopole foundations from 3,000kJ to 5,500kJ; and

1.4.4 an increase in maximum generating capacity from 1.2 gigawatts (GW) to 1.4 GW.

1.5 Preparation of this SoCG has been informed by discussions between the Parties during teleconferences on 11 and 30 October 2018. The purpose of this SoCG is to set out agreed factual information about the Application. It is intended that this SoCG will provide information to facilitate the determination of the Application.

1.6 This SoCG relates to the following reports submitted as part of the Application (see Table 1).

Table 1 Reports supporting the Application

Document title	Ecodoc reference	Appendices	Ecodoc reference	Appendices	Ecodoc reference
Sofia Offshore Wind Farm Non-Material Change Application: Environmental report	002642083-03	Appendix A-Offshore ornithology: Updated impact assessment for increased wind turbine blade diameter	002632249-02		
		Appendix B-Environmental appraisal of increased hammer energy	002636963-02	Appendix A-Additional underwater noise modelling at Sofia offshore wind farm, Dogger Bank	002669687-01
				Appendix B - Auditory Injury Assessment: cumulative exposure to piling noise	002668408-01
				Appendix C - Environmental Appraisal of Increased Hammer Energy Addendum: Assessment of fish receptors	002668403-01

2. The Application

2.1 The Application was submitted on 15 June 2018. The Application was accompanied by the reports detailed within Table 1 above.

2.2 It is agreed between the Parties that the Application only relates to the offshore elements of the Project consented by the DCO and does not relate to the onshore elements of the Project nor does it relate to either the onshore or offshore elements of Teesside A within the DCO.

2.3 It is agreed between the Parties, that in accordance with DCLG Planning Act 2008: Guidance on Changes to Development Consent Orders guidance (2015), from an EIA context, a non-material change application must focus on establishing whether the proposed changes are likely to result in any new or materially different likely significant effects from the approved application. The process is therefore, focused solely on those effects to which the proposed change relates.

3. Matters Agreed between the Parties

3.1 Introduction

3.1.1 The Parties are AGREED on all matters as set out below.

3.2 Screening

3.2.1 It is agreed between the Parties that the only topics that required consideration for the Application were ornithology, marine mammals, benthic ecology, and fish and shellfish.

3.3 Ornithology

3.3.1 It was agreed between the Parties, that Natural England as the relevant Statutory Nature Conservation Body (SNCB), would respond to the Application on ornithology.

3.4 Benthic ecology

3.4.1 It was agreed between the Parties, that the Application would not result in any change to the worst case assumptions presented within the original Environmental Statement (ES) for benthic ecology and therefore, no further assessment is required for the Application.

3.5 Marine Mammals

3.5.1 It is agreed between the Parties that the use of NOAA thresholds and the most recent population density data for the updated marine mammal impact assessment is appropriate.

3.5.2 It is agreed between the Parties, that the Marine Mammal Mitigation Protocol (MMMP), required under the DCO and deemed Marine Licences (dMLs), will address mitigation for noise propagation for the Project and note that this may include noise reduction measures.

3.6 Fish and shellfish

3.6.1 It is agreed between the Parties that the assumption of the worst case scenario for fish and shellfish in the ES (that was documented within the SoCG with the MMO during Examination) is unlikely to change. The MMO has requested technical advice (from Cefas), on the updated modelling provided however, the MMO is confident that the impact of underwater noise on herring can be effectively mitigated, should there be the requirement, to ensure that no new or materially different impacts occur from what was originally assessed.

3.6.2 It is agreed between the Parties that, in respect of fish and shellfish, the Application does not result in any new, likely significant effects for the agreed worst case scenario for any of the receptors pursuant to the original ES that informed the grant of the DCO.

3.6.3 SOWFL note that Cefas raised issues regarding the assessment methodology used within the NMC application for underwater noise propagation particularly in relation to the following areas:

3.6.3.1 Fish flee speeds. Cefas considers there is a lack of empirical data to inform the flee speeds of individual fish species that introduces uncertainty in the assessment of noise exposure on fish at the species level.

3.6.3.2 Cefas has questioned whether the assessment of SELcum for eggs/larvae underestimates the spatial extent of the impact risk area as the model results have been derived for a fleeing receptor and applied to a static receptor which has produced results for a fleeing rather than static receptor

3.6.4 SOWFL note that Cefas advised that the risk of significant effects resulting from underwater noise propagation on fish, particularly the Flamborough Head herring spawning as a result of the increase in hammer energy proposed is difficult to predict due to the uncertainties set out in section 3.6.3. Uncertainty remained as to the level of effect on fish behaviour as there is no standard industry methodology available to robustly address the areas noted in Points 3.6.3.1 and 3.6.3.2.

3.6.5 SOWFL have provided further information, included in Appendix A, considered by SOWFL to be based on a worst case, over precautionary underwater noise propagation assessment methodology, which clearly demonstrates no behavioural or TTS effects on the Flamborough Head herring spawning ground resulting from the increase in hammer energy to 5,500kJ. The MMO has requested technical advice (from Cefas), on the updated modelling provided however, the MMO is confident that the impact of underwater noise on herring can be effectively mitigated, should there be the requirement, to ensure that no new or materially different impacts occur from what was originally assessed.

3.6.6 It is agreed between the parties that Innogy will cooperate and engage as part of an industry group with the MMO and their advisors reviewing the status of current methodologies for assessment of underwater noise on fish, and assist, as appropriate in the refinement of these approaches.

4. Innogy Response to Comments from MMO

4.1 Appendix B to this SoCG sets out Innogy's responses to queries raised on the Application by the MMO on and refers to the agreements made between the Parties as set out in Section 3 of the SoCG.

Appendix A

Supporting information for Underwater Noise Propagation Assessment

Sofia Offshore Wind Farm Limited
Windmill Hill Business Park • Whitehill Way• Swindon • Wiltshire • SN5 6PB

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Introduction

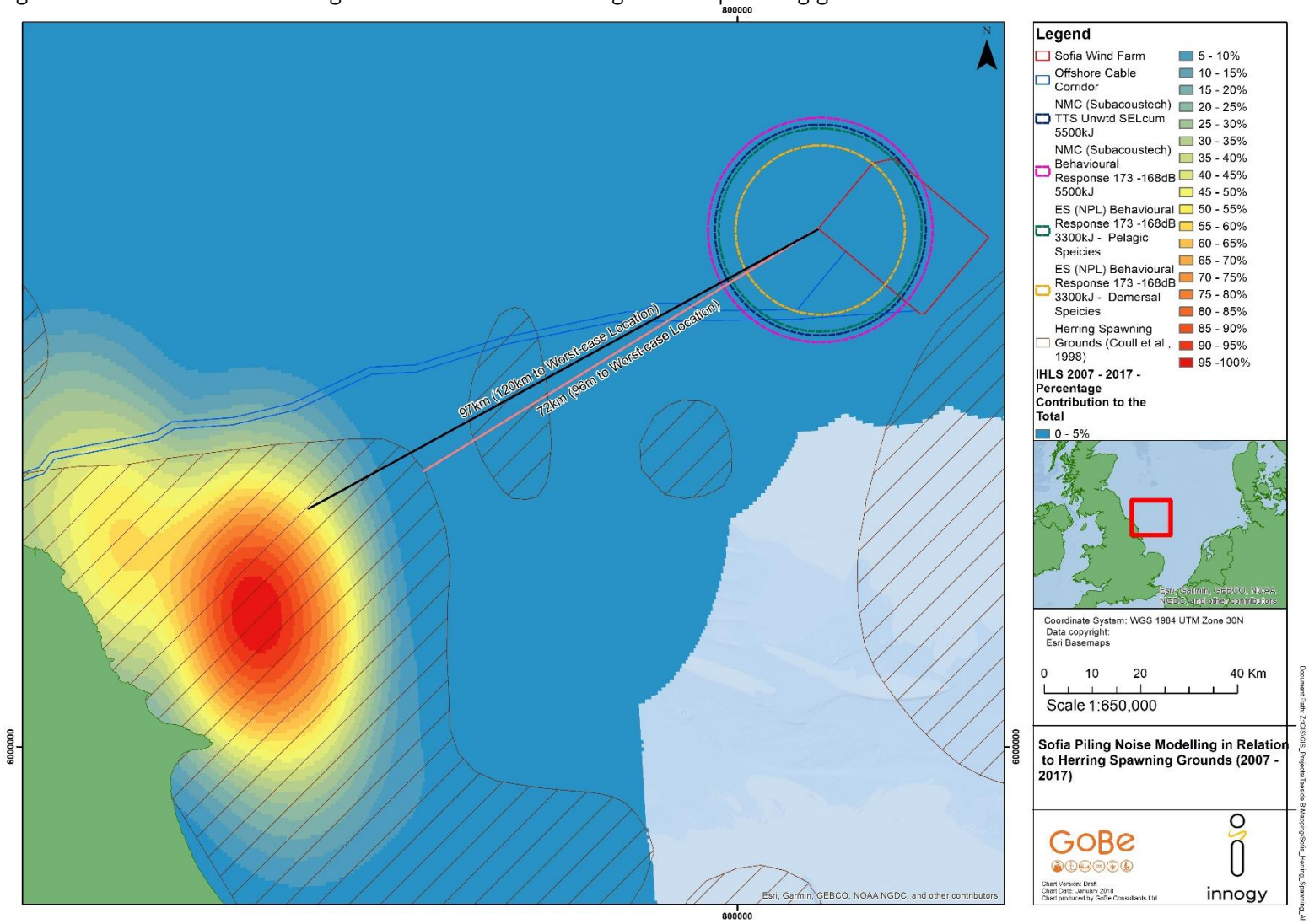
SOWFL understand that in the absence of a standardised contemporary approach to the assessment of behavioural effects of underwater noise from wind farm construction activity on fish receptors, the MMO and Cefas have sought further information to that provided by SOWFL as part of the NMC application. In their email of the 7 November 2018, the MMO requested further information specifically related to the effects of the increase in hammer energy to 5,500kJ on the Flamborough Head herring spawning ground, namely "modelling that is based on the predicted received single pulse Sound Exposure Levels at the spawning ground based on the 5,500kJ hammer energy".

SOWFL considers that the assessment it undertook as part of the NMC application was adequately robust and appropriate. Notwithstanding this, SOWFL has undertaken further modelling (including assuming stationary fish), but has done so only due to the timescales required for consideration of the NMC application and to address the uncertainties raised by Cefas.

SOWFL note that this information has been provided to the MMO only to clarify potential noise impact ranges for the NMC application and to confirm that there will be no effects on the Flamborough Head spawning ground which would require mitigation. SOWFL strongly do not advocate the use of the Hawkins (*et al*, 2014) criteria for establishing behavioural effects (given the environment in which the study was conducted) or the use of the SELcum stationary fish model (as this is not representative of how an active fish such as herring is likely to respond if disturbed), and it therefore, presents an over-precautionary and unrealistic method of assessing underwater effects.

Before, discussing the latest modelled outputs, it is important to consider the context of the SOWFL wind farm array location in relation to the Flamborough Head spawning ground, and Figure 1 presents this further contextual information along with the original fish modelling outputs from the NMC application work.

Figure 1: SOWF UWN modelling in relation to Flamborough Head spawning ground



For clarity, SOWFL confirm that the Flamborough Head herring spawning ground lies some 96km from the closest point of the array based on the Coull et al (1998) data (and 72km from the furthest modelled behavioural response contour that was established within the NMC application assessment), and 120km from the 50-55% spawning effort contour, based on the 10 year (2007-2017) International Herring Larvae Survey (IHLS) dataset (and 97km from the furthest modelled behavioural response contour).

The latest modelling work has been undertaken by Subacoustech Ltd and has produced the following outputs:

- SPLpeak outputs;
- SEL single strike (SELss) outputs; and
- SELcum stationary fish outputs (using Popper et al (2014)).

Modelling Output

Tables 1, 2 and 3 present the output of the modelling undertaken. For the SPLpeak and SELss the most precautionary behavioural effect criteria that could theoretically be used is that established in Hawkins *et al* (2014), noting that it is widely accepted to be overly precautionary as the study was undertaken in a calm sea lough and therefore, not representative of open ocean environments such as the in the southern North Sea. The SELcum outputs are as presented in the NMC application (i.e., based on Popper *et al* (2014) 186dB) but assume a static receptor, which again is overly precautionary.

Using these criteria, the worst case behavioural (SPLpeak and SELss) or TTS (SELcum) impact ranges for the three modelled parameters for 5,500 kJ hammer energy are set out below:

- SPLpeak: maximum possible impact range at 160dB-165dB is 37km – 28km
- SELss: maximum possible impact range at 135dB-145dB is 77km – 39km
- SELcum stationary fish: maximum possible impact range at 186dB is 34km

As noted above, the closest point of the Flamborough herring spawning ground based on the more precautionary Coull *et al* data) to the array area is 96km. This modelling has demonstrated that even when using criteria that is accepted as being unrealistically precautionary assumptions (in the case of the Hawkins criteria) and the further assumption that fish will remain static when exposed to noise, the distance of the spawning grounds remains significantly beyond any modelled theoretical impact range. It can therefore, be concluded with confidence that there is no pathway for behavioural effects from piling at SOWF to manifest on the Flamborough Head herring spawning grounds.

References:

Coull, K.A., Johnstone, R., and S.I. Rogers. (1998). Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd.

Hawkins et al. (2014) Responses of free-living coastal pelagic fish to impulsive sounds. J. Acoust. Soc. Am., Vol. 135, No. 5

Popper A N, Hawkins A D, Fay R R, Mann D A, Bartol S, Carlson T J, Coombs S, Ellison W T, Gentry R L, Halvorson M B, Løkkeborg S, Rogers P H, Southall B L, Zeddies D G, Tavolga W N (2014). Sound Exposure Guidelines for Fishes and Sea Turtles. Springer Briefs in Oceanography, DOI 10. 1007/978-3-319-06659-2

Table 1: SPLpeak outputs (yellow highlights indicate range based on Hawkins criteria)

Table 1	Unweighted SPLpeak								
	200 dB	195 dB	190 dB	185 dB	180 dB	175 dB	170 dB	165 dB	160 dB
5500 kJ single strike									
Area (km²)	2.7	9.9	34	100	260	600	1200	2000	3300
Maximum Range (m)	930	1800	3300	5800	9400	14000	21000	28000	37000
Minimum Range (m)	920	1800	3300	5600	9000	13000	18000	23000	28000
Mean Range (m)	930	1800	3300	5700	9200	14000	19000	26000	33000
550 kJ single strike									
Area (km²)	0.17	0.68	2.7	9.9	34	100	260	600	1200
Maximum Range (m)	240	470	930	1800	3300	5800	9400	14000	21000
Minimum Range (m)	230	460	920	1800	3300	5600	9000	13000	18000
Mean Range (m)	240	470	930	1800	3300	5700	9200	14000	19000

Note: the 550 kJ single strike refers to the soft start hammer energy

Table 2: SELss outputs (yellow highlights indicate range based on Hawkins criteria)

Table 2	Unweighted SELss									
	180 dB	175 dB	170 dB	165 dB	160 dB	155 dB	150 dB	145 dB	140 dB	135 dB
5500 kJ single strike										
Area (km²)	2.5	11	46	160	450	1000	2100	3700	6200	10000
Maximum Range (m)	900	1900	3900	7300	12000	19000	28000	39000	56000	77000
Minimum Range (m)	890	1900	3800	7000	12000	17000	24000	30000	36000	43000
Mean Range (m)	900	1900	3800	7100	12000	18000	26000	34000	44000	56000
550 kJ single strike										
Area (km²)	0.11	0.54	2.5	11	46	160	450	1000	2100	3700
Maximum Range (m)	190	420	900	1900	3900	7300	12000	19000	28000	39000
Minimum Range (m)	180	410	890	1900	3800	7000	12000	17000	24000	30000
Mean Range (m)	190	420	900	1900	3800	7100	12000	18000	26000	34000

Note: the 550 kJ single strike refers to the soft start hammer energy

Table 3: SELcum modelling outputs assuming a stationary receptor (maximum range highlighted yellow)

Table 3 5500kJ Sequence 3 (5h30m)	Unweighted SELcum (stationary animal model)					
	219 dB	216 dB	210 dB	207 dB	203 dB	186 dB
Area (km²)	2.6	6.4	36	79	200	3000
Maximum Range (m)	920	1400	3400	5100	8200	34000
Minimum Range (m)	900	1400	3400	5000	7900	27000
Mean Range (m)	910	1400	3400	5000	8000	31000

Appendix B

Table 2: Innogy's response to the Marine Management Organisation queries and agreement of parties

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
Marine Mammals – See Section 3.5 Matters Agreed			
Underwater Noise: Appendix B – Environmental Appraisal of Increased Hammer Energy:			
1. There was only a small increase in impact ranges for low-frequency cetaceans for Permanent Threshold Shift (PTS) (60 m for 5,500 kJ compared to 50 m the 3,000 kJ). Clarification for this small increase should be provided.	1. The value provided for 3,000 kJ was "less than" 50 m: there is considerable uncertainty in acoustic modelling in this 'near field' of less than 50 m so the distance is not stated to a greater degree of accuracy. Thus the distance of "<50m" is likely to be around 30m to 40m and therefore the increase caused by the 5,500kJ hammer energy would be more likely to be around 20/30m rather than the apparent 10m increase that the model outputs would suggest.	1. Acknowledged. No further action required	1. Agreed. See Section 3.5
2. It is appropriate that the new criteria as set out by the National Oceanic and Atmospheric Administration 2016 (NOAA) have been considered in the assessment, which reflects recent advances in the scientific literature. Tables 6.17-6.18, 6.20-6.21, 6.23-6.24 and 6.26-6.27 compare the NOAA criteria against the original	2. Acknowledged, and Innogy agree that it is correct to state that the single pulse metrics of SEL_{ss} and SPL_{peak} describe a sound in a different way, although they both attempt to derive a range for the same effect using a single sound impulse. The National Marine Fisheries Service (NMFS) criteria (i.e., NOAA criteria) represent the	2. Acknowledged. No further action required	2. Agreed. See Section 3.5.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
ES criteria (e.g. Lucke or Southall) and show the percentage change between the maximum impact risk ranges. However, it should be noted that the assessment is comparing criteria which apply two different metrics (single strike SEL vs SPLpeak). Therefore, a straightforward comparison cannot be made.	most up to date criteria dataset. Innogy are conscious of the limitations of comparing different modelled metrics (as it does not provide an exact like for like exercise), however, Innogy believe that the approach taken is consistent with standard industry practice (as applied on a number of recent Projects that are in a similar position to the Sofia Offshore Wind Farm such as Triton Knoll (i.e., consented but as yet constructed projects whose ES' were developed pre- NOAA criteria)) and is the best available option to enable a comparison between original modelling and contemporary modelling. The direct comparison of the 3,000kJ and 5,500kJ hammer has been made in Section 6.3 of the Environmental Appraisal report. However, given that the assessment criteria have been updated by NOAA, Innogy considered this was a useful		

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
	comparison to make. Innogy would stress that the key point is whether the change in hammer energy results in a significant change in the impact assessed between the original application and the NMC application and this has been demonstrated not to be the case.		
Appendix B – Auditory Injury Assessment: cumulative exposure to piling noise:			
4. The proposed mitigation to reduce the risk of impact includes the standard 500 m mitigation zone and the use of acoustic deterrent devices (ADDs). For harbour porpoise, the report highlights that "ADDs have been shown to substantially reduce the number of harbour porpoise up to 5 km to 10 km from the ADD, with a complete deterrence range of at least 1.1 km and a deterrence efficiency of 88% out to 15 km". For minke whales, the report states that "ADDs have been shown to successfully	4 & 5. Innogy maintain their position with regard to efficacy of ADDs on marine mammals and welcome the recognition that they may be effective at adequately mitigating PTS risk for harbour porpoise with a 5,500kJ hammer. It should be noted that this NMC document relates to a hammer energy increase for monopoles only and therefore, comments relating to pin pile (i.e., the 2,300kJ scenario) are not strictly relevant to the application. Notwithstanding	4 & 5. The MMO advise that in the Brandt et al. (2012) study, some animals were still present within 750 m of the source, and total deterrence was observed only to 1.9 km in Brandt et al. (2013). The MMO note that appropriate mitigation will be developed through the MMMP. The MMO welcome the response regarding minke whales and ensuring that appropriate mitigation will be applied under the	4 & 5. Agreed. See Section 3.5.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
deter minke whales at ranges of at least up to 1.5km (and possibly larger ranges as whale were not tracked beyond this range)". 5. Whilst ADDs may be effective in reducing the risk of PTS for harbour porpoise for the 5,000 kJ monopile scenario (impact range of 930 m), there is uncertainty over the larger impact ranges for the 2,300 kJ pin pile scenario, where distances of 6.5 km are predicted. Similarly, ADDs cannot be relied upon as an appropriate mitigation measure for minke whales, given the predicted impact ranges (9.5 km for PTS). Large Temporary Threshold Shifts (TTS) ranges are predicted for all marine mammals, particularly low frequency cetaceans. ADDs will simply	that, Innogy note the concerns with regard to the 2,300kJ hammer energy PTS ranges for harbour porpoise with jacket foundations and would emphasise that the studies that identified 88% efficiency at 15km also noted (Brandt et al 2012[1]) significant deterrence out to 7.5km and therefore, ranges equal to or below this should be considered within mitigation range. Innogy do not consider that complete deterrence is the threshold for the MMMP, rather it is considered standard practice for them to reduce impacts to acceptable (negligible) levels. Innogy recognise that under a 5,500kJ hammer energy scenario for minke whale, a detailed consideration of risk will be required when devel-	MMMP to adequately reduce the risk of PTS.	

[1] Brandt, Miriam & Hoeschle, Caroline & Diederichs, Ansgar & Betke, Klaus & Matuschek, Rainer & Witte, Sophia & Nehls, Georg. (2013). Far-reaching effects of a seal scarer on harbour porpoises, Phocoena phocoena. Aquatic Conservation Marine and Freshwater Ecosystems. 23. 222-232. 10.1002/aqc.2311.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
not be effective out to these ranges.	oping the MMMP, and if necessary measures will be taken to ensure that appropriate mitigation is applied under the MMMP to adequately reduce the PTS risk. The nature of any such mitigation will be developed in consultation with the MMO and its advisors at that juncture (which will not be until after the project has secured a CfD and the specifics of the proposed likely construction methodology and programme is better known). Innogy note that the function of a MMMP is to mitigate against PTS and not TTS effects.		
6. ADDs introduce additional acoustic disturbance in the marine environment, and the extent of marine mammal displacement from ADDs may exceed the range of displacement from the activity itself if noise abatement measures are applied (Dähne et al., 2017). Noise abatement measures, such as big bubble	6. The regulation of underwater noise in the UK does not currently restrict specific levels of noise (as is the regulatory practice in countries such as Germany, for example). Rather, the EIA and HRA processes inform whether any specific mitigation is required. The work undertaken by Innogy with respect to this NMC application has demonstrat-	6. The suggestion in the original comments from the MMO (14 August 2019) was intended for Innogy to consider ways in which to minimise their overall 'impact footprint' to the marine environment during the time of construction rather than a recommendation for a licence condition.	6. Agreed. See Section 3.5.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
curtains and acoustic barriers, reduce the amount of noise pollution emitted at source. The MMO expect to see such source mitigation considered as a primary means of reducing the potential acoustic impact of pile driving operations.	ed that (in EIA and HRA terms) the increase in hammer energy does not result in a change to the existing EIA, HRA and AA conclusions. On the basis of these conclusions (which it is noted are not disputed by the MMO in their response) and given that the MMO reached agreement with the applicant during the DCO Examination phase of the project that EIA, HRA and AA (with respect to underwater noise) were acceptable on the basis on which they were proposed (noting that potential use of ADDs were included as part of the mitigation options), then it is considered unnecessary to suggest new mitigation is merited as part of the NMC application.	The most direct and comprehensive way to mitigate the risk of acoustic impact on marine species is to reduce the amount of noise pollution emitted at source (noise abatement). Acknowledged. No further action required.	
Fish and Shellfish – Worst Case Scenario – See Section 3.6 Matters Agreed			
Appendix C – Assessment of fish receptors:	Innogy reiterates that the purpose of the Sofia Offshore Wind Farm Appendix C: Environmental Appraisal of Increased Hammer Energy Adden-	Acknowledged. No further action required	Agreed. See Section 3.6

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
	dum: Assessment of fish receptors report (referred to as the Environmental Appraisal)2 is to establish whether the conclusions of the EIA and HRA remain valid given the proposed increase in hammer energy for monopole foundation solutions. Innogy points out, as cited within the Environmental Appraisal report, that the MMO agreed with the worst case assumption in the ES that installation of pin piles represent the worst case scenario for fish (when compared to monopole foundations) on the basis that the greater temporal effect but slightly reduced propagation range associated with a high number of pin pile foundations was more relevant in EIA terms than a greater propagation range but reduced tem-		

[2] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010051/EN010051-002279-SOWF-DCO%20NMC%20Application%20June%202018%20-%20Appendix%20C%20-%20Environmental%20Appraisal%20of%20Increased%20Hammer%20Energy%20Addendum%20Assessment%20of%20fish%20receptors.pdf

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
	poral effect associated with the monopoles. Innogy refers the MMO to the Statement of Common Ground that was signed during the Dogger Bank Teesside A & B (as Sofia was known at that stage) examination. The document can be found here: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010051/EN010051-001322-Forewind%20-%20SocG%20with%20MMO.pdf. The agreed statement referred to is ID 5-D-1 within the SoCG. Given that the total consented number of pin piles has not changed and that the hammer energy for pin piles is not increasing, the worst case assumptions and assessment as presented in		

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
	the ES remain valid and no further assessment was needed for the NMC application. However, following consultation with the MMO further information on noise propagation for fish for the increase in hammer energy was presented in the Environmental Appraisal for context only. The modelling work undertaken to inform the assessment presented within the Environmental Appraisal followed a 'like for like' approach (as far as reasonably practicable) using methods used within the EIA which the MMO agreed for the DCO through the pre-application and Examination stages. It should also be noted that Natural England in their response to the NMC application (24 July 2018 stated "*Natural England is content that the potential for fish and shellfish to be impacted by*		

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
	noise was adequately considered within the ES and it remains so. This decision is based on the fact that the maximum duration of piling events were considered in the original ES rather than the noise associated with a single piling event. In the ES, the maximum duration of piling events (202 days) was based on the piling duration for pin-pile (multi-leg) foundations which is significantly greater than the 71 day piling duration required for 200 WTG monopole foundations. We are therefore content that the impacts remain within the WCS assessed within the original ES". In addition, during a teleconference on the 26 September between Innogy and Natural England, Natural England further agreed no further assessment was required for the NMC application for fish and shellfish. Given the nature of the NMC application and the		

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
	previous agreements with the MMO regarding methodology and assessment conclusions Innogy does not consider it appropriate for the assessment of fish receptors to be reconsidered within the NMC application process. It is also important to note that the worst case assumption made in the ES which accompanied the DCO application has not been amended by the NMC application.		
Fish and Shellfish – Noise Propagation Assessment – See Section 3.6 Matters Agreed			
7. Some clarifications are required for Table 5.3 (shown below for reference): a. There is no such thing as SELpeak, this should be the peak Sound Pressure Level (SPL). Note, the references to SELpeak should also be amended in the subsequent text. b. The second (white) rows showing the impact	7 a. Innogy note the comment raised by the MMO and confirm that the wording should have referred to SPLpeak and not SELpeak.	7. Acknowledged. No further action required	7. Agreed. See Section 3.6

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
ranges for the peak SPL of > 207 dB re 1 µPa are presumably for fish with swim bladders not involved in hearing and fish with swim bladders involved in hearing (not fish with no swim bladder). This needs clarification.	7 b. This table is incorrectly labelled: the >207 dB SPL_{peak} thresholds are set for species of fish with a swim bladder, both where the swim bladder is and is not involved with hearing (see Table 5.1). Therefore, the white rows are for fish with swim bladder (all types) as distinct from the rows above.		
8. Table 5.4 shows very small (<50 m) SELcum impact ranges for mortality and recoverable injury for fish receptors (except for recoverable injury in fish with swim bladder involved in hearing), presumably because the model has assumed a fleeing speed of 1.5 ms-1. This fleeing speed has not been supported by references. However, the MMO is not aware of scientific evidence which would support fleeing in fish. Such evidence should be provided, or alternatively the effects on fish should be	8. The ranges modelled for recoverable injury or mortal injury are low as a consequence of both the relatively high noise thresholds (i.e. generally in excess of 200 dB SEL_{cum}) and the fleeing aspect. Clearly the TTS ranges for a stationary fish receptor will be considerably greater than those calculated for injury, although it is worth noting that the TTS ranges defined are for the species most sensitive to sound, and others will be less than, or much less than, this calculated range (see response to point 19 d below).	8. The MMO advise that the 5,500 kJ hammer energy modelling presented for fish receptors alongside the NMC application is predicting sizable effect zones for Temporary Threshold Shift (TTS) up to 21. 8 km, a 23.4% increase from the currently consented 3,000 kJ hammer energy. [Innogy comment: The ES predicted possible avoidance ranges for 3,000kJ between 17.5 – 21km. The NMC assessment predicted equivalent effect ranges for 5,500kJ of 21.8km. It	8. See Section 3.6. Updated modelling has been provided. This information is currently under review by the MMO. The MMO is confident that effects can be mitigated should there be the requirement.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
modelled for stationary animals. Sizeable effect zones are predicted for TTS in fish, up to 21.8 km for a hammer energy of 5,500 kJ.		should be noted that this is a difference of between 24.6% and 3.8%]. While Innogy have provided the reference for fish fleeing speed, the SELcum impact ranges for fish receptors do appear to be very small (<50 m) and the MMO would expect that the behavioural impact ranges to be larger than those presented for TTS. In the MMOs opinion, although the risk of significant effects is not likely to be high, the behavioural impacts are difficult to quantify given the lack of scientifically agreed thresholds and the MMO cannot agree with Innogy that the impacts of an increased 5,500 kJ maximum hammer energy would be very low. However, the MMO do recognise if a 5,500 kJ maximum hammer energy is applied for monopiles,	

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
		the duration of piling would be still be limited to a maximum of 71 days. The MMO are of the opinion that scientific evidence to support fleeing in fish has not been provided for the noise propagation assessment. The applicant has provided a reference for the 'generic' swimming speed used in the assessment (Hirata K, 1999). However, the MMO advise that this is not empirical evidence that fish will flee from the source. It is recognised that fish will likely respond to a loud noise source, and reactions have been observed such as schooling more closely or moving to the bottom of the water column, but in the absence of evidence to support the fleeing assumption, this assumption is not valid and fleeing should not be presumed. Innogy advise that the NMC process necessitated a comparison to the approach taken in determining the original application and	

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
		therefore, the approaches taken sought to adopt new criteria whilst remaining consistent with the assessments undertaken within the original ES. Innogy recognise that the approach to assessing temporary injury (TTS) and behavioural effects has evolved since the consent award for Sofia offshore wind farm. Innogy recognise that the injury criteria used to assess effects has been updated (to Popper et al, 2014) and that behavioural effects are typically now characterised by more qualitative means than modelled approaches, as evidenced in recent offshore wind farm applications (i.e., Thanet Extension, Moray West and Hornsea Project Three for example). Innogy recognise that this has created points of debate between both parties. It is recognised that alternative assessment techniques (to that used in the like for like	

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
		assessments presented within the NMC application) may result in different outputs of effect range for the monopole solution. Given the following points, innogy consider that any variances are unlikely to change the overall agreed magnitude of effect and therefore, no significant effects are likely from the hammer energy increase: • The monopole solution being sought in the NMC would very significantly reduce the duration of noise emission compared to the pin pile solution; • The most sensitive species to underwater noise effects was identified within the ES as herring. The existing conclusions made in the ES remain valid in relation to these species in that herring spawning grounds are over 90km from the Sofia array area and, as shown in Appendix A, will therefore be beyond the range of any effect; • Within the ES it was identified that the	

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		other species are present over very wide extents within the southern North Sea and therefore any effects will be spatially limited in that context and therefore, not be significant in EIA terms; • The original ES presented a range of effect for possible avoidance from 15.5 – 19.5km (2,300kJ) and 17.5 – 21km (3,000kJ). The NMC identified maximum equivalent ranges of 14.6km (2,300kJ), 16.7km (3,000kJ) and 21.8km (5,500kJ). These ranges are all considered broadly equivalent and the magnitude of effect (as identified and defined within the ES) would not be different for any of these outputs and similarly it would be unlikely to change even if subtly different ranges for equivalent effects were identified using alternative techniques. As a result of the lack of an appropriate	

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
		methodology to address specific issues (see points 3.6.3.1 and 3.6.3.2), SOWFL has provided further information based on a worst case, unrealistic underwater noise propagation assessment methodology set out in Appendix A which clearly demonstrates no behavioural effects on the Flamborough Head spawning ground.	
9. Behavioural effects have been assessed using the Popper et al. (2014) TTS impact criterion and comparing the results to those predicted in the ES for demersal and pelagic species in response to a peak level of 173 dB re 1 µPa (based on data from McCauley et al. (2000) and Pearson et al. (1992) for behavioural response in fish). The following statement is made in the report: *In order allow for an examination of the impact of an increased hammer energy, the TTS impact criterion has been selected as the closest possible comparison to the possible avoidance re-*	9 & 10. Innogy recognise the constraints of comparing different metrics. However, Innogy consider it (in the context of the Environmental Appraisal and its purpose i.e. to identify if new, materially different, likely significant effects are occurring as a result of the proposed change) to be a reasonable, robust approach. Innogy consider that it is important to recognise the full statements made in Appendix C to the Environmental Appraisal in relation to behavioural effects rather than the selected statement provided here. For avoidance of doubt the full	9 & 10. The MMO maintain their position that a threshold to assess TTS cannot be used as a substitute for assessing behaviour, as these are not the same thing. The MMO advise that Innogy's statement highlights that "*using the INSPIRE model, the maximum range of TTS (all fish) unweighted SELcum of 186 re 1 µPa2s was found to be 21.8 km for a hammer energy of 5,500 kJ, which is within the range of propagation distances predicted within the ES modelling for both demersal and pelagic species in response to a peak level of 173 dB re 1µPa*".	9. See Section 3.6.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
sponse modelled by NPL. It has previously been demonstrated to and recognised by the MMO and Cefas (in relation to other offshore wind farm developments) that the modelled noise propagation contours for both the 186Db SELcum metric threshold and the 168dB SPLpeak metric threshold as identified by McCauley et al. (2000) and defined as representing the outer limit for moderate disturbance, are comparable in terms of spatial extent. Although the metrics themselves are not analogous, the areas of potential effect generated by the modelling can be used to inform the assessment of both criteria in general terms. This comparative approach has been developed in relation to other offshore wind farm developments where it has not been possible to carry out exactly like-for-like modelling.	statement read: *As Popper et al. (2014) concluded that there is insufficient data available to apply quantitative thresholds for behavioural effects of noise on fish, a direct comparison of the NPL and INSPIRE model output is not possible, given that different metrics were calculated. Therefore, in order allow for an examination of the impact of an increased hammer energy, the TTS impact criterion has been selected as the closest possible comparison to the possible avoidance response modelled by NPL. It has previously been demonstrated to and recognised by the MMO and Cefas (in relation to other offshore wind farm developments) that the modelled noise propagation contours for both the 186dB SELcum metric threshold and the 168dB SPL metric threshold as identified by McCauley et al. (2000) and defined as representing the outer*	Thus, when monopole foundations with a hammer energy of 5,500kJ are considered, in the MMO's opinion, it is questionable that a sound justification has been presented in the NMC application documentation to demonstrate that no greater impacts would occur on fish receptors than presented in the ES (which as presented within Section 6.9 of Chapter 13 Fish and Shellfish Ecology (Application Ref 6.13). In terms of behaviour, the MMO thus notes that the potential effects on fish receptors resulting from the increase in hammer energy using the methodology within the NMC application documentation remains uncertain. Thus it is not unreasonable to expect behavioural impact ranges to be larger than this distance (of 21.8 km).	

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
10. It is possible that for another wind farm, similar contours were produced. However, these are different metrics and to be clear, a threshold to assess TTS in fish cannot be used as a substitute for assessing behaviour. Furthermore, and more importantly, the cumulative exposure will vary depending on the location and the exposure time.	*limit for moderate disturbance, are comparable in terms of spatial extent. Although the metrics themselves are not analogous, the areas of potential effect generated by the modelling can be used to inform the assessment of both criteria in general terms. This comparative approach has been developed in relation to other offshore wind farm developments where it has not been possible to carry out exactly like-for-like modelling. Using the INSPIRE model, the maximum range of TTS (all fish) unwtd SELcum of 186 re 1 µPa^{2}s was found to be 21.8 km for a hammer energy of 5,500 kJ, which is within the range of propagation distances predicted within the ES modelling for both demersal and pelagic species in response to a peak level of 173 dB re 1µPa (Table 4.1, above).* *As previously stated, the ES considered that the temporal disturbance from construction noise has*	As a result of the lack of an appropriate methodology to address specific issues (see points 3.6.3.1 and 3.6.3.2), SOWFL has provided further information based on a worst case, unrealistic underwater noise propagation assessment methodology set out in Appendix A which clearly demonstrates no behavioural effects on the Flamborough Head spawning ground.	

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
	a greater effect on fish and shellfish than the maximum range disturbance. The worst case scenario outlines a piling duration of 202 days for pin pile installation, which is significantly greater (185%) than the 71 days required for monopole installation and therefore, this component of the impact magnitude will be greatly reduced. Accordingly, it is the conclusion of this assessment that there is no evidence to suggest that the magnitude of effect on fish receptors (as presented in the original ES and agreed to by the MMO) would increase as a result of the proposed increased maximum hammer energy to 5,500 kJ. As a result the impact assessment as presented in the original ES and summarized in Table 4.2 above, remains a valid worst case assessment. Accordingly, Innogy reasserts its position that the agreed worst case scenario (based on jacket		

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	foundations) remains valid and that a detailed assessment into effects on fish from monopole foundations is not necessary. Furthermore, and notwithstanding this point, even when monopole foundations with a hammer energy of 5,500kJ are considered, a sound justification has been presented to demonstrate that no greater impacts would occur on fish receptors than presented in the ES (which as presented within Section 6.9 of Chapter 13 Fish and Shellfish Ecology (Application Ref 6.13) were concluded to be between negligible and minor).		
11. The Popper criteria do not quantitatively address behavioural responses. Behavioural effects are particularly difficult to assess, since they are highly dependent on behavioural context (Ellison et al. (2012) and responses may not scale with received sound level (Gomez et al., 2016). Thus, there is considera-	11. It is agreed that the behavioural effect ranges may well extend beyond that of TTS, although at distances of beyond 10 km, the behavioural effect is likely to be limited. Popper *et al.* (2014) states the risk of behavioural effects in relation to offshore pile driving for most species of fish at these ranges is low. The uncertainty, recognised	Acknowledged. No further action required	Agreed. See Section 3.6.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
ble uncertainty in assessing the risk of behavioural responses, and it is recommended that the application of simplistic sound level thresholds for behaviour should be avoided. Nevertheless, generally speaking, we can expect behavioural impact ranges to be larger than those presented for TTS	by the MMO for further evaluation of disturbance using the application of simplistic sound threshold levels, is noted.		
12. Eggs and larvae have not been considered although the relevant thresholds for this group have been modelled in Tables 5.3 and 5.4 (thresholds are the same as for fish with swim bladders not involved in hearing).	It is noted that "Eggs and larvae" were not considered within the original ES and the scope of that assessment was agreed with the MMO. All effect ranges presented within Table 5.3 and 5.4 for fish with no swim bladders are within a few hundred metres of the noise source, and therefore, if any eggs or larvae were present in the region of the development, significant impacts would not be anticipated (given the context of the likely wide spread distribution of such receptors, as indicated in the ES).	Acknowledged. No further action required	Agreed. See Section 3.6.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
	Please also refer to our response to comment 19.a below.		
13. The report concludes that the significance of these impacts will be no greater than that concluded within the original ES, when a 5,500 kJ maximum hammer energy is applied for monopile foundations. Given the uncertainty over the SELcum assessment and potential effects on behaviour, the MMO is unable to say at this time that we agree with the conclusion.	13. Innogy refer the MMO back to the original agreed position reached during the DCO Examination as set out in the Statement of Common Ground (see above) where it was established that pin pile effects related to the worst case scenario for fish (i.e. the greater temporal effect but slightly reduced propagation range associated with a high number of pin pile foundations was more relevant in EIA terms than a greater propagation range but reduced temporal effect associated with the monopoles). As no change to the total number of pin piles has been proposed through the NMC application, the worst case assessment still stands. The conclusion that the greater temporal effect but slightly reduced propagation range associated	13. SOWFL note that Cefas raised issues regarding the assessment methodology used within the NMC application for underwater noise propagation particularly in relation to the following areas: • Fish flee speeds. Cefas considers there is a lack of empirical data to inform the flee speeds of individual fish species that introduces uncertainty in the assessment of noise exposure on fish at the species level. • Cefas has questioned whether the assessment of SELcum for eggs/larvae underestimates the spatial extent of the impact risk area as the model results have been derived for a fleeing	13. Agreed. See Section 3.6.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
	with the higher number of pin pile foundations should remain valid as a worst case, is further supported by the outputs of the modelling of increased hammer energy as presented within the Environmental Appraisal. The modelling has demonstrated that the noise propagation ranges from the increase in hammer energy to 5,500kJ are not materially different from the outputs for 3,000kJ. This clearly demonstrates that there will be no new, or materially different, likely significant effects from the increase in hammer energy. SELcum outputs were all within 50m of the piling noise source (see Table 5.4). Even given the uncertainties associated with SELcum outputs, it would take an increase well in excess of 100% in the 5,500kJ hammer energy outputs for them to exceed the SPLpeak outputs for the 3,000kJ (Table 5.3). The SPLpeak outputs (for the 5,500kJ	receptor and applied to a static receptor which has produced results for a fleeing rather than static receptor SOWFL note that Cefas advised that the risk of significant effects resulting from underwater noise propagation on fish, particularly the Flamborough Head herring spawning as a result of the increase in hammer energy proposed is difficult to predict due to the uncertainties set out in section 3.6.3. Uncertainty remained as to the level of effect on fish behaviour as there is no standard industry methodology available to robustly address the areas noted in Points 3.6.3.1 and 3.6.3.2. SOWFL have provided further information, included in Appendix A, considered by SOWFL to be based on a worst case, over precautionary underwater noise propagation assessment methodology, which clearly demonstrates no behavioural or TTS	

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	hammer energy) are comparable with the original ES and those conclusions were considered not to be significant in EIA terms (a conclusion to which the MMO agreed in the DCO Examination).	effects on the Flamborough Head herring spawning ground resulting from the increase in hammer energy to 5,500kJ. The MMO has requested technical advice (from Cefas), on the updated modelling provided however, the MMO is confident that the impact of underwater noise on herring can be effectively mitigated, should there be the requirement, to ensure that no new or materially different impacts occur from what was originally assessed.	
Fisheries:			
14. The use of pin piles will result in a longer period of piling (202 days), and whilst the MMO agree that the use of pin piles could result in a potential overlap with more than one spawning season of some fish species, the MMO do not currently agree with the statement that the temporal aspect of underwater noise is considered to have the greatest effect on fish and shellfish species, as it does not	14. As noted above, Innogy refers the MMO to the signed Statement of Common Ground for the Dogger Bank Teesside A& B (as Sofia was known at that stage) examination. The document can be found here: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010051/EN010051-	14. Acknowledged. No further action required	14. Agreed. See Section 3.6.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
consider the particular sensitivities of individual receptor groups or species.	001322-Forewind%20-%20SocG%20with%20MMO.pdf. The agreed statement referred to is ID 5-D-1 within the SoCG.		
15. During the pre-application and application stage, herring was identified as a main species of concern in terms of impacts from noise and vibration from piling operations. Here the Flamborough Head herring spawning ground located off the coast of Yorkshire is considered the main spawning area for the central North Sea Banks herring stock. 16. The impact ranges shown in Tables 5.3 and 5.4 are not discussed in the context of their proximity to the Flamborough Head spawning grounds. Noise contours must be presented, ideally in map form, with the spawning and nursery grounds of herring presented alongside or overlaid. Ten years of International Herring Larval Survey (IHLS) data should be	15, 16, 17 & 18. The noise contours cited in Table 5.3 and 5.4 extend to a maximum of 21.8km (TTS all fish uwtd SELcum in Table 5.4). The Project lies in excess of 80km from the Flamborough Head grounds (as identified in Figure 6.5 of the fish chapter of the ES, located here: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010051/EN010051-000288-6.13%20ES%20Chapter%2013%20Fish%20and%20Shellfish%20Ecology.pdf). This is a significant distance (greater than 58km) from the maximum possible extent modelled within Table 5.4, and therefore, Innogy confirm that there will be no	15 – 18. The MMO advise that their comments 15-18 have been addressed sufficiently. Acknowledged. No further action required	15 – 18. Agreed. See Section 3.6.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
used to inform this, and data is now available up to 2018. 17. Alternatively, as a minimum, the distance (in m/km) between the Flamborough Head spawning grounds and the nearest point where piling operations will take place should be described and discussed in the context of the predicted impact ranges shown in Tables 5.3 and 5.4. 18. Information on the requirements for pin piling/monopiling for offshore substations along the export cable route is also required, either as part of the discussion, or shown in a contour map. You should also consider whether piling requirements associated impact ranges for offshore converter stations, offshore collector platforms, met masts and accommodation platforms will potentially overlap with herring spawning grounds.	effects on the herring grounds resulting from the piling within the array area. It is noted that concerns raised during the DCO Examination of the project, with regard to Flamborough Head herring spawning related solely to the cable installation works (that may pass through it) and not underwater noise from foundation piling. No changes to the location of offshore substations or works along the export cable are proposed within the NMC application and as such, no further assessment is required.		

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19. Table 5.4 presents predicted impact ranges for fish using criteria from Popper et al. (2014) using an assumed fleeing swimming speed of 1.5ms-1. There are a number of issues with this table; a. Eggs and larvae have not been included in the assessment using criteria from Popper et al. (2014). A revised assessment which includes this receptor group should be provided and this should be based on stationary response as they are an immobile receptor. b. Impact ranges are listed for; i. Mortality - fish with no swim bladder ii. Recoverable Injury – fish with no swim bladder iii. Mortality – fish with swim bladder not involved in hearing	19 a. The only quantitative SEL_{cum} criterion for eggs and larvae is for mortality. An INSPIRE run (undertaken internally by Subacoustech in 2018) assuming a stationary receptor suggests that this could occur over 1000 to 2000 metres. It should be noted based on the qualitative criteria for eggs and larvae, that there is only a "moderate" risk of recoverable injury near (i.e. tens of metres) to the pile and at all other ranges the risk is low. This range should therefore be considered highly precautionary. 19 b. It should be noted that some noise thresholds apply for multiple categories: e.g. recoverable injury for "fish with swim bladder not involved in hearing" and recoverable injury for "fish with swim bladder involved in hearing" are both 203 dB SEL_{cum}. Hence "v. fish with swim bladder" does not discriminate whether the swim bladder is	19. Acknowledged. No further action required.	19. Agreed. See Section 3.6.

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
iv. Mortality – fish with swim bladder involved in hearing v. Recoverable injury – fish with swim bladder c. The impact ranges of recoverable injury for fish with swim bladder involved in hearing is missing from the table. The table should be amended to include this receptor group or an explanation provided as to why it has been omitted. d. An assumed fleeing swimming speed of 1.5ms-1 has been used for fish as a receptor. Evidence in the form of scientific publications must be presented to support the fleeing swimming speed of 1.5ms-1 (this is discussed in more detail under section 7).	involved with hearing. 19 c. See b. 19 d. The reference is Hirata K (1999). Swimming speeds of some common fish. National Maritime Research Institute (Japan). Data sourced from Iwai T, Hisada M (1998). Fishes – Illustrated Book of Gakken (in Japanese). Knowing that there will be substantial variation between species, 1.5 m/s has been used as a 'generic' flee swim speed in most recent equivalent assessments (Triton Knoll being a recent example).		
Additional comments:			
1. Better signposting is needed in order to find	1. Innogy acknowledge that better signposting	Acknowledged. No further action required.	-

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
the correct documents and relevant sections for the assessment of fish receptors.	may have made the NMC application documents easier for the MMO to navigate. Innogy can confirm that the documents supporting the application are as set out in Table 1 in the main body of the SoCG.		

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
2. On page 14 of 'Sofia Offshore Wind Farm Non-Material Change Application', the report refers to Appendix B; 'A detailed environmental appraisal of the increased hammer energy including potential impacts on marine mammals and fish has been carried out by SOWFL and is included in Appendix B* to this report.' 3. On page 21 of this document, there is a page titled 'Appendix B* Environmental appraisal of increased hammer energy' but there is no text afterwards, it's a blank page.	In reference to points 2 and 3, on page 21 of Sofia Offshore Wind Farm Non-Material Change Application: Environmental report (Ecodoc Reference 002642083-03) the document referred to as Appendix B is Appendix B-Environmental appraisal of increased hammer energy (Ecodoc Reference 002636963-02). A blank page was provided to refer to Appendix B but keep all reports separate for submission.	Acknowledged. No further action required	-

MMO comment (14 August 2019; DCO/2014/00013)	Innogy Response	Points of discussion (teleconferences 11 October, 30 October and 7 November 2018)	Agreement of parties
4. Furthermore, on page 6 of 'Sofia Offshore Wind Farm, Appendix B: Auditory Injury Assessment: cumulative exposure to piling noise', the report states that 'A further supporting report (Technical Report**, Doc Ref; 002668403-01) considers the noise exposure implications for fish receptors.' 5. The assessment of fish receptors is in Appendix C (not Appendix B*) i.e. Appendix C: Environmental Appraisal of Increased Hammer Energy Addendum: Assessment of fish receptors (it is not titled as a Technical Report'**).	In reference to points 4 and 5, innogy acknowledges unhelpful referencing. The technical report referenced is Appendix C: Environmental Appraisal of Increased Hammer Energy Addendum: Assessment of fish receptors (Ecodoc Reference 002668403-01).	Acknowledged. No further action required	-