Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

The Applicant's comments on Perenco UK Limited's Deadline 4 Submission

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1 The Applicant's comments on Perenco UK Limited Deadline 4 Submission

1. This document presents the Applicant's response to Perenco's Deadline 4 submissions [REP4-050 and REP4-051].

Table 1 The Applicant's response to Perenco's comments on the Technical Note on the impacts of accessing the Waveney Installation

<table>
<tr><th>ID</th><th>Stakeholder Comment</th><th>Applicant Response</th></tr>
<tr><td>1</td><td>This technical note provides an overview of predicted impacts on accessing the Waveney Installation (by helicopter) when the wind turbine generator bases are within 1.34nm (assuming rotors of 300m diameter).</td><td>The Applicant and Perenco have agreed to refer to distances to blade tip as this value is independent of turbine size. The distance here for 1.34nm (assuming 300m rotor diameter) corresponds to a 1.26nm separation from the turbine blade tips.</td></tr>
<tr><td colspan="3">1 Data</td></tr>
<tr><td>2</td><td>Two datasets have been used:
A: Data at hourly intervals for the Waveney platform from 1/1/2021 to 31/12/2022
B: Data at 10-minute intervals for the Waveney platform from 16/7/2019 to 31/12/2020
Dataset A contains more parameters allowing a fuller analysis and has better data quality.
The following parameters have been used in the analysis:
<table><tr><th>Parameter</th><th>Units</th><th>Tag in Source Data</th></tr><tr><td>Wind Direction</td><td>Degrees</td><td>WindDir_deg_10min</td></tr><tr><td>Visibility</td><td>m</td><td>Visibility_m</td></tr><tr><td>Wind Speed</td><td>Knots</td><td>WindSpeed_kts_2min</td></tr><tr><td>Air Temperature</td><td>Degrees Celsius</td><td>AirTemp_degC_2min_Mean</td></tr><tr><td>Cloud-base</td><td>Feet</td><td>Cloud_Height1_ft</td></tr><tr><td>Significant Wave Height
Dataset A only</td><td>m</td><td>WaveRadar_Hs_4RMS_m_30min</td></tr><tr><td>Dew Point</td><td>Degrees Celsius</td><td>DewPoint_degC_2min</td></tr></table>
Data points falling outside the period of normal helicopter operations at Waveney: 06:30 – 21:30, were excluded from the analysis.
For each data point it was determined whether or not it was within daylight hours (from 30 mins before sunrise to 30 mins after sunrise) by reference to the times of sunrise and sunset at Norwich as found at [REDACTED].</td><td>Both datasets were provided by Perenco from the West Sole Alpha Platform.
Aviation data is usually recorded offshore automatically on a 10-minute frequency, as per the second dataset (dataset B) listed by Perenco.
The data from 1/1/2021 to 31/12/2022 (dataset A) lacked key aviation data, such as air pressure, that is helpful in determining the parameters to be applied when calculating figures such as the take-off distance required. Also, being recorded on an hourly basis, the dataset lacked granularity on the combination of daylight commencement and concurrent met data. However, dataset A did provide comprehensive wave data that was lacking in dataset B.
It is not agreed that Dataset A (1/1/2021 to 31/12/2022) contained better quality data as a key aviation parameter (air pressure) was missing.</td></tr>
</table>

ID	Stakeholder Comment	Applicant Response
2 Flying Conditions		
3	For any flights to be possible, the wind speed must be no more than 60 knots and the significant wave height no more than 6m. In addition, for operations under instrument flight rules (IFR), the visibility must be at least 1.5km and the cloud base at least 300' in daylight or 400' at other times. Flying is only possible when aircraft will not suffer icing. Icing can be expected to occur under clear air conditions (when visibility is at least 1km) and the temperature measured at the platform is less than 1.5oC for low level flying or 4oC when flying at the minimum safe altitude (MSA) over the array.	The AW139 helicopters used on the Southern North Sea are not normally equipped and certified for flight in icing conditions. The Perenco definition of icing conditions is not correct. Except for specific conditions like freezing rain, in-flight icing occurs in cloud with a visibility of less than 1,000m, the ambient temperature of zero degrees Celsius or lower and visible moisture present. Using Perenco's incorrect assumption of icing conditions would not have captured true icing events. The Applicant has assumed a Lapse Rate of 2ºC per 1,000ft. After discussion with helicopter operators (workshop with 4 helicopter operators for Hornsea Project Three), it is assumed that a transit at 500ft VMC by day and 1,000ft VMC at night would be the minimum acceptable transit altitudes. Any icing occurring below those altitudes would prevent flying. If Perenco's new operator wishes to use higher transit altitudes then the percentage of no flying conditions will increase and the percentage of usable IMC decrease.
4	Flying under visual flight rules (VFR) requires the visibility to be at least 4km in daylight or 5km at other times and the cloud base to be at least 600' in daylight or 1200' at other times	Reference should be to Visual and Instrument Meteorological Conditions (VMC and IMC). Reference to the IFR and VFR is not helpful, as for example IFR can be flown in VMC.
5	Under rules agreed between the helicopter operators and the Civil Aviation Authority (CAA) which are soon to be implemented, any flights to/from a facility located within 3nm of any wind turbine generator will be limited to daylight and when visibility is at least 5km and the cloudbase is at least 700'	The proposal is currently a draft that will be issued for consultation. The implementation of the Rule Change will probably take several years due to a backlog in work, post Brexit. However, the Applicant has taken account of this potential change which in fact makes minimal difference to Day VMC access. At Deadline 4 the Applicant submitted the Waveney Helicopter Access Supplementary Analysis [REP4-039]. This identified the following change to the Day VMC access if the CAA proposals are implemented:

<table>
<tr><th>ID</th><th>Stakeholder Comment</th><th>Applicant Response</th></tr>
<tr><td></td><td></td><td>
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<tr><th>Condition</th><th>2020
Dataset 1</th><th>2021
Dataset 2</th><th>2022
Dataset 2</th></tr>
<tr><td>Current Day VMC
Cloud base >=600ft AND Visibility >=4000m</td><td>93.2%</td><td>94.5%</td><td>95.4%</td></tr>
<tr><td>Draft Day VMC Limitations
Cloud base >=700ft AND Visibility >=5000m</td><td>90.8%</td><td>93.3%</td><td>94.7%</td></tr>
<tr><td>Loss of DAY VMC</td><td>2.4%</td><td>1.2%</td><td>0.7%</td></tr>
</table>
The impact on the periods of Day VMC access will be small.

The annual average Day VMC access is very similar to Perenco’s average shown in Figure 3 column 2. Although Perenco has not considered 2020 and merged 2021 and 2022 into a single column.
</td></tr>
<tr><td colspan="3">3 Logistical Constraints</td></tr>
<tr><td>6</td><td>Before a flight departs, weather forecasts will be used to verify whether conditions will permit the flight to land at its destination. If the forecast weather window unfavourable or is too short, the flight would not depart. For the purposes of these calculations, it has been assumed that a minimum weather window of 2 hours would be required for a flight to be scheduled.</td><td>In general, flights to Normally Unmanned Installations (NUIs) are conducted in good weather to lessen the probability of staff being stranded overnight on a platform with minimal domestic facilities.

Weather forecasting is not exact and so assuming that the recorded met data is a replication of the forecast is extremely optimistic. The Applicant has used Vantage flight and passenger data, provided by Perenco, to determine when a historic flight would have been restricted. This methodology shows the true impact of DEP on access to the Waveney Platform, which Perenco has not rebutted.

The actual met and Vantage data shows that operating under Day VMC would have minimal impact on access to the Waveney Platform, even when applying the proposed CAA increased cloud and visibility limits.</td></tr>
<tr><td>7</td><td>Helicopters operating out of Norwich airport support operations at many installations. Should weather conditions prevent a flight from being</td><td>The Applicant’s analysis of historical flight data specifically addresses this point based on actual flight data. This is described in Appendix A of</td></tr>
</table>

ID	Stakeholder Comment	Applicant Response
	operated, there is limited opportunity to reschedule the flight later in the day. This effect has not been explicitly modelled but the analysis shows the proportion of times within the day when conditions would permit one or two flights as appropriate. The denominator where one flight is required (flights to a non-producing installation (NPI) such as a rig at Waveney or rotors turning flights for a system reset) is the total number of times within the day that meet the conditions of being within the normal operating hours and (in the case of flights to the Waveney platform) are also daylight. Where 2 flights are required to the Waveney platform within the day, the denominator is reduced to only include those times where both flights would fall within normal operating hours and daylight.	**Environmental Statement Appendix 16.2 - Helicopter Access Study** [APP-205].
8	The Waveney platform is a normally unatended installation (NUI) which provides no accommodation except in an emergency. The helideck is rated for daylight use only. For a crew to carry out work on the platform, either: - two flights are required on the same day within the hours of daylight and with sufficient time between them to allow work to be undertaken; or - a helicopter must remain on the platform with rotors turning whilst work is undertaken. The former is the most common but, where a system reset is required which can be undertaken within around 20 minutes, the later may occur. For the purposes of this analysis, it has been assumed that rotors turning visits account for 10% of all platform visits. Where two flights are required within the day, they need to be separated by at least 5-8 hours. For the purposes of this analysis a minimum separation of 5 hours is assumed.	The Applicant's analysis of historical flight data specifically addresses this point based on historical flight data. In practice a third situation would be possible where the second flight is brought forward and working time is limited. This is described in Appendix A of **Environmental Statement Appendix 16.2 - Helicopter Access Study** [APP-205] and is repeated below: *In 2020, flight operations on two days would have been restricted.* *• 27/10/20 there were two flights, the first landing at 08:08 to drop personnel and a second at 15:34 to extract personnel. The conditions turned from VMC to IMC at 13:50, so the second flight would have to be brought forward, limiting the working time on the platform.* *• 29/10/20 there were also two flights. The flight landed under VMC at 07:58 and a second flight occurred at 15:22. The conditions turned from VMC to IMC at 14:50, so the second flight would have to be brought forward, limiting the working time on the platform.* *In 2021, there was one occasion on the 23/2/2021 where a flight landed at 09:24 under IMC conditions. However, until 08:40 the conditions were below IMC limits and so an approach would not have been successful anyway. The conditions improved to VMC at 09:40 and so the landing would only have been delayed by 16 minutes.*

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		In summary, there were two flights out of 72 in 2020 where the DEP would have restricted operations, requiring early extraction of personnel. In 2021, there was one flight where a slight delay would have been required.
9	When an NPI such as a rig is stationed at Waveney, as required for a well workover or when the wells are being plugged and abandoned, the NPI will have a helideck rated for day and night use. The NPI also has accommodation. Although typically, NPI operations are serviced by 2 flights per day, these flights would not be dependent on one another. For the purposes of this analysis, as long as one flight can be made during the day, no impairment to operations is assumed.	For an NPI two flights a day, changing over 24 staff per day, seems excessive. Could Perenco supply flight record data from similar operations to support this assertion?
4 Scenarios		
10	4.1 Current status (baseline) The baseline for this analysis is the current status. Currently, flights can operate under instrument flight rules (IFR) to the Waveney NUI in daylight and to an NPI stationed at the Waveney platform in daylight or at night.	Noted.
11	4.2 DEP greater than 1.34nm1,2 but within 3nm of Waveney Under the new rules agreed by helicopter operators with the CAA and to be introduced shortly, the presence of wind turbine generators within 3nm of Waveney will restrict flights to the NUI and to a rig stationed at Waveney.	Assuming the CAA does introduce revised limits within 3nm of a wind farm, then the current Dudgeon Windfarm is within 3nm of Waveney. Therefore, flights will already be restricted to Day VMC only. Installing DEP will impose no additional regulatory access restrictions.
12	4.3 DEP less than 1.34nm1 from Waveney	At the joint meeting on 26th April 2023 in Norwich, it was agreed that with a stabilisation point at 0.5nm from Waveney, 360º access would be available with an obstacle free radius of 1.01nm. An obstacle free radius is the distance to the nearest rotor tip. Perenco's current helicopter operator, Bristow Helicopters, use 0.5nm. This distance is also permitted by the industry guidance shown in the HeliOffshore Flightpath Management Guidance; the CAA does not define a minimum distance. Therefore, the status quo is a stabilisation point at 0.5nm from Waveney. Perenco's future helicopter operator (commencing January 2024) states that they will use 0.75 nm due to the minimum range of the radar they are using. As the approaches to Waveney will be conducted in Day VMC, and

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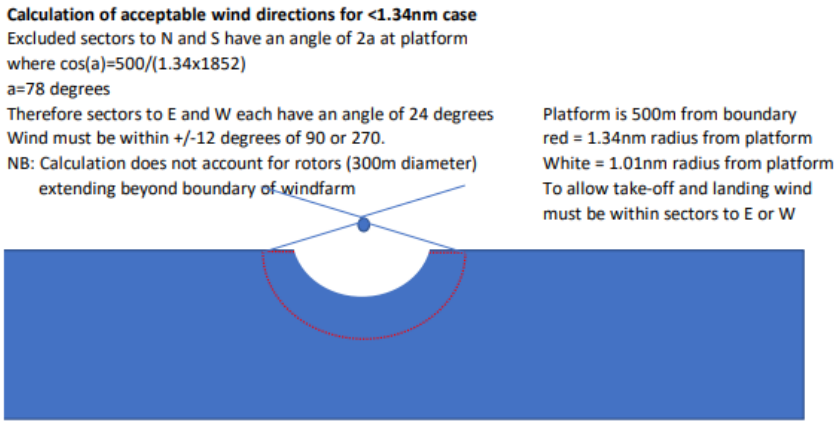
	As there would be insufficient space to turn into a stabilised final approach track, flights would be restricted to when the wind is broadly from the west or from the east. As shown in Figure 1 below, the permited wind directions are from between 78o and 102o or between 258o and 282o .  *Figure 1: Calculation of Available Wind Directions*	there are no nearby platforms to cause confusion, the minimum radar range should not be a consideration. At the meeting in Norwich, the Applicant and Perenco calculated a different radius of turn, with Perenco using a shallower angle of bank of 11º at 80 kt to achieve a Rate 1 turn. As Perenco stated this was the value applied by the AW139's autopilot, it was accepted as a worst case. The following distance was jointly calculated: • Radius of turn 0.43 nm (786m) • Stabilised approach point 0.5nm (926m) • Minimum separation distance from obstacles 0.08nm (150m) • Total rounded up to 1.01nm. It was agreed between both experts that all distances should be between the platform and the turbine rotor tips, as that distance is independent of the final turbine chosen. Therefore, all references to 1.34nm by Perenco are understood to be 1.26nm (1.01nm + the future increase in stabilised approach distance of 0.25nm). Routine flights occur safely to platforms within wind farms, such as Hornsea One and Two, under exactly the same Commercial Air Transport Regulations as to Waveney, with smaller distances than 1.01nm. This distance requirement is supported by Protected Provisions sought by Harbour Energy for the Johnston Wellheads inside the boundary of the Hornsea Four windfarm. That oil and gas operator (undoubtedly based on advice from their operator) has sought an obstacle free radius of 1600m (0.86nm) around the wellheads. Another gas operator has successfully drilled wells using the Shelf Perseverance jack-up (NPI) located over the Blythe NUI. Blythe has several wind turbines in the Dudgeon Windfarm located 1,200m (0.65nm) from the platform. The operator chose to locate Blythe close to the pre-existing Dudgeon wind farm and has successfully operated helicopter flights to the NUI and NPI. Helidecks in close proximity to obstructions have also been common in oil fields for many decades, as shown by the Ekofisk complex that has several helidecks and obstructions in a small area.

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		 In summary, the status quo is that flights are being conducted on a daily basis, under the same Aviation Regulations, to platforms closer than 1.01nm to wind turbine tips. Apart from introducing a new operator in 2024 that intends to use an increased stabilisation distance of 0.75nm, no further justification is provided by Perenco why an obstacle free radius of 1.01nm is not acceptable.
5 Results		
13	A simple count of all daylight times when visual flight rules (VFR) are possible yields the same result (94% of daylight hours) as presented by the Applicant in Anatec's Helicopter Access Report. This, and the other percentages presented by the Applicant do not however represent the proportion of helicopter operations that will be unaffected. Comparative discussions with the Applicant and Anatec revealed that the Applicant has over-simplified their analysis whilst Perenco has applied a more rigorous methodology (set out in Sections 2 and 3 above) to assess the realistic impact on future aviation operations.	The Applicant has used Perenco supplied real world data to calculate the historic impact on flights to Waveney. It is disputed that the Applicant has "over simplified their analysis". The meteorological assessment calculated the percentage of day VMC and IMC conditions and then applied those to actual flight data supplied by Perenco. The analysis is shown in Appendix A to the Helicopter Access Report and the Deadline 4 Supplementary Analysis. This shows the historic impact on actual flights required by Perenco. Applying the actual met data to the actual flights flown is a more robust methodology than applying the hypothetical cases used by Perenco in

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		Sections 2 and 3 of their Note. Perenco has not sought to show the actual impact on historic flights but merely shown generic cases.
14	As shown in Figure 2, flights to an NPI stationed at Waveney will be significantly affected by the construction of DEP. If, as proposed by Perenco, the distance from Waveney to the nearest rotor tip is at least 1.5nm for all wind turbine generators except for one which may have rotor tips no less than 1.01nm from Waveney, then operations in support of a rig at Waveney would be viable, but almost half of the flights currently possible would become unavailable in some months. If, as suggested by the Applicant, the rotor tip of any wind turbine generator were less than 1.01nm from Waveney, helicopter support of rig operations would be completely impracticable with only a small percentage of current flying windows being available.	This statement, and Figures 2 and 3 are incorrect. In this statement Perenco increases their required distance from 1.26nm from Waveney to the closest turbine blade tip (1.34nm to the turbine hub) to 1.5nm to the turbine tip without any further justification. Then it is stated that if one turbine tip is no closer than 1.01nm then operations would be viable. Their figures 2 and 3 column 3 then show that with any turbine tips less than 1.34nm (1.26nm to tips) any operations would only allow access from the east or west. No clear justification is given for these range of figures. Current practice is that flights to platforms located within 1.01nm from wind turbine tips can be conducted safely. Protected Provisions for another gas operator wishing to fly to an NPI situated over wellheads inside a potential wind farm state that 1600m (0.86nm) is required. A second gas operator currently operates a NPI over the Blythe Platform to drill gas wells. Several wind turbines are located 1200m (0.65nm) from that platform. Perenco's requirement for an additional 0.25nm is due to the changing of the current 0.5nm stabilisation point to 0.75nm by their future operator. No other justification for this increase in distance is given. If the CAA changes the regulations regarding flights within 3nm of a wind farm, then any NPI over Waveney will be restricted to Day VMC operations due to the existing Dudgeon Windfarm. Therefore, the figures in Figure 2 column 2 are incorrect, as day only access will be permitted. It is difficult to provide a direct comparison to the Perenco claims, as the monthly figures for 2021 and 2022 have been combined and the data for 2020 has been ignored, despite coming from one of their own platforms. The Applicant's Supplementary Analysis Table 3.2 shows the following annual Day VMC. The annual average is similar to the Perenco figure of 93% shown in their Figure 3 column 2.

<table>
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<tr><th>Condition</th><th>2020
Dataset 1</th><th>2021
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Dataset 2</th></tr>
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Cloud base >=600ft AND Visibility >=4000m</td><td>93.2%</td><td>94.5%</td><td>95.4%</td></tr>
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Cloud base >=700ft AND Visibility >=5000m</td><td>90.8%</td><td>93.3%</td><td>94.7%</td></tr>
<tr><td>Loss of DAY VMC</td><td>2.4%</td><td>1.2%</td><td>0.7%</td></tr>
</table>
The calculations in Perenco’s Figure 2 column 3 are also incorrect as they do not take account of current flights being flown to platforms within 1.01nm of wind turbine tips. Therefore, and based on multiple examples, the access figures shown by Perenco in their column 3 should be the same values as Day VMC.
The calculations in Figure 3 column 2 are similar to the those reported by the Applicant in the Helicopter Access Report. Figure 2 column 3 again does not take account of current practice where flights to platforms located closer than 1.01nm are conducted safely on a routine basis.
</td></tr>
<tr><td>15</td><td>As shown in Figure 3, the impact of DEP on flights to the Waveney platform is less than to an NPI. This is because flights to the NUI are already restricted to daylight hours. Never-the-less if, as proposed by Perenco, the distance from Waveney to the nearest rotor tip is at least 1.5nm for all wind turbine generators except for one which may have rotor tips no less than 1.01nm from Waveney, then operations in support of a rig at Waveney would be viable, but around one in 10 flights currently possible would become unavailable in all months. If, as suggested by the Applicant, the rotor tip of any wind turbine generator were less than 1.01nm from</td><td>The Applicant recognises the 1.01nm buffer. However, there does not seem to be evidence to support the 1.5nm buffer for further turbines. Perenco’s submission here is based on a 1.26nm buffer (1.34nm to WTG tower assuming a maximum rotor diameter of 300m).
The difference between 1.01nm and 1.26nm is due to the changing of the current 0.5nm stabilisation point to 0.75nm by Perenco’s future operator. No other justification for this increase in distance is given.</td></tr>
</table>

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<tr><th>ID</th><th>Stakeholder Comment</th><th>Applicant Response</th></tr>
<tr><td></td><td>Waveney, helicopter support of rig operations would be completely impracticable with only a small percentage of current flying windows being available.</td><td></td></tr>
<tr><td>16</td><td>Results from the much larger 2019-21 dataset (dataset B) are entirely consistent with those shown in Figures 2 and 3:
06:30-21:00 Day and night (Rig)
Data from 1/1/21-31/12/22
Flight times available as a proportion of current status
<table>
<tr><th>Month</th><th>With >=1.34nm to WTG base (1.26nm to rotor tip)</th><th>With <1.34nm (access only from E or W)</th></tr>
<tr><td>January</td><td>55%</td><td>7%</td></tr>
<tr><td>February</td><td>63%</td><td>9%</td></tr>
<tr><td>March</td><td>73%</td><td>7%</td></tr>
<tr><td>April</td><td>91%</td><td>4%</td></tr>
<tr><td>May</td><td>93%</td><td>6%</td></tr>
<tr><td>June</td><td>95%</td><td>4%</td></tr>
<tr><td>July</td><td>94%</td><td>5%</td></tr>
<tr><td>August</td><td>93%</td><td>5%</td></tr>
<tr><td>September</td><td>83%</td><td>7%</td></tr>
<tr><td>October</td><td>71%</td><td>3%</td></tr>
<tr><td>November</td><td>59%</td><td>6%</td></tr>
<tr><td>December</td><td>52%</td><td>3%</td></tr>
<tr><td>Annual Average</td><td>77%</td><td>6%</td></tr>
</table>
Figure 2: Flight Times Available to a Rig as a Proportion of the Current Status</td><td>The figures in this table are in broad agreement with those presented by the Applicant for 1.01nm, however, Perenco's requirement for an additional 0.25nm is due to the changing of the current 0.5nm stabilisation point to 0.75nm by their future operator. No other justification for this increase in distance is given.</td></tr>
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06:30-21:00 Daylight only (Waveney) - Requires two flights per day within 05:00-10:00 hrs of each other.
Data from 1/1/21-31/12/22

Flight times available as a proportion of current status

Month	With >=1.34nm to WTG base (1.26nm to rotor tip)	With <1.34nm (access only from E or W)
January	94%	6%
February	90%	7%
March	88%	5%
April	98%	2%
May	92%	2%
June	93%	2%
July	93%	2%
August	97%	2%
September	95%	3%
October	91%	2%
November	93%	3%
December	84%	1%
Annual Average	93%	3%

Figure 3: Flight Times Available to a Waveney NUI as a Proportion of the Current Status

References

Protected Provisions sought by Harbour Energy for the Johnston Wellheads inside the boundary of the Hornsea Four windfarm: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010098/EN010098-002299-Harbour%20Energy%20-%20Response%20to%20SoS%20request%20for%20information%2027%20Apr%2023.pdf