REPORT

Natura Impact Statement

Wicklow Export Cable Corridor Foreshore Licence Application

Client: Wicklow Sea Wind Limited

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Enhancing Society Together

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1 Introduction

This Natura Impact Statement (NIS) considers the European sites that have been screened in and determines if the proposed works for the Wicklow project (outlined in Schedule of Works (Royal HaskoningDHV, 2022a – document reference UB1019-RHD-ZZ-XX-RP-Z-0011)), either alone or in combination with other plans or projects, will cause an adverse effect on the integrity of the European sites.

2 Natura Impact Statement

In the case of the proposed survey work, a NIS is required if Likely Significant Effect (LSE) on any European Site cannot be excluded, on the basis of objective information (without the use of mitigation measures), for the proposed work, alone or in combination with other plans or projects.

2.1 Potential Effects on Marine Mammals

There is the potential to cause LSE for all screened in marine mammal species: harbour porpoise, bottlenose dolphin, grey seal and harbour seal. The following sections provide further information on the potential for effects for all the relevant species and respective Special Area of Conservation (SACs).

2.1.1 Potential for Underwater Noise Effects

As outlined in Section 8.4 of Supporting Information for Screening for Appropriate Assessment (SISAA) (Royal HaskoningDHV, 2022b - document reference UB1019-RHD-ZZ-XX-RP-Z-0009), underwater noise can cause both physiological (e.g. lethal, physical injury and auditory injury (Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS)) and behavioural (e.g. disturbance and masking of communication) impacts on marine mammals (e.g. Bailey *et al.,* 2010; Madsen *et al.,* 2006; Thomsen *et al.,* 2006, Thompson *et al.,* 2010). In order to determine the potential for underwater noise effects on marine mammal species, it is important to relate the potential noise of the activity to the known thresholds of effect for different marine mammal species, and to determine the range at which both injurious (e.g. PTS) and behavioural (e.g. disturbance) effects may occur in relation to the source location.

Underwater noise modelling has not been undertaken in order to determine what those potential effect ranges may be. A desk-based review of reported effect ranges for these activities has been undertaken to determine what the potential effect ranges may be (**Table 1**), and the worst-case and most relevant effect range will be taken forward for the assessment. The most recent marine mammal underwater noise effect thresholds are those from National Marine Fisheries Service (NMFS) (2018) and Southall *et al*. (2019), and therefore the effect ranges taken forward for assessment should utilise these thresholds (wherever possible) to ensure the most recent scientific advice and knowledge is taken into account.

TTS is the mildest form of hearing impairment that can occur during exposure to a loud sound. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in marine mammals recovers rapidly after the noise ends. For intermittent sounds, less threshold shift will occur than from a continuous exposure with the same energy (Wieting, 2019). Marine mammals in the cable Area of Search (AoS) are unlikely to incur TTS hearing impairment due to the characteristics of the sound sources, which include low source levels (215 to 226 dB re 1 µPa-m) and generally very short pulses and duration of the sound. Even for high-frequency cetacean species (e.g., harbour porpoises), which may have increased sensitivity to TTS, individuals would have to make a very close approach and remain very close to vessels operating these sources in order to receive multiple exposures at relatively high levels, as would be necessary to cause TTS (Wieting, 2019). Therefore, TTS has not been assessed further.

Table 1 summarises the results of the desk-based review, with the ranges to be taken forward, and reflects the equipment that will be used, as described in Schedule of Works (Royal HaskoningDHV, 2022a - document reference: UB1019-RHD-ZZ-XX-RP-Z-0011). For harbour porpoise, the potential PTS onset range is 23m and the potential disturbance range is 3.77km. This is based on modelling that was undertaken by BEIS (2020) for the Southern North Sea SAC Review of Consents for a sub bottom profiler using the NMFS (2018) thresholds for harbour porpoise. Wieting (2019) included a review of known PTS onset ranges for a geophysical survey (specifically sub bottom profiler) for all marine mammal species, also under the NMFS (2018) thresholds. This found that the PTS threshold was not breached for dolphin species; PTS onset has therefore not been assessed for dolphin species, as the threshold is not breached in any of the modelled ranges included in the review.

For the potential for disturbance for dolphin and seal species, no reported effect ranges were found through the desk-based review under the NMFS (2018) thresholds, and therefore a conservative approach has been taken. The disturbance effect range of 1.5km is used, as this is the largest reported disturbance range, other than for harbour porpoise, and has been used in other underwater noise assessments (e.g. Neart na Gaoithe Offshore Wind Farm (2019)).

Table 1 Desk-based review of reported geophysical effect ranges for marine mammals

Equipment	Species	Potential effect	Threshold (and source)	Reported range of effect (m)	Reference
Sub bottom profiler	Harbour porpoise	PTS onset	155 SEL_{cum} dB re 1 µPa (NMFS, 2018)	23m	BEIS (2020)
		Behavioural	140 SPL_{RMS} dB re 1 µPa unweighted (NMFS, 2018)	3.77km	
Sub bottom profiler (220 dB re 1 µPa @ 1m peak)	Harbour porpoise	PTS	Not reported	32m	Shell (2017) *cited in* Neart na Gaoithe Offshore Wind (2019)
	Bottlenose dolphin	PTS	Not reported	0m	
	Cetaceans	Disturbance	Not reported	1.5km	
Sub bottom profiler (215 SPL_{peak} dB)	Bottlenose dolphin	PTS	230 dBpeak / 185 dB SEL_{cum} (NMFS, 2018)	0m	Wieting (2019)
	Harbour porpoise	PTS	202 dBpeak / 155 dB SEL_{cum} (NMFS, 2018)	<3m	
	Pinnipeds	PTS	218 dBpeak / 185 dB SEL_{cum} (NMFS, 2018)	<3m	

The maximum predicted effect ranges for the risk of PTS onset or potential disturbance during the geophysical surveys at the cable AoS are presented in **Table 2**.

Table 2 Potential effect ranges and areas used in the Appropriate Assessment

Potential effect	Species	Maximum reported range of potential effect (m)	Maximum predicted area of potential effect (km^2)*
Risk of PTS onset	Harbour porpoise	23m	0.0017km^2
	Bottlenose dolphin	-	-
	Grey seal	<3m	0.00003km^2
	Harbour seal		

Potential effect	Species	Maximum reported range of potential effect (m)	Maximum predicted area of potential effect (km²)*
Disturbance	Harbour porpoise	3.77km	44.65km²
	Bottlenose dolphin	1.5km	7.07km²
	Grey seal		
	Harbour seal		

** based on the area of a circle, using the impact range as the radius*

2.1.2 Potential Effects of the Project Alone

2.1.2.1 Harbour Porpoise

Rockabill to Dalkey SAC

The Rockabill to Dalkey SAC is located 16.5km from the cable AoS, and as such is the closest designated SAC for harbour porpoise. It is not appropriate to use a SAC population estimate for assessment, as the harbour porpoise is wide ranging and it is not possible to determine whether there is any site fidelity of harbour porpoise, or what the potential number of harbour porpoise within the site may be at any one time. The following assessment therefore uses the wider Celtic and Irish (CIS) Sea Management Unit (MU) reference population of 62,517 harbour porpoise (Inter-Agency Marine Mammal Working Group (IAMMWG), 2021).

The potential effects on harbour porpoise from the Rockabill and Dalkey SAC have been assessed and put into the context of the harbour porpoise abundance estimate for the CIS MU. The density estimate of harbour porpoise of 1.046 individuals per km² (Rogan *et al.*, 2018) was used in order to determine the number of harbour porpoise potentially at risk of PTS onset or disturbance, based on the potential area of effect outlined in **Table 2.**

The assessment indicates that, without any mitigation, less than one individual may be at risk of PTS onset, (0.000003% or less of the CIS MU reference population), and up to 47 individuals (0.075% of the reference population) could be temporarily disturbed during geophysical surveys, based on the worst-case scenario (**Table 3**). Therefore, under these circumstances, there is **no potential adverse effect on the integrity of the Rockabill to Dalkey SAC in relation to the conservation objectives for harbour porpoise.**

In addition, as stated in the Schedule of Works (Royal HaskoningDHV, 2022a – document reference UB1019-RHD-ZZ-XX-RP-Z-0011), good practice measures will be in place, as per the *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014) guidance. These will include the establishment of a monitoring zone (with a range of 500m) around the survey vessel, with the aim of ensuring that there are no marine mammals present within the monitoring zone prior to the commencement of the acoustic equipment. This would greatly reduce the potential for harbour porpoise to be at risk of PTS onset.

Table 3 Estimated No. of Harbour Porpoise Potentially Effected during Geophysical Surveys at Rockabill to Dalkey SAC

Potential effect	Maximum reported range and area of potential effect	Maximum number of individuals	Percent of reference population	Potential for Adverse Effect
Risk of PTS onset	23m 0.0017km²	0.002 harbour porpoise	0.000003% of CIS MU	**No.** Permanent effect. Less than one individual and 0.000003% or less of the reference population could be at risk of PTS onset.

Potential effect	Maximum reported range and area of potential effect	Maximum number of individuals	Percent of reference population	Potential for Adverse Effect
Disturbance	3,770m 44.65km^2	46.7 harbour porpoise	0.075% of CIS MU	**No.** Temporary effect. 0.075% or less of the reference population could be temporarily disturbed.

Other Harbour Porpoise Designated SACs

There are a number of other designated SACs with harbour porpoise listed as a feature within the same CIS MU reference population as has been assessed for the Rockabill to Dalkey SAC. These are:

- North Anglesey Marine / Gogledd Môn Forol SAC;
- West Wales Marine / Gorllewin Cymru Forol SAC; and
- North Channel SAC.

Harbour porpoise are considered part of a wider population within the CIS MU, and the highly mobile nature of this species means that the concept of a 'site population' is not considered an appropriate basis for expressing Conservation Objectives for this species. Therefore, the reference population for assessments is the CIS MU population in which all SACs screened in for harbour porpoise are situated.

The potential effects of the geophysical surveys at the cable AoS have been assessed for the CIS MU reference population for harbour porpoise (62,517 individuals), as part of the assessment for the Rockabill to Dalkey SAC (see above). As the cable AoS is not located within the other harbour porpoise SACs (as listed above), there is no potential for direct underwater noise effects in relation to the area of the other SACs.

The assessment of the potential effects of the project alone for the Rockabill to Dalkey SAC (**Table 3**) in relation to the CIS MU are the same for the potential effects on the other harbour porpoise SACs as listed above (**Table 4**), as they are all located in the same CIS MU for harbour porpoise.

Therefore, there would be **no adverse effect on the integrity of the North Anglesey SAC, West Wales Marine SAC or North Channel SAC, in relation to the Conservation Objectives for harbour porpoise.**

Table 4 Assessment of Effects for Harbour Porpoise

Harbour porpoise designated SAC	Potential effect	Potential for Adverse Effect
North Anglesey Marine SAC	Risk of PTS onset	No. Permanent effect. Less than one individual and 0.000003% or less of the CIS MU reference population could be at risk of PTS onset.
	Disturbance	No. Temporary effect. 0.075% or less of the CIS MU reference population could be temporarily disturbed.
West Wales Marine / Gorllewin Cymru Forol SAC	Risk of PTS onset	No. Permanent effect. Less than one individual and 0.000003% or less of the CIS MU reference population could be at risk of PTS onset.

Harbour porpoise designated SAC	Potential effect	Potential for Adverse Effect
	Disturbance	No. Temporary effect. 0.075% or less of the CIS MU reference population could be temporarily disturbed.
North Channel SAC.	Risk of PTS onset	No. Permanent effect. Less than one individual and 0.000003% or less of the CIS MU reference population could be at risk of PTS onset.
	Disturbance	No. Temporary effect. 0.075% or less of the CIS MU reference population could be temporarily disturbed.

2.1.2.2 Bottlenose Dolphin

The Pen Llyn a'r Sarnau SAC

The Pen Llyn a'r Sarnau SAC is located 68km from the cable AoS, and as such is the closest designated SAC for bottlenose dolphin. As the bottlenose dolphin is wide ranging, the following assessment uses the wider IS MU reference population of 293 (IAMMWG, 2021), but also puts the potential effects into context of the bottlenose dolphin population within this SAC (of 330 individuals).

The potential effects on bottlenose dolphin within the Pen Llyn a'r Sarnau SAC have been assessed and put into the context of the bottlenose dolphin abundance estimate for the IS MU. Using the density estimate of bottlenose dolphin of 0.036 individuals per km^2 (Rogan *et al*., 2018), in order to determine the number of bottlenose dolphin potentially at risk of disturbance, based on the effects areas as outlined in **Table 2.**

The assessment indicates that, without any mitigation, less than one (0.25) individual (0.09% of the IS MU reference population or 0.08% of SAC count) could be temporarily disturbed during geophysical surveys, based on the worst-case scenario (**Table 5**). Therefore, under these circumstances, there is **no potential adverse effect on the integrity of the Pen Llyn a'r Sarnau SAC in relation to the conservation objectives for bottlenose dolphin.**

Table 5 Estimated No. of Bottlenose Dolphin Potentially Effected during Geophysical Surveys at Pen Llyn a'r Sarnau SAC

Potential effect	Reported range and area of effect	Maximum number of individuals	Percent of reference population	Potential for Adverse Effect
Disturbance	1.5km 7.07km^2	0.25 bottlenose dolphin	0.09% of IS MU (or 0.08% of the Pen Llyn a'r Sarnau SAC bottlenose dolphin population)	**No.** Temporary effect. 0.064% or less of the reference population could be temporarily disturbed.

Other Bottlenose Dolphin Designated SACs

There is one other designated SACs with bottlenose dolphin listed as a feature within the same IS MU reference population, as has been assessed for the Pen Llyn a'r Sarnau SAC. This is Cardigan Bay SAC.

The potential effects of the geophysical surveys at the cable AoS have been assessed for the IS MU reference population for bottlenose dolphin (293 individuals) which includes the Cardigan Bay SAC, as part of the

assessment for the Pen Llyn a'r Sarnau SAC (see above). As the cable AoS is not located within the other bottlenose dolphin SAC (as listed above), there is no potential for direct underwater noise effects in relation to the area of the other SAC.

The assessment of the potential effects of the project alone for the Pen Llyn a'r Sarnau SAC (**Table 5**) in relation to the IS MU are the same for the potential effects on the other bottlenose dolphin SAC as listed above (**Table 6**), as they are all located in the same IS MU for bottlenose dolphin. Therefore, there would be **no adverse effect on the integrity of the Cardigan Bay SAC in relation to the Conservation Objectives for bottlenose dolphin.**

Table 6 Assessment of effects for bottlenose dolphin

Bottlenose dolphin designated SAC	Potential effect	Potential for Adverse Effect
Cardigan Bay SAC	Disturbance	**No.** Temporary effect. Less than one individual and 0.09% or less of the IS MU reference population could be temporarily disturbed.

2.1.2.3 Grey Seal

Lambay Island SAC

The Lambay Island SAC is located 43km from the cable AoS, and as such is the closest designated SAC for grey seal. As the grey seal is wide ranging, the following assessment uses the Republic of Ireland (RoI) MU reference population of 7,284 (Ó Cadhla *et al*., 2013), but also puts the potential effects into context of the Lambay Island grey seal population estimate of 347 individuals.

The potential effects on grey seal within the Lambay Island SAC have been assessed and put into the context of the grey seal abundance estimate for the RoI MU. A density estimate of grey seal within the cable AoS of 0.041 individuals per km^2 (Carter *et al*., 2020) has been used to determine the number of grey seal potentially at risk of PTS onset or disturbance, based on the effects areas as outlined in **Table 2.**

The assessment indicates that, without any mitigation, less than one individual (0.000001) may be at risk of PTS onset, (0.00000002% or less of the RoI MU reference population or 0.0000006% of Lambay Island count), and less than one (0.29) individual (0.004% of the RoI MU reference population or 0.08% of Lambay Island count) could be temporarily disturbed during geophysical surveys, based on the worst-case scenario (**Table 7**). Therefore, under these circumstances, there is **no potential adverse effect on the integrity of the Lambay Island SAC in relation to the conservation objectives for grey seal.**

In addition, as stated in the Schedule of Works (Royal HaskoningDHV, 2022a – document reference PC1509-RHD-ZZ-XX-RP-Z-0012) good practice measures will be in place, as per the *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014) guidance. These will include the establishment of a monitoring zone (with a range of 500m) around the survey vessel, with the aim of ensuring that there are no marine mammals present within the monitoring zone prior to the commencement of the acoustic equipment. This would greatly reduce the potential for grey seal to be at risk of PTS onset, effectively negating the potential for risk of injury to grey seal.

Table 7 Estimated No. of Grey Seal Potentially Effected during Geophysical Surveys at Lambay Island SAC

Potential effect	Reported range and area of effect	Maximum number of individuals	Percent of reference population	Potential for Adverse Effect
Risk of PTS onset	<3m 0.00003km^2	0.000001 grey seal	0.00000002% of RoI MU (or 0.0000006% of the Lambay Islands SAC count)	**No.** Permanent effect. Less than one individual and 0.00000002% or less of the reference population could be at risk of PTS onset.
Disturbance	1,500m 7.07km^2	0.29 grey seal	0.004% (or 0.08% of the Lambay Islands SAC count)	**No.** Temporary effect. 0.004% or less of the reference population could be temporarily disturbed.

Other Grey Seal Designated SACs

There are a number of other designated SACs with grey seal listed as a feature within the Irish Sea. These are:

- Pen Llyn a'r Sarnau SAC;
- Saltee Islands SAC;
- Cardigan Bay SAC;
- Pembrokeshire Marine SAC; and
- The Maidens SAC.

Grey seal are considered part of a wider population beyond the SACs themselves and the highly mobile nature of this species means that the concept of a 'site population' is not considered an appropriate basis for expressing Conservation Objectives for this species. Therefore, the reference population for assessments is the RoI MU reference population for SACs in the RoI and the relevant MU reference populations for the SACs in Wales and Northern Ireland.

Therefore, the potential effects of the geophysical surveys at the cable AoS have been assessed for the RoI MU reference population grey seal (7,284 individuals) for the Saltee Islands SAC, the South and West England and Wales MU (6,000 individuals) for the Pen Llyn a'r Sarnau SAC, the Cardigan Bay SAC and Pembrokeshire Marine SAC in Wales and the Northern Ireland MU reference population (505) for The Maidens SAC in Northern Ireland, based on the assessment for the Lambay Island SAC (see above). As the cable AoS is not located within the other grey seal SACs (as listed above), there is no potential for direct underwater noise effects in relation to the area of the other SACs.

The assessment of the potential effects of the project alone for the Lambay Island SAC (**Table 7**) are the same for the potential effects on the other grey seal SACs as listed above (**Table 8**) and have been put into the context of the relevant MU reference population.

Therefore, there would be **no adverse effect on the integrity of the Pen Llyn a'r Sarnau SAC, the Saltee Islands SAC, the Cardigan Bay SAC, Pembrokeshire Marine SAC or for The Maidens SAC in relation to the Conservation Objectives for grey seal**.

In addition, the good practice measures would effectively negate the potential for any injury (PTS onset) in grey seal from all SACs.

Table 8 Assessment of effects for grey seal

Grey seal designated SAC	Potential effect	Potential for Adverse Effect
Pen Llyn a'r Sarnau SAC	Risk of PTS onset	**No.** Permanent effect. Less than one individual and 0.00000002% or less of the reference population (for the South and West England and Wales MU) could be at risk of PTS onset.
	Disturbance	**No.** Temporary effect. Less than one individual and 0.005% or less of the reference population for the (for the South and West England and Wales MU) could be temporarily disturbed.
Saltee Islands SAC	Risk of PTS onset	**No.** Permanent effect. Less than one individual and 0.00000002% or less of the reference population (for the RoI) could be at risk of PTS onset.
	Disturbance	**No.** Temporary effect. Less than one individual and 0.004% or less of the reference population (for the RoI) could be temporarily disturbed.
Cardigan Bay SAC	Risk of PTS onset	**No.** Permanent effect. Less than one individual and 0.00000002% or less of the reference population for the (for the South and West England and Wales MU) could be at risk of PTS onset.
	Disturbance	**No.** Temporary effect. Less than one individual and 0.005% or less of the reference population for the (for the South and West England and Wales MU) could be temporarily disturbed.
Pembrokeshire Marine SAC	Risk of PTS onset	**No.** Permanent effect. Less than one individual and 0.00000002% or less of the reference population (for the South and West England and Wales MU) could be at risk of PTS onset.
	Disturbance	**No.** Temporary effect. Less than one individual and 0.005% or less of the reference population for the (for the South and West England and Wales MU) could be temporarily disturbed.
The Maidens SAC.	Risk of PTS onset	**No.** Permanent effect. Less than one individual and 0.0000002% or less of the reference population (for the Northern Ireland MU) could be at risk of PTS onset.
	Disturbance	**No.** Temporary effect. Less than one individual and 0.06% or less of the reference population (for the Northern Ireland MU) could be temporarily disturbed.

2.1.2.4 Harbour Seal

Lambay Island SAC

The Lambay Island SAC is located 43km from the cable AoS, and as such is the closest designated SAC for harbour seal. As the harbour seal is wide ranging, the following assessment uses the wider RoI MU reference population of 4,007 (IAMMWG, 2015), but also puts the potential effects into context of the Lambay Island SAC harbour seal population estimate of 60 individuals (Morris & Duck, 2019).

The potential effects on harbour seal within the Lambay Island SAC have been assessed and put into the context of the harbour seal abundance estimate for the RoI MU. A density estimate of harbour seal within the cable AoS of 0.0006 individuals per km^2 (Carter *et al*., 2020) has been used to determine the number of harbour seal potentially at risk of PTS onset or disturbance, based on the effects areas as outlined in **Table 2**.

The assessment indicates that, without any mitigation, less than one individual may be at risk of PTS onset, (0.000000001% or less of the RoI MU reference population), and up to 0.004 individuals (0.00001% of the RoI MU reference population) could be temporarily disturbed during geophysical surveys, based on the worst-case scenario (**Table 9**). Therefore, under these circumstances, there is **no potential adverse effect on the integrity of the Lambay Island SAC in relation to the conservation objectives for harbour seal.**

In addition, as stated in the Schedule of Works (Royal HaskoningDHV, 2022a - UB1019-RHD-ZZ-XX-RP-Z-0011) good practice measures will be in place, as per the *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014) guidance. These will include the establishment of a monitoring zone (with a range of 500m) around the survey vessel, with the aim of ensuring that there are no marine mammals present within the monitoring zone prior to the commencement of the acoustic equipment. This would greatly reduce the potential for individuals to be at risk of PTS onset, effectively negating the potential for risk of injury to harbour seal.

Table 9 Estimated No. of Harbour Seal Potentially Effected during Geophysical Surveys at Lambay Island SAC

Potential effect	Reported range and area of effect	Maximum number of individuals	Percent of reference population	Potential for Adverse Effect
Risk of PTS onset	<3m 0.00003km^2	0.00000002 harbour seal	0.000000001% of RoI MU (or 0.00000005% of the Lambay Island SAC population)	**No**. Permanent effect. Less than one individual and 0.000000001% or less of the reference population could be at risk of PTS onset.
Disturbance	1,500m 7.07km^2	0.004 harbour seal	0.00001% of RoI MU (or 0.007% of the Lambay Island SAC population)	**No**. Temporary effect. 0.00001% or less of the reference population could be temporarily disturbed.

Other Harbour Seal Designated SACs

There are a number of other designated SACs with harbour seal listed as a feature within the Irish Sea. These are:

- Slaney River Valley SAC;
- Murlough SAC;
- Strangford Loch SAC; and

- The Maidens SAC.

Harbour seal are considered part of a wider population, and therefore, the reference population for the assessments are the RoI MU reference population for SACs screened in for further assessment in the RoI, and the Northern Ireland MU reference population for SACs screened in for further assessment in Northern Ireland.

The potential effects of the geophysical surveys at the cable AoS have been assessed for the RoI MU reference population for harbour seal (4,007 individuals) for the Slaney River Valley SAC, and as part of the Northern Ireland MU reference population (1,012) for the Murlough SAC, the Strangford Loch SAC, and The Maidens SAC, based on the assessment for the Lambay Island SAC (see above). As the cable AoS is not located within the other harbour seal SACs (as listed above), there is no potential for direct underwater noise effects in relation to the area of the other SACs.

The assessment of the potential effects of the project alone for the Lambay Island SAC (**Table 9**) are the same for the potential effects on the other harbour seal SACs as listed above (**Table 10**) and have been put into context of the relevant MU reference population.

The assessments indicate (**Table 10**) that there would be **no adverse effect on the integrity of the Slaney River Valley SAC, the Murlough SAC, the Strangford Lough SAC, or for the Maidens SAC, in relation to the Conservation Objectives for harbour seal**.

Table 10 Assessment of effects for harbour seal

Harbour seal designated SAC	Potential effect	Potential for Adverse Effect
Slaney River Valley SAC	Risk of PTS onset	**No.** Permanent effect. Less than one individual and 0.000000001% or less of the RoI MU reference population could be at risk of PTS onset.
	Disturbance	**No**. Temporary effect. Less than one individual and 0.00001% or less of the RoI MU reference population could be temporarily disturbed.
Murlough SAC	Risk of PTS onset	**No.** Permanent effect. Less than one individual and 0.00000002% or less of the Northern Ireland MU reference population could be at risk of PTS onset.
	Disturbance	**No.** Temporary effect. Less than one individual and 0.0004% or less of the Northern Ireland MU reference population could be temporarily disturbed.
Strangford Lough SAC	Risk of PTS onset	**No**. Permanent effect. Less than one individual and 0.00000002% or less of the Northern Ireland MU reference population could be at risk of PTS onset.
	Disturbance	**No.** Temporary effect.

Harbour seal designated SAC	Potential effect	Potential for Adverse Effect
		Less than one individual and 0.0004% or less of the Northern Ireland MU reference population could be temporarily disturbed.
Maidens SAC	Risk of PTS onset	**No.** Permanent effect. Less than one individual and 0.00000002% or less of the Northern Ireland MU reference population could be at risk of PTS onset.
	Disturbance	**No.** Temporary effect. Less than one individual and 0.0004% or less of the Northern Ireland MU reference population could be temporarily disturbed.

2.1.3 Potential Effects of the Project In-Combination

Plans and projects included in the in-combination assessment are described in Section 7 of SISAA (Royal HaskoningDHV, 2022b - document reference UB1019-RHD-ZZ-XX-RP-Z-0009). The following sections include an in-combination assessment for all screened in marine mammal species (and SACs).

2.1.3.1 In-Combination Assessment for Harbour Porpoise

Table 11 below presents the assessments of the potential for in-combination effects for the above listed in-combination projects with regard to all screened in harbour porpoise SACs. As concluded for each of the harbour porpoise SACs, the number of harbour porpoise potentially at risk of PTS and disturbance remains low, and there is therefore no potential for adverse effect on the integrity of any harbour porpoise SACs as a result of in-combination effects.

All in-combination projects are within the Celtic and Irish Seas MU for harbour porpoise and are therefore put into context for the Celtic and Irish Seas MU reference population.

Table 11 In-Combination Assessment for Harbour Porpoise Designated SACs

Designated SAC	In-combination project	Assessment for Project	Potential for Adverse Effect
Rockabill to Dalkey SAC	The proposed survey at Wicklow	Up to 0.002 harbour porpoise may be at risk of PTS onset (0.000003% of the CIS MU reference population), and up to 47 harbour porpoise may be disturbed (0.075% of the CIS MU reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
	Dublin Array[1]	The potential for disturbance from geophysical surveys to the harbour porpoise will be minimised due to use of mitigation and no impacts on the conservation objectives of the SAC are predicted.	Any disturbance from the geophysical survey and positioning equipment is likely to be localised, short term and reversible. Therefore, the project will not adversely affect the integrity of the site.

[1] *https://www.gov.ie/en/consultation/6e8ba-rwe-renewables-ireland-site-investigations-for-the-proposed-dublin-array-offshore-wind-farm/*

Designated SAC	In-combination project	Assessment for Project	Potential for Adverse Effect
	Leinster (representative of other SI works)	The same assessment has been undertaken for the Leinster project as for the proposed survey at Wicklow, with the same species densities, reference populations and effect ranges. Therefore, up to 0.002 harbour porpoise may be at risk of PTS onset (0.000003% of the CIS MU reference population) and up to 47 harbour porpoise may be disturbed (0.075% of the CIS MU reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
	Dublin Port[2]	The NIS for this project concluded that the underwater noise from dredging vessels will not be any greater than background shipping noise, and that therefore disturbance and displacement upon the harbour porpoise community within Rockabill to Dalkey Island SAC shall not occur.	The NIS stated that the project will not adversely affect the integrity of the site, and no reasonable scientific doubt remains as to the absence of such effects.
	Arklow Wind Park Phase 1 (dredging)[3]	Based on the assessment for Dublin Port (due to the Arklow harbour NIS being unavailable) underwater noise from dredging vessels will not be any greater than background shipping noise, and that therefore disturbance and displacement upon the harbour porpoise community within Rockabill to Dalkey Island SAC shall not occur.	Due to the activity and noise associated with dredging there is no potential adverse effect.
	All in-combination projects	Underwater noise effects may occur as a result of the two geophysical surveys for the cable AoS and for Leinster. Overall, 0.004 harbour porpoise may be at risk of PTS onset (or 0.000006% of the CIS MU reference population), and up to 117 individuals may be disturbed (or 0.18% of the CIS MU reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
North Anglesey Marine SAC	The proposed survey at Wicklow	As for Rockabill to Dalkey SAC.	As for Rockabill to Dalkey SAC.
	Dublin Array	SAC screened out of AA, only adjacent sites to the project have been assessed.	N/A
	Leinster (representative of other SI works)	As for Rockabill to Dalkey SAC.	As for Rockabill to Dalkey SAC.
	Dublin Port	Due to the low level of noise from dredging activities and limited impact range, the works at Dublin Port have not been considered unless SACs are adjacent to the project.	N/A
	Arklow Wind Park Phase 1 (dredging)	Due to the low level of noise from dredging activities and limited impact range, the works at Arklow harbour have not been considered unless SACs are adjacent to the project.	N/A
	All in combination	As for Rockabill to Dalkey SAC.	Due to the low number of individuals potentially affected, and the low

[2] *https://www.gov.ie/en/consultation/355de-dublin-port-maintenance-dredging/*
[3] *https://epawebapp.epa.ie/terminalfour/DaS/DaS-view.jsp?regno=S0027-01*

Designated SAC	In-combination project	Assessment for Project	Potential for Adverse Effect
	projects		percentage of the reference population, there is no potential for adverse effect.
West Wales Marine / Gorllewin Cymru Forol SAC	The proposed survey at Wicklow	As for Rockabill to Dalkey SAC.	As for Rockabill to Dalkey SAC.
	Dublin Array	SAC screened out of AA, only adjacent sites to the project have been assessed.	N/A
	Leinster (representative of other SI works)	As for Rockabill to Dalkey SAC.	As for Rockabill to Dalkey SAC.
	Dublin Port	Not considered (only adjacent SACs included in in-combination assessment).	N/A
	Arklow Wind Park Phase 1 (dredging)	Not considered (only adjacent SACs included in in-combination assessment).	N/A
	All in-combination projects	As for Rockabill to Dalkey SAC.	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
North Channel SAC	The proposed survey at Wicklow	As for Rockabill to Dalkey SAC.	As for Rockabill to Dalkey SAC.
	Dublin Array	SAC screened out of AA, only adjacent sites to the project have been assessed.	N/A
	Leinster (representative of other SI works)	As for Rockabill to Dalkey SAC.	As for Rockabill to Dalkey SAC.
	Dublin Port	Not considered (only adjacent SACs included in in-combination assessment).	N/A
	Arklow Wind Park Phase 1 (dredging)	Not considered (only adjacent SACs included in in-combination assessment).	N/A
	All in combination projects	As for Rockabill to Dalkey SAC.	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.

2.1.3.2 In-Combination Assessment for Bottlenose Dolphin

Table 12 below provides the assessments for the potential for in-combination effects for the above listed in-combination projects with regard to all screened in bottlenose dolphin SACs. As concluded for each of the bottlenose dolphin SACs, the number of bottlenose dolphin potentially at risk of PTS and disturbance remains low, and there is therefore no potential for adverse effect on integrity on any bottlenose dolphin SAC as a result of in-combination effects. All in-combination projects are within the Irish Seas MU for bottlenose dolphin and are therefore put into context for the Irish Seas MU reference population.

Table 12 In-Combination Assessment for Bottlenose Dolphin Designated SACs

Designated SAC	In-combination project	Assessment for Project	Potential for Adverse Effect
The Pen Llyn a'r Sarnau SAC	The proposed Survey at Wicklow	Up to 0.25 bottlenose dolphin may be disturbed (0.09% of the IS MU reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
	Dublin Array	SAC screened out of AA, only adjacent sites to the project have been assessed.	N/A

Designated SAC	In-combination project	Assessment for Project	Potential for Adverse Effect
	Leinster (representative of other SI works)	The same assessment has been undertaken for the Leinster project as for the proposed survey at Wicklow, with the same species densities, reference populations and effect ranges. Therefore, up to 0.25 bottlenose dolphin may be disturbed (0.09% of the IS MU reference population).	Due to the low number of individuals potentially effected, and the low percentage of the reference population, there is no potential for adverse effect.
	Dublin Port	Due to the low level of noise from dredging activities and limited impact range, the works at Dublin Port have not been considered unless SACs are adjacent to the project.	N/A
	Arklow Wind Park Phase 1 (dredging)	Due to the low level of noise from dredging activities and limited impact range, the works at Arklow harbour have not been considered unless SACs are adjacent to the project.	N/A
	All in combination projects	Underwater noise effects may occur as a result of the two geophysical surveys for the cable AoS and for Leinster. Overall, up to 3.5 individuals may be disturbed (or 1.2% of the IS MU reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
Cardigan Bay SAC	The proposed Survey at Wicklow	As for The Pen Llyn a'r Sarnau SAC.	As for The Pen Llyn a'r Sarnau SAC.
	Dublin Array	SAC screened out at AA, only adjacent sites to the project have been assessed.	N/A
	Leinster (representative of other SI works)	As for The Pen Llyn a'r Sarnau SAC.	As for The Pen Llyn a'r Sarnau SAC.
	Dublin Port	Not considered (only adjacent SACs included in in-combination assessment).	N/A
	Arklow Harbour	Not considered (only adjacent SACs included in in-combination assessment).	N/A
	All in combination projects	As for The Pen Llyn a'r Sarnau SAC.	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.

2.1.3.3 In-combination Assessment for Grey Seal

Table 13 below provides the assessments for the potential for in-combination effects for the above listed in-combination projects with regard to all screened in grey seal SACs. As concluded for each of the grey seal SACs, the number of grey seals potentially at risk of PTS and disturbance remains low, and there is therefore no potential for adverse effect on integrity on any grey seal SAC as a result of in-combination effects. All in-combination projects are within the RoI MU for grey seal and therefore only SACs in the RoI MU have been assessed and put into context for the RoI MU reference population.

Table 13 In-combination Assessment for Grey Seal Designated SACs

Designated SAC	In-combination project	Assessment for Project	Potential for Adverse Effect
Lambay Island SAC	The proposed survey at Wicklow	Up to 0.000001 grey seal may be at risk of PTS onset (0.00000002% of the RoI MU reference population) and up to 0.29 grey seal may be disturbed (0.004% of the RoI MU reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
	Dublin Array	The potential for disturbance from geophysical surveys to the harbour porpoise will be minimised due to use of mitigation and no impacts on the conservation objectives of the SAC are predicted.	Any disturbance from the geophysical survey and positioning equipment is likely to be localised, short term and reversible. Therefore, the project will not adversely affect the integrity of the site.
	Leinster (representative of other SI works)	The same assessment has been undertaken for the Leinster project as for the proposed survey at Wicklow, with the same species densities, reference populations and effect ranges. Therefore, up to 0.000001 grey seal may be at risk of PTS onset (0.00000002% of the RoI MU reference population) and up to 0.29 grey seal may be disturbed (0.004% of the RoI MU reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
	Dublin Port	The NIS for this project concluded that the underwater noise from dredging vessels will not be any greater than background shipping noise, and that therefore disturbance and displacement upon the grey seal community within Lambay Island SAC shall not occur.	The NIS stated that the project will not adversely affect the integrity of the site, and no reasonable scientific doubt remains as to the absence of such effects.
	Arklow Wind Park Phase 1 (dredging)	Based on the assessment for Dublin Port (due to the Arklow Harbour NIS being unavailable) underwater noise from dredging vessels will not be any greater than background shipping noise, and that therefore disturbance and displacement upon the grey seal community within Lambay Island SAC shall not occur.	Due to the activity and noise associated with dredging there is no potential adverse effect.
	All in combination projects	Underwater noise effects may occur as a result of the two geophysical surveys for the cable AoS, and for Leinster. Overall, 0.000002 grey seal may be at risk of PTS onset (or 0.00000004% of the RoI MU reference population), and up to 0.6 individuals may be disturbed (or 0.008% of the RoI MU reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
Saltee Islands SAC	The proposed survey at Wicklow	As for Lambay Island SAC.	As for Lambay Island SAC.
	Dublin Array	SAC screened out of AA, only adjacent sites to the project have been assessed.	N/A
	Leinster (representative of	As for Lambay Island SAC.	As for Lambay Island SAC.

Designated SAC	In-combination project	Assessment for Project	Potential for Adverse Effect
	other SI works)		
	Dublin Port	Not considered (only adjacent SACs included in in-combination assessment).	N/A
	Arklow Bank Wind Park Phase 1 (dredging)	Not considered (only adjacent SACs included in in-combination assessment).	N/A
	All in combination projects	As for Lambay Island SAC.	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.

2.1.3.4 In-combination Assessment for Harbour Seal

Table 14 below presents the assessments of the potential for in-combination effects for the above listed in-combination projects with regard to all screened in harbour seal SACs. As concluded for each of the harbour seal SACs, the number of harbour seal potentially at risk of PTS and disturbance remains low, and there is therefore no potential for adverse effect on integrity on any harbour seal SAC as a result of in-combination effects. All in-combination projects are within the RoI MU for harbour seal and therefore only SACs in the RoI MU have been assessed and put into context for the RoI MU reference population.

Table 14 In-combination Assessment for Harbour Seal Designated SACs

Designated SAC	In-combination project	Assessment for Project	Potential for Adverse Effect
Lambay Island SAC	The proposed survey at Wicklow	Up to 0.00000002 harbour seal may be at risk of PTS onset (0.000000001% of the reference population) and up to 0.004 harbour seal may be disturbed (0.00001% of the reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
	Dublin Array	The potential for disturbance from geophysical surveys to the harbour seal will be minimised due to use of mitigation and no impacts on the conservation objectives of the SAC are predicted	Any disturbance from the geophysical survey and positioning equipment is likely to be localised, short term and reversible. Therefore, the project will not adversely affect the integrity of the site.
	Leinster (representative of other SI works)	The same assessment has been undertaken for the Leinster project as for the proposed survey at Wicklow, with the same species densities, reference populations and effect ranges. Therefore, up to 0.00000002 harbour seal may be at risk of PTS onset (0.000000001% of the reference population) and up to 0.004 harbour seal may be disturbed (0.00001% of the reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.

Designated SAC	In-combination project	Assessment for Project	Potential for Adverse Effect
	Dublin Port	The NIS for this project concluded that the underwater noise from dredging vessels will not be any greater than background shipping noise, and that therefore disturbance and displacement upon the harbour seal community within Lambay Island SAC shall not occur.	The NIS stated that the project will not adversely affect the integrity of the site, and no reasonable scientific doubt remains as to the absence of such effects.
	Arklow Bank Wind Park Phase 1 (dredging)	Based on the assessment for Dublin Port (due to the Arklow Harbour NIS being unavailable) underwater noise from dredging vessels will not be any greater than background shipping noise, and that therefore disturbance and displacement upon the harbour seal community within Lambay Island SAC shall not occur.	Due to the activity and noise associated with dredging there is no potential adverse effect.
	All in combination projects	Underwater noise effects may occur as a result of the two geophysical surveys for the cable AoS, and for Leinster. Overall, 0.00000004 harbour seal may be at risk of PTS onset (or 0.000000002% of the reference population), and up to 0.01 individuals may be disturbed (or 0.0002% of the reference population).	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.
Slaney River Valley SAC	The proposed survey at Wicklow	As for Lambay Island SAC.	As for Lambay Island SAC.
	Dublin Array	SAC screened out of AA, only adjacent sites to the project have been assessed.	N/A
	Leinster (representative of other SI works)	As for Lambay Island SAC.	As for Lambay Island SAC.
	Dublin Port	Due to the low level of noise from dredging activities and limited impact range, the works at Dublin Port have not been considered unless SACs are adjacent to the project.	N/A
	Arklow Bank Wind Park Phase 1 (dredging)	Due to the low level of noise from dredging activities and limited impact range, the works at Arklow Harbour have not been considered unless SACs are adjacent to the project.	N/A
	All in-combination projects	As for Lambay Island SAC.	Due to the low number of individuals potentially affected, and the low percentage of the reference population, there is no potential for adverse effect.

2.2 Potential Effects on Birds of The Murrough SPA

2.2.1 The Murrough SPA

Description of Designation

The Murrough SPA is a coastal wetland complex, covering an area of approximately 960 hectares (ha), located along 13 km of coastline between Kilcoole station and Wicklow town. Within the SPA is a gradient of coastal habitats from marine water 200 m below the low water mark to freshwater wetlands up to 1 km inland. A key habitat separating the marine and non-marine wetlands is a shingle ridge (consisting of a shingle beach

and stony ridge) along the length of the site. Low sand hills occur at the north end, and a rich grassy sward is found in other areas, particularly the south end. A range of freshwater and brackish marsh habitats are noted to occur within the SPA, including sedge and reed fen, reed-marsh dominated by reeds and rushes, and areas of sedges, iris bed and wet grassland. There is a brackish, partly tidal lake with saltmarsh (Broad Lough) at the south end of the site. An estuarine channel enters the sea at The Breaches.

The site qualifies as a SPA under Article 4.1 of the Birds Directive by supporting more than 1% of the national breeding population of little tern (a species listed under Annex I of the EU Birds Directive), and by supporting internationally important numbers (>1% of biogeographic regional population) of light-bellied brent goose and nationally important (>1% of national population) numbers of red-throated diver (an Annex I species), greylag goose, wigeon, teal, black-headed gull and herring gull. The wetland of the SPA and its associated waterbirds are of special conservation interest and are designated as a qualifying feature (Wetland & Waterbirds).

Whilst not qualifying features, the site also sees regular occurrence of the following Annex I species: little egret, whooper swan, Greenland white-fronted goose, golden plover, Sandwich tern, short-eared owl and kingfisher.

Conservation objectives

The conservation objectives for all species features of The Murrough SPA are, "*to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA,"* where 'favourable conservation status' of a species is achieved under the following criteria (NPWS 2022):

- population dynamics data on the species indicates that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

2.2.2 Potential Effects of the Project Alone

2.2.2.1 Potential for Disturbance from Vessel Movements and Survey Activities

The proposed site investigation surveys that involve the presence of a vessel are: sub-bottom profiling, geotechnical site investigations, SSS and MBES. Surveys may be scheduled in any month or season of the year and will involve vessel movements (including some use of jack-up barges); surveying of currents and waves using instruments placed on surface or seabed-mounted buoys; mapping and surveying of seabed using sonar and magnetometer technology; vibrocore (up to 8 m), and core sampling of solid seabed; and grab sampling (typically 0.1m^2) of benthic macrofauna and sediment. A worst-case scenario of one vessel in operation for surveys is used for project-alone assessment.

SNCB guidance for similar activities in UK waters (Natural England 2022) suggests that medium to high-risk sources of potential direct impact to birds are:

- Disturbance/displacement/barrier effects by visual or noise disturbance to birds from survey activities (presence of vessels and other survey equipment); and
- Changes in suspension of sediments and other solid material (affecting water clarity).

Medium to high-risk sources of potential indirect impact to birds via prey and/or supporting habitats are suggested to be:

- Disturbance/displacement effects by visual, noise, vibration or other physical disturbance to prey species e.g. fish and invertebrates; and

- Changes in suspension of sediments and other solid material (affecting siltation rates and water clarity).

These impacts are predicted to similarly be the predominant routes to potential effects on SPA features in Irish waters and are the primary consideration in Appropriate Assessment.

2.2.2.2 Little Tern

Status

The biogeographic population of little tern (subspecies *albifrons*) was estimated at 19,000 to 25,000 birds (AEWA (Agreement on the Conservation of African-Eurasian Migratory Waterbirds) CSR7, 2018). Birds of Conservation Concern in Ireland 4: 2020-2026 (BoCCI4) (Gilbert *et al.* 2021) listed the species as Amber status in Ireland due to a localised breeding population (BL), defined as more than 50% of the Irish population being found at ten or fewer sites. BoCCI4 also noted the species' world population is concentrated outside of Europe. The global population was estimated at 173,000 adults (Mitchell *et al.* 2004, based on UK population estimate of 1,900 AONs constituting 2.2% of global population) and is reported to be decreasing (BirdLife International 2022).

The little tern has a plunge-diving foraging method, reaching depths of up to 80 cm (Cabot & Nisbet 2013, pp27). Among terns it is the most adherent to inshore waters (Green 2017). Their key prey during the breeding season is fish of approximately 8 cm length for adults, and smaller fish and marine invertebrates such as crustaceans for nestlings (Green 2017). Fish species of importance include, variously, clupeids such as herring or sprat, and sandeels. Key prey invertebrates include *Natantia* genus prawns (Green 2017).

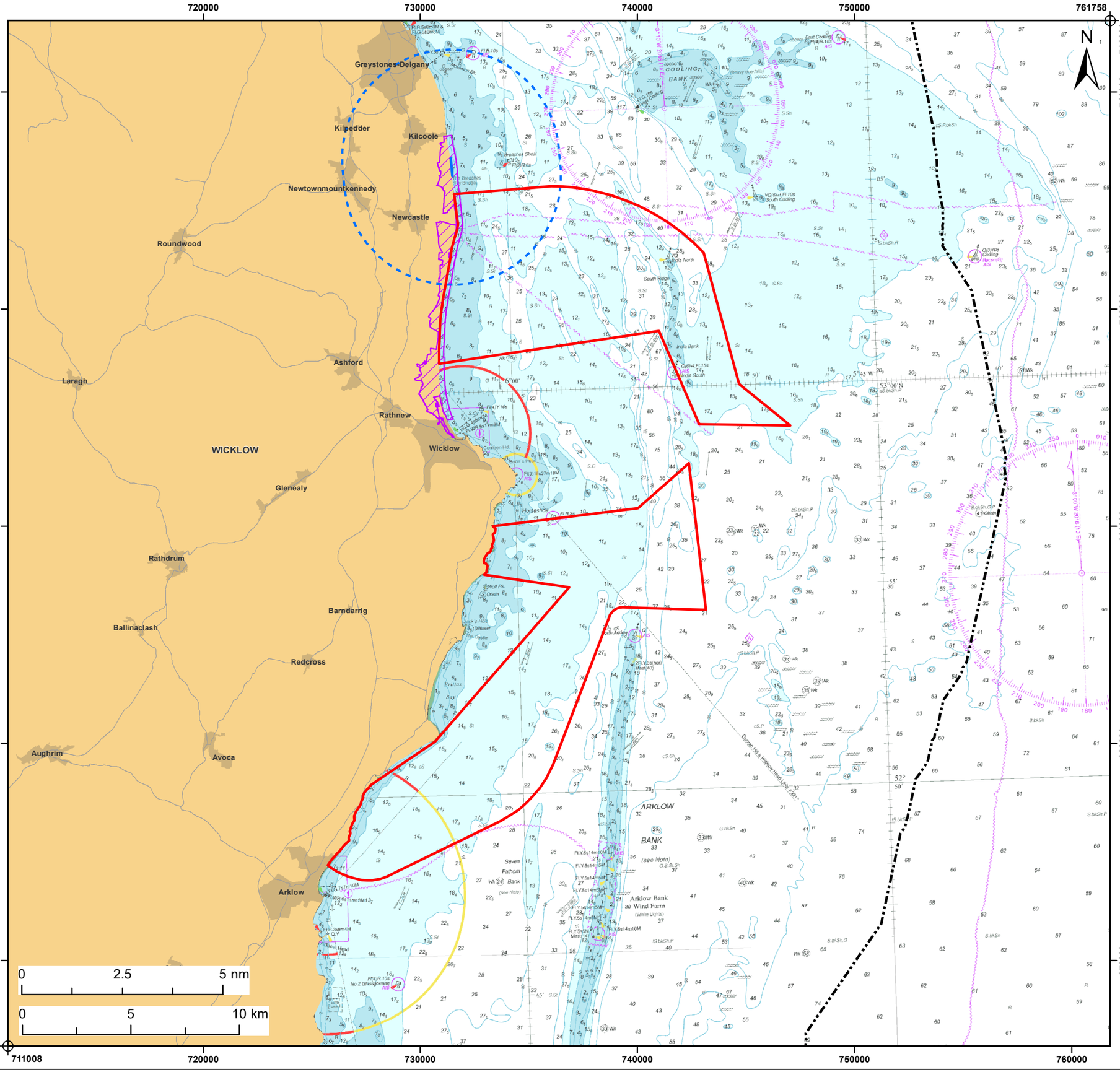
Little tern is a breeding qualifying interest of The Murrough SPA and an Annex I listed species under the EU Birds Directive. Within the boundary of The Murrough SPA, little tern breed adjacent to The Breaches along an approximate 1 km section of the shingle beach, approximately halfway between Kilcoole and Newcastle. In the SPA citation baseline year 1995, the breeding population was 36 pairs (72 breeding adults). Kilcoole Little Tern Conservation Project, co-ordinated by BirdWatch Ireland and NPWS, reports that the colony was 14 pairs (28 breeding adults) in 1985 and that in recent years the range in population size is commonly 50-80 breeding pairs (100-160 breeding adults) (Kilcoole Little Tern Conservation Project 2022). 106 pairs were recorded in 2006 (i.e., 212 breeding adults). The Murrough SPA is considered likely to be the most important site in Ireland for breeding little tern (NPWS 2015) and based on population estimates above the breeding colony in individual years achieves sufficient size to be considered of international importance (>1% of biogeographic regional population).

Functional linkage and seasonal apportionment of potential effects

The cable AoS as mapped overlaps with The Murrough SPA (if the northern landfall options in Area A are used, the southern options (in Area B) avoid the SPA). The survey area boundary as initially drafted extended to approximately 40 m from the location of the little tern colony adjacent to The Breaches. Following identification of the little tern colony location and the proximity of the colony to the initial cable AoS, the Area A boundary was amended to create a buffer of approximately 800 m between the little tern colony and the cable AoS.

The revised cable AoS as mapped extends to approximately 30 m below the high-water line and overlies approximately 8 km of the 13 km of coastline occupied by the SPA. The resulting overlap area is of marine intertidal and open water habitat totalling 180 ha or approximately 19% of the SPA's total area (**Figure 1**). If the maximum breeding season foraging range of little tern (5 km, Woodward *et al.* 2019) is applied to estimate the maximum semi-circular marine foraging area of the little tern breeding population of The Murrough SPA, the location and extent of this area and the survey area results in approximately 40% of the predicted little tern foraging area overlapping with the survey area. There is therefore functional linkage between the little tern

feature of The Murrough SPA and the cable AoS when foraging during the breeding season. Little tern are predicted to be present during their published breeding season in the biogeographic region (May to early August, Furness 2015), and absent during other months. All potential effects discussed relate to the breeding season with no impact considered to occur in other months.



Legend:

- Wicklow Cable Area of Search
- The Murrough Special Protection Area (SPA)
- Little Tern Colony
- Little Tern Colny 5km Buffer

Client:	Project:
Wicklow Sea Wind Limited	Wicklow Offshore Wind Farm

Title: Wicklow Cable Area of Search and the Predicted Foraging Area of Little Tern from the Colony Adjacent to The Breaches within The Murrough SPA, County Wicklow (Based on 5km Maximum Foraging Range across Tracking Studies, Woodward *et al*. 2019)

Figure: 1 | Drawing No: PC3392-RHD-ZZ-XX-DR-Z-0094

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	07/07/2022	[redacted]		A3	1:175,000

Co-ordinate system: IRENET95 Irish Transverse Mercator

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Potential effects on the qualifying feature

The little tern feature of The Murrough SPA has been screened into the Appropriate Assessment due to the potential risk of direct or indirect impacts of survey activities on little tern foraging during the breeding season, via reduced accessibility of prey. The assessment examines the impact of the project alone via changes to water quality (in particular via resuspension of sediment).

Changes to water quality

As visual foragers detecting prey from above the water (Cabot & Nisbet 2013), little tern foraging is sensitive to significant changes in water clarity, for example as a result of significantly increased suspended sediment or other fine solids. However, survey activities are not expected to cause sediment suspension to a more significant degree than natural processes, as determined in the SISAA (Royal Haskoning 2022b - document reference UB1019-RHD-ZZ-XX-RP-Z-0009) Section 8.3 assessment for migratory fish, therefore there is unlikely to be a water clarity impact on little tern foraging from proposed surveys. Potential for pollution from survey activities will be controlled through compliance with MARPOL, and no significant effect is considered possible via this route.

Summary

In summary, no pathway for significant adverse effect on little tern foraging from survey activities is predicted for the project alone. The survey activities will have no adverse effect on integrity of The Murrough SPA from potential effects upon the little tern breeding qualifying feature.

2.2.2.3 Red-throated Diver

Status

The biogeographic (European) population of red-throated diver was estimated at 42,100-93,000 pairs, which equates to 84,200-186,000 mature individuals (BirdLife International 2015). The global population was estimated at 200,000 to 600,000 individuals (Wetlands International 2015, via BirdLife International 2022) and is reported to be decreasing (BirdLife International 2022). Birds of Conservation Concern in Ireland 4: 2020-2026 (BoCCI4) (Gilbert et al. 2021) listed the species as Amber status in Ireland due to a ‘moderate’ non-breeding population decline of 39% over the approximate 20-year period 1994 to 2015/16. Crowe et al. (2011) reported a national peak count of 200 individuals within the Irish Wetland Bird Survey (I-WeBS) count year 2009/10. BoCCI4 also noted the species’ world population is concentrated outside of Europe.

The red-throated diver uses inshore waters of sheltered coasts for all non-breeding activities (foraging, roosting) while present in Irish and other sub-Arctic waters during migration and wintering periods. The species has a surface-diving pursuit foraging strategy and the marine diet is composed of fish, crustaceans, molluscs and annelid worms (Birdlife International 2022).

Red-throated diver is a wintering (i.e., non-breeding) qualifying interest of The Murrough SPA and an Annex I listed species under the EU Birds Directive. Within the boundary of The Murrough SPA, red-throated diver are likely to occupy subtidal marine waters. The Murrough SPA features a nationally important wintering population of red-throated diver, given as 32 individuals (mean of peak count for years 1995/6 to 1999/2000) at designation.

Functional linkage and seasonal apportionment of potential effects

The Murrough SPA that overlaps with the cable AoS is marine habitat that is likely to be the sole habitat of the SPA occupied by red-throated diver. The zone of influence (ZoI) of the survey area regarding divers and other sensitive diving birds is outlined in SISAA (Royal HaskoningDHV, 2022b - document reference UB1019-RHD-ZZ-XX-RP-Z-0009) to be 5 km. Applying this ZoI as a radius around the overlap area between the SPA and the survey area, the entire marine extent of The Murrough SPA lies within the ZoI, or approximately 100% of red-throated diver habitat of the SPA. There is therefore functional linkage between the red-throated diver feature of The Murrough SPA and the cable AoS during all activities undertaken by the birds (resting and foraging). Red-throated diver are predicted to be present in The Murrough SPA during their migration (September-November and February-April, Furness 2015) and winter periods (December-January, Furness 2015) and absent during all other months. All potential effects discussed relate to the migration and winter periods (September to April) with no impact considered to occur in other months.

The wintering population of red-throated diver in the Irish Sea or Celtic Sea is smaller than those within the North Sea BDMPS (biologically defined minimum population scale) and is formed from a small proportion (maximum 20% of a given source population) of the breeding populations of Greenland, Fennoscandia and the UK (based on Furness 2015 Table 4 'NW England and Wales' and Table 5 'SW England and Channel'). The passage migration population is larger and includes large proportions (up to 95%) of some western UK breeding populations (including some SPA populations) (Furness 2015 Table 7 'UK Western Waters plus Channel'). Among the total population of a non-breeding red-throated diver SPA in these waters such as The Murrough SPA, a maximum of 5% of individuals are predicted to be adults from breeding SPAs elsewhere (Furness 2015 Table 7, total SPA adults as a proportion of total BDMPS). Since in the case of The Murrough SPA this equates to two individuals linked to breeding SPAs (5% of 32), no effect on other SPAs is therefore predicted should an effect be identified on The Murrough SPA itself.

Potential effect on the qualifying feature

The red-throated diver feature of The Murrough SPA has been screened into the Appropriate Assessment due to the potential risk of direct or indirect impacts of survey activities on diver foraging during the winter season, via disturbance and displacement of birds, or reduced accessibility of prey. The assessment examines the impact of the project alone via underwater noise disturbance, above water noise and visual disturbance, and changes to water quality (in particular via resuspension of sediment).

Underwater noise disturbance

Noise associated with survey activities entails vessel noise (typical profile 50-200 Hertz (Hz), 170 dB, Shoreline Ltd 2022) and also acoustic survey instruments as outlined in the Schedule of Works (Royal HaskoningDHV 2022a):

- MBES – 200 and 400 kilohertz (kHz), 210 dB at source;
- Sub-bottom profiling – 0.2, 5 and 20 kHz, amplitude 222 dB at source; and
- Side scan sonar - >600 kHz, 215-226 dB at source.

Red-throated diver and other seabirds which feed within the water column were suggested to experience 'moderate' effects of underwater noise (Wilson et al. 2006) because birds with this foraging strategy spend prolonged periods with their heads (therefore auditory systems) underwater, and furthermore some diving bird species may rely on hearing when foraging underwater (Hansen *et al.* 2017, Zeyl *et al.* 2022). In experimental studies by Crowell *et al.* (2015), red-throated diver showed a neurological response to sound at a higher threshold (i.e. were less sensitive) than diving ducks. All examined diving species showed greatest sensitivity in the range 1000 to 3000 Hz (Crowell *et al.* 2015). Red-throated diver had a threshold sound level pressure of

65-85 dB in air in the frequency range 500 to 6000 Hz. Assuming this level of auditory sensitivity applies during dives, this data suggests that red-throated diver are vulnerable to hearing injury if underwater in sufficiently close proximity to the 5 kHz sound from sub-bottom profiling instruments, which are 222 dB at source. However, the likelihood of any red-throated diver being in sufficient proximity to experience injury is considered to be low due to the tendency for vessels themselves to have a (temporary and reversible) displacement effect on red-throated diver (see below). Due to the brief use of sub-bottom profiling within the survey programme which limits the exposure time for red-throated diver, and the likelihood that red-throated diver will be out of range of injurious underwater noise levels as a result of displacement, an underwater noise effect on red-throated diver is not considered to be likely.

Above water noise and visual disturbance

Red-throated diver are scored as highly vulnerable to disturbance and displacement from marine shipping (Fliessbach *et al.* 2019) which is likely to occur largely as a response to above-water noise and visual stimuli caused by vessels. A boat-based study of disturbance responses by divers in Inner Galway Bay (Gittings *et al*. 2015) recorded flush disturbance of two red-throated divers at, respectively, 15 m and 100 m from the survey boat (which was 15 m in length and 5 m wide travelling at maximum 10 knots which resembles the scale of the survey vessel). Topping and Petersen (2011) report flush responses at 1 km from ship-based surveys. Mendel *et al*. (2019) report that distribution of divers at a larger scale indicated avoidance of shipping lanes up to 5 km away. There is therefore strong evidence for displacement effects of vessel movements on red-throated diver. However, while the overlap of the cable AoS with the marine waters of The Murrough SPA plus a precautionary 5 km ZoI is approximately 100% of the marine waters, the individual survey vessel itself is only capable of exerting an effect over a small proportion of this area when present within it, and furthermore any displacement effects of the survey vessel's presence and movement will be temporary and reversible. There is also capacity for vessel operators and crew to employ best practice in line with issued ecological guidance regarding red-throated diver, to actively avoid or reduce probability of displacement of birds from surveys of the area in months when the species is likely to be present. Most immediately this would include re-routing of vessel movements at the meso scale (100 m to 1 km) to provide a wide berth to red-throated divers located on the water. On the basis that surveys within marine waters of The Murrough SPA will be infrequent, temporary and localised relative to the total cable AoS and the survey programme, and any displacement effects will be temporary and reversible, it is considered that there is no potential for survey activities of the project alone to cause significant effects through above-water noise or visual disturbance of red-throated diver.

Changes to water quality

As pursuit diving foragers in the water column, red-throated diver foraging is likely to be sensitive to significant changes in water clarity, for example as a result of significantly increased suspended sediment or other fine solids. However, survey activities are not expected to cause sediment suspension to a more significant degree than natural processes, as determined in the SISAA (Royal Haskoning 2022b) Section 8.3 assessment for migratory fish, therefore there is unlikely to be a water clarity impact on red-throated diver foraging from proposed surveys. Potential for pollution from survey activities will be controlled through compliance with MARPOL, and no significant effect is considered possible via this route.

Summary

In summary, no pathway for significant effect on red-throated diver from survey activities is suggested for the project alone. The survey activities will have no adverse effect on the integrity of The Murrough SPA from potential effects upon the red-throated diver qualifying feature.

2.2.3 Potential Effects of the Project In-combination

Plans and projects included in the in-combination assessment are described in Section 7 of SISAA (Royal HaskoningDHV 2022b - document reference UB1019-RHD-ZZ-XX-RP-Z-0009). The following sections include an in-combination assessment for all screened in bird species.

2.2.3.1 In-Combination Assessment for Little Tern of The Murrough SPA

Table 15 below presents the assessments of the potential for in-combination effects for the above listed in-combination projects with regard to little tern. The risk of impacts on nesting or foraging remains low, and there is therefore no potential for adverse effect on the integrity of The Murrough SPA as a result of in-combination effects.

Table 15 In-combination Assessment for Little Tern of the Murrough SPA

Designated SPA	In-combination project	Assessment for Project	Potential for Adverse Effect
The Murrough SPA	The proposed survey at Wicklow	The cable AoS as amended is at nearest distance 800 m from the little tern colony, therefore no route to direct effects on terns while nesting is considered to exist. There is also no potential for significant effects on foraging terns.	Any effects on prey are likely to be localised, temporary and reversible within a small proportion of the terns' available foraging area, and no other route to impact is considered likely for foraging or nesting terns. Conservation objectives are not impeded or compromised by the project activities. There is no potential for adverse effect.
	Dublin Array	The Murrough SPA was screened out for Appropriate Assessment. At 8 km from the SPA, no route to impact was considered to exist between the project activities, e.g., vessel movements, and little tern of The Murrough SPA as vessel movements from Port of Wicklow would follow typical shipping routes of this port and no works would be carried out within the little tern foraging range.	Due to distance of the works from the SPA and the survey vessel movements not introducing any novel vessel traffic levels or routes close to the SPA, there is no potential for adverse effect
	Leinster (representative of other SI works)	The Murrough SPA was screened out for Appropriate Assessment. At 15 km from the SPA, no route to impact was considered to exist between the project activities, e.g., vessel movements, and little tern of The Murrough SPA as vessel movements (if originating from Port of Wicklow) would follow typical shipping routes of that port and no works would be carried out within the little tern foraging range.	Due to distance of the works from the SPA and the survey vessel movements not introducing any novel vessel traffic levels or routes close to the SPA, there is no potential for adverse effect.
	Dublin Port	At 25 km or more from the SPA, no route to impact was considered to exist between the project activities, e.g., vessel movements, and little tern of The Murrough SPA as vessel movements would originate from Port of Dublin and would follow typical shipping routes of that port and no works would be carried out within the little tern foraging range.	Due to distance of the works from the SPA and the survey vessel movements not introducing any novel vessel traffic levels or routes close to the SPA, there is no potential for adverse effect.

Designated SPA	In-combination project	Assessment for Project	Potential for Adverse Effect
	Arklow Wind Park Phase 1 (dredging)	The Murrough SPA and its qualifying features were not considered in Assessment for this project due to the distance of the SPA from all activities exceeding the 20 km search range for potentially affected designated sites.	Due to the predicted nearest distance of little terns from activity and noise associated with dredging exceeding 15 km (20 km – 5 km foraging range), there is no potential adverse effect.
	All in combination projects	Overall, there is potential for one vessel (from the Wicklow project) to be present within 5 km of the little tern colony (the predicted foraging area). In-combination, the footprint of the survey vessel when stationary and moving, and survey instrument noise, is insufficient to impact on foraging little tern via visual or noise disturbance, or displacement of their prey. The Wicklow project vessel is expected to enter within 1 km of the nesting colony and there is no potential for an in-combination effect of disturbance at the colony.	Due to the localised, temporary nature of surveys and the low number of vessels, plus the absence of a potential in-combination effect in proximity to the colony itself, there is no potential for an adverse effect in-combination with other projects.

2.2.3.2 In-combination Assessment for Red-throated Diver of The Murrough SPA

Table 16 below presents the assessments of the potential for in-combination effects for the above listed in-combination projects with regard to red-throated diver. The risk of impacts on foraging or resting birds remains low, and there is therefore no potential for adverse effect on integrity of The Murrough SPA as a result of in-combination effects.

Table 16 In-combination Assessment for Red-thraoted Diver of the Murrough SPA

Designated SPA	In-combination project	Assessment for Project	Potential for Adverse Effect
The Murrough SPA	The proposed survey at Wicklow	Any instances of direct disturbance and displacement of red-throated diver through above water noise or visual imposition from the survey vessel will be temporary and reversible. Survey activities are considered unlikely to cause underwater noise, reduced water clarity or reduced availability of prey and affect red-throated diver by these routes.	Any displacement effects will be localised, temporary and reversible. Conservation objectives are not impeded or compromised by the project activities. There is no potential for adverse effect.
	Dublin Array	The Murrough SPA was screened out for Appropriate Assessment. At 8 km from the SPA, no route to impact was considered to exist between the project activities, e.g., vessel movements, and red-throated diver of The Murrough SPA as vessel movements from Port of Wicklow would follow typical shipping routes of this port and no works would be carried out within 5 km of the red-throated diver marine habitat of the SPA.	Due to distance of the works from the SPA and the survey vessel movements not introducing any novel vessel traffic levels or routes close to the SPA, there is no potential for adverse effect
	Leinster	The Murrough SPA was screened out	Due to distance of the works from

Designated SPA	In-combination project	Assessment for Project	Potential for Adverse Effect
	(representative of other SI works)	for Appropriate Assessment. At 15 km from the SPA, no route to impact was considered to exist between the project activities, e.g., vessel movements, and red-throated diver of The Murrough SPA as vessel movements (if originating from Port of Wicklow) would follow typical shipping routes of that port and no works would be carried out within 5 km of the red-throated diver marine habitat of the SPA.	the SPA and the survey vessel movements not introducing any novel vessel traffic levels or routes close to the SPA, there is no potential for adverse effect.
	Dublin Port	At 25 km or more from the SPA, no route to impact was considered to exist between the project activities, e.g., vessel movements, and red-throated diver of The Murrough SPA as vessel movements would originate from Port of Dublin and would follow typical shipping routes of that port and no works would be carried out within 5km of the red-throated diver marine habitat of the SPA.	Due to distance of the works from the SPA and the survey vessel movements not introducing any novel vessel traffic levels or routes close to the SPA, there is no potential for adverse effect.
	Arklow Wind Park Phase 1 (dredging)	The Murrough SPA and its qualifying features were not considered in Assessment for this project due to the distance of the SPA from all activities exceeding the 20 km search range for potentially affected designated sites.	Due to the predicted nearest distance of red-throated diver from activity and noise associated with dredging exceeding 20 km, there is no potential adverse effect.
	All in combination projects	Overall, there is potential for only project alone vessels to undertake works within 2 km of the coastline of The Murrough SPA between September and March. In-combination effects will be limited in this period to Wicklow project surveys 2 or more kilometres from the coastline (i.e., outside the SPA). In April the survey vessel could potentially be present in the marine habitat of the SPA. The footprint of one survey vessel present temporarily in the SPA marine waters will cause only temporary and reversible displacement effects, and will not cause underwater noise or prey displacement effects sufficient to affect red-throated diver foraging.	Due to the localised, temporary nature of surveys and the low number of vessels, there is no potential for an adverse effect in-combination with other projects.

3 Conclusion

This NIS has considered the potential for adverse effects of the proposed site investigation surveys on the features of interest and conservation objectives of the European sites with a pathway of effect to the proposed Wicklow project.

The NIS objectively concludes that no adverse effects are expected on the features of interest or conservation objectives of any European site and the integrity of the sites will not be adversely affected.

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