

FOOD AND ENVIRONMENT PROTECTION ACT 1985 : PART II (AS AMENDED) -
DEPOSITS IN THE SEA IN CONNECTION WITH MARINE CONSTRUCTION WORKS

Licence 31744/08/0

The Secretary of State for Environment, Food and Rural Affairs (hereinafter referred to as "the Licensing Authority") hereby authorises:

**BARROW OFFSHORE WIND LIMITED
AGERN ALLE 24-26
2970 HORSHOLM
DENMARK**

Company Registration No: **4145993**

(hereinafter referred to as "the Licence Holder") to deposit in the sea the substances or articles the particulars of which are set out at paragraph 1.1 of the attached Schedule. The Licence is subject to the conditions of use set out, or referred to, in the said Schedule.

This licence shall be valid from the beginning of the day of **20 February 2008**, (hereinafter referred to as the start date of this licence) to the end of the day of **28 February 2009**, (hereinafter referred to as the end or expiry date of this licence), and replaces licence 31744/07/1 and all the terms and conditions in the schedule associated with that licence.

For the purposes of this licence and attached schedule and unless indicated otherwise:-

- (i) all times shall be taken to be Greenwich Mean Time (GMT), and,
- (ii) all co-ordinates shall be taken to be latitude and longitude degrees and minutes to two decimal places.

Signed:

Marine Environment Team

for and on behalf of the Licensing Authority

Date of issue: 20 February 2008

The Licence Holder is urged to read carefully all the conditions and requirements of this Licence which are set out in the Schedule. You should acknowledge receipt of this licence and confirm that you have understood its term by signing and returning Form FEP 14 within 28 days of the date of issue of this licence

1. Particulars of the deposit

- 1.1 The type of works for which the deposit of the substances or articles as specified in paragraph 1.4 of this Schedule are :

**Gabion
Windfarm
Mattress**

- 1.2 Details of the works requiring the deposit of the substances or articles as specified at paragraph 1.1 of this Schedule are:-

Barrow Offshore Wind Ltd is proposing to construct a 108MW offshore wind farm and associated infrastructure in the eastern Irish Sea approximately 7km off the coast of Barrow-in-Furness (referred to as the Barrow wind farm).

A Geotechnical Survey will be carried out prior to the wind farm construction and will include:-

8 no. boreholes to a nominal depth of 45m below the seabed.

The wind farm will consist of 30 wind turbines each with an output of up to 3.6mw. The turbines will be arranged in a rectangular grid of four rows of seven or eight turbines, with the longest side facing into the prevailing south westerly wind. The rows will be staggered and will be separated by a distance of approximately 750m, within the rows the turbines will be separated by approximately 500m. The turbines will consist of a tower up to 80m above mean sea level, on which will be mounted a rotor with a maximum diameter of 104m. The maximum total height to vertical blade tip will therefore be 129m above mean sea level. In addition to the wind turbines, there will be an offshore substation platform, which will comprise 33kV and 132kV switchgear, a single 33/132kV transformer, an anemometry mast and associated control and instrumentation systems. In addition cables will be laid to shore, and then connected to the existing electricity network. The cables will come ashore at a 'landfall' point south of the existing Heysham Power Station. The cables will then be run underground for approximately 2-3km to a substation at Heysham.

- 1.3. Such works are as detailed in the drawing(s) and sectional plan(s) detailed below which were submitted in support of your application to the Licensing Authority of 30 May 2002

- 1.4 The substances or articles authorised for deposit at sea are:

**Iron / Steel
Concrete
Silt
Stone / Rock
Gravel
Other**

- 1.5. The Licence Holder and any Agent and Contractor acting on their behalf is permitted to deposit the substances or articles specified at paragraph 1.4 of this Schedule, at the following location(s):

BARROW OWF

**53 59.711 N 03 19.882 W
54 00.712 N 03 18.346 W
53 59.265 N 03 15.639 W**

53 58.265 N 03 17.159 W

- 1.6. The works shall be carried out in accordance with the works schedule and method statement as detailed in the following:

The Geotechnical Survey will be carried out in accordance with 'Outline Method Statement barrow Offshore Windfarm Geotechnical Site Investigation, by Seascore Ltd.' as supplied to the Department 23 February 2004.

The scope of work for this ground investigation work includes:-

8 no. boreholes to a nominal depth of 45m below the seabed.

Piezocone penetration tests (PCPTs) at 30 locations to first refusal across the 3.5km x 3.0km wind turbine site.

A combination of sampling and testing along the overwater section of the cable route (approx. 26km), comprising CPTs and Vibrocores (18 no. of each) to a maximum depth of 5m.

Details of how the survey will be carried out is as follows:-

Wind Farm Site

A mobile overwater borehole drilling and CPT system would be deployed from either a dynamically positioned vessel or a jack up. As a result of the limited water depth at the site, drilling operations may be conducted with the DP vessel held on position by means of a four point anchor spread. If this is required, the vessel will lay and retrieve this anchor pattern using the DP system to provide motive power. A third party anchor handling vessel will not be required.

Drilling Methodology:

Once the vessel is in position, it is proposed to utilise standard offshore soils drilling and sampling techniques as used within the oil industry. Drilling operations will be conducted through a seabed reaction frame capable of gripping the drill pipe via hydraulic clamps, providing a hole re-entry guide by means of a bit guide frame and stabilising the drill string at the mudline for the performance of cone penetration testing and push sampling.

During drilling operations the collars will keep the drillstring in tension, thereby stabilising the borehole and aiding penetration. The drillstring will be equipped with a 9½" O/D tungsten open centre dragbit. Should tougher formations be encountered the drilling spread will be equipped with a wide range of alternative bits.

Rotation of the drillstring will be effected by a hydraulic top drive power swivel. The flushing agent will be fed to the drillstring via a single side entry mud swivel mounted on the crown of the power swivel. With the careful control of the mud pump pressure, mud flow rates and rotation speed, the drilling engineer will lower the drillstring through the formations by use of the drawworks winch. As the drillstring penetrates the formations all changes in the drilling parameters will be logged by the drilling engineer within the drilling journal. To enable samples to be taken, or insitu tests to be conducted the drillstring can be halted at predetermined depths and the sampling/testing tools are then deployed through the opened mud valve.

CPT Methodology:

The Wilson Cone Penetration Test (CPT) system enables CPT tests to be performed in situ from the base of the borehole thus enabling soil parameters to be measured. Push sampling will be also be conducted by the Wilson WIP system enabling 72mm diameter samples of 900mm in length. Samples can be recovered from predetermined depths down the borehole and recovered samples can then be taken for subsequent laboratory testing either offshore

or in a land based laboratory.

Reaction for the tests to balance the penetration thrust will be supplied by a seabed reaction frame (SBF) which will be deployed to the seabed prior to the tripping of the drillstring; deployment will be achieved by use of a heavy lift winch. To ensure entry to the SBF the API drillstring is deployed with a mechanically attached bit guide travelling on the SBF heavy lift cables. To complement this, the crown of the SBF consists of a wide rimmed funnel narrowing at its base thus ensuring clear access to and from the SBF clamps. The Wison / WIP system will be used in conjunction with a rotary drilling system.

The borehole will be advanced to the required test level by the drilling engineer. At the test level the rotation and penetration of the drillstring is halted, the drilling engineer will ensure that the borehole has been flushed clean and the flush pump is then halted. With the drillstring halted the mud valve can be opened therefore allowing access to the drillstring for the testing tool. The SBF clamps are then engaged. The borehole is now ready to be tested or sampled. By operation of the dedicated electric frequency modulated self-tensioning winch the CPT operator will hoist the testing tool from its "lay down" area on the deck to the rooster box. When the tool has been raised to height, which will allow safe entry into the rooster box, the winch will be halted and the tool will be guided by the assistant driller to position directly above the open mud valve.

The tool can now be lowered down the drillstring to the bit, where it seats and latches under its own weight. The CPT operator starts the test from the control cabin and the cone penetrometer or sample tube is hydraulically pushed into the soil at a constant rate of 20 mm/s. The movement of a hydraulic ram on the winch logs the depth, which is proportional to the movement of the cone / tube. Throughout the test the measurements of cone tip resistance, sleeve friction and pore pressure is displayed graphically in the control cabin. The data is converted to a digital signal prior to transmission up the umbilical by a down hole data acquisition unit. Upon reaching the maximum achievable stroke of 3m, 1m or the limiting thrust capacity the test is terminated.

Wind Farm Construction Methodology

The primary system for positioning the jack-up will comprise a GPS system, which takes its signals from two satellites. The secondary system will be a handheld GPS for identification of gross errors. The positioning system the jack-up will work to an accuracy of sub 1m in the horizontal plane, and decimeters in the vertical plane. The accuracy of both horizontal and vertical control will be increased as the receiver records more data from the satellite.

The monopiles will be transported to site from the pre-assembly base port using a service vessel and are positioned in place by a jack-up barge. Subject to confirmation of the localised ground conditions, driven piles are the preferred option. In this case, the pile is lifted into the vertical plane using cranes on board the jack-up vessel. The hammer is located on top of the pile and driving continues until the pile is driven to the requisite depth into the seabed

In the event that the monopile needs to be drilled and grouted into the seabed, the procedure would typically be as follows:

- The hole is drilled to accept the monopile, with the excavated material being discharged to the immediate surrounding area. Approximately 900m³ of excavated material is anticipated for a foundation of up to 6m diameter, with a nominal penetration of 32.5m into the seabed.
- It is anticipated that seawater will be used as the drilling lubricant and a method called 'reverse circulation' implemented in order to return the drill

- water to the drilling platform, where it can be cleaned for reuse.
- The monopile is placed in situ in the drilled hole; and
 - Grout is pumped into the annulus around the monopile.

The grout will be cement-based and a volume of approximately 10m³ per foundation may be required. Approximately 50% excess grout will result and be deposited in the area immediately around each foundation forming a 'collar' type structure, which aids protection against scour.

A transition piece, complete with pre-installed features such as boat landing platform, cathodic protection, cable ducts for the subsea cables and turbine tower flange, is mated with the monopile and secured. This connection may require additional high strength concrete grout.

The wind turbine towers shall be transported to site in a similar fashion to the monopiles. The erection of the tower section requires a high reach crane that is usually operated from the deck of a jack-up barge. There would be typically a four day delay between installation of the monopile and the installation of the wind turbine and tower to allow any grout to cure and set.

The tower will be delivered as a single piece or in several sections. The tower section is lifted into the vertical plane and positioned over the transition piece. The tower is secured to the transition piece by a bolted connection. The upper tower sections, if applicable, are positioned in a similar manner and bolted in place.

The nacelle assembly is transported to the site as one, or possibly, two modules. It is lifted into position on top of the tower and bolted in place.

The turbine blades may be attached to the rotor hub onshore and shipped to site as a complete unit. A high reach crane is used to lift this assembly and a smaller crane to assist. Finally, a bolted connection is made to the nacelle assembly. Alternatively, the rotor hub may be pre-assembled to the nacelle assembly, in which case, the blades would be transported separately, as a set of three, to the site.

At a convenient stage in the overall installation procedure, the substation will be installed. It is anticipated that a monopile foundation similar to that used for the wind turbines will be adopted. The installation sequence is similar to that for the wind turbines. The substation is delivered in modular form to the local pre-assembly base, where it is made into a number of sub-assemblies. It is then transported to the site and installed on the foundation/platform.

It is anticipated that a scour hole extending 6m down current from the monopile and up to 3m deep could develop around each case within 10 tidal cycles.

Once the scour hole has developed, stone of a suitable size and grading is placed around the base of the monopile. This will require approximately 200m³ of stone per monopile, which is obtained from a quarry, transported and placed using barges equipped with fall pipes to allow the stone to be 'tremied' into the scour holes.

Alternatives to stone such as pre-filled mattresses may also be considered. These would be designed to prevent localised scour. They would be manufactured and transported to site for installation from the same construction vessels that install the wind turbines and their foundations.

The 33kV subsea cables, which connect the wind turbines together in strings, are laid on the seabed along each row and will be buried to a minimum depth

of 1m. The 33kV subsea cables, which connect the wind turbines at the end of each row to the substation platform, will be buried to a minimum depth of 2m.

The cables are typically delivered to site, pre-cut to length for ease of installation. They may be delivered by sea to the local port used for the pre-assembly base, or by road to the same facility. In either case, the cables will most likely be delivered on a cable reel. This is loaded onto the laying/installation vessel for installation at the windfarm site. The methodology is described in detail below.

The 132kV subsea cable, which delivers the electricity from the offshore substation platform to shore, will be buried to a depth of 1 - 3m depending on localised seabed conditions. The exact depth of the cable below seabed level is dictated by the conditions revealed by the geotechnical and geophysical investigations during the detailed design phase. Installation may be by cable trencher or cable plough.

This cable will be delivered to the site directly from the manufacturing facility on board a cable lay vessel. This is because of the length and weight of the cable and the need to keep the number of joints or terminations to a minimum.

As soon as the cable laying barge is on site, and the equipment on board has been checked, the barge is pulled as close as possible to the shore to start the cable landing. When the cable end is in its final position for cable jointing, pulling stops and the cable will be secured ashore.

Once ready, the barge starts the laying operation. During the lay operation, the barge position is permanently monitored and kept along the planned route. The cable laying control is based on the seabed profile data recorded in the marine survey performed before the laying, and the subsequent study on the laying parameters.

On completion of laying, the barge comes to a stop and is positioned in a suitable configuration to allow the cable to be floated to the J-tube bellmouth of the offshore substation platform. The cable is cut to length, sealed and capped. Divers will be present during the cable pulling onto the substation platform, to assist the operation. Support personnel on board the substation platform operate the winch for the cable pulling operation.

Cable burial is performed after cable lay, either simultaneously or post trenching. If a trenching machine is found to be the most appropriate form of burying the cable, the machine is deployed from a suitable vessel, the cable is picked up by the machine and, as the trench is cut, the cable is lowered in before the trench collapses back onto the cable. Cable ploughs cut a slit into the seabed by means of disc shaped shares, preceded by a cable shoe to guide the cable to the bottom of the slit. The final choice of burial method depends on the water depth and seabed material.

Burial is required at the landfall to avoid the cable being exposed during the natural rise and fall of the foreshore and seabed, and to allow the cable to pass under existing sea defences. Generally, the criterion is to install the cable below the lowest level of movement expected, and burial depth is influenced by the anticipated wave and current conditions. This is expected to be a minimum of 2m below seabed level.

Any unburied inter array cable sections will be buried, where possible, with jetting technique. At locations where it is impossible to jet the cable down to a satisfactory depth due to sea-bed conditions, pre-filled mattresses may be deployed or rock dump may be installed to protect the inter array cable ends.

Once the crossing of the sea defences has been achieved, the cable is drawn through the feeder pipes and plastic ducts, which have been installed from the offshore connection point to the buried joint bay established on the landward side of the defences, where the marine and land cables are mated. The pipe ends are sealed to ensure that seawater is not siphoned under the sea defences.

The following sequence of events for the landfall is typical:

- the cable is pulled ashore from a cable laying barge, lying as close to shore as possible at high tide;
- winches are used to assist the pull ashore and when the cable is above the proposed route, the buoyancy is released to allow the cable to sink to the seabed;
- at low tide, a back-hoe excavator works up the beach from the low water mark, excavating a trench into which the cabling is immediately placed; and
- the trench is then backfilled using the excavated material. The trench will be of sufficient depth, a minimum of 2m is proposed, to ensure that the cable is not subsequently exposed by seasonal or storm induced movement of the foreshore.

Excavation, burial and reinstatement of each section of the landfall works takes place within one tidal cycle.

2. Persons Responsible for the Deposit of the Substances or Articles

2.1. The Agents and Contractors permitted to engage in activities subject to the terms and conditions of this licence are:-

<u>Name of Agent or Contractor</u>	<u>Function</u>
RSK Environment	Other Agent
Seacore Limited	Vessel Operator
Marine Projects International Ltd	Construction Contractor
CNS Renewables Ltd	Construction Contractor
Bonn & Mees	Construction Contractor

2.2 The following operators and vessel(s) or vehicle(s) are permitted to engage in activities subject to the terms and conditions of this licence are:

<u>Name of Vessel or Vehicle Registration</u>	<u>Operator</u>	<u>Type</u>
Seaspan Excalibur	Seacore Limited	DREDGER Geotechnical Survey Vessel
Deep Diver	Seacore Limited	Geotechnical Survey Vessel
TBA	Seacore Limited	Geotechnical Survey Vessel
Matador pontra		DREDGER Geotechnical Survey Vessel
Resolution FOB JR		DREDGER SHIP

2.3 All vessels employed to perform the deposit operation permitted by this Licence **31744/08/0** shall be so constructed and equipped as to be capable of the proper performance of these operations in compliance with the conditions set out in the Schedule to this licence **31744/08/0**. Details of the vessels that may operate under this Licence **31744/08/0** are set out in sub-paragraph 2.2, and the standard equipment to be on all vessels operating under this Licence **31744/08/0** are set out in paragraph 10.

3. Distribution of copies of this Licence 31744/08/0

3.1 The Licence Holder is required to ensure that a copy of this licence **31744/08/0** and attached Schedule, any special conditions and any subsequent revisions or amendments thereto is given to:

3.1.1. All Agent(s) and Contractor(s) as detailed at paragraph 2.1; and

3.1.2 The Masters of all vessels and transport managers responsible for the vehicles employed in the pursuance of this Licence **31744/08/0** and detailed at paragraph 2.2.

3.2 Copies of this Licence **31744/08/0** shall also be available at the following locations :

3.2.1 at the address of the Licence Holder;

3.2.2 at any site office, located at or adjacent to the site of the works, used by the Licence Holder, agent(s) or contractor(s) responsible for the loading transportation or deposit of those substances or articles detailed at paragraph 1.2.1 of this Schedule; and,

3.2.3 on board each vessel or at the office of any transport manager with responsibility for vehicles from which licensed deposits are to be made.

4. Inspection of the Operation

4.1 The documents referred to in paragraph 3 shall be available at all reasonable times for inspection by an authorised Enforcement Officer at the locations stated in that paragraph.

4.2 The Licence Holder must advise the Licensing Authority and District Inspector of Fisheries (being a designated officer responsible for enforcement of this Licence) 5 working days before the licensed operation, or an individual phase of the operation is expected to commence.

5. Returns to be made to the Licensing Authority

5.1 The Licence Holder is required to acknowledge receipt of this licence **31744/08/0** and confirm that you have understood its term by signing and returning Form FEP 14 within 28 days of the date of issue of this Licence. No operations permitted under the terms of this licence **31744/08/0** shall commence until the FEP 14 form has been signed and returned to the Licensing Authority.

5.2 All persons referred to at paragraph 2.1 and 2.2 of this Schedule shall provide an acknowledgement, using Form FEP 13, of their receipt of this licence **31744/08/0** and their understanding of all the conditions specified therein to the Licensing Authority within 28 working days of the start date of this Licence **31744/08/0** or prior to engaging in any activity to which this Licence relates, whichever is the sooner.

- 5.3 Only those Agent(s) or Contractor(s) whose names appear at paragraph 2.1 and the vessel(s) and operator(s) whose names appear at paragraph 2.2 may operate under the terms of this Licence **31744/08/0** . Any changes must be notified to and be approved by the Licensing Authority in writing prior to operating under this Licence **31744/08/0** .

6. Contacts

- 6.1 Except where otherwise indicated, the primary point of contact with the Licensing Authority and the address for returns and correspondence shall be:-

**Marine and Fisheries Agency
Marine Environment Team
6B , 3-8 Whitehall Place
London SW1A 2HH**

Tel: 020 7 270 8696

- 6.2 For the purposes of this Licence **31744/08/0** any references to the Local District Inspector of Fisheries shall mean the relevant District Inspector in the area(s) located at:-

**Marine Fisheries Agency,
Fisheries Office,
Bradley's Chambers,
26 London Street,
Fleetwood,
Lancashire
FY7 6JG**

Tel: 01253 873515

- 6.3 For the purposes of this Licence **31744/08/0** any references to the Centre for Environment, Fisheries, and Aquaculture Science (CEFAS) shall mean:-

**Centre for the Environment, Fisheries, and Aquaculture Science
(CEFAS),
The Laboratory
Remembrance Avenue
Burnham-on-Crouch
Essex CM0 8HA**

7. Force Majeure

- 7.1 If, by reason of "force majeure" the substances or articles specified at sub-paragraph 1.4 of this Schedule, are deposited otherwise than in the area authorised by this licence at paragraph 1.5, full details of the circumstances shall be notified to the Licensing Authority within 48 hours of the incident occurring.

"force majeure" may be deemed to apply when, due to stress of weather or any other cause, the master of a vessel determines that it is necessary to deposit the substances or articles because the safety of human life and/or of the vessel is threatened.

8. Changes to this licence

- 8.1 In the event of the Licence Holder becoming aware that any of the information on which the granting of this licence **31744/08/0** was based has changed or is likely to change, he/she shall notify the Licensing Authority at the earliest opportunity of the details.
- 8.2 Similarly in the event that the Licence Holder wishes any of the particulars set down in the Schedule to be altered he/she shall inform the Licensing Authority at the earliest opportunity. The terms and conditions of this Licence apply until such time as they may be varied by the Licensing Authority.

9. Supplementary Conditions

The Licence Holder must submit the reports of monitoring activities set out in the following Supplementary Conditions to the Licensing Authority at the appropriate time in order to allow the Licensing Authority to consider if any action may be required to mitigate or correct any adverse effects which may be identified.

The Licensing Authority reserves the right to vary or attach additional conditions to this Licence in the event that:

- i. the results of monitoring studies required under the Terms of the Schedule to this Licence,
- or
- ii. any other observed effects considered to be directly associated with the works permitted by this Licence suggest a risk of significant adverse environmental impact.

- 9.1 Pre-construction monitoring must be carried out in 2004 to provide a baseline for subsequent monitoring of the effects of the windfarm. The Licence Holder will need agreement from the Licensing Authority that the pre-construction monitoring has generated adequate baseline data to support the construction and post construction monitoring. Assuming that the construction of the windfarm is completed as scheduled during the summer months of 2004, a post-construction monitoring must commence in late summer/autumn to follow the completion of the works. Monitoring must be carried out at the same time each year for comparative purposes in 2005, 2006 and 2007. Therefore, the initial monitoring schedule is as follows:-

Pre-Construction	2004
Construction	2005
Post Construction/Operation	2006/2007/2008

Further monitoring requirements may be imposed by the Licensing Authority in the light of the results of each phase of the monitoring programme.

- 9.2 If the period of construction varies from that described in Supplementary Condition 9.1 above, or where unavoidable problems occur in meeting this schedule, the Licence Holder must notify the Licensing Authority and seek instruction on the monitoring schedule.
- 9.3 The monitoring reports must be forwarded to the Licensing Authority & Natural England on an annual basis, or more frequently if the results trigger further monitoring work. Each report must be forwarded to the Licensing Authority within 3 months of the completion of the analyses. The Licence Holder should advise the Licensing Authority if circumstances suggest that there will be a delay in the submission of reports. The reports should include assessment, conclusions and an executive summary and the data within all reports should be presented in its processed and unprocessed forms.

The various components of the monitoring programme and resultant reports, as described in Supplementary Conditions 9.4 to 9.8 of this Licence, should be integrated so as to compare related environmental parameters e.g. the bird monitoring should address the conclusions of the benthic studies which should similarly draw on the sedimentary studies.

Monitoring of Sedimentary and Hydrological Processes, Benthic Ecology, Electromagnetic Fields and Noise & Vibration

- 9.4 The Licence Holder must carry out a programme of sedimentary, hydrological, benthic and other monitoring, as outlined in Annex 1 attached to this Schedule. The full specification for the monitoring programme (to be prepared by the Licence Holder) will be subject to separate written agreement with the Licensing Authority following consultation with CEFAS and Natural England at least one month prior to the proposed commencement of the monitoring work.
- 9.5 The Licence Holder must make provision during the construction phase of the windfarm to install facilities to enable subsea noise and vibration from the turbines to be assessed and monitored during the operational phase of the windfarm. Before completion of the construction phase the Licence Holder must supply a specification to the Licensing Authority of how it proposes to measure subsea noise and vibration - at various frequencies across the sound spectrum at a selection of locations immediately adjacent to, and between turbines, within the array and outside the array at varying distances - in order to fulfill the monitoring requirement outlined in Annex 1 attached to this Licence. Such a study would need to reflect differences in foundation/tower type, water depths and sediment types within the site and would need to be supported by adequate baseline data. Collaborative studies, e.g. research funded by COWRIE in this respect, would be an acceptable means of fulfilling this condition.

Fish Monitoring

- 9.6 Since very little is known about the potential effect of windfarms in terms of enhancing or aggregating fish populations, the Licence Holder must produce proposals for adequate pre-construction baseline and post-construction surveys of fish populations in the area of the windfarm. The Licence Holder shall, in drawing up such proposals, canvas the views of local fishermen. The proposals must be submitted to the Licensing Authority at least one month prior to the proposed commencement of the monitoring work. (See also Annex 1 in relation to monitoring of electro-sensitive species).
- 9.7 The Fisheries Liaison Officer (see Supplementary Condition 9.15) shall pay due regard during the conduct of any fisheries surveys to the need to safeguard the safety of any persons engaged in fishing operations on the site of the windfarm.

Ornithological Monitoring

- 9.8 Ornithological monitoring must be carried out as outlined in Annex 2 attached to this schedule. The full specification for the monitoring will be subject to separate written agreement with the Licensing Authority following consultation with CEFAS and Natural England prior to the proposed commencement of the monitoring work.
- 9.9 Post-construction monitoring must be undertaken annually for three years. The level of any subsequent ornithological monitoring, during the lifetime of the windfarm's operation, will be determined, in consultation with Natural England, having regard to the magnitude of any change in bird populations observed during the initial monitoring period.

Cetaceans

- 9.10 During construction the Licence Holder must ensure that disturbance to cetaceans is minimised, including temporary suspension of piling operations if cetaceans are sighted in the area. During the Geotechnical Survey the sighting of cetaceans in the area will be carried out in accordance with 'Method statement for the sighting of whales, dolphins and porpoises (cetaceans), seals (pinnepeds), and basking sharks, Seascore.' as supplied to the Department 23 February 2004.

Timing

- 9.11 As there are internationally important numbers of common scoter in the vicinity of the windfarm the Licence Holder must ensure that works are undertaken in the months of March to October (inclusive) so as to minimise disturbance to over-wintering birds. Any specific requirement for works outside these times shall only take place after written approval from the Licensing Authority (following consultation with CEFAS and Natural England). In so far as is practicable, the majority of the piling or drilling works shall only be undertaken during the months of April to June.

Interference

- 9.12 The Licence Holder must ensure that a Notice to Mariners is issued at least 10 days prior to works commencing warning of the start date for the construction of the windfarm and the expected supply/construction vessel routes from the local service ports to the array. A second Notice to Mariners must be issued warning of the timing and route of laying the submarine cable. These Notices to Mariners must be updated and reissued at appropriate intervals and supplemented by VHF radio broadcasts as deemed appropriate and agreed with the Maritime and Coastguard Agency.
- 9.13 The Licence Holder must ensure that a suitably qualified and experienced liaison officer or officers are appointed (for fisheries and environmental liaison) and the Licensing Authority notified before any work commences, to establish and maintain effective communications between the Licence Holder, contractors, fishermen, conservation groups and other users of the sea during the project.
- 9.14 The Licence Holder must ensure that information is made available and circulated in a timely manner through the liaison officer(s) to minimise interference with fishing operations and other users of the sea.
- 9.15 The Licence Holder must ensure that the liaison officer's environmental remit includes:
- Monitoring compliance with the commitments made in the Environmental Statement and the Environmental Management Plan.
 - Providing a central point of contact for the monitoring programme described in Annexes 1 and 2.
 - Liaison with fishermen, conservation groups and other users of the sea concerning any amendments to the method statement and site environmental procedures.
 - Inducting site personnel on the site/works environmental policy and procedures.
- 9.16 The Licence Holder must submit a copy of a Project Environmental Management Plan for the approval of the Licensing Authority, in consultation with CEFAS and Natural England, prior to the proposed commencement of construction work to ensure that

satisfactory arrangements are in place for liaison on environmental issues (as such the plan should provide names and contact details for the environment liaison officer(s)). This must be submitted to the Licensing Authority at least 1 month prior to the proposed commencement of works.

Seabed Morphology and Scour

- 9.17 The Licence Holder must undertake a bathymetric survey around a sample of adjacent turbines (minimum of 4) within 3 months of completion of the construction of the windfarm (or sooner if practicable) to assess changes in the bathymetry within the array. The number of turbines selected for these works should be sufficient so as to be representative of the different sediment types present at the site (e.g. cohesive, mobile etc). The survey is to be undertaken immediately after construction is complete and repeated at 6 monthly intervals for a period of 3 years. This shall specifically address the need for (additional) scour protection around the turbine pylons. The Licence Holder must submit the data in the form of a report to the Licensing Authority, including proposals for scour protection measures.
- 9.18 To ensure the integrity of the windfarm infrastructure and minimise hazards to mariners this 6 monthly monitoring should also investigate the cable route to ensure that the cable remains buried (such monitoring would need to continue throughout the lifetime of the windfarm although the frequency must be reviewed in discussions with the Licensing Authority at the end of the 3 year monitoring programme). The Licensing Authority recommends that bathymetric surveys are taken of the cable route following any major storm event to ensure that the cable remains buried.
- 9.19 The Licence Holder must ensure that the inter array cables are buried to a depth of 1.5 metres to 2 metres and that the export cables, between the array and shore, are buried to a depth as specified in the attached Annex 3 to minimise the risk of emergence and reduce the potential effects of electromagnetic fields.
- 9.20 If the monitoring results carried out under condition 9.17 indicate that scour protection is not required, or if the Licence Holder's plans for scour protection differ substantively from the measures detailed in the Provisional Method Statement provided to the Licensing Authority on 13 December 2002 or in the Environmental Impact Statement, the Licence Holder must seek approval from the Licensing Authority for the change in the works previously notified to the Licensing Authority.

Should additional cable protection be required (e.g. rock armour) a separate Food and Environment Protection Act/Coast Protection Act application must be submitted.

- 9.21 Any scour protection placed around the monopile foundations should be inert material with minimal fines and the Licensing Authority's approval is required for the nature and origin of the material. All scour protection should be level with the seabed.

General

- 9.22 The Licence Holder shall not permit any development to commence as authorised by this Licence until a protocol has been submitted to the Licensing Authority which has been formally agreed with an Archaeologist representing the County Council adjacent to the site of works. This shall detail what action must be taken to protect any archaeological and shipwreck remains that were identified in the Environmental Statement submitted in support of the applications for consent for the works or any such artifacts which may be discovered during the course of progressing the development. Action to be taken to protect any archaeological and shipwreck remains during the Geotechnical Survey are detailed in 'Jackup Positioning Procedure for

Avoidance of Archaeological Sites and Seabed Obstructions, Seascore.' as supplied to the department 23 February 2004

- 9.23 The Licence Holder must ensure that any debris or temporary works placed below MHWS are removed on completion of the works authorised by this Licence. (Drill cuttings, if drilled with water-based muds, can be left on the seabed within the area leased from the Crown Estate for the construction of an offshore windfarm. However, should these need to be removed and sea disposal considered an application for a separate FEPA Licence will be required).
- 9.24 The Licence Holder must undertake a pre-construction bottom and side scan sonar survey in grid lines across the area of development (turbine array, cable route, and any vessel access routes from the local service port(s) to the construction site) following discussions with the Licensing Authority as to those parts of the operation for which this is deemed necessary. Local fishermen must be invited to send representatives to be present during the survey. All obstructions found on the seabed must be plotted. A post construction survey must be undertaken along the same grid lines (within operational and safety constraints), any new obstructions must be removed at the developers expense.
- 9.25 All chemicals utilised in the drilling operation must be selected from the List of Notified Chemicals assessed for use by the offshore oil and gas industry under the Offshore Chemicals regulations 2002 (this list can be viewed/downloaded at www.cefas.co.uk). Should any system other than a water-based mud be considered for use in the drilling operation written approval and guidance of disposal of any arisings will be required from the Licensing Authority.
- 9.26 The Licence Holder must ensure that any chemical agents placed within the void of the monopile, e.g. biocides, corrosion inhibitors etc. are selected from the List of Notified Chemicals (see Supplementary Condition 9.25). The use of any chemical not contained on this list will require prior consent from the Licensing Authority following a comparable ecotoxicological hazard/risk assessment undertaken at the Licence Holders own expense.
- 9.27 The Licence Holder must ensure that all protective coatings; paints etc. used are suitable for use in the marine environment and, where necessary, are approved by the Health and Safety Executive.
- 9.28 The Licence Holder must ensure that storage, handling, transport and use of fuels, lubricants, chemicals etc. during construction on vessels and equipment should prevent releases to the marine environment, i.e. bunding should be 10% total volume of all reservoirs, containers etc.
- 9.29 The Licence Holder must produce a Marine Pollution Contingency Plan for spills, collision incidents during construction and operation, and this must be adhered to. The Contingency Plan must have regard to plans for Morecombe Bay, Heysham Port, Barrow Port & offshore installations. The plan should include Natural England's emergency contact pager number, 07626 419491, for the marine Pollution Officer. Practices used to refuel vessels at sea must conform to industry standards.
- 9.30 Directional drilling equipment should be utilised in preference to other techniques for cable laying but, if this can be shown not to be practicable, the Licence Holder must ensure that all reasonable care is taken to minimise disturbance and re-suspension of seabed sediments. Jetting will be permitted within the wind farm array. If jetting is required outside this area, the Licensing Authority must be informed so that an assessment can be made of the potential impacts prior to any jetting being undertaken.

- 9.31 The Licence Holder must ensure that all reasonable care is taken to prevent the accidental or uncontrolled release of wet concrete/grout into the marine environment.
- 9.32 The Licence Holder must ensure that the top layers of sediment are separated from the sub-surface sediments during works in the intertidal zone (where practicable) and replaced in the trench in the appropriate sequence to assist re-colonisation of benthic organisms.
- 9.33 All the above conditions are also applicable to the substation platform which must be considered as an integral part of the development.
- 9.34 In addition to the initial Licence charge paid with the application (or application for extension) relating to this Licence, the Licence Holder shall pay a further annual instalment of the Licence charge in respect of the second period of twelve months of the Licence (equivalent to the extension charge in force at the due date). Payment of the annual instalment shall be due and be made to the Licensing Authority 28 days prior to the anniversary of the original start date of this Licence.
- 9.35 The Licence shall be deemed to become invalid and shall be liable to be revoked in the event that the Licence Holder fails to make full payment of each annual instalment of the Licence charge within a period of 28 days following the respective due date for payment.
- 9.36 The Licensing Authority reserves the right to seek a further variation charge in the event that the Licence Holder requests any significant change to the work or the working methods to which this Licence applies, or to its terms and conditions. Should the Licence Holder seek to make changes to the terms and conditions of this Licence or to the work to which it relates which in the opinion of the Licensing Authority will require it to be substantially re-assessed, the Licensing Authority may seek to revoke this Licence and request a revised application.
- 9.37 In addition to the powers of variation or revocation set out in sections 8(10) and (11) of the Food and Environment Protection Act 1985, the Licensing Authority may suspend this Licence if it appears to the Licensing Authority that there has been a breach of any of its provisions or if it appears to the Licensing Authority that this Licence ought to be suspended because of a change in circumstances relating to the marine environment, the living resources which it supports or human health or because of increased scientific knowledge relating to any of those matters or for any other reason that appears to the Licensing Authority to be relevant. Any such suspension may apply to some or all of the activities permitted by this Licence (as specified in the notice of suspension) and may be imposed either for a period of time specified in the notice of suspension or for an indefinite period until the Licensing Authority is satisfied that conditions specified in the notice of suspension have been met

10. Conditions relating to the Construction, Equipment and Operation of the Vessels engaged upon Deposit Operations

- 10.1. All motor powered vessels engaged in operations to which this licence **31744/08/0** relates must be fitted with the following equipment:
 - 10.1.1 Electronic positioning aid to provide navigational data e.g. GPS, etc.
 - 10.1.2 Radar
 - 10.1.3 Echo sounder
 - 10.1.4 Multi-channel VHF
- 10.2. All vessels' names or identification shall be clearly marked on the hull or superstructure.
- 10.3. All communication on VHF working frequencies shall be in the English Language.
- 10.4. Under no circumstances shall a vessel engage in the deposit operations until all equipment specified in this paragraph is fully operational.

EXPLANATORY NOTES

This page does not form part of this licence **31744/08/0** or its associated schedule but the licence holder is recommended to read the following guidance notes.

1. The granting of this licence **31744/08/0** does not absolve the Licence Holder from obtaining such other authorisations, consents and approvals which may be required under any other legislation, controls or regulations.
2. Under Section 8 of the Food and Environment Protection Act 1985, the Licensing Authority may vary or revoke this Licence **31744/08/0** if it appears to the Authority that the Licence Holder is in breach of any conditions in it or for any other reason that appears to the Authority to be relevant.
3. A person who makes a deposit, or causes a deposit to be made, at sea in contravention of the conditions specified in this licence 31744/08/0 may be found guilty of an offence under Section 9(1) of the Food and Environment Protection Act. It is a defence under Section 9(3) of the Act for a person charged with such an offence to prove that the operation was carried out for the purpose of securing the safety of the vessel or of saving life ("force majeure") and that he/she took steps within 48 hours following the incident to send full details of the incident including those relating to the operation, the locality and the circumstances in which it took place and the substances or articles concerned, to the Licensing Authority (see paragraph 6 of the schedule).
4. If the works authorised by this Licence **31744/08/0** are unlikely to be completed by the expiry date of this licence, the Licence Holder should apply for a replacement licence at least 10 weeks prior to the expiry date of this Licence

This is an annex to the schedule of Licence 31744/08/0

MONITORING REQUIREMENTS

This Annex summarises the minimum physical and biological (excluding birds) monitoring requirements that must be undertaken to comply with the conditions of Licence 31744/08/0. Full details of the proposed survey specifications to meet these requirements are to be set out in a separate report to be agreed by the Licensing Authority, in consultation with CEFAS and Natural England, prior to the commencement of any survey works.

1. Suspended Sediment Concentrations (SSC)

The following monitoring is required in order to validate and confirm predictions. Monitoring will use Optical Backscatter Sensor (OBS) instrumentation, and will comprise three fixed moorings (locations to be agreed) plus selected water column profiling, during construction, of any sediment plume. Full calibration of the sensors will be required (see below for details), and should be included in a report and presented to the Licensing Authority. Instrument deployment will be for a period of at least four weeks, and will be provided concurrently at each site during the pre-construction, construction and post-construction periods.

Calibration of Sensors

- Using water samples collected during each of the three deployment periods and during the selected sampling;
- Covering a full tidal cycle, at hourly intervals and during spring tides (provided construction occurs over this period), during each of the three deployment periods, and at hourly intervals for two monopiles, for the duration of any sediment plume associated with construction activities;
- And using subsequent standard techniques for gravimetric and particle size distribution analysis to enable accurate conversion of results to SSC.

These would need to be deployed as follows:

- At a representative point identified by the modelling and within the sediment plume to measure near-field effects of sediment release.
- At a representative point identified by the modelling and within the sediment plume to measure far-field effects
- At a point outside the predicted area of the sediment plume to provide a 'control' measure of natural suspended sediment levels over the respective monitoring periods.

Alternative approaches may be acceptable but the methodologies would have to be submitted to the Licensing Authority for review and agreement at least one month prior to the proposed commencement of the monitoring work.

In line with condition 9.4 of the Licence should suspended sediment levels associated with the construction works be shown to be at unacceptable levels (ie above threshold) works may need to be suspended while a less disruptive methodology is investigated. Background levels from the monitoring programme will be used to set suitable threshold levels.

2. Seabed Morphology and Scour

(See Supplementary Licence Conditions 9.17 and 9.18)

Monitoring of seabed morphology should include the cable route (both between the turbines and to shore) to assess sediment movements in relation to the cable burial depth and the long term integrity of the cable.

The Environmental Impact Statement suggests that tillite/boulder clays will disperse quickly due to the dynamic environment. However, compacted clays may take longer to be broken up by severe wave activity. An assessment of the quantities and likelihood of compacted clays being released during construction is required as part of the pre, during and post construction monitoring.

3. Contaminants

The Environmental Impact Statement predicted that sediment redistribution during construction would be low. To assist in validating this prediction in addition to the suspended sediment concentration monitoring described above further sediment samples for contaminant analyses are required from within and adjacent to the turbine array and the cable route. The outcome of the pre-construction monitoring may necessitate the addition of mitigation measures to minimise and control the release of sediments during the cable laying operation.

4. Current Monitoring

To monitor predictions made in the Environmental Impact Statement for the Barrow offshore windfarm of a wake effect downstream of each monopile, further investigation is required.

Post construction ADCP monitoring should be undertaken taking transects through the wake region. The results should be compared to the predictions and discussed in the context of possible disruption to coastal processes. If changes in current velocity are significantly greater than predicted, then the consequences for the sediment transport regime will need to be re-evaluated.

5. Benthic Organisms

Sample locations for ongoing monitoring must be determined by factors such as precise monopile locations, location of cables etc. Sample locations must also take full account of factors such as sensitive areas, coastal processes modelling outputs (for sediment transport/deposition information) and geophysical surveys (to ensure adequate coverage of seabed habitats). The following samples should be taken to adequately cover the extent and direction of the full tidal excursion. The number and location of the sample points needs to be submitted to the Licensing Authority along with a plan and rationale and agreed with CEFAS and English Nature at least one month prior to the survey works commencing.

Indicative sample locations (based on a minimum of 23 sites (maximum of 35 sites) with 3 replicate grabs at each) would be:

- 5 sites (minimum) within the windfarm area, representing different habitat types and up/down drift conditions.
- 3 sites (minimum) within the near-field area of the monopile foundations to determine scour effects etc.
- 4 sites (minimum) to the east of the windfarm within the area affected by sediment transport and deposition.
- 4 sites (minimum) to the north, north west, west, south west and south of the turbine array but within the tidal excursion.
- 3 sites (minimum) along the cable route.
- 4 sites (minimum) nearby but remote from the windfarm (controls). NB these should be outside the tidal excursion and be spaced at reasonable distances around the development area.

Colonisation of monopiles and scour protection must be determined by diver-operated video observations and analyses with some accompanying sample collection for verification and identification.

Intertidal invertebrate sampling must be undertaken at lower, mid and upper shore sampling stations along three transects running perpendicular to the shore in the area of the cable

landfall. The precise details of the monitoring for the cable route and the reinstatement works are dependent on the methodologies used. The Licence Holder must therefore provide the details of the methodology used for cable laying at least 2 months prior to works commencing so that recommendations on the benthos monitoring specifications can be made.

NB. The sedimentary and benthic data sets must be closely related and the resultant reports should include quality assurance, statistical analyses and full species lists.

6. Electromagnetic Fields

The Licence Holder must provide the Licensing Authority with information on attenuation of field strengths associated with the cables, shielding and burial described in the Method Statement and related to data from the Rødsand windfarm studies in Denmark and any outputs from the COWRIE tendered studies in the UK. This is to provide reassurance that the cable shielding and burial depth(s), both between the turbines and along the cable route to shore, given the sediment type(s) at the Barrow site are sufficient to ensure that the electromagnetic field generated is negligible. Should this study show that the field strengths associated with the cables are sufficient to have potential detrimental effect on electrosensitive species, further biological monitoring to that described in Section 7 of this Annex may be required to further investigate the effect.

7. Marine Fish

(See also Supplementary Licence Condition 9.7)

The Environmental Impact Assessment observed electrosensitive species (eg Thornback Ray, Basking Shark) in Morecambe Bay and in the vicinity of the Barrow site. In the absence of any evidence that electromagnetic fields do not pose a risk to such organisms, monitoring work is required to determine the numbers and distribution of such species in the vicinity of the Barrow offshore windfarm (this should include the establishment of a baseline and the use of adequate controls). The results should be presented and discussed in combination with the EMF studies described in the preceding section (6).

8. Noise and Vibration

(See also Supplementary Licence Conditions 9.5)

Detailed post construction data must be collected on the frequency and magnitude of underwater noise produced by the Barrow offshore windfarm. The choice of sites for installing monitoring equipment should reflect the different conditions such as sediment type, water depth and pile type. This data is required for a variety of purposes, including:

- In combination with the biological aspects of the monitoring programme proposed in Annexes 1 and 2, the data would help to elucidate any interactions between noise generation and the provision of new habitat and fish aggregation effects of the turbine support structures.
- Determining the effects of distance depth and background sources on noise propagation.

9. Numerical Models

All numerical model computations within the Environmental Impact Statement were completed without any wind forcing. It is suggested that the model be rerun with wind forcing from various directions and strengths. It should also be shown how the model was validated for these directions.

----- **This is the end of this Annex** -----

Annex 2

This is an annex to the schedule of Licence 31744/08/0

ORNITHOLOGICAL MONITORING

Monitoring will commence with at least a year of baseline, pre-construction data gathering and monitoring during the year of construction. Post-construction monitoring will be undertaken annually for three years. The level of subsequent monitoring, during the lifetime of the windfarm's operation, will be determined, in agreement with Natural England, by the magnitude of change in bird populations observed in the initial monitoring period. The ornithological monitoring programme may have to be adapted and amended as new technologies and research findings become available.

Monitoring should be linked, where appropriate, with the benthic monitoring.

Monitoring reports will be provided to Natural England annually, or more frequently where the results of the data may trigger further monitoring work. Monitoring of an agreed reference site will also be carried out in parallel to the windfarm site.

Monitoring will need to fulfill the following objectives:

1. Determine whether there is change in bird use and passage, measured by species, abundance and behaviour, of the windfarm site and the reference site.
2. Determine whether there is a barrier effect to movement of birds through the site.
3. Determine the distribution of wildfowl and divers in the Irish Sea, covering the Barrow site and the vicinity. This will include movements of wildfowl to and from Walney Island and common scoter.
4. IF objectives 1 or 2 reveal significant use of the Barrow site by populations of conservation concern, at heights that could incur a risk of collision, a programme of collision risk monitoring will be implemented.

Detailed study design is not presented at this stage as some uncertainties are the subject of research in progress. In addition, monitoring methods may change in response to novel research results or the development of new technologies.

The Licence Holder and their consultants must develop a detailed design for this study in conjunction with Natural England before monitoring can be undertaken.

Note:

It is recommended that the collection of baseline data continue through construction, and that subsequent monitoring from dedicated boat surveys during the operating phase take place during the spring and autumn when bird usage and movements through the site are likely to be most frequent.

Boat surveys should allow for the survey areas (site and reference) to be covered at least twice in the spring and autumn and should coincide with the aerial surveys whenever possible.

The co-funded aerial survey programme of Liverpool Bay should be extended to cover the Barrow site and Warwick Energy should continue to contribute to the programme for its duration.

----- **This is the end of this Annex** -----

Annex 3**This is an annex to the schedule of Licence 31744/08/0**

Distance from shore (kilometres)		Recommended Depth of burial (Metres)
From	To	
0	1.8	1.3m
1.8	3.2	1.1m
3.2	3.4	1.1m
3.4	4.0	1.4m
4.0	7.8	1.4m
7.8	8.9	1.4m
8.9	9.4	1.1m
9.4	11.5	0.6m
11.5	12.5	1.4m
12.5	14.88	1.4m
14.88	15.04	1.4m
15.04	23.4	0.6m
23.4	25.6	0.9m
25.6	26.6	0.6m
26.6	26.7	1.1m

----- This is the end of this Annex -----