ENVIRONMENTAL IMPACT ASSESSMENT OFFSHORE SCOPING REPORT

LONDON ARRAY OFFSHORE WIND FARM PROJECT

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1 Introduction

1.1 THE PROPOSED DEVELOPMENT

The London Array consortium (London Array), is proposing the development of a large offshore wind farm located in the Outer Thames Estuary. The proposed site is located on and between two long sandbanks located approximately 20km from both the Essex and Kent coasts. Site selection and feasibility studies commenced in late 1999 and key environmental studies were scoped with the statutory agencies and have been progressing from 2002 until the present time.

This scoping report sets out the work already completed, that which is underway and that which remains to be carried out. Where methodologies have not yet been agreed for certain areas of study, proposals for the way forward have been suggested. London Array acknowledge the support received from the Greater Gabbard Project regarding the format of this Offshore Scoping Report.

London Array's proposal has been awarded an Option for an 'Agreement for Lease', by the Crown Estate, for an offshore wind farm of up to 1,000 MW to be constructed in a number of phases. The site assessment would cover an area of approximately 245 km^2, however, the actual area developed would be somewhat less. The final development would involve the construction of approximately 250 – 300 wind turbines together with associated offshore transformers, undersea cable to the shore, onshore cabling and a new onshore substation to connect 1000MW to the existing 400kV transmission system.

1.2 THE DEVELOPMENT CONSORTIUM

London Array comprises three partners: Shell WindEnergy Ltd, E.ON UK Renewables and CORE Ltd.

Shell WindEnergy Ltd is one of the 10 largest wind farm asset owners in the world and has secured, or operates, about 660MW of wind projects across Europe and the USA. Shell WindEnergy has access to considerable experience and expertise with regard to offshore developments as part of the Royal Dutch/Shell Group of companies. Shell U.K. Limited, its parent company, has more than 30 years of offshore experience in the UK sector and The Shell Petroleum Company Limited was one of the joint venture parties, together with Powergen, Nuon and Amec, in the UK's first offshore wind project at Blyth in Northumberland.

E.ON UK Renewables, recently re-branded from Powergen Renewables, comprises a group of companies under E.ON UK Renewables Holdings Ltd and is part of the E.ON group, the world's largest investor-owned utility. E.ON UK Renewables is one of the UK's leading wind farm owner-operator-developers and is currently building a 60MW offshore wind farm called Scroby Sands off the coast of Great Yarmouth. It is also progressing 180MW of offshore wind farm development in the Solway Firth. E.ON UK Renewables has stakes in 19 wind farms that supply enough renewable energy to power a town the size of Blackpool. The company also operates two hydro power stations in Wales and burns biomass material in coal-fired power stations.

CORE Ltd is a joint venture between Farm Energy and Energi E2. Farm Energy was originally established as a specialist wind power manufacturing and servicing company in 1988. In 1997, the company reorganised to concentrate on development work for onshore and offshore wind farms in the UK. Energi E2 is a leading Danish energy generator, whose production portfolio includes around 700MW of renewable energy, of which 400MW is wind power. E2 has acquired considerable offshore experience and recently completed the 165MW Nysted offshore wind park in Denmark.

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1.3 REGULATORY AND POLICY BACKGROUND

The UK government has committed itself to cutting the emission of a basket of green house gases to 12.5% below 1990 levels by 2008-2012 as its contribution to the European Union commitment to the Framework Convention on Climate Change, agreed at Kyoto in 1997. More recently the Government has set itself a domestic target for reduction in carbon dioxide emissions beyond this commitment. The domestic target is to reduce CO_2 emissions to 20% below 1990 levels by 2010. In November 2000, the Government published the UK Climate Change Programme, which outlines the target areas and policies through which it aims to achieve these targets.

The target areas identified in the Climate Change Programme include energy generation, transportation and domestic and business energy efficiency. Expansion of the proportion of electricity produced by renewables is seen within the programme as a major contributor to greenhouse gas emission reductions within the energy sector, alongside promotion of combined heat and power plant, subject to the cost to consumers being acceptable.

Also within the Climate Change Programme, the Government states that its main objective in the energy sector is to work towards the target of obtaining 10% of the UK's electricity supply from renewable sources by 2010. More recently the Government announced an extension in its domestic renewables target to 15% by 2015. The Government's aspiration is by 2020 to double renewables share of electricity to 20%. The development of renewable energy will be vital to meeting the Government's CO_2 reduction targets, and will provide economic benefits for the UK economy.

The Climate Change Programme recognises that the domestic goal for a 20% reduction in carbon dioxide emissions by 2010 over 1990 levels is only '*a first stage towards what will be needed in the longer term.'* The Energy White Paper, published in February 2003, sets out

the longer term strategic framework for the UK's energy policy and accepted that the UK should put itself on a path to reducing carbon dioxide emissions by some 60% by 2050.

In its entirety, the wind farm could have a generation capacity of up to 1,000MW. The result would be enough electricity to supply almost 25% of London's homes with their electricity1. In addition, a fossil fuelled power station will produce 1.9 million tonnes more CO2 than the London Array wind farm, for the same amount of electricity produced per year. If fully operational by 2010 it is predicted that the full development would deliver almost 10% of the Government's targets for renewables in 2010.

1.3.1 Offshore Wind Farm Consents Process

It is intended to seek consents for the elements of the development outside local authority jurisdiction through applications under the following provisions:

(a) Section 36 Electricity Act 1989 - for the construction and operation of the wind farm. The scope of this consent will include the wind turbines and their foundations, offshore sub-stations, cables between wind turbines, and cables towards the shore as far as the boundary of local authority jurisdiction.

(b) Section 5 Food and Environment Protection Act 1985 - consent for the placement of wind turbine and substation foundations in the sea bed and the laying of cables between the wind turbines and cables to mean high water springs.

(c) So far as necessary a Works Licence from the Port of London Authority for all parts of the development within that authority's jurisdiction.

Consents may additionally be required under Section 109 Water Resources Act 1991 for the erection of structures in a main river (so far as the River Swale is a main river) and for taking cables through sea defences (under the Land Drainage Act 1991).

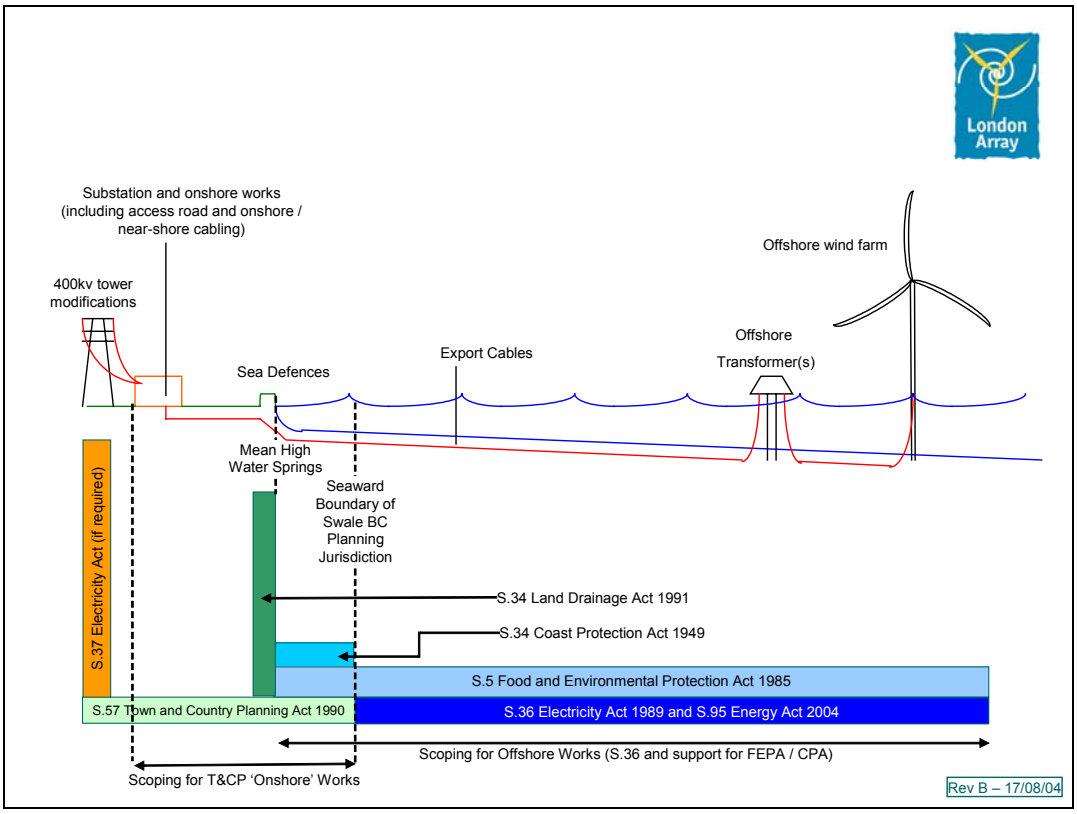
Consents required for the onshore and inter-tidal elements of the proposed development are addressed in a separate onshore scoping report available on request. This report also addresses the possibility of local authority jurisdiction below mean low water springs.

The schematic presented in Figure 1 shows in simplistic terms the inter-relationship between the various key consents required for the London Array project.

[1] Based on 2001 census information

Figure 1 London Array key Consent / License regimes and associated Offshore Scoping requirements

(Note: This schematic illustrates the legal framework for the key environmental consents for which application will be made to enable London Array to be constructed)



1.3.2 Environmental Impact Assessment

The Environmental Impact Assessment Directive (97/11/EC) requires an EIA to be completed in support of an application for development consent for certain types of project. Offshore wind farms are listed in Annex II of the Directive, as 'installations for the harnessing of wind power for energy production (wind farms)', and these provisions have been transposed into UK legislation.

Electricity Act

The need for EIA for electricity generation projects requiring consent under Section 36 of the Electricity Act 1989 is provided for in England and Wales by The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000. These set out the statutory process and minimum requirements for environmental impact assessment. However, site-specific issues would require further investigation and these issues would be the subject of a detailed scoping process with the Department of Trade and Industry and other Stakeholders.

Food & Environment Protection Act
No regulations applying the EIA directive have been made under this Act. However, Section 8 of the Act requires applicants to provide the licensing authority with such information as it deems necessary to enable it properly to consider the application. The licensing authority's policy is that this information shall include the equivalent of a formal ES in support of all offshore wind farm projects to inform the process of impact assessment.

Coast Protection Act
An EIA is also required to satisfy the Harbour Works (Environmental Impact Assessment) Regulations 1999 where a scheme is proposed which is to be sited in or partly within a port or harbour.

Other Consents
Often marine schemes will include a significant landward element that also requires consent under other legislation such the Town & Country Planning Act which may, in turn, trigger the need for an EIA under associated EIA Regulations.

Where the various consents impose a requirement for more than one EIA, the Marine Consents and Environment Unit advises that the consenting authorities will normally be content for the developer to provide a single Environmental Statement, provided that its scope is sufficient to incorporate the range of environmental issues which each can be expected to consider. This may, for example, take the form of separate volumes addressing particular topics, such as the foreshore and land-based issues and sub-tidal matters.

The Conservation (Natural Habitats, etc.) Regulations 1994
These regulations transpose Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) into national law. The Regulations place a duty on the Secretary of State to propose a list of sites which are important for either habitats or species (listed in Annexes I and II of the Habitats Directive respectively) to the European Commission. Once the Commission and UK Government have agreed that the sites submitted are worthy of designation, they are identified as Sites of Community Importance (SCIs). The UK Government must then designate these sites as Special Areas of Conservation (SACs) within six years. The Regulations also require the compilation and maintenance of a register of European sites, to include SACs and Special Protection Areas (SPAs) classified under Council Directive 79/409/EEC on the Conservation of Wild Birds (the Birds Directive). These sites form a network termed Natura 2000.

The Habitats Regulations apply only as far as the limit of territorial waters (12 nautical miles from baseline). The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 apply the Habitats Directive and the Birds Directive in relation to oil and gas plans or projects wholly or partly on the United Kingdom’s Continental Shelf and superjacent waters outside territorial waters (the UKCS).

The Regulations make it an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2, or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4. Further details of the ornithology assessments for this project are detailed in Section 4.2.3.

Appropriate Assessment

The Habitats Regulations require that projects not connected with the nature conservation management of a Natura 2000 site which are likely to have a significant effect on the notified interests of that site should be assessed so as to establish the implications of the project for the interests of the designated area. This requirement applies to designated SPAs and SACs and to proposed SPAs and candidate SACs on lists submitted by the UK Government to the European Commission for approval.

The designated sites in the Thames Estuary and their relationship to the project are shown at Figure 10 and listed in Tables 2 and 3. The only likely requirement for this project to be subject to Appropriate Assessment thus far identified relates to the effects of the proposed cable route through the Swale SPA and Ramsar site. Information required to support Appropriate Assessments for these sites will be mostly included in the Environmental Statement for the onshore works which will include the effects of works in the inter-tidal area.

Cumulative and In-combination Impacts

The need to consider cumulative impacts is a requirement of the EIA process (and the Habitats Regulations, in the case of Natura 2000 sites are affected). Projects to be included in such an assessment must include those in the past, present and foreseeable future. Projects to be included in such an assessment must include not only other potential wind farms but also other types of projects taking place in the marine environment. Further details of London Array's assessment of cumulative effects are detailed in Section 4.4. These assessments have been developed in conjunction with the other wind farm developers in the Thames Estuary under the auspices of the Thames Estuary Developers Group.

1.4 CONTEXT OF THE SCOPING REPORT

London Array is responsible for preparing Environmental Statements that will be submitted to support applications for the various consents required for the London Array project and described earlier in section 1.3.1.

The purpose of the offshore scoping report is to identify the main issues envisaged through the construction and operation of the offshore elements of the overall project and to propose relevant environmental studies for the competent authorities and Statutory Consultees to consider. To this end, a formal scoping opinion request has been made to the DTI who will in turn consult with the relevant competent authorities and key Statutory Consultees to seek their comment on the adequacy of the proposed studies.

In addition to the bodies that DTI will formally consult, London Array is circulating the document to a much wider distribution (the initial distribution list is provided in appendix C) and welcomes comments from these additional stakeholders on the proposals described in the document.

A similar process is being undertaken to support the onshore and near-shore works which will be consented under the Town and Country Planning Act 1990[2].

[2] London Array Offshore Wind Farm Project – Environmental Impact Assessment (On-Shore Works) Scoping Report, Revision A, 23 July 2004.

It should be noted that the marine works between the mouth of the Swale (the extent of the jurisdiction with Swale Borough Council and Canterbury City Council) and the shore will also require FEPA / CPA approval. The offshore scoping exercise should therefore extend for the purposes of FEPA / CPA to the mean low water springs. Please refer to the schematic in Figure 1 which illustrates in simple terms the extent of the consents and the associated scoping.

1.5 STRATEGIC ENVIRONMENTAL ASSESSMENT

The DTI published a Consultation Paper entitled "Future Offshore", in December 2002, setting out a strategic framework for the future development of the offshore wind energy industry. This paper highlighted the Governments intention to undertake Strategic Environmental Assessment (SEA) to inform the potential location of future offshore wind farms ahead of the introduction of the EU SEA Directive in 2004.

The SEA for the second Round of Offshore wind farm development was released for consultation in May 2003, focusing on three strategic areas, namely the Thames Estuary, the Wash and the North West (Liverpool Bay).

The London Array site falls within the Thames Estuary SEA area. London Array recognises the relevance of the SEA Report to the implementation of this project, particularly where cumulative environmental impact issues are involved. Consideration will be taken of the conclusions of the SEA report in undertaking the EIA, particularly the issues identified for the Thames Estuary including:

- Sediment transport processes;
- Conservation sites, biodiversity habitats and species;
- Collision risk, displacement, disturbance and barrier effects on birds;
- Collision and subsequent loss of inventory from cargo vessels;
- Collision and loss of life from passenger vessels;
- Seascape issues and visual impact.

1.6 BEST PRACTICE

The survey methods adopted for the London Array project would build upon various best practice guidelines available to the industry and detailed discussions with the statutory agencies, for example DEFRA and CEFAS Guidance, CAA Guidelines, JNCC guidance etc.

1.7 ASSESSMENT AND MONITORING

The Environmental Impact Assessment Directive (97/11/EC) imposes obligations on member states for an EIA to be completed in support of an application for development consent for offshore wind farm projects. This scoping document has been prepared in order to explain the potential benefits and impacts of a wind farm in the Outer Thames Estuary area, to provide an overview of the work scoped and undertaken to date and to agree a suitable schedule and methodology for the remaining baseline works and site surveys which are required to understand the current situation on the offshore and on-land sites, and to compile a comprehensive environmental impact assessment. The consent applications would only be submitted once the consortium have carried out an extensive consultation process with all interested parties.

Should specific impacts be identified during the survey work, further surveys can be commissioned to determine the impacts in more detail, and any appropriate mitigation . If the applications for consent are successful survey work would be carried out during and after construction to verify any potential impacts and fine tune mitigation procedures. These would be the subject of a further consultation once the initial surveys are completed.

2 Project Description

2.1 OBJECTIVES OF THE DEVELOPMENT

The principal objective of the proposed development is the generation of energy from a renewable source, in line with the government's target of generating 10% of UK electricity demand from renewable sources by 2010. More recently, the Government announced an extension of this target to 15% by 2015. The Government's aspiration is to double the renewable sector's share of electricity generation to 20% by 2020. The development of renewable energy will be vital to meeting the Government's CO_2 reduction targets, and will provide economic benefits for the UK economy. The London Array project would offset the emission of greenhouse gases, in line with the UK's commitments under the Kyoto Protocol.

2.2 ELECTRICITY GENERATION AND EMISSIONS OFFSET

It is worth calculating the emissions that will be output by electricity generators should neither the London Array wind farm nor any alternative renewable generator of the same annual electricity output, be developed. These emissions would comprise carbon dioxide (the main gas contributing to climate change), sulphur dioxide and nitrous oxides, which together are the main cause of acid rain.

According to the DTI "Energy Trends" publication in March 2004 the CO_2 emissions from a fossil fuel power station can be calculated to be 601gCO_2/kWh. Estimations for the annual electricity yield for London Array allow a comparison between the CO_2 emissions for London Array and a fossil fuel power station. A fossil fuelled power station will produce 1.9 million tonnes more CO_2 than the London Array wind farm, for the same amount of electricity produced per year.

The wind farm proposal would have a total installed capacity of approximately 1,000MW depending on the final turbine size used.

The capacity factor for the site, that is the net annual output as a proportion of the maximum annual output for constant ideal wind conditions, has been estimated at 35%. This factor includes availability figures and losses in electrical cabling up to the point of connection with the existing transmission network.

The annual net output from the wind farm taking into account the above capacity factor is 3100 GWh/yr which would offset the equivalent to approximately 1.9 million tonnes of fossil fuel carbon dioxide emissions per annum. In addition there will be additional savings relating to Sulphur Dioxide and Nitrogen Oxides which will be presented in the Environmental Statement.

The proposed London Array Wind Farm would generate enough electricity to supply almost 25% of London's homes with their electricity[3]. If fully operational by 2010 it is predicted that the full development would deliver almost 10% of the Government's targets for renewables in 2010.

[3] Based on 2001 census information

2.3 SITE SELECTION

There are a number of physical factors affecting the suitability of potential offshore wind farm sites including the wind regime, water depth, distance to shore, availability of a grid connection, suitability of seabed strata for foundation structures. One of the main technical and economic factors affecting the choice of site is the proximity to a main load centre, in this case London. Therefore, London Array Consortium undertook a broad site selection process to identify a suitable location in the UK, considering these physical factors. This considered all aspects of a number of areas that would have a bearing on the economic viability and the technical and environmental acceptability of an eventual wind energy development. The Thames Estuary was selected as the most appropriate location.

The consortium commissioned Metoc PLC, in 2001, to undertake an environmental feasibility study to establish the most suitable location for a wind farm in the Thames Estuary. The study assessed all environmental issues, sensitivities, constraints and risks pertinent to development, including associated power connection ashore, within a large area encompassing around 800 km^2 of sea and offshore sandbanks. Supporting studies include a Connection Feasibility Study by NGC (2001) and also a Cable Route Selection Study by Metoc (2002). The final site location was selected following a detailed assessment of the Outer Thames Estuary area.

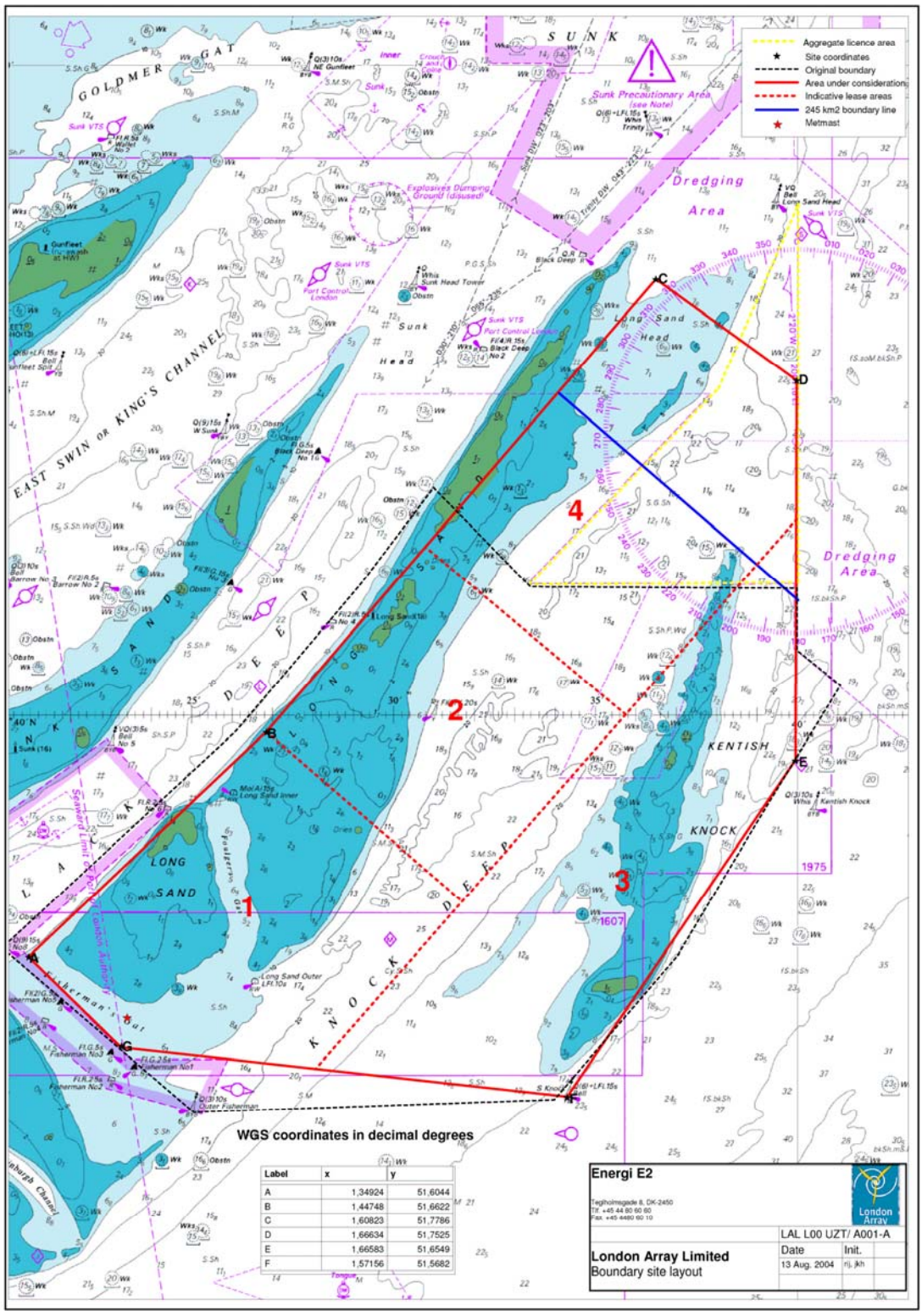
This study identified a total area of approximately 245 km^2 as the most appropriate area for the development. The total area, including the shallow and inter-tidal areas and Knock Deep, are shaped to avoid the active dredge areas in the north and to minimise impact on the existing shipping route through Fisherman's Gat in the south. London Array has avoided buoyed shipping routes throughout and buffer zones are 250m or more to the nearest turbine.

This site falls within the Thames Estuary Strategic Environmental Assessment (SEA) area, defined by the DTI and Crown Estate as one of the areas where applications would be permitted in the second round of UK offshore wind farm developments.

2.4 SITE LOCATION

The site is located in the Outer Thames Estuary on and between two compacted sandbanks, Long Sand and Kentish Knock, straddling the Knock Deep channel, which is approximately 20m in depth. Water depths across the site ranges from 1.5 to 23 metres. The site is bounded to the west by Black Deep, the main approach to the Port of London, and in the south by the approaches to the Fisherman's Gat. In the east the water depth increases fairly rapidly into an area of high shipping intensity. Long Sand and Kentish Knock therefore provide natural barriers for two sides of the site. There are a number of designated areas along the coastline in the vicinity of the site including Special Protection Areas (SPA's), Special Areas of Conservation (SAC's) and Sites of Specific Scientific Interest (SSSI's). These designations will be carefully considered during the EIA process. Please also see 2.6.9.

Figure 2 Site Location Map



The layout shown in Figure 2 above has been prepared for the general consultation process. The layout shows the survey area including the extension to the north and the site coordinates. The project boundary in London Array´s Round 2 submission to CE is also shown. Areas numbered 1-4 denote proposed construction phases as detailed further in Appendix A.

Prior to publication of this report, this layout has been shown to Crown Estate, fishermen, DTI, CEFAS, DEFRA, PLA and THLS.

1. Black dotted line denotes original project site boundary in London Array´s Round 2 submission to CE, with a site area of 245 km2.
2. South-western corner of the site is under discussion with PLA and other navigation authoritites.
3. Extended area to the north of site is a potential replacement for any area of the site found unsuitable for development.
4. Solid red line denotes the boundary of the area being considered for the location of windfarm structures.
5. The blue line shows where 245 km2 is reached within the solid red line.
6. The dotted yellow line shows the boundary of aggregate licence area 108/1, 109/1 and 113/1. Discussions have started with Britannia, UMD and RMC marine on options to use some or all of this area for Phase 4.

Figure 3 below provides the cable route proposed in a desk study carried out for the project by Metoc. The results of the geophysical survey currently underway of the route and information from the PLA and other stakeholders are likely to lead to adjustments to the cable corridor(s) and the routes of individual cables.

Figure 3 Proposed Marine Cable Route.

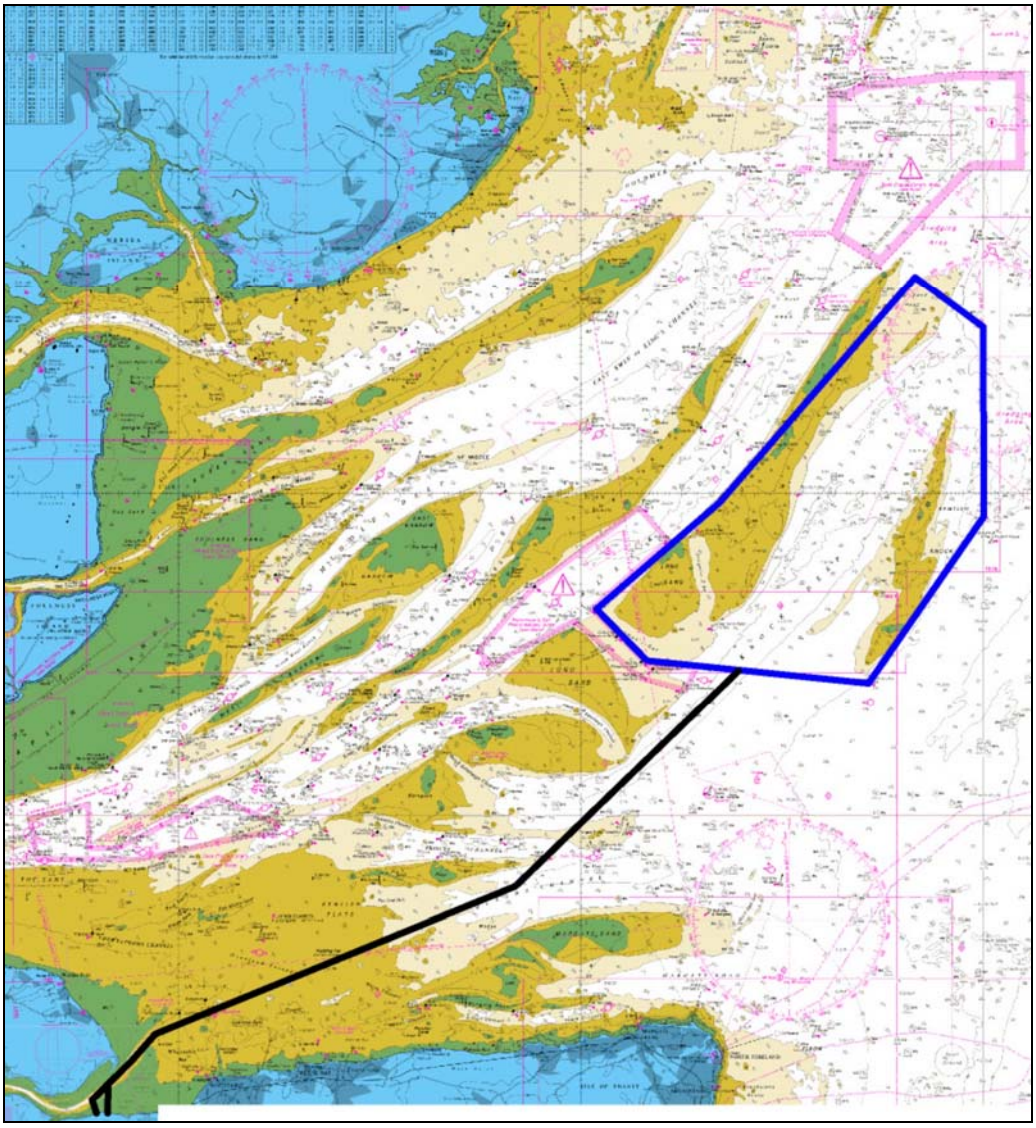


Figure 3 above indicates the proposed route for the export cables, of which there will be up to 6, from the wind farm to the shore connection point. This route has been selected on the basis of a desk study carried out for the project by Metoc. The results of the geophysical survey of the route and information from the PLA and other stakeholders are likely to lead to adjustments to the cable corridor and the routes of individual cables.

2.5 PHYSICAL CHARACTERISTICS

2.5.1 Oceanographic Characteristics

Studies have been carried by London Array into the oceanographic and seabed conditions, including wave and tidal conditions, bathymetry, surface seabed conditions and geophysical and geotechnical surveys.

Metoc undertook an environmental feasibility study in 2001, on behalf of London Array, with the objective of identifying the most stable sandbanks in the wider Thames Estuary. The study concluded that specific parts of Long Sand and Kentish Knock were the least mobile sand banks in the Thames Estuary and that the sand banks to the south of Fisherman's Gat were perhaps the most mobile, as demonstrated by the closure of the North Edinburgh Channel in recent years.

A coastal process desk study carried out by ABP marine environmental research has determined estimates of the wave and tidal regime in the Thames Estuary around the proposed site location. Values for Highest Astronomical Tide (HAT) and Lowest Astronomical Tide (LAT) for this site are not published by UKHO, therefore, estimates have been derived by ABPmer. Spring and Neap mean tidal ranges for Long Sand are 4.3m and 2.5m respectively, with a peak range of 5m.

Geophysical surveys carried out in this area confirm that large areas of Long Sand and smaller areas of Kentish Knock lie at less than 4m below LAT and will be difficult to access for the construction of wind turbines. Other areas of the sandbanks exhibit significant mobility, relatively steep slopes and large sand waves. Within Knock Deep, water depths up to 25m below LAT were recorded.

A detailed geophysical survey will be carried out during summer 2004 to assist in refining the design of the wind farm layout and turbine locations. This will be supplemented by detailed geotechnical surveys prior to construction.

2.5.2 Geological Characteristics

The site area is underlain by a considerable thickness of sand and gravel, ranging from 20m on the sandbanks to 5m in the centre of Knock Deep. The surface deposits are mostly underlain by London Clay, and a number of ancient river channels.

2.6 WIND FARM COMPONENTS AND THEIR INSTALLATION

The details of the wind farm components would not be known until after all necessary statutory consents are in place and the procurement process has completed. Therefore, the Environmental Statement would consider all of the likely components and corresponding methods of installation. For the purpose of undertaking the environmental impact assessment a worst-case scenario would be considered for all aspects of the construction, operation and decommissioning of the wind farm.

2.6.1 Wind Turbines

The London Array site would accommodate the installation of between 250 and 300 turbines. Currently, 3MW and 3.6MW turbines are available on the market with a hub height of 80m and a blade diameter of 111m. However, due to the rapid development in wind turbine technology this could increase to 7MW by the commencement of the last phase of

construction. The Environmental Statement will cater for a range of turbines that may be available for the later construction phases estimated to have hub heights in the region of 100 metres and a blade diameter of approximately 130 metres, resulting in a total height to blade tip in the region of 165 metres above mean sea level. These dimensions present a guide only and would change according to manufacturer.

We would seek to maintain clearances from the sea level at MHWS to blade tip that would be acceptable to RYA, MCA and other stakeholders. The wind turbines would be placed in a layout which gives the best utilisation of the wind while at the same time offering the most harmonic visual impression and accommodating any navigation and environmental constraints. Whilst the visual impact for the proposed development is expected to be minimal as the minimum distance to the coastline is 20 kilometres (~10 nautical miles), the EIA will examine any potential viewpoints and undertake a cumulative assessment where appropriate. At this stage the visual impact of the proposed development on the coastline is not expected to be significant.

The final turbine model would not be selected until after all of the statutory consents are in place, however, they are likely to be three bladed with a horizontal axis nacelle positioned on a tubular tower.

A photograph of the 2MW turbines during construction at Scroby Sands Wind Farm, located off Great Yarmouth, is shown in Figure 4.

Figure 4 E.ON UK's Scroby Sand Wind Farm during Construction

The rotor blades would start to turn in wind speeds of between 2 and 5m/s and optimum power output is generally achieved at around 12-18 m/s. Turbines would generally shut down once wind speeds exceed 25 m/s for safety reasons. Power is controlled automatically as wind speed varies. All rotor blades on the wind turbines within the wind farm would rotate in the same direction, i.e. clockwise when viewed from the windward direction.

The turbines would have tubular steel towers assembled from two or three sections. The nacelle placed on top of the tower would contain a variable speed gearbox. The voltage of the turbine generator may be from 690-6,000 V and the turbine transformer, located either within the base of the tower or within the nacelle, may step this up to 30-50 kV.

The final turbine colour would be decided in consultation with the regulatory authorities. It is anticipated that this would be semi-matt pale grey or similar.

2.6.2 Foundations

The final foundation type would be dependent on a number of factors including but not restricted to site conditions, contractors specific choice, available construction equipment and cost.

Initial studies indicate that a combination of both monopile and gravity foundations would be used at the site depending on the variation of depth and seabed geology over the site area. However, the visual appearance of the foundations above sea level will be similar. Other foundation options that are less likely to be used are also detailed below and include steel tripod, piled concrete tripod, supported steel monopile, and suction bucket

Monopile Foundation

A monopile foundation constitutes a large diameter circular steel pile, which is driven or vibrated into the seabed. Alternatively, in the case of very hard deposits of clay or rock it can be placed in a pre-drilled hole. The length of the pile varies depending on the actual subsea conditions and water depths.

Heavy duty equipment, normally cranes operating from a jack-up platform or floating barge, is necessary to install the piles into the sea bed.

The turbine tower is bolted on to a flange on top of the monopile at a level above which the water/wave level is expected to reach. An access/work platform is usually provided at this level.

Figure 5 Monopile Installation at E.ON UK's Scroby Sands Wind Farm

Multi-pile Foundation

Foundations on multiple piles have not been used to support offshore wind turbines to date. However structures supported on multiple piles have been used for offshore oil and gas installations.

The multi-pile foundation may take many forms but would likely comprise a circular central column, with steel leg structures. The foundation is supported by piles with diameters in the order of 1.2 m to 1.8 m, which are driven or vibrated into the sea bed, depending on soil conditions. The height and width of the structure would also depend on site conditions.

Multi-pile foundations would be constructed onshore and would be transported to the site on barges. Minimal preparation of the sea bed is necessary, for example the clearing of obstacles and basic levelling to receive a piling template. The piles can be installed by cranes, operating from a jack- up or a floating barge and would be driven or vibrated into place.

Gravity Foundation

Gravity-type foundations have been used for the construction of several of the existing offshore wind farms. Gravity foundations have been successfully used since the early stages of offshore wind farm development. Vindeby (1991), Tunø Knob (1995), Middelgrunden (2000) and the recently constructed Nysted (2003) offshore wind farms in Denmark all feature concrete gravity foundations.

Such bases may take many different shapes but would generally comprise a base with a large plan area and a central tower. This type of base relies on its mass to resist overturning forces. The foundation would generally comprise a hollow concrete or steel structure which is filled with a high density material once the base has been placed in position.

A high degree of site preparation is usually required for this type of foundation as the base relies on firm contact with the underlying stratum, which must be strong enough to resist the high compressive forces experienced. The foundation is usually placed on a pre-prepared bed of compacted, crushed stone, which is provided in a shallow excavated area to provide embedment of the structure into the bed.

Gravity foundations would usually be built in dry dock, or at a land location in close proximity to a suitable harbour, and would be floated or transported by barge to the site. Concrete caissons would generally have a high self weight and thus, a relatively large crane would be required for installation.

Steel tripod
The steel tripod has been extensively used in the oil & gas industry for offshore platforms. The concept consists of a steel tube construction above seabed, and of three steel piles driven into the seabed. The concept has not yet been used for wind turbines, but may be an option for London Array for use in areas of greater water depths.

Piled concrete tripod
Piled concrete tripod is a composite construction using steel piles and a concrete construction above seabed. The structure is stiffer than steel monopiles, but has a disadvantage at shallow water as the base is elevated above sea bed and complicates boat landing. An additional strength of the concept is a possibility to use the high stiffness of the concrete shaft to replace flexible steel-tower to heights up to 20-30 meter above mean sea level. The concept can be split in three structural parts: piles, concrete base and concrete shaft/tower. The parts are connected with grouted joints.

Supported steel monopile
The supported steel monopile is basically a steel tripod, but has one of the three piles placed centrally to enable use of fewer welded joints.

Suction bucket
Suction buckets have been used for deep sea anchoring, and in a few cases for other constructions.

The overall stability of the structure is based on suction instead of driving the piles in the seabed. The foundation principle was developed for large water depths, where pile driving was impossible. The foundation principle (large mono bucket) is used for one demonstration wind turbine in Frederikshavn (Denmark) and will be used for a 4.5 MW Enercon wind turbine installed offshore in 2004.

2.6.3 Corrosion Protection

Sections of foundations would require protection against corrosion. This can be done with a coating which would be applied onshore and allowed to harden prior to installation. In addition, protection can be achieved by the installation of sacrificial anodes.

In the case of a monopile foundation, the provision of anodes is not always the preferred solution as forces generated during pile driving can damage anodes fixed to the structure before installation. In this case corrosion protection may be achieved by providing an additional thickness of steel over that required for structural strength. In the case of a multi-

pile foundation, which would be fabricated on land prior to installation, the underwater sections of the structure would most likely be protected by the provision of sacrificial aluminium anodes.

2.6.4 Scour Protection

Marine structures can be susceptible to erosion of the bed sediment in the vicinity of their foundations due to the action of waves, currents and tides. This is commonly referred to as scour. The requirement for scour protection at the London Array wind farm will not be known until further studies have been carried out at the site and site design is completed. The Environmental Statement will assess the potential use of scour protection solutions including the material used, installation methodologies and maintenance.

2.6.5 Cables

A power system study undertaken by PB Power on behalf of London Array concluded that the most economic connection for a sub-sea cable connection over the distance envisaged for this project would be achieved with XLPE insulated three-core AC cable up to 220kV in capacity. As a result, up to six three-core AC cables would be required to transmit 1000MW to shore. In the timescale of the project, however, XLPE three-core cable may be available with even larger circuit ratings, which would potentially reduce the total number of cables.

A variety of cable installation methods will be proposed and assessed in the Environmental Statement. Byelaw consent, under the Land Drainage Act 1991, would also be sought from the Environment Agency to take cables through any sea defences.

2.6.6 Offshore Transformer Station(s)

Offshore substation modules would be required to step up the voltage of the electricity generated at the wind turbines to a voltage that is suitable for transmission ashore. A photograph of a typical transformer substation is shown in Figure 6 below. More detailed design information will be made available as the project develops.

Figure 6 Installation of Offshore substation at Nysted Offshore Wind Farm

2.6.7 Cable Crossings

Two notable cable crossing points have been identified (BritNed and Kentish Flats) and the proposed solutions for these crossings will be detailed in the ES.

2.6.8 Wind Farm Layout

Technical and environmental considerations, determined through the baseline site surveys, would guide the design and layout of the wind farm components. Hence the results of surveys and consultation may highlight constraints on the site that will influence the overall site layout. Design considerations would include, for example, geotechnical conditions, metocean conditions, constraints highlighted through baseline studies e.g. designated areas, visual effects, energy yield etc.

The wind turbines would be placed in a layout, which gives the best utilisation of the wind while at the same time offering the most harmonic visual impression, whilst fitting in with any navigation and environmental constraints.

One of the key issues influencing the design of the wind farm layout is the possible impact of the wind turbines on navigation radar, VTS systems and VHF communications adjacent to recognised shipping routes. The junction of Fisherman's Gat and Black Deep at the southern end of Long sand is of particular concern to the PLA, THLS and MCA. London Array has agreed to ensure that no turbines are located within 500m of the buoyed channel through Fisherman's Gat. Other parts of the original external boundary proposed in the Round 2 submission to the Crown Estate, have also been adjusted to give better clearance from recognised shipping routes, as shown in Figure 2.

Studies to establish what, if any, effects the turbines might have on maritime navigation and safety communications systems have been carried out at Nysted Wind Park in the Baltic. Nysted comprises 72 2.3MW turbines, roughly equivalent to one of the four phases envisaged for London Array and a good approximation for the corner of the site adjacent to Fisherman's Gat and Black Deep. Early indications are that there should be no significant problems but the final reports and the results of further studies currently being undertaken by the MCA, specifically at North Hoyle, will need to be carefully considered.

In the event that some of the turbines in the south-western corner of the site have to be relocated for navigation safety reasons, or boundaries have to be adjusted for other reasons, London Array has identified an area to the north of the original site in which to expand to achieve the full 1000MW envisaged for the wind farm. This area has been included in the area being surveyed and modelled for coastal processes purposes by London Array to ensure that any relocation takes place into an area that has been properly assessed. Part of this area is occupied by an active, licensed aggregates license area, and London Array has entered into discussions with the relevant aggregates companies, United Marine Dredging, Britannia Aggregates and RMC Marine, to agree options for this area, which would, by the current programme not be required until 2009 at the earliest. Discussions are continuing to reach a mutually acceptable solution.

2.6.9 Cable Landfall

The onshore connection, which is less than 1km, would be subject to an application for consent from the local planning authorities, under the Town and Country Planning Act 1990

and an application under Section 37 of the Electricity Act, 1989. A separate onshore scoping exercise is underway relating to these works.

Potential sites were identified and assessed, taking account of technical, environmental and economic factors. The Environmental Statement will include an outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for his choice, taking into account the environmental effects. This may include both alternatives leading to the choice of Cleve Hill for the on-shore connections and alternative arrangements for the facilities to be provided at Cleve Hill.

2.7 WIND FARM CONSTRUCTION

2.7.1 Site Access

The construction phases for the project would include both onshore and offshore works. A 24-hour working period would be implemented all year round to carry out all offshore activities taking advantage of periods of suitable weather. This approach would reduce the overall duration of construction and hence the period over which construction activities have the potential to impact on the environment would be kept to a minimum.

2.7.2 Lighting and Marking

It is anticipated that temporary safety zones would be established around the areas where construction activities are underway, in compliance with the International Lighthouse Authority Maritime Buoyage System. Marine warning lights, mounted on temporary buoys would mark this area. London Array, in accordance with the relevant regulations, would issue a Notice to Mariners and arrange for Radio navigational Warnings to be issued by the Maritime and Coastguard Agency. A Marine Liaison Officer would be responsible for informing, in advance, fishing vessel operators and other marine users, of construction works associated with the offshore cable and wind farm site.

2.7.3 Construction Programme

The wind farm would be installed and commissioned in a number of phases, the timing of which would be subject to consultation and assessment as part of the EIA process.

A Gantt chart of the proposed project programme for the construction phase is attached in Appendix A.

A proposed construction phase would include the following elements:

- The construction site is mobilised and wind farm components are delivered;
- Pre-construction preparation works for the offshore site are undertaken, such as debris clearance, etc,
- Civil engineering works are undertaken for the onshore substation prior to commissioning the first phase of the offshore works;
- The installation plant is mobilised and foundations for the wind turbines and the substation are installed by the installation vessel. Typically, monopiles / multipiles would be drilled/driven into the seabed. Gravity foundations would be transported to the site and placed on the surface of the seabed following preparation and levelling;
- The wind turbine towers are installed onto the foundations and the nacelles and blades are attached;

- Scour protection is placed around the turbine and substation platform base locations, where required;
- The 33kV sub-sea cables within the wind farm are installed, as required for each offshore phase;
- Electrical equipment for the onshore substation is delivered and installed, as required for each offshore phase;
- the 132kV sub-sea electricity cables are laid between the onshore substation and the offshore substation, as required for each offshore phase;
- The connection to the grid connection point would be made prior to the commissioning of the first phase of the development;
- The systems are tested and commissioned and the construction plant is demobilised.

Procedures and routes for site access, in terms of liaison with other sea users, would be agreed during the consultation process to ensure minimal disruption in the vicinity of the site. Measures such as Fishing/Port Liaison and the provision of Guard Boats would assist in a smooth operation.

2.7.4 Environmental Management System - Construction

Given the scale of the development of offshore wind farms including the construction, commissioning and operational phases it is important to provide an Environmental Management System (EMS) for their development.

This is a requirement for any project falling under the EC Directive 97/11/EC on the assessment of the effects of certain public and private projects on the environment, including installations for the harnessing of wind power for energy production.

London Array would formulate an environmental policy, which would be specific to the project and would be included in tender documents as a requirement on contractors. An Environmental Manager would be appointed, with responsibility for the preparation and implementation of the Environmental Management System (EMS).

During the development period, the Environmental Manager would prepare a project EMS. This would ensure that all the environmental demands, set by the authorities, are fulfilled throughout the project lifecycle and that the necessary documentation is provided. The EMS will be in accordance with the standards for ISO 14001 and the environmental policy of the project. The aim would be transparency for all environmental issues in the construction phase and the flexibility to make environmental improvements. The EMS that is applied during the construction phase would be used to develop the Operational EMS for the wind farm.

2.7.5 Health and Safety - Construction

A Construction Stage Health and Safety Plan would be put in place under the requirements of the Construction (Design and Management) Regulations, 1994 (CDM Regulations). The CDM Regulations are aimed at improving the management and co-ordination of health, safety and welfare throughout all stages of construction projects to reduce the potential for serious accidents.

2.8 Wind Farm Operation

2.8.1 Site Access

London Array would have a requirement for 24 hour operational control of the wind farm and hence access to the wind farm could be required all year round for maintenance purposes.

2.8.2 Lighting and Marking

The lighting and marking of the wind farm during the operation period would be specified following consultation with Trinity House Lighthouse Authority, the Maritime and Coastguard Agency and the Royal Yachting Association. English Nature would be consulted regarding any potential impact to birds, as a result of the lighting arrangements.

The position of all turbines, subsea cables and ancillary structures would be notified to the UK Hydrographic Office so that their location can be incorporated onto the relevant Admiralty Charts.

2.8.3 Wind Farm Control

Despite the minimal requirement for assistance or interference during normal operations, to actively manage the scheduled and unscheduled maintenance of such an installation will require careful planning and logistical management.

To achieve this, service bases will be established at local ports in close proximity to the proposed wind farm for the operational period of the wind farm. There are several potential locations along the North Kent Coast and Thanet, and on the Essex side up to Harwich Haven.

Information relating to on-site conditions, turbine status and generated output would be held within a Supervisory Control and Data Acquisition (SCADA) System, linked to each individual turbine. They would be monitored and controlled remotely allowing any turbine or group of turbines to be shut down, if required for maritime safety operations.

2.8.4 Wind Farm Inspection and Maintenance

Access for offshore servicing is dependent on weather conditions, tidal variations, waves and sea currents, therefore, effective preventive as well as planned maintenance activities would take place when access conditions are favourable. An intelligent and robust control and monitoring system would be one of the backbones of the maintenance strategy to allow immediate and, where practical, remote response to faults, efficient control and protection of the wind turbines and to support the preventative maintenance activities.

The wind farm will be covered by a warranty period, which would typically be five years in duration. During this time, the equipment suppliers would typically be responsible for aspects such as the operation and maintenance of the wind turbines, scour protection, offshore substations and submarine cables. On this basis, the operation and maintenance of the balance of plant would become the developer's responsibility. The detail of such aspects would be the subject of contractual and commercial negotiations with suppliers as part of the process of tendering.

Periodic Maintenance of Turbines
Periodic maintenance campaigns would be carried out on an annual basis, planned for execution during periods of best access conditions and least impact on the turbine output, this is usually during the summer period.

Periodic maintenance would be carried out according to the supplier's specifications. The work scope comprises function and safety tests, visual inspections, analysis of oil samples, change of filters, lubrication, check of bolts, replacement of brake pads, oil change on gear box or hydraulic systems, etc.

Scheduled Maintenance of Turbines
Scheduled maintenance applies primarily to inspections and work on wearing parts which may deteriorate or fail between the periodic overhauls. Preventive maintenance is essential to keep costs at a minimum. A scheduled inspection of each turbine would be carried out at least every six months.

Unscheduled Maintenance of Turbines
Unscheduled maintenance refers to all sudden defects. This could range from small defects to total breakdowns of main components. The unscheduled maintenance is often costly as it can result in a loss of production. Vessels similar to those used during the construction process may have to be employed for these maintenance tasks.

Emergency Shutdown of Turbines
Turbines would be monitored and controlled remotely allowing any turbine or group of turbines to be shut down, if required, for maritime safety operations. Marine safety and navigation issues will be agreed with MCA and PLA.

2.8.5 Environmental Management System - Operation
An Environmental Management System (EMS) would be put in place for the operational period of the wind farm. The Environmental Management Plan would be based upon the system implemented for the construction period (See Section 2.7.4). The system would ensure that the environmental monitoring, as specified in the statutory consents, are undertaken and reported and that the wind farm is operated and maintained in a manner that is considerate of the environment.

2.8.6 Health and Safety - Operation
A Health and Safety Plan would be put in place during the operation period. Turbines would be monitored and controlled remotely allowing any turbine or group of turbines to be shut down, if required, for maritime safety operations.

2.9 Wind Farm Decommissioning
London Array recognises the need to restore the seabed to its proper condition at the end of the project's life. The decommissioning process would be outlined in the Environmental Statement (ES). Whilst London Array may wish to re-power the wind farm after the design life of the original turbines, any re-power would be subject to a further consenting process, survey work and environmental assessment. A decommissioning assessment covering this process would be produced at the end of the project life.

Design considerations for all offshore constructions will ensure that the ability to decommission safely and efficiently is addressed as part of the design process.

2.9.1 Decommissioning Method

The wind farm would be decommissioned at the end of commercial operation. A draft decommissioning plan will be agreed with Crown Estate prior to the commencement of construction in line with the UK's obligation under the OSPAR Convention for the Marine Environment of the North East Atlantic, or other legislation in place at the time of decommissioning.

Consideration will be given to this aspect in the ES, however, the simplest decommissioning methods are those of 'reverse installation' whereby structures and equipment are removed by a simple reversal of the installation sequence, using similar techniques and facilities.

2.9.2 Site Access

It is envisaged that site access requirements during the decommissioning phase will be similar to the requirements for the construction phase.

2.9.3 Post Decommissioning Monitoring

Requirements for post decommissioning monitoring would be agreed between London Array, and the appropriate authorities in consultation with other Government Departments and stakeholders. Details of any post decommissioning monitoring would be included in a Decommissioning Plan.

The presence of any wind farm structures that are not fully recovered or buried, would be subject to monitoring, at suitable intervals, as specified in the Decommissioning Plan. The presence of any remains would be notified to mariners and would be marked on the relevant Admiralty Charts.

3 Consultation

3.1 Consultation Overview

This scoping process is intended to incorporate the main survey work to form baseline studies, ensuring an investigation of all major issues that must be included within the Environmental Impact Assessment (EIA). The consortium has consulted and will continue to do so with all relevant bodies including fishing, nature conservation, navigation, aviation, recreational sailing, local and national interests etc. Where these consultations indicate a potential adverse impact, further studies and analysis would be commissioned to address the issues raised. The proposed contents list for the Environmental Statement is included in Appendix B, which highlights all areas that would be included when undertaking the environmental impact assessment.

It should be noted that the potential for cumulative impact would be considered for all issues. The Thames Estuary Developers Group is also assessing which areas should be addressed collaboratively to ensure that the most appropriate solution is adopted. The cumulative issues are addressed in more detail in Section 4.4.

London Array has already started a process of consultation with a number of statutory and other consultees. For information, Appendix C contains the list of recipients of this scoping report.

3.2 Continuous Consultation

As outlined previously, London Array has completed and is undertaking a number of different studies, the methodology for which has already been agreed with the relevant consultees, with a tranche of work still remaining.

Table 1 below contains a table which sets out work completed and underway. The list is intended to provide a broad overview of the current London Array datasets and facilitate identification of that which is outstanding.

RPS Group Plc have been appointed to assist the project in scoping the detail of the outstanding studies and carrying out the consultation regarding methodology and impact assessment and to coordinate the production of the Environmental Statement.

The baseline studies form the basis for gathering information to feed into the stakeholder dialogue. The consortium would continue to consult with all relevant bodies during the survey and study period, including fishing, nature conservation, navigation, local and national interests. Where these consultations indicate a potential impact, further analysis would take place to address the issues raised.

London Array will work with the consultees to ensure all aspects of this proposal are responsibly and comprehensively covered within survey work to address all known and predicted impacts.

Table 1 List of Studies Complete and Underway

1	Wind resource desk study	Garrad Hassan	Jan to Apr 01
2	Environmental feasibility study	Metoc	Jan to May 01
3	NGC connection feasibility study	NGC	Jul to Nov 01
4	Met buoy with 10m anemometry mast	Trinity House	Dec 01 to ongoing
5	Wind data analysis	Power Technology	Jan 02 to ongoing
6	NGC connection applications and offers	NGC	May 02 to Feb 03
7	Cable route/landing/selection study	Metoc/Shell/Global Marine	May 02 to Jul 02
8	Bathymetric, seismic & sidescan site and cable route surveys	Shell Expro, Arup & Osiris	Summer 02
9	AC study	PB Power	Jul 02 to Feb 03
10	Bird survey scoping study	Ecology Consult	Feb 02 to Aug 02
11	Commercial fishing study	Steven Heald	Aug 02
12	Fish and benthic scoping studies	CMACS	Apr 02 to Mar 03
13	Quarterly Fish Trawl Surveys	CMACS	Complete Spring 04
14	Preliminary Transport Assessment	Wynns & Global Marine	Oct to Dec 02
15	Bird field study (on & offshore)	Ecology Consulting	Sep 02 to ongoing
16	Regional aerial bird surveys	WWT	Aug 02 to ongoing
17	Shipping and collision risk study (Phase I)	Corrocean	Mar 03 to Apr 03
18	Coastal processes desk and Scoping (Phase I)	ABPmer	Jul 03 to Aug 03
19	Cable crossing study	Metoc	Aug 03 to Sep 03
20	Coastal processes data collection & analysis (Phase II)	ABPmer & EMU	Jan 04 - ongoing
21	Shipping and collision risk study (Phase II)	Scoping Stage	ongoing
22	Benthic sample (no. 200) collection & analysis	CMACS Liverpool Uni	June 04 - ongoing
23	Geophysical Site Investigations	Shell Expro & Osiris	May 04 – ongoing
24	Coastal processes modelling (Phase III)	ABPmer & EMU	ongoing
25	Onshore substation outline design	Mott MacDonal	April 04 - ongoing

3.3 List of Consultees

This scoping document provides the outline of the proposed baseline studies for the work required to complete the Environmental Impact Assessment (EIA) and the Environmental Statement (ES) only. The ES would support the applications, for consent for onshore and offshore works, under Section 36 of the Electricity Act 1989, Section 5 of the Food and Environment Protection Act 1985, Section 34 of the Coast Protection Act 1949, Section 37 of the Electricity Act 1989 and Section 57 of the Town and Country Planning Act 1990 and others, if required.

This list is not intended to be exhaustive. The stakeholder dialogue process would lead the consortia in the introduction to a number of additional organisations for consultation. It is also intended to hold a number of public exhibitions prior to the submission of an application.

4 Scoping of Environmental Effects

The following information provides an overview of the surveys and studies completed to date and makes recommendations for further proposed surveys. The list is not exhaustive. It is intended to identify the main survey work to be undertaken to allow a comprehensive impact assessment to be completed. London Array have, and will continue to consult with all relevant bodies, including fishing, nature conservation, navigation, local and national interests. Where these consultations indicate a potential impact, studies will be commissioned to analyse and report on the issues raised.

It should be noted that a number of the surveys and methodologies have already been scoped (Table 1) and agreed with the relevant authorities and stakeholders including approximately 24 months of ornithology survey work which has been undertaken to date at this site. The survey methods have built upon various best practice guidelines available to the industry in combination with consultation regarding detailed survey and assessment methodology, for example DEFRA and CEFAS Guidance, CAA Guidelines, JNCC guidance etc. The results of these surveys will be complemented by the ongoing works and proposed additional surveys, to ensure that a comprehensive impact assessment can be undertaken.

4.1 The Physical Environment

The potential for effects on the physical environment arise from the physical existence of the wind farm, the construction methods adopted and the materials used in the development.

4.1.1 Coastal Processes

The physical presence of the turbine foundations and ancillary structures has the potential to impact on the tidal flows and wave energy in the vicinity of the development. There is the potential for alteration of sediment transport patterns and also increased suspended sediment concentrations during the construction of the wind farm.

Potential effects on the physical environment include:

- increased levels of suspended sediment leading to smothering of benthic habitats, requirements for increased maintenance dredging, contamination of neighbouring aggregate sites with fines
- modified sandbank and channel formations leading to large scale morphological change, with consequential increased exposure of adjacent coastlines to waves
- interruption of sediment pathways with consequential up & down-drift effects both in terms of fines (whilst on pathway to “sinks” in local estuaries) and sand for banks

Assessments are therefore required to determine the extents of such effects, in terms of magnitude, spatial extent and duration and placed into context against natural variations.

London Array commissioned ABP Marine Environmental Research Ltd. (APBmer) to undertake an initial Coastal Process Scoping Study .

A Coastal Processes Study is necessary for a successful offshore wind farm development in relation to:

- Designing a scheme that can be accommodated by the local environment and having minimal impact on it
- Designing a scheme that can deal with the environmental conditions to which it is exposed, by establishing appropriate engineering design parameters.

It would be necessary to assess the magnitude and significance of changes caused directly to the following:

- Sediments (e.g. composition, particle size)
- Hydrodynamics (e.g. waves, tidal flows)
- Sedimentary Environment (e.g. sediment re-suspension, sediment transport pathways and sediment deposition).
- Sedimentary structures (e.g. channels, banks)
- Suspended sediment concentrations.

Consideration of the above issues would be made with respect to the following effects of the proposed development:

- Near-field (i.e. the area within the immediate vicinity of the turbine grid)
- Far-field (i.e. the coastline, sites of scientific and conservation interest)

Requirements for a Coastal Process Study

A coastal process study would be necessary in order to inform on the following pre-existing conditions:

- Baseline sediments:
    - Composition and chemical properties
    - Particle size distribution and settling velocities
- Baseline Hydrodynamic factors:
    - Tidal flows
    - Wave regime
    - Bathymetry (including bed features)
- Baseline Sedimentary Processes:
    - Identification of the process-control of sediment re-suspension, transport and deposition
    - Identification of sediment pathways
    - Quantification of sediment transport concentrations (SSC)
    - Quantification of long-shore and cross-shore sediment transport sediment stability and erodability.

Specific issues and interactions required from the coastal process studies include:

- Scour around turbine structures and the justification requirements, if any, for scour protection material
- Scour around any supply cables overlying the sediment surface and the resulting potential for higher SSC’s and the development of free-spans

- Spatial design of the turbine grid array and the subsequent pattern of constructive/destructive interference of waves, and its effect on the spatial distribution of sedimentation
- Spatial design of the turbine grid array and the subsequent wave diffraction, which may increase the potential to cause alternate regions of high erosion and sedimentation along the coastline or within other sensitive sites; quantification of any change to wave energy impacting the coast and the angle of approach of the waves
- Non-linear interaction of waves and currents and the subsequent quantification of the extent to which bed sediment is mobilised, particularly during storms
- Sediment mobility and the natural variability of sediment depth within the near-field and the effect on turbine strength/stability, choice of foundation material and turbine structure, and burial depth for any cables
- Effect of localised sediment dumping and higher SSC's resulting from any cable burial process.

ABPmer Recommendation For Survey Methodologies

ABPmer made the following recommendations for data collection to aid in addressing the above issues:

Tidal Regime

Measurement of local variations in water levels at a minimum of 3 locations spread across the development site, and along Knock Deep. Minimum duration of 30 days, sampling no coarser than every 15 minutes. Data to be sampled in combination with atmospheric pressure variations and wind conditions obtained from an adjacent met station.

Measurement of currents at a minimum of 3 locations spread within the development site. Minimum duration of 30 days, sampling every 15 minutes minimum.

Purchase of data from previous CEFAS and BODC deployments.

Wave Regime

Measurement of directional waves at a minimum of 3 locations within the development site, plus 2 offshore locations. Minimum duration of one winter period (3 months).

Purchase of long-term offshore wave data from Met Office UK Waters Model.
Purchase of time series of offshore data coincident with deployment dates.

Sediment Regime

High resolution bathymetry and sidescan data across the development site at a line spacing of not greater than 100m

Grab sampling and particle analysis of surface sediments at around 200 sites.

Measurement of suspended sediment concentrations at a minimum of 3 locations across the development site using a combination of ADCP, water sampling (spring and neap tide periods) and optical backscatter devices. Analysis of water samples for sediment type and concentration.

Coastal Process Modelling

Coastal modelling is an important component of a coastal process study, but by itself cannot deliver all the requirements of the investigation. Coastal modelling needs to be supported by an adequate description of the marine environment, built from site surveys and other data (as detailed above), tested sufficiently to prove the capability of the model, applied correctly to investigate meaningful scenarios and interpreted carefully to draw out correct assessment.

The coastal process issues to be modelled in determining the issues and interactions, as detailed above, would include:

- Baseline Scenarios
    - Tides – spring and neap tidal events
    - Waves – representative events which have influence on sediment movements, including consideration of seasonal variations
    - Sediments – to support the conceptual model
    - Climate change - to investigate the sensitivity to increased sea levels and increased storminess
- Wind Farm Scenarios
    - Construction/decommissioning phase to investigate dispersion of sediments arising
    - Operation phase to investigate near and far-field impacts, scour issues
- Cumulative Effects
    - Extra to 'isolated' wind farm scenarios include other planned developments to consider cumulative effects.

Coastal Process Study Status

- ABP have scoped the coastal process study with CEFAS
- Data collection survey was designed in consultation with CEFAS. The survey, which covers and area slightly larger than that under consideration for wind farm structures, is currently underway.
- Modelling work is due to commence in August 2004.

4.1.2 Air Quality

During the construction and decommissioning phase effects to air quality are anticipated to be slight and temporary, due to the location of the site and the relatively low amount of construction work onshore.

During operation of the wind farm there would be no atmospheric emissions as a direct result of the energy generation.

It is, therefore, anticipated that as effects would not be significant, air quality is not specifically assessed in the environmental statement.

4.2 The Biological Environment

A study of the biological environment looks at the potential for effects on marine species including marine ecology (benthic, fish and marine mammal) and birds.

4.2.1 Designated Sites

Tables 2 and 3 below list the major coastal nature conservation designations in Kent and Essex and their main reasons for designation. These include Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar Sites and Sites of Special Scientific Interest (SSSI). National Nature Reserves are not identified, since where these occur they lie within the curtilage of an SSSI. All of the designated sites occur along the coast and none exist in the offshore marine environment or within the area of potential impact from the proposed wind farm development.

Table 2 Summary of Major Nature Conservation Designations – North Kent Coast

Kent Sites	Designation	Summary Reasons for Designation
Thanet Coast and Sandwich Bay	Ramsar	Coastal habitats supporting breeding & wintering birds, rare plants & invertebrates
The Swale	Ramsar	Estuarine habitats supporting breeding & wintering birds, rare plants & invertebrates
Medway Estuary & Marshes	Ramsar	Estuary complex supporting breeding & wintering birds, rare plants & invertebrates
Thames Estuary & Marshes	Ramsar	Estuarine habitats supporting breeding & wintering birds, rare plants & invertebrates
Thanet Coast	SAC	Sublittoral reefs and intertidal sea caves
Thames Estuary & Marshes	SPA	Estuarine habitats supporting breeding & wintering birds, rare plants & invertebrates
Thanet Coast & Sandwich Bay	SPA	Coastal habitats supporting breeding & wintering birds
Medway Estuary & Marshes	SPA	Estuary complex supporting breeding & wintering birds
The Swale	SPA	Estuarine habitats supporting breeding & wintering birds
Thanet Coast	SSSI	Cliffs & foreshore supporting breeding & wintering birds, rare plants & invertebrates
Sheppey Cliffs & Foreshore	SSSI	Cliffs & foreshore supporting geological and fossil interest
South Thames Estuary & Marshes	SSSI	Estuary & Marshes supporting breeding & wintering birds
Medway Estuary & Marshes	SSSI	Estuary & Marsh complex supporting breeding & wintering birds
The Swale	SSSI	Estuarine habitats supporting breeding & wintering birds

Table 3 Summary of Major Nature Conservation Designations – Essex Coast

Essex Sites	Designation	Summary Reasons for Designation
Foulness	Ramsar	Estuarine saltmarsh complex supporting waterfowl, rare plants & invertebrates
Benfleet & Southend Marshes	Ramsar	Marshes & mudflats supporting waterfowl
Crouch & Roach Estuaries	Ramsar	Estuaries supporting waterfowl, scarce plants & rare invertebrates

Essex Sites	Designation	Summary Reasons for Designation
Hamford Water	Ramsar	Estuarine basin supporting overwintering waterfowl
Colne Estuary	Ramsar	Estuarine saltmarsh complex supporting overwintering waterfowl and summer waterfowl
Dengie	Ramsar	Estuarine saltmarsh complex supporting waterfowl, rare plants & invertebrates
Blackwater Estuary	Ramsar	Estuarine saltmarsh complex supporting waterfowl, rare plants & invertebrates
Essex Estuaries	SAC	Estuarine mudflat & saltmarsh species & communities
Foulness	SPA	Estuarine complex supporting breeding, overwintering & summer birds
Benfleet & Southend Marshes	SPA	Marshes & mudflats supporting overwintering waterfowl
Crouch & Roach Estuaries	SPA	Estuaries supporting waterfowl
Hamford Water	SPA	Estuarine basin supporting overwintering waterfowl
Colne Estuary	SPA	Estuarine complex supporting breeding, overwintering and summer birds
Dengie	SPA	Estuarine complex supporting breeding, overwintering and summer birds
Blackwater Estuary	SPA	Estuarine complex supporting breeding, overwintering and summer birds
Foulness	SSSI	Estuarine saltmarsh complex supporting waterfowl, rare plants & invertebrates
Benfleet & Southend Marshes	SSSI	Saltmarshes & mudflats supporting waterfowl, rare plants & invertebrates
The Cliff, Burnham-on-Crouch	SSSI	Estuarine river stretch supporting important fossils
Mucking Flats & Marshes	SSSI	Estuarine river stretch supporting overwintering waterfowl, scarce plants and rare invertebrates
Crouch & Roach Estuaries	SSSI	Estuaries supporting waterfowl, scarce plants & rare invertebrates
Holland on Sea Cliff	SSSI	Cliff exposures supporting geomorphologically important features
Clacton Cliffs & Foreshore	SSSI	Foreshore & cliff exposures & excavations supporting geological importance
Dengie	SSSI	Estuarine saltmarsh complex supporting waterfowl, rare plants & invertebrates
Colne Estuary	SSSI	Estuary supporting overwintering waterfowl and summer waterfowl
Hamford Water	SSSI	Estuarine basin supporting breeding & overwintering waterfowl & rare plants
Blackwater Estuary	SSSI	Estuarine complex supporting waterfowl, rare plants & invertebrates

4.2.2 Marine Ecology

The University of Liverpool Centre for Marine and Coastal Studies (CMACS) were commissioned by the Consortium to undertake an initial scoping study of Marine Ecology.

The scope of this initial assessment has included:

- Marine benthic invertebrate communities
- Fish species and communities
- Marine mammals

In consultation with DEFRA and other Statutory Consultees, the Consortium have commenced some of these surveys. Full scoping has taken place and survey methodologies have been agreed with English Nature and CEFAS.

A literature review has been undertaken to collect information on marine ecology within the Study Area, wider Thames Estuary and the south North Sea region.

In addition, information has been obtained through consultation with consultees including the Centre for Environment Fisheries and Aquaculture Science (CEFAS), English Nature (EN), the Environment Agency (EA) and Kent and Essex Sea Fisheries Committee (KESFC). As an initial step in this consultation process an outline survey approach was sent to provide an indication of the likely surveys that would be undertaken to inform a full impact assessment.

Informed by the desk based study, the following work was undertaken:

- A review of existing information related to each element of the marine ecosystem (benthic invertebrates, intertidal communities, fish and marine mammals), including their current status, and importance
- A preliminary review of the potential impacts of construction, operation and decommissioning of the wind farm on marine ecology
- A review of potential cumulative impacts assessed by considering the combination of effects of all the known proposed wind farm developments at Gunfleet Sands and Kentish Flats
- A review of statutory body concerns and requirements
- Development of appropriate field survey requirements to provide information for a comprehensive impact assessment
- Overview of likely field survey requirements for monitoring within pre-construction, post-construction/operational periods.

A summary of the findings of the initial desk study work are provided below.

Marine Mammals

Thirteen cetacean (whales and dolphins) and two pinniped (true seals, eared seals and walrus) species have been recorded in the southernmost North Sea and Thames Estuary. This area is, however, relatively poor in both numbers and diversity as compared to other areas around the UK. The Small Cetacean Abundance in the North Sea (SCANS) project, a major international collaborative survey program carried out in 1994 to provide baseline data on cetacean abundance in the North Sea, Baltic and Celtic Seas, recorded no cetaceans in the area (Hammond *et al*. 2002). However, surveys carried out by the Joint Nature

Conservation Committee (JNCC), Seabirds at Sea Team observed 0.01 - 0.09 animals/km during November to April and May to October for both the white-beaked dolphin *Lagenorhynchus albirostris* and the harbour porpoise *Phocoena phocoena* in proximity to the Thames Estuary (Northridge *et al*., 1995; JNCC, 1998). The harbour porpoise is, however, the most common cetacean species found in UK waters, and indeed, north-eastern European waters.

The common seal *Phoca vitulina*, is the only pinniped species found in any numbers in the Thames Estuary. However, their population size in this area is very low in comparison to other areas of the UK with common seals numbers along the Essex and Kent coastlines accounting for 0.3% of the Great Britain population.

Benthic

There are no recorded nationally rare or scarce benthic species in the immediate vicinity of the proposed development site. However, the Thames estuary does contain two rare benthic species which are the amphipod *Corophium lacustre* and the lagoon sand shrimp *Gammarus insensibilis* both of which are brackish water species.

Fish

The fish fauna of this region has been well documented and the estuaries and coastal waters of this area contain a diverse number of species with 112 marine or estuarine fish recorded including ten sharks and rays and 100 teleosts (bony fish) (Swaby and Potts, 1998).

The estuaries and shallow bays and coastal waters of this area play an important role as breeding and nursery grounds for many important fish species, notably:

- Sole (*Solea solea*) spawn in shallow inshore areas close to sandbanks less than 30m deep. The Thames estuary is sited as a major spawning ground for this species.
- Cod (*Gadus morhua)* do not spawn in the Thames Estuary. Cod spawn in offshore waters of the North Sea from January to April. From age 1 to 2 juveniles begin to move into the Thames Estuary.
- Herring (*Clupea harengus*). The Thames basin contains a population of herring reproductively isolated from the North sea stock whose principal spawning ground is at the seaward end of the River Blackwater estuary, Essex (Henderson, 1987). The North Sea populations spawn offshore from the Kent and Suffolk coastlines. The dependency of herring on specific substrates makes the species particularly susceptible to impacts. The Blackwater herring is a distinct sub species and is an important commercial fish. There is a second (less substantial) spawning ground of the Thames Estuary stock off Herne Bay. It is also possible that a smaller, North Sea sub-species of herring spawns in the Medway in Stangate Creek.
- Plaice (*Pleuronectes platessa*). Main spawning areas occur in offshore waters in the central and southern North Sea and the English Channel with the eggs and larvae drifting onto the coastline.
- Sprat (*Sprattus sprattus*) is most abundant in the relatively shallow waters of the southern North Sea. Important spawning areas are centred on the inner German bight and the English East Coast
- Whiting (*Merlangius merlangus*) the spawning season is long, beginning in January in the south and there is a spawning ground situated off shore of the southeast English coastline.

- Lemon sole (*Microstomus kitt*) along East English coast including the Kent, Suffolk and Essex coastlines.
- Sandeel (*Ammodytes marinus*) spawns throughout much of the southern North Sea.
- Thornback ray (*Raja clavata*) spawns throughout much of the Thames Estuary.
- Bass (*Dicentrarchus labrax*) historically, the Thames Estuary has not been considered an important spawning area, but it is now believed that Bass may be spawning in increasing numbers. Estuary is important nursery ground.
- Mackerel (Scomber trachurus)
- Brill (Scophthalmus rhombus)
- Dab (Limanda limanda) Widspread throughout the North Sea, Thames Estuary is not considered to be an important spawning ground, but is an important nursery ground for this species.
- Flounder (Platichthys flesus) Thames Estuary is important nursery area. Species spawns offshore in deeper water.

This area of the southern North Sea and its associated coastline are important nursery areas for a number of fish species. These species are:

- Herring *(Clupea harengus)*
- Whiting (*Merlangius merlangus*)
- Sole *(Solea solea)*
- Cod (*Gadhus morhua*)
- Lemon sole *(Microstomus kitt)*
- Plaice *(Pleuronectes platessa)*
- Sprat *(Sprattus sprattus)*
- Thornback ray (*Raja clavata*)
- Bass (*Dicentrarchus labrax*)
- Flounder (Platichthys flesus)

The tidal Thames is the largest nursery ground for Sole (*Solea solea)* in England and Wales. The Thames and Blackwater estuaries are also the largest nursery grounds for Sea Bass (*Dicentrarchus labrax*) in the southern North Sea (Kelley, 1988).

Migratory Fish

The most common diadramous fish (species that migrate between freshwaters and marine waters) around British waters are the salmon (*Salmo salar*), the sea trout (*Salmo trutta*) and the eel (*Anguilla anguilla*). A small number of salmon and sea trout are caught in the river Thames and in surrounding rivers and estuaries. Eels can be found in most estuaries and rivers in the area.

Two species of shad are found in the British Isles the Allis and the Twaite Shad. There are various recorded shad catches around Kent between 1973 and 1996 at Kingsworth power station, Medway Swale estuary at Gravesend, Blackwell point on the Thames and at Allington weir (the tidal limit for river Medway, Essex). In the UK spawning stocks are known only to occur in selected rivers in Wales, the English/welsh borders the Solway Firth and the Thames where principle spawning is second week of July, returning to the sea by the end of July. These two species are discussed further below.

Rare/Threatened and Protected Species
This region has confirmed records of all seven British marine and estuarine species protected under national, European and international legislation. These are:

- Lampern (*Lampetra fluviatilis*)
- Sea Lamprey (*Petromyzon marinus*)
- Sturgeon (*Acipenser sturio*)
- Allis Shad (*Alosa alosa*)
- Twaite Shad (*Alosa fallax*)
- Common Goby (*Pomatoschistus microps*)
- Sand Goby (*Pomatoschistus minutus*)

Both species of Shad (*Alosa alosa* and *Alosa fallax*) are listed on Annexes II and V of the Habitats directive. Allis shad are listed on Appendix II of the Bern convention and Twaite shad is listed on Appendix III and both species are included on the UK BAPSG list of priority species. Shad populations have declined significantly throughout Europe with the Twaite shad now virtually absent in several rivers where it was believed to have spawned. Physical barriers and poor water quality are thought to be responsible for this. Allis shad are currently protected under Schedule 5 of the Wildlife and countryside act 1981 and the Twaite shad has been recommended for addition to this under section 9-(4) (a). This would make it an offence to obstruct access to spawning grounds or to damage, or destroy gravel used for spawning.

Within the Thames estuary itself the occurrences of 18 species of rare or little known fish have been reported (Andrews and Wheeler, 1984). Oceanic species sited in the Thames estuary and surrounding coastal waters such as the Sunfish (*Mola mola*) have mostly been attributed to vagrancy.

Sharks, Skates and Rays
Sharks, Skates and rays belong to a group of ancient fish characterised by a cartilaginous skeleton known as Elasmobranchs. Rays such as the Thornback ray (*Raja clavata*), and the cuckoo ray (*Raja naevus*) are present in the region and are targeted by commercial fishing vessels. Blonde rays (*Raja brachyura*) are also occasionally caught commercially. However, common skate (*Raja batis*) although present around most of the UK coastline is mostly absent from this region.

Several species of shark which occur within the region are:

- Spurdog (*Squalus acanthias*)
- Tope (*Galeorhinus galeus*)
- Lesser-spotted dogfish (*Scyliorhinus caniculus*)
- Angel shark (*Squatina squatina*)

Other sharks possibly occurring in the area are the Porbeagle *(Lamna nasus)* which is found in temperate to cold water latitudes and has been reported in the North Sea off England and Scotland. The Thresher shark (*Alopias vulpinus*), which readily approaches the shoreline following schools of fish, and the Basking shark (*Cetorhinus maximus)* which occurs in small numbers throughout the North sea and is included in the UK biodiversity action plan and also protected from exploitation under the Wildlife and Countryside act (1981).

Proposed Survey Methodologies

Modelling and Measuring Underwater Noise

Very little is known about the nature and intensity of noise and vibration generated by construction activities. In particular, there is very little available data on the noise and vibration that is generated during pile driving. Experiences of carrying out assessments for other wind farm developments would suggest that prior to the development an underwater noise modelling exercise should be carried out to determine site specific propagation properties. Progress of COWRIE industry wide studies and monitoring at other offshore wind farm site should also be closely monitored with findings incorporated or referred to as appropriate.

Beam Trawl Surveys in the Region of the Thames Estuary Wind Farm and Associated Cable Routes.

The following is intended to provide an overview to queries raised during preparation of the initial draft proposal, and takes on board comments provided by CEFAS and EN following initial suggestions.

Broad Approach: Initial Descriptive Surveys and Subsequent Monitoring

The broad approach taken for both beam trawl and grab surveys is to provide reasonably detailed information on the communities in the area, (including areas within the main tidal excursion) which would include maps of benthic communities. More detailed studies would be required for pre and post development monitoring, which would include surveys of benthos and fish in selected areas in more detail, the areas selected on the basis of both the known distributions (as a result of the initial surveys plus existing information) and more detailed knowledge of the technical proposals. Further suggestions for monitoring would be provided as part of the EIS.

The sites in the proposed development areas were chosen so as to have a slightly higher density of coverage where the seabed appears to be more varied in terms of sediment and depth (as determined from a combination of BGS maps and admiralty charts together with preliminary sidescan interpretation).

Area Covered – Beam Trawls

London Array have taken on board comments regarding the unnecessarily high density of beam trawling within the proposed development area and the relatively lack of those outside the proposed development area in the amended survey proposal. There were 60 beam trawl sites including a number somewhat further away from the development area. The original proposal included sites at approximately 2km from the outer edge of the development on the up and downstream sides but this was amended to include sites at up to 6 km away on the offshore side and 6 and 14 km away on the inshore side. On a big spring tide the maximum tidal excursion would be expected to be around 12-14 km from the edge of the proposed area. CMACS undertook half hour 4m beam trawls with a 6m mesh at five of the sites.

Selection of suitable control areas for future monitoring from the region of these more distant sites looks likely to be sensible given the nature of the seabed (admiralty charts and BGS maps), but may need to be refined once we have more information on what habitats and communities are present within the proposed development area.

Survey Methods

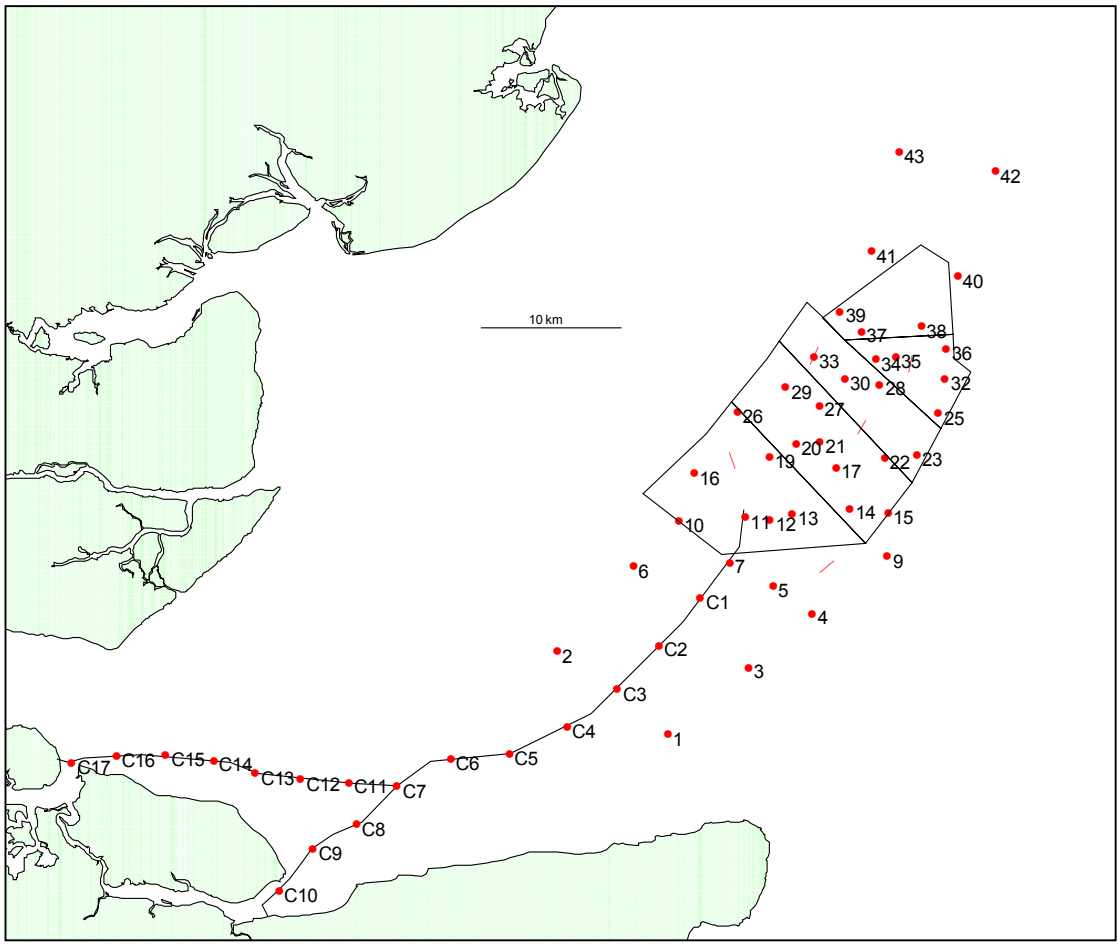
A total of 60 beam trawl sites were completed (see Figure 7 below). Of these, a total of forty three sites are in the region of the proposed wind farm, including up and downstream in and just beyond the maximum likely tidal excursion, and a further seventeen along the possible cable routes. It is proposed that surveys be carried out four times per year over one year. Sites to be surveyed would be reassessed after the first tow surveys.

Each beam trawl completed was on average 300m in length (2 knots for five minutes = 309 metres; not precisely to scale on the maps). Gear used: mainly 2m beam trawl with 4mm square cod end mesh, with a chain matrix between the beam and foot-rope. Warp was sufficiently long to ensure gear fished the bottom properly. Tows were into the current (at very roughly the orientations shown), at approximately 2 knots over ground. A number of the sites within the proposed development areas were completed using larger gear and longer tows in order to catch more larger demersal fish. The equipment used was a standard commercial "6 fathom" otter trawl, with 4 inch rubber discs on the groundrope, and a 15 ft (4.6m) mouth when deployed, with the addition of a non –standard 10mm square mesh sleeve in the cod end. Otter trawls were fished for 25 minutes at a speed of 1.6 knots over the ground, (equivalent to 1236 m) into the current.

All animals, including macroinvertebrates, were identified and counted on board where possible. Samples of difficult organisms, or large samples which cannot be dealt with in time on board, were preserved and taken to the laboratory for subsequent identification. A photograph of each beam trawl haul was taken.

GPS fixes to WGS84 standard were provided for the beginning and ends of tows so they can be repeated later.

Figure 7 Positions of beam trawl (red dots) and otter trawl red (lines) samples taken over a one year period from April 2003 until February 2004 inclusive.



Fauna

It was agreed to obtain 230 grab locations covering the proposed development area and the proposed cable route, including an alternative route that has subsequently been discarded, as will be explained in the Environmental Statement. The general approach taken is to maximise ground coverage by using single replicates in most instances, with three replicates at circa 10% of sites in order to confirm the replicability over small scales – locations of these shown in Figures 8 and 9. Thus a total of 278 samples for fauna are proposed.

The survey has been broadly based around a grid of 1.2 km spacing. However, this grid was superimposed over a map of broad seabed types as identified by sidescan survey (preliminary assessment), and the site positions were then modified in order to ensure sufficient coverage of these seabed types. It will later be possible to reinterpret/refine the seabed interpretation on the basis of information on both sediment type and biological community.

Sites have been added to allow coverage of a much wider area on the up and downstream sides of the site. This is as a result of initial feedback regarding the beam trawl surveys where CEFAS and English Nature both requested that the area covered be expanded.

At a few sites, beam trawl surveys have indicated the presence of aggregations of Ross worm *Sabellaria spinulosa* in December and/or February, (though none were found during the April or July surveys at the same sites). In order to further investigate this, London Array commissioned surveys by drop-down video during geophysical site investigations in order to further investigate the distribution of *S. spinulosa*. In addition, grab sampling stations in this survey have been positioned directly over the centre of those beam trawl sites where the main aggregations were found.

Cable route

Along the cable route the proposed grab sites were spaced at circa 2-2.5 km intervals.

Analysis

Sieving took place over a 1mm mesh and samples preserved in formalin. All macrofauna will be subsequently identified to species wherever possible.

At each location separate sediment samples were obtained for particle size analysis and total organic content.

Interpretation will include identification and extent of biotopes as well as relation of community descriptors (numbers of taxa, numbers of fauna, diversity indices etc) to factors such as sediment type, depth etc using a combination of GIS and PRIMER analysis.

Sediment analysis

Forty-one sites as shown in Figure 8 are to be sampled for detailed chemical analysis. Chemical analysis to be carried out on the following suggested determinands:

- A suite of heavy metals to be determined; presently suggested are lead, copper, zinc, cadmium, nickel, mercury
- PCBs (ICES7 congeners)
- Chlorinated pesticides
- TBT
- Total Petroleum Hydrocarbons (C10-37) and Polynuclear Aromatic Hydrocarbons (EPA 16 compounds)

Figure 8 Locations for day grabs. Positions of grab samples for faunal and sediment analysis.

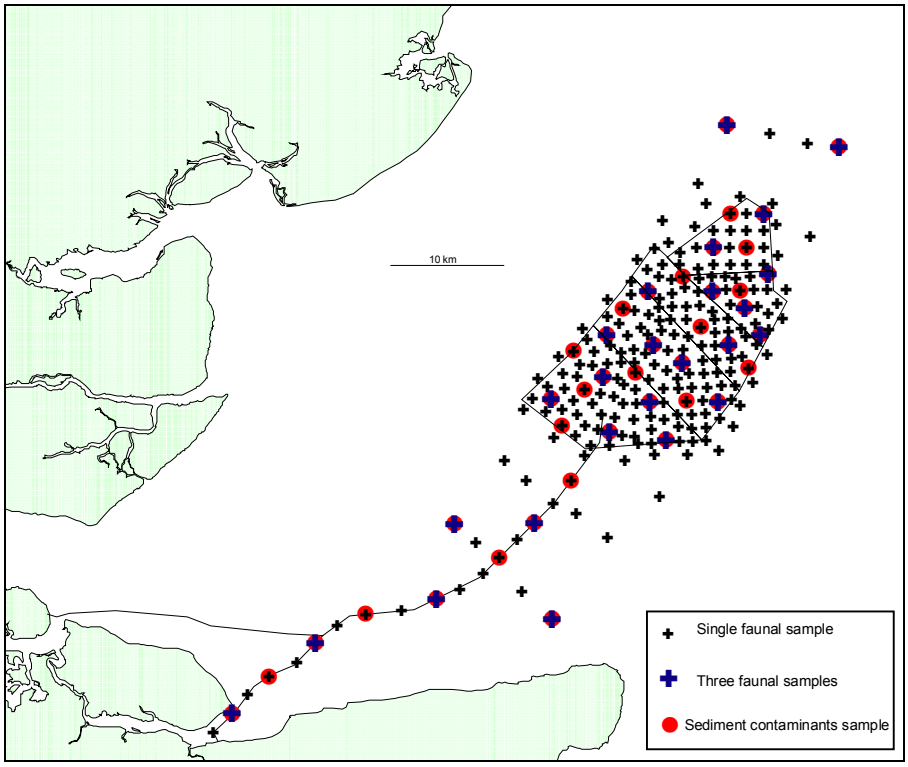
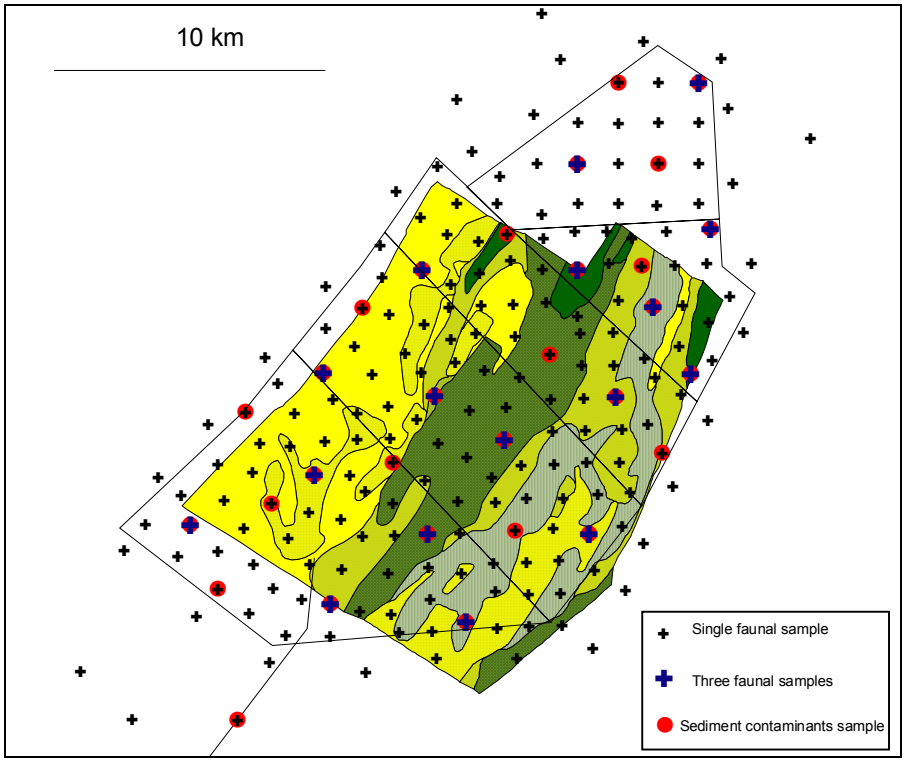


Figure 9. Location for day grabs - close up of the main area with sediment descriptions as provided by the initial interpretation of seabed types from geophysical survey.



Other Surveys etc. to be considered for the Environmental Impact Assessment

- Underwater noise and vibration - modelling of underwater noise levels during construction and operation.
- EMF - Interpretation of the industry-wide COWRIE study and modelling.
- Intertidal invertebrate communities - investigation of the intertidal invertebrate community in the area of the cable landfall through transect sediment core analysis and biotope mapping.

The Marine Ecology surveys will be important in informing other survey work and consultants undertaking an assessment of the environmental ecology of the site and in producing a comprehensive impact assessment.

Marine Ecology Status

- Quarterly Beam Trawl Surveys commenced in April 2003 and have now completed.
- The Benthic survey was rescoped by CMACS to reflect comments from CEFAS and English Nature and is now complete. Samples are currently being processed in a laboratory.
- Marine mammals. DEFRA, English Nature and JNCC have received the mammal observations recorded by the aerial and boat based surveys. Although these surveys were commissioned to survey the bird populations, detailed records of mammal sightings have been maintained. London Array is currently collating this data into an interpretive report for inclusion in the Environmental Statement.

4.2.3 Ornithology

Ecology Consulting were commissioned by the Consortium to undertake an initial scoping study and methodologies of Ornithology.

In consultation with DEFRA and other Statutory Consultees, the Consortium have commissioned the commencement of these surveys. Full scoping has taken place with English Nature (EN) and RSPB. Surveys on the basis of the agreed methodologies commenced in August 2002 and 23 months of surveys have been carried out to date. These surveys will satisfy the minimum of 2 years data available for assessment prior to submission of applications for consent.

Preliminary data on the current ornithological conditions and nature conservation designations were collated from a variety of sources including the JNCC Coastal Directories Project, the JNCC Seabirds at Sea surveys (summarised in the Atlas of Seabirds Distribution in NW European Waters), the Wetland Bird Survey (WeBS) and the Seabird Colony Register.

Findings from Initial Desk Study

Nature Conservation Protected Areas

The location of coastal protected sites in the Thames Estuary study area are shown on Figure 10. The conservation designations located closest to the site are shown in Table 4:

Figure 10 Main nature conservation sites in the Outer Thames area.

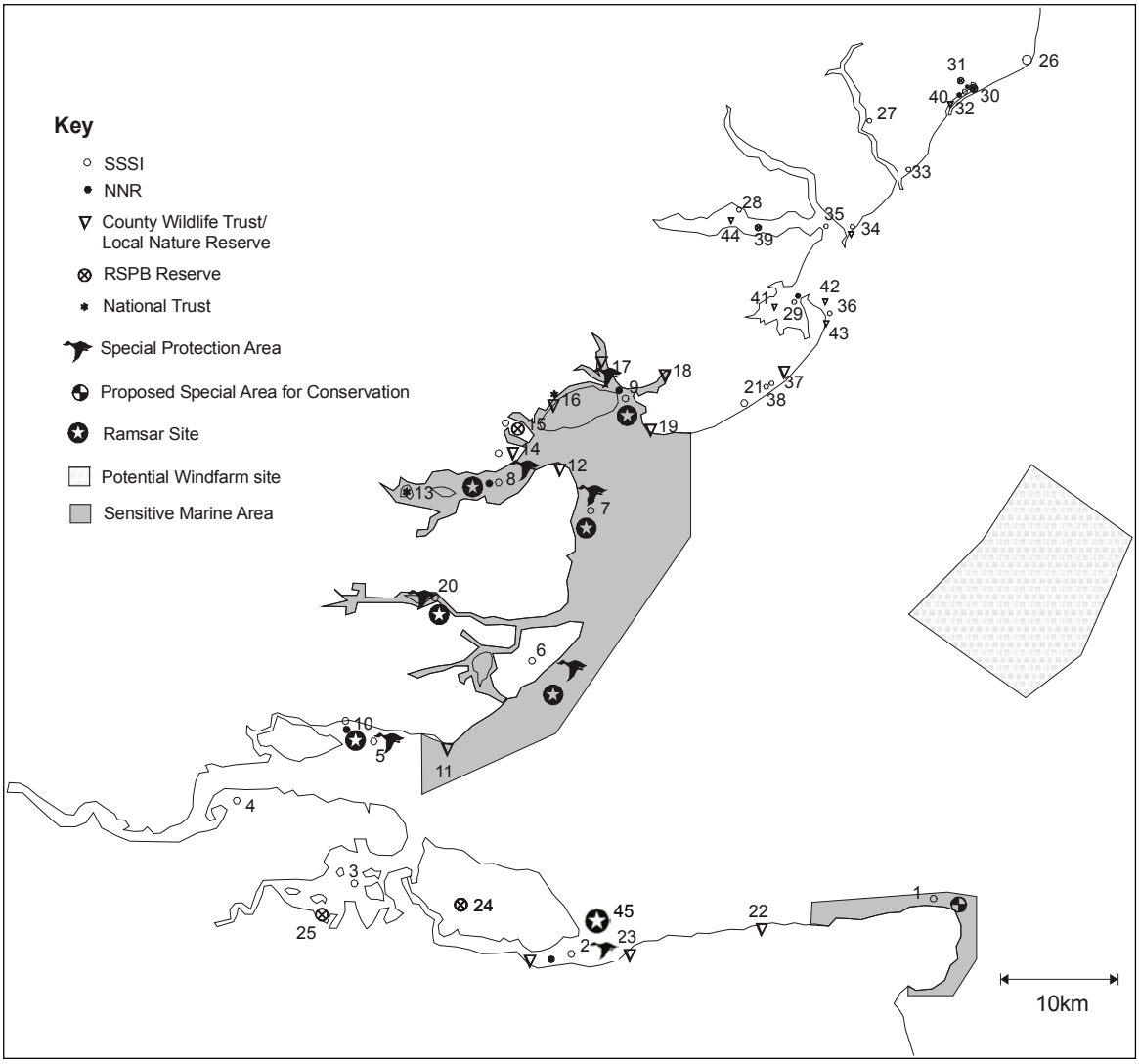


Table 4 Coastal Protected Sites Located Closest to the Proposed Development.

Map ref.	Site	Status	Area (ha)	Main conservation interest
1	Thanet Coast	pSAC, SMA, SSSI	819	Extensive sub-littoral chalk reefs, covering most of the near-shore area and extending into the littoral. Extensive occurrence of partly submerged caves and tunnels in the intertidal zone. Rich intertidal algal flora. Supports large numbers of wintering birds (average peak count 10,300) with one internationally important species (turnstone). Little tern colony.
6-9, 20	Essex Estuaries	pSAC, SMA	19,250	Includes Blackwater and Colne Estuaries, Dengie, Foulness and River Crouch marshes (see below). Important for six major habitats: (1) glasswort and other annuals colonising mud and sand, (2) cordgrass swards, (3) Atlantic salt meadows, (4) Mediterranean saltmarsh scrubs, (5) estuaries and (6) intertidal mudflats and sandflats.
6	Foulness	SPA, Ramsar, SSSI	10,968	Internationally important wintering waterfowl populations. Nationally important for breeding Sandwich, common and little terns and wintering hen harriers.
7	Dengie	NNR (part), SPA, Ramsar, SSSI	3,127	Tidal mudflats, shell gravel beaches and saltmarsh. A mean peak count of 30,100 wintering waterfowl, with three internationally important species (grey plover, knot and bar-tailed godwit).
45	Swale	SPA, Ramsar, SSSI	6,514	Brackish and freshwater, floodplain grazing marsh with ditches, and intertidal saltmarsh and mudflat. Internationally important numbers of wintering waterfowl (Dark-bellied Brent Goose, Grey Plover, Redshank, Wigeon and Black-tailed Godwit). The saltmarsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates.

***Key**: NNR – National Nature Reserve, pSAC – proposed Special Area for Conservation, SMA – Sensitive Marine Area, Ramsar – Wetland of international importance, SPA – Special Protection Area, SSSI – Site of Special Scientific Interest*

Due to the distance to shore, none of the coastal designations will be directly affected by the offshore wind farm site. The grid connection cable will be routed so as to avoid significant impact on any conservation sites. There may however be the potential for temporary indirect effects. Birds moving between wintering areas, for example, may fly through the wind farm and hence be at risk of collision. If such collisions were to occur at a significant level then impacts may occur on the wintering populations of birds at some of these protected sites.

Breeding Seabirds

The nationally and regionally important seabird breeding colonies in the study area are shown in Table 5. All data are derived from the Seabird Colony Register (Lloyd et al. 1991) or more recent information, if available. Their locations (numbered in Table 5) are shown on Figure 11.

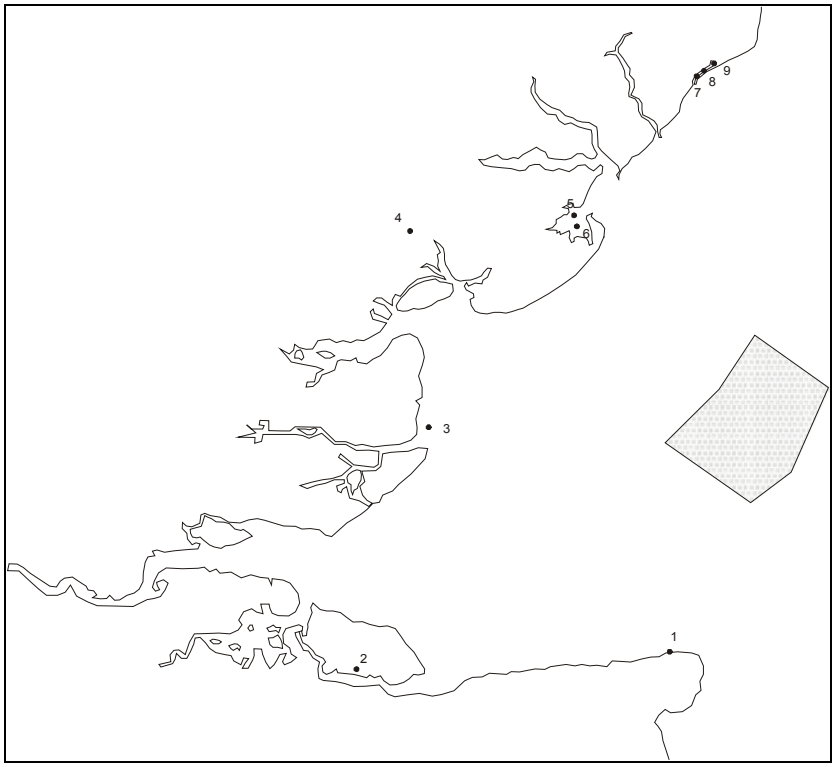
Table 5. Seabird breeding colonies in the Thames Estuary study area (nationally/ regionally important numbers)

Species	**Map ref.**	**Colony site**	**Number of breeding pairs**
Fulmar	1	Margate	c. 100 R. Increasing rapidly
Cormorant	4	Abberton Reservoir	500 I
Black headed gull	2	Sheppey	c. 4,000 R
	6	Hamford Water	>6000 N
Lesser black backed gull	9	Orfordness	8200 I
Sandwich tern	2	Sheppey	350 N
	3	Essex coast	290 N
	8	Havergate	250 I
Common tern	2	Sheppey	500 N
	3	Essex coast	410 N
Little tern	1	Margate	c. 30 N
	2	Sheppey	c. 60 N
	3	Essex coast	340 N
	5	Horsey Island	40 N
	7	Orford Beach	25 N

***Key**: I = internationally important numbers, N = nationally important numbers, R = regionally important numbers, where importance has been defined as >1% of resource at each scale.*

Most of these species would be unlikely to make significant use of the wind farm area, as it is located so far offshore and so distant from the breeding colonies.

Figure 11. Main seabird colonies in the Outer Thames area. Note: the grey area is the proposed wind farm site, as in Figure 10.



Seabirds at Sea

The JNCC Seabirds at Sea data provides some information on the seabird numbers that the potential wind farm site is likely to hold. The numbers likely to occur within the area that could be affected by the wind farm have been estimated from the densities reported in the Atlas of Seabirds Distribution in NW European Waters (Table 6). Coverage of the area in which the wind farm would lie, however, has been quite low, so the conclusions that can be drawn from these data are quite limited and should be treated with caution. Generally only very low densities have been reported in the vicinity of the potential wind farm area through the year. Only one species was recorded offshore in numbers reaching national importance, red-throated diver. In addition a concentration of common scoter (likely to exceed national importance) has been reported to the west of the wind farm area on the Essex coast, and it is possible that this may reflect an important population generally in the area (including possibly the wind farm area).

Given the distribution and abundance of other seabirds in the region generally (from the JNCC atlas and from WeBS counts, Musgrove *et al*. 2001), it is also possible that the proposed wind farm area site may support important numbers of terns and cormorants.

Table 6. Reported seabird densities and estimated numbers in the wind farm area, derived from densities reported in the Atlas of Seabird Distribution in NW European Waters (Stone et al. 1995), and the conservation importance of those numbers.

Species	**Max density (No. per km^2)**	**Main period**	**Approximate numbers in wind farm area**	**Preliminary assessment of importance**
Red throated Diver	0.49 (0.99 in inshore waters)	Nov – Mar	110	National
Fulmar	0.99	All year	220	Local
Gannet	0.99	Sep-Feb	220	Local
Cormorant	0.09	Oct-Feb	20	Local
Common Scoter	10+ (inshore waters, Essex)	Jan – Apr	-	National (inshore waters)
Red-breasted merganser	0.49 (inshore Kent)	Nov-Apr	-	Regional (inshore waters)
Black headed Gull	0.5+	Oct – Feb	110+	
Common Gull	0.99	Nov – Apr	220	Local
Lesser black-backed gull	0.99	All year	220	Local
Herring gull	1.99	All year	440	Local
Great black-backed gull	1.99	All year	440	Local
Kittiwake	0.99	Nov - Mar	220	Regional
Common/arctic tern	0.09	Apr-Sep	20	Local
Guillemot	4.99	Nov-Feb	1090	Regional
Razorbill	0.99	Oct-Mar	220	Regional

Evidence from existing offshore wind farms have not found any significant impact on seabird populations. There is some evidence of localised disturbance effects in some circumstances, though the most comprehensive study to date showed no disturbance effect at all. Collision rates have generally been low/negligible, and there have been no documented impacts that were considered to be significant. However, these studies have only been carried out at a small number of sites and only on a small number of seabird species. Therefore a cautious approach should be taken, particularly with novel situations, where information on effects is sparse.

Wintering/Passage Waterfowl

The coastline around the study area supports a range of internationally important estuarine bird populations. The current population levels area summarised in Table 7, extracted from the WeBS annual report (Musgrove *et al*. 2001). The locations of these sites are shown on Figure 10.

Table 7. Internationally important waterfowl populations in the study area.

Site	Species	5-year mean peak count	Species	5-year mean peak count
Swale Estuary	Wigeon Grey plover Black-tailed godwit	18,970 2,832 1,213	Shoveler Knot	457 4,498
Blackwater Estuary	Dark-bellied brent goose Grey plover Black-tailed godwit	8,891 4,762 1,004	Shelduck Dunlin Redshank	3,425 24,988 2,238
Medway Estuary	Shelduck Grey plover Redshank	3,642 2,780 2,936	Pintail Dunlin	1,004 19,859
Colne Estuary	Dark-bellied brent goose Redshank	3,762 1,528	Ringed plover	
Dengie Flats	Grey plover Bar-tailed godwit	3,189 2,276	Knot	9,425
Crouch-Roach Estuaries	Dark-bellied brent goose	4,539		
Thanet	Turnstone	753		
Alde-Ore	Avocet Lesser black-backed gull	946 5,373	Redshank	3,082
Deben	Redshank	2,124		
Orwell	Redshank	2,098		
Stour	Grey plover Dunlin Redshank	3,226 14,996 2,679	Knot Black-tailed godwit	6,280 2,411
Hamford Water	Dark-bellied brent goose Grey plover Redshank	6,829 4,636 2,078	Teal Knot	 3,752

The main bird interest in the study area is the wintering waterfowl populations that roost/feed on the Essex, Kent and south Suffolk estuaries. The counts in Table 7 have been presented as the mean peak count over the most recent 5 years for which data were available, the usual standard for determining such population sizes (Musgrove *et al*. 2001).

The proposed wind farm site lies 20km from the shore at its nearest point, so it is very unlikely be regularly over-flown by inter-tidal birds moving between feeding areas, or between feeding and roosting areas. Movements through the area are more likely to be restricted to longer-distance migratory movements between wintering sites.

Landbird Migrants

Coastal regions are known to concentrate migrant birds under certain weather conditions, though these birds are usually more widely scattered over a broad front (Alerstam 1990). There are no specific features to concentrate migrants further offshore, so the risk of any adverse population effects occurring through collision between birds and the turbines would be likely to be very low/negligible. Evidence from the Blyth wind farm is particularly relevant, where very low numbers of migrant collisions have been reported (Still *et al*. 1996, Painter *et al*. 1999).

Proposed Methodologies For Baseline Assessment

Aims

The aims of the assessment are as follows:

- To establish the importance of the area for birds, in particular for migratory and wintering populations;
- To predict the potential ornithological impacts of the construction, operation and de-commissioning of the wind farm and predict the significance of the impact;
- To develop mitigation measures to reduce potential ornithological impacts;
- To assess the residual impacts following mitigation and the significance of these;

The onshore grid connection and its associated infrastructure would be assessed in tandem with the marine component, but this would be submitted as a separate Section 37 application.

The potential for cumulative effects would form a component of the assessment where appropriate (particularly in relation to the other proposed offshore wind farms in the region).

Collation Of Existing Data

This would include the collation and analysis of all the relevant background data, including information from the JNCC Seabirds at Sea project, the Seabird Colony Register, the Wetland Bird Survey and any other local sources of information. It would include a preliminary assessment of the potential effects on the coastal and offshore nature conservation sites in and around the proposed offshore wind farm area designated for their bird interest. It would identify known concentrations of birds in the area, any bird migration routes and any other aspects of the area's ornithology that might be affected by the proposed wind farm. This would provide background information for the OIA and enable further refinement of the field studies to be made if necessary.

Field Studies

Survey Area And Period

The surveys should focus on the area that could potentially be affected by the development, e.g. 1km from possible turbine positions. However, a wider area around this should be surveyed, to provide information on where best to locate the turbines in order to minimise any risk of adverse ornithological effects. Data from a wider area would also be needed to assess the importance of the proposed wind farm site in relation to other feeding areas in the vicinity. This would be particularly important for potentially sensitive species such as roseate tern. A survey area extending at least 5km from all the possible turbines locations should be covered (extending over a total area of 600km^2). With such a large area, one major advantage of

aerial surveys is that they could cover the whole of this area in a single day, which would not be possible by boat.

The methodologies outlined in *Manual For Aeroplane And Ship Surveys Of Waterfowl And Seabirds, Komdeur et al. 1992* will be followed throughout the surveys, though these will be tailored to suit the specific requirements of the OIA and the key species likely to be present (see below).

Given that there is year-round bird interest in the area (and potentially using the development site), it would be essential to ensure that at least a full year's survey data are collected for the OIA.

Bird densities would be calculated using the DISTANCE sampling software package (Buckland *et al*. 1993), which enables more robust estimates to be made and account to be taken of factors affecting counting efficiency.

Aerial Surveys

As the extent of the survey area is large, aerial surveys would be the most appropriate method to cover this efficiently. Aerial survey techniques have been refined since the publication of Komdeur *et al.* (1992); the precise methodology should follow that developed for the environmental impact assessment of the effects of the Danish offshore wind farms (Noer *et al*. 2000, Kahlert *et al*. 2000).

Flights should be conducted at 80m altitude, and transect lines should be 2km apart. Surveys should be undertaken at monthly intervals throughout the year (though poor weather conditions may limit survey activity during winter in particular). Two surveyors would be required for each survey, so that numbers can be recorded by distance bands each side of transect lines simultaneously. A navigator, equipped with a GPS, would be needed to assist the pilot and inform observers of the precise position at regular intervals along each transect line. Data should be collected continuously, recording the precise time of each observation, rather than in pooled blocks (pooled in time or distance). From a Health and Safety perspective it would be essential to use a twin-engine aircraft rather than the suggested single-engine, to enable a safe return to land if an engine failed. In order to give the best viewing conditions, a Partenavia aircraft (which is high-winged to allow unobstructed views) should be used. It is important that observers should be trained in aerial survey and data recording. It is therefore proposed to use the most experienced aerial survey team in the UK for this work, who are based at the Wildfowl and Wetlands Trust at Slimbridge.

Boat-based Survey

Boat surveys have been carried out to supplement the data collected during the aerial surveys. The main aim of this was to provide data for species that are less readily identified by aerial surveys, and to provide data on flight movements and heights.

The boat survey area ncludes a minimum area of 2km around the possible wind turbine locations, which are typically covered in a single day's survey. This work has required a boat/ship of sufficient size to enable observations to be made from a level of 5-10m above sea level. A survey route has been designed to provide a 2km interval between transects. This is sufficient to provide an adequate sample from the study area, without potentially

displacing birds into adjacent transects. The same route has been used for all the surveys. A GPS record of the precise route has been taken, so that the location at all times is known.

The observation team has included a surveyor and recorder. All surveyors are experienced ornithologists able to identify all the species encountered accurately.

All birds encountered, their behaviour, flight height and approximate distance from the boat, and direction from the boat have been recorded. A range-finder has been used to estimate distances of the birds from the ship.

Surveys have been carried out at least once per month over the last 23 months. Alternate visits have covered the high and low tide periods.

The Komdeur *et al.* (1992) methodology specifies recording data in 10-minute blocks. This reduces the spatial resolution of the data collected, making analysis of the factors affecting the birds' distribution less precise. Instead recording the precise time of each observation has been recorded continuously, which has been linked to the GPS data to give the precise location of each bird/flock encountered.

As well as, bird species, number of individuals present, flight height, behaviour, distance from the ship, in transect or not in transect, plumage, age, sex, moult, flight direction, notes on whether the bird is oiled and associations between or within species, the ship's position have been recorded, speed and course, and presence of other vessels. Hydrographic and biological data will be incorporated into analyses from the other surveys being carried out for the Environmental Statement.

If the initial results from these boat surveys indicate that there are regular bird flight routes through the wind farm area, then it may be necessary to carry out additional fixed point observations in order to obtain more detailed information on rates of movement through the wind farm site. If necessary, such observations should be made from a boat at fixed points within the wind farm site, once per month. These should record bird flight movements through the wind farm site. The survey vessel would be anchored at each of ten sample points for a 30-minute period each day, and all birds seen recorded together with their flight height, direction and behaviour.

Proposed Assessment Methodology

Integration and Analysis of Data on Birds' Ecological Resources

As part of the environmental statement, a study of the birds and the ecological resources that they use would be undertaken. Analyses of the marine ecological survey data would be carried out, in order to better understand the ecological resource that the wind farm area provides, and to determine how it is affected by the development. The aim is to understand the factors affecting the key bird species' distributions in the area, including sea depth and substrate type and prey distribution. This would enable potential effects to be fully evaluated, and any effects of the proposed wind farm to be more fully determined.

Impact Assessment

The information collected and evaluated during the determination of the baseline ornithological status of the study area would be used as the basis for identifying and

predicting potential ornithological impacts associated with the proposed development. The full range of impacts would require appraisal, including direct, indirect and secondary impacts, both temporary and long term and adverse and beneficial. The level of significance of any identified impacts would be addressed, across all phases of the project lifecycle. The assessment methodology would follow that developed specifically for bird impacts on wind farms by the British Wind Energy Association (BWEA) and SNH.

The available information on the impacts of existing offshore (and relevant onshore) would be collated to update knowledge on the effects of wind farm developments on coastal birds.
Once the potential environmental impacts have been evaluated, feasible and cost-effective measures to prevent significant adverse impacts or reduce them to acceptable levels (should they be likely to occur), and enhance the significant positive benefits should be developed if possible. These results would feed back into the project design.

Status of Ornithological Study

- Ornithological studies for London Array commenced in August 2002 and 23 months of surveying has been completed to date including aerial, boat and shore based surveys.
- Initial reports indicate larger concentrations of some species than originally anticipated.
- Detailed discussions with Government departments, English Nature and RSPB are taking place to agree additional areas of work and more detailed analysis of the data collected.

4.3 The Human Environment

The potential for effects on the human environment are classified as follows:

- Landscape and Seascape
- Commercial Fisheries
- Navigation
- Archaeology and Cultural Heritage
- Tourism
- On-land Implications and Socio-economics
- Noise
- Marine Recreation and Amenity
- Traffic
- Offshore Oil and Gas
- Marine Aggregate Extraction
- Subsea Cables and Pipelines
- Marine Waste Disposal and Dumping
- Military and Civil Aviation
- Abandoned Munitions
- Electromagnetic Interference

4.3.1 Landscape and Seascape

The visual effect of wind farms results both from their physical presence and from the eye-catching nature of blade movement. On land, and near shore, this makes the visual effects an important issue on aesthetic grounds. The location of the study area in the central Thames

Estuary means that this is likely to be less of an issue, although from high coastal locations, sight of the development is still likely. Further, there may be concern from recreational users that their at-sea view will change as a result of the development.

This study would involve a review of the existing landscape and visual resource and an assessment of existing landscape character, quality and sensitivity concentrated on a 35km radius study area taking account of parameters such as landscape designation, landscape quality, the scale of the landscape in which the proposed development is to be located, the nature of views and the extent to which views contribute to the character of the landscape.

The assessment would require description, classification and evaluation of the landscape:
Description is the process of collecting and presenting information about landscape/seascape and visual resources in a systematic manner;
Classification is the more analytical activity whereby landscape/seascape resources, in particular, are refined into units of distinct and recognisable character;
Evaluation is the process of attributing a value to a given landscape/seascape or visual resource, by reference to specified criteria.

The baseline assessment would comprise three stages: desk study, field survey and analysis.

The potential extent of the visual resource that could be affected can be broadly identified through the production of a zone of visual influence (ZVI) map. For the offshore wind farm development proposed, this should comprise a computer generated ZVI map based upon Ordnance Survey digital topographical information. The ZVI should be produced at a recognised scale, ideally 1:100,000, should consider an area 35 Km in radius around the proposed development and should model the theoretical visibility of the proposed turbines to both blade tip height and nacelle (hub) height. The ZVI should identify zones from where differing numbers of turbines could theoretically be seen (e.g. areas where 1-25, 26-50 and 51-75 etc turbines are visible). In addition, the ZVI should consider areas of "shared visibility" with other wind farm developments i.e. identify areas within the ZVI radius from where more than one other wind farm is theoretically visible.

The ZVI and initial desk study would be used in the identification of sites from which photomontages should be produced, with the final locations being agreed with statutory stakeholders. Initially approximately 20 key viewpoints would be identified within landscape designations lying on the coastlines, tourist attractions, residential areas and transport corridors etc. A visual impact assessment at these 20 viewpoints would be undertaken. A finer set of approximately 5-8 viewpoints would then be selected as having most sensitivity to visual design and photomontages would be created for each. A detailed visual impact assessment would then be completed for each of these viewpoints. Approximately 2 nightime photomontages would be undertaken.

The potential for cumulative effects would form a component of the assessment where appropriate (particularly in relation to the other proposed offshore wind farms in the region).

All visual work would be completed using the maximum impact in relation to turbine output, height, rotor diameter and layout spacing allowing a comprehensive landscape impact assessment and ensuring the worst-case impact is assessed. The final design would, therefore, only improve on that impact. However, given the known meteorological conditions

and the fact that the nearest turbine will be over 20km from the coastline, it is unlikely that the visual impact will be significant.

4.3.2 Commercial Fisheries

The Thames Estuary is known to be an important fishing ground, although initial desk studies indicate that the proposed wind farm site is situated in a relatively inactive area for fishing. The shallow sands are mainly targeted by drift netting and the deeper, heavily fished waters around the site are targeted by larger trawling vessels.

London Array has scoped (with English Nature and CEFAS) and carried out the following studies to date:

- Commercial fishing study - Steven Heald (TXU) Aug 02
- Fish and benthic scoping studies - CMACS Liverpool Uni - Apr 02 to Mar 03
- Quarterly Fish Trawl Surveys - CMACS Liverpool Uni – Spring 03 to Spring 04

In addition, we have appointed the project's Fisheries Liaison Officer in order to develop the project's construction and operational philosophies with regard to fishing activities. London Array will also adhere to best practice in terms of consultation and interaction with fishing vessels as set out by UKOOA and BWEA.

Anchored angling and long-lining may positively benefit from the presence of the wind farm, as the turbine piles will act as an artificial reef. Artificial reefs have been shown in some areas to have a beneficial effect on angling (e.g. Milon, 1989) and commercial fisheries (e.g. Bombace, 1989; Yamane, 1989). Grove et al (1989) demonstrated that flatfish, including sole and dab, were attracted to submarine structures at distances of over half a kilometre. Gadoids such as cod and whiting are well know to be attracted to artificial structures raised off the seabed (Cripps and Aabel, 1995; Valdemarsen, 1979). This has also been shown, in some cases, to result in an increase in fish catches per unit effort (e.g. Ambrose and Swarbrick, 1989; Santos et al, 1996; Westerberg, 1994)

The available data on the impacts of artificial reefs on fish densities and biomass have been reviewed by Pickering & Whitmarsh (1997) and Grossman *et al* (1997). A recent ETSU report on the effects on offshore wind farms on marine wildlife concluded that "effects on fish population dynamics will be determined by immigration/attraction of fish to wind farms following construction" (ETSU, 2001).

The baseline studies and local consultation determine the fishing activities and intensities in and around the proposed wind-farm site on Long Sand and Kentish Knock. This would include an assessment of data available from the DEFRA statistical office. The areas of ocean and sea are split into rectangular sections known as ICES (International Council for the Exploration of the Sea) rectangles and fishing activity data is available for four rectangles, covering the Thames Estuary.

The assessment would entail:

- Analysis of the surveillance data and catch data to establish fishing patterns and species targeted for each of the ICES rectangles. The analysis of this data highlights popular fishing areas and the main species of fish caught within the rectangle.
- To assess the impact of the proposed wind-farm development the two sets of data would then be combined to provide a broad estimation of the yearly catch taken from the wind-farm area.
- The surveillance data can also be used to provide statistical data of the fishing fleet in the Thames Estuary and as a graphical means of illustrating popular fishing areas using spatial distribution.
- NFFO Fishing Intensity assessment (site and regional)

Initial contact has been made with a variety of local fishing associations and individuals to appraise them of the wind farm proposal and facilitate more detailed discussions. A strategy meeting has been held with Kent & Essex Sea Fisheries Committee to finalise London Array's contact lists and agree the best format and approach for a series of local meetings. These meetings have been held during May – August 2004 to disseminate the project plans and consult fishing interests regarding the layout and potential interaction between different fishing activities and the wind farm.

London Array will also seek to adopt recommendations being produced in a report which is being commissioned by DTI to examine the interaction between fishing vessels and offshore wind turbines.

Cumulative and in-combination effects will be assessed across all stages of the development, by the Fishing Liaison Officer in consultation with the fishing interests.

4.3.3 Navigation

The Thames Estuary is one of Europe's busiest commercial highways with many large ships moving to and from their berths. Each year over 27,000 large ships navigate the Thames.[4] Large numbers of yachts, motor boats, dinghies, pleasure boats, tugs, work boats, fishing boats, canoes and rowing boats are welcomed onto the Thames each year, taking part in races, events, working and cruising. The Port of London Authority (PLA) is responsible for managing shipping and navigation within the Thames Estuary.

One of the key criteria for the selection of the London Array development area was the availability of the two sand banks which form a natural barrier to navigation and are therefore not part of any of the major shipping routes through the Estuary. Notwithstanding this, a comprehensive navigational study assessing the collision risks associated with such a development will be carried out. It is London Array's view that this study must be a regional assessment to ensure that the potential cumulative issues are fully addressed.

[4] Web Site: http://www.portoflondon.co.uk

The potential for effects to safety of navigation during the construction, operation and decommissioning phases include:

- Direct interference or obstruction
- Safe navigation during periods of inclement weather
- Effects on communications, radar and positioning systems
- Access to and navigation within the wind farm
- Cumulative impacts with other developments

London Array commissioned Corrocean (March 2003) to carry out a desktop Shipping and Collision risk study aimed at scoping the full field data acquisition and modelling requirements.

Initial scoping and consultation (undertaken by Metoc PLC on behalf of the consortia) was also carried out with the Maritime & Coastguard Agency (MCA), the Port of London Authority and Medway Ports Authority.

The navigation impact study would entail identification of commercial and leisure craft activities in the area of the site and an assessment of the potential impact to navigation due to the wind farm. This would also include a collision risk assessment.

The following main activities are proposed:

- Analysis of shipping routing and traffic characteristics in the area
- Perform collision frequency assessments for the proposed area, for both ship to wind turbine and ship-to-ship collisions, addressing three different scenarios:
    - No wind farm in the area
    - Wind farm with no risk reduction safety measures in place
    - A wind farm with risk reducing safety measures in place
- Determine the knock-on effects and consequences in terms of risk due to the proposed wind farm development, particularly focusing on the following:
    - Due to changes in ship routeing in the area
    - Direct increase in collision risk
    - Obstructions in the use of the area or nearby areas.

The assessment would take account of fishing effort in the area and leisure craft using the area as well as larger vessels.

4.3.4 Archaeology and Munitions Risk Assessment

The importance of the Thames Estuary as a major water borne access route for settlers, invaders and traders is reflected in the abundance of archaeological materials found along the estuary. For example, evidence of Roman wrecks has been found from continental pottery recovered in the nets of fishermen working in inshore waters. The Roman Shipwrecks Project is investigating an area off the North Kent coast at Herne Bay, to the south of the proposed cable route. Under the Protection of Wrecks Act 1973, designated wrecks and surrounding seabed must be preserved. The Metoc Environmental Feasibility Study identified from a desk study a number of wrecks over the area of the proposed site and adjacent to the cable route, but none of these has been designated. The nearest designated wreck is in the South Edinburgh Channel, to the south and west of the site, and the cable route. By the time the detailed site survey is carried out, under the provisions of the National Heritage Bill,

responsibility for marine archaeology out to the 12 mile limit will rest with English Heritage, who would be consulted.

Scope of Assessment

The installation of foundations, cables and other ancillary equipment on the seabed creates the potential for damage to any features of archaeological significance located within the vicinity of the proposed wind farm. An archaeological assessment would be undertaken to assess and mitigate against potential impacts on known and unforeseen archaeological features.

The archaeological assessment would include evaluation of both the geophysical survey data as well as a desktop archaeological study. Archaeological assessment would require the completion of a magnetometer survey.

The assessment would be carried out by an archaeologist experienced in maritime archaeology and would identify the potential for any wrecks in the vicinity of the site and proposed cable route. Known wrecks and artefacts would be identified from wreck data obtained from the Wrecks Officer of the Hydrographic Office. Any anomalies identified on the seabed would be subject to further consultation with English Heritage, who have responsibility for marine archaeology out to the 12 nautical mile limit.

The baseline archaeology study would comprise the following elements:

- a broad overview of the maritime history of the Thames Estuary;
- a brief background to UK policy and statutory protection given to wrecks in UK waters;
- a desktop study identifying any recorded wrecks and other features of maritime interest within the Outer Survey Area;
- a desktop examination of any potential wrecks sites found during geophysical surveys;
- an estimate of the historical importance of each recorded feature;
- definition of a suggested exclusion zone around each suspected wreck site.
- identification of any wrecks and other features of maritime interest within the Coastal Study Area (to cover possible cable routes);
- identification of features of archaeological interest in the foreshore zone and its immediate hinterland within the cable route and coastal study area (to cover possible landfall infrastructure);
- consideration of the potential for deposits, former land surfaces and features of prehistoric date in the survey area and cable route and coastal study area (to cover possible impacts from piling/trenching on buried material).

MOD will be consulted to ascertain whether the areas proposed for development could potentially harbour risks from unexploded munitions. A detailed munitions risk assessment will be carried out by RPS which will cover the following elements:

- British and Allied activity in the area – 1939 to present
- German ordnance dropped on or near to the proposed off shore facilities for the London Array sites.
- Type and deployment of German Air dropped ordnance.
- Clearance report posts 1945.
- Ministry of Defence Munitions sea Dumping Program.
- Ship Wrecks in the Area.

- Risk assessment and recommendations for future use of the area.
- Risk mapping detailing affected areas.

4.3.5 Tourism

The London Array site is located more than 20 km from the nearest point on the Kent coast and 21.5 km from the nearest point on the Essex coast. The proposed site would only be visible from either shoreline on very clear days. As such, any impact, of the wind farm, on land based tourism in either area is likely to be insignificant.

Experience from existing offshore wind farms would indicate that the wind farm would attract interest and regular visits from sailors and other boat users and it is likely that boat trips to visit the site will be offered from the nearest ports on both shorelines. Such visits are unlikely to adversely affect the development of fish refugia. However, by far the greatest impact will be upon the millions of air travellers that will pass over the site each year en-route to the various London airports. In this respect the project is likely to provide a shop window for UK technology and offer a positive image of a country taking seriously its commitment to combat the threat of climate change.

4.3.6 Onshore Implications and Socio-economics

Coupled with any development offshore, there will be factors onshore that will need to be addressed during the site investigation, construction, operational and, finally, decommissioning phases of the project. These factors are associated with the storage and transport of equipment, accommodation and movement of construction and operational personnel, and onshore operational facilities. These include offices, storage and the means to support communications by sea or air. During each phase of the project, the demand for equipment and facilities will vary.

The ES would include an assessment of the effects to local, regional and national economies, levels of permanent and temporary employment arising as a result of the development phases (both direct and indirect), effects on tourism and public opinion.

4.3.7 Noise

Construction Noise

Offshore construction in-air and subsea noise would comprise ships engines, noise of piling hammers and augering operations etc. The only construction operation that would be likely to be heard onshore and would not be part of the ordinary noise environment in the Thames area would be the noise of piling operations for turbine foundations.

An assessment of the potential noise impact on residential properties in the nearest coastal areas, from the piling operations required as part of the construction process would be undertaken as part of the EIA. This assessment would include predictions of the maximum noise levels arising from piling operations for the type and size of piling hammers likely to be used on the site.

An assessment of the potential noise impact on residential properties in the vicinity of the onshore substation, from the construction operations would be undertaken as part of the EIA. This assessment would include predictions of the maximum noise levels arising from

construction activities and machinery likely to be used on the site and is the subject of the onshore scoping exercise.

Operational Noise
Noise emissions generally associated with wind turbines are from two sources, aerodynamic and mechanical. Aerodynamic noise is the sound generated due to air passing over the blades of the turbine as they rotate. Mechanical emissions are those associated with the engineering components of the turbine such as the gearbox, the generator and the directional equipment that rotates the blade housing, or nacelle, with respect to the wind to optimise energy capture.

An assessment of the potential noise impact on residential properties in the nearest coastal areas, from operational noise would be undertaken as part of the EIA.

In the absence of any guidelines for assessment of the impact of offshore wind farms on human receptors, guidelines for onshore wind farms would have to be used. The preferred methodology used for the assessment of wind farm noise on land in the UK are those recommended by the Working Group on Noise from Wind Turbines (WGNWT).

Subsea Noise – Construction and Operational
An assessment of the potential subsea noise levels and any associated impact on marine mammals or fish will be scoped and carried out as part of the environmental assessment process.

4.3.8 Marine Recreation and Amenity

A large number of yachts, motor boats, dinghies, pleasure boats, tugs, work boats, fishing boats, canoes and rowing boats are welcomed onto the Thames each year, taking part in races, events, working and cruising. These activities will be considered in the navigation assessment (discussed in Section 5.3.3) and consultation will continue throughout the process with all local clubs and societies etc. It is anticipated that this would be undertaken through the RYA and local sailing clubs and associations.

The effects of the wind farm on recreational angling would also be assessed.

4.3.9 Traffic

Temporary minor increases in traffic levels are anticipated due to the transportation of materials and equipment during the construction and decommissioning phases, as well as traffic movements resulting from routine maintenance activities. It is expected that the main traffic movements would be marine based.

Traffic disruption may occur for a short period of time during the construction of the onshore components (substation, onshore cabling).

A study of the increased traffic volumes arising from the construction activities (e.g. heavy goods vehicles required to transport any equipment) would be undertaken to minimise any impacts to local roads.

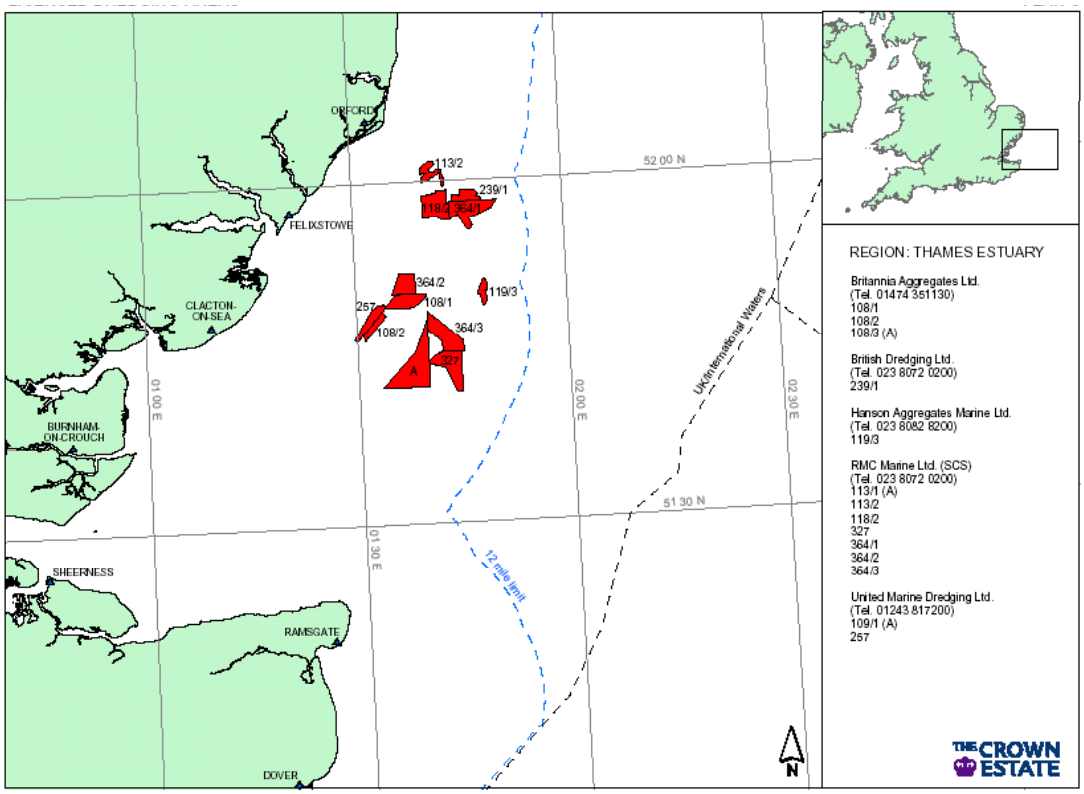
4.3.10 Offshore Oil and Gas Exploration

There are no oil and gas licences in the vicinity of the project sites or cable route to shore. The nature of the underlying geology is not commensurate with the presence of hydrocarbons and any future interest in the area is unlikely.

4.3.11 Marine Aggregate Extraction

There are a number of commercial sand and gravel extractions activities ongoing in the vicinity of the proposed development although none are located within the wind farm area. The operators of Marine Aggregate Extraction licences will be consulted regarding the proposed wind farm. The effects of the wind farm on these activities, including the likely cumulative and in-combination effects will be assessed within the Environmental Statement.

Figure 12 Aggregate Extraction Sites in the vicinity of the development



4.3.12 Subsea Cables and Pipelines

There are no subsea cables identified within the immediate vicinity of the proposed development. However, there are two cables which will require crossing solutions on the power export route to shore (BritNed and Kentish Flats). Discussions are taking place regarding the technical solutions and these will be detailed in the ES.

4.3.13 Marine Waste Disposal and Dumping

Barrow Deep sludge disposal site, some 15km to the west of the proposed site received sewage sludge from 1889 to 1915 and from 1967 to 1997. Black Deep disposal site, 10km to the west of the proposed site, took sewage from 1915 to 1967. Consultation will be required with DEFRA and CEFAS to establish the extent of sludge disposal and dispersion in the vicinity of the site and cable route and any implications for the construction process.

4.3.14 Civil and Military Aviation

During initial investigations, London Array has followed the recommended notification procedure and MoD have all confirmed that they have no objections to the proposed location for the wind farm. Notifications and consultations with CAA and NATS are currently ongoing.

The proposed site is well to the East of the Shoeburyness military firing ranges and is clear of Military Practice and Exercise Areas (PEXA), although there are PEXA to the North, West and East of the site.

4.3.15 Electromagnetic Interference

Wind turbines, as with any large structure, has the potential to interfere with electromagnetic signals, particularly television and communication systems. The potential effects of the wind farm on marine navigation systems would be addressed as part of the navigation impact assessment.

Potential interference to television and communication systems would be assessed following consultation with local and regional television and radio service providers as well as operators of communications infrastructure (for example mobile phone operators).

It is worth noting that tests of all navigational aids (GPS, radar, VHF etc) are being carried out on Nysted and North Hoyle and these results will assist in the assessment process.

4.4 Cumulative Effects

The need to consider cumulative impacts is a requirement of the EIA process. The Environmental Statement would consider cumulative effects with other existing, present and proposed projects and activities, not just offshore wind farms, these would include any coastal shore based wind farms, dredging activities, coastal protection initiatives, shipping, oil and gas exploration, aggregate extraction etc.

It should be noted that cumulative effects would be specifically addressed in a number of the assessments as part of this project including ornithology, benthos, fish, marine mammals, landscape and seascape, navigation etc.

Projects to be included in the assessment of potential cumulative effects, subject to availability of information, would include:

- Existing completed projects
- Uncompleted projects holding planning consent
- Plans or projects for which an application has been made and is under consideration by the consenting authorities;
- On-going activities in the marine environment e.g. dredging, fisheries
- Plans and projects which are ‘reasonably foreseeable’

London Array would seek to cooperate with other Round 2 developers to establish reasonable assumptions to achieve a thorough exploration of cumulative effect issues.

4.5 Environmental Impact Matrix

The range of potential environmental effects described above are summarised in the following tables. The environmental factors have been determined by considering each stage of the development and identifying potential issues which could arise. The level of significance of each potential effect would be determined in the ES.

The tables consider a hierarchy of primary, secondary and tertiary effects arising from a given development operation/characteristic. Primary effects result directly from the development characteristic, for example introduction of sediment into the water column from augering turbine foundations. Secondary effects are indirect effects being caused directly by the primary effect, for example increased turbidity of water resulting from introduction of sediment. Tertiary effects are indirect effects caused directly by secondary effects i.e. behavioural effects on fish due to increased water turbidity.

The tables are not intended to be exhaustive and should be used as a guide to the potential environmental effects only.

Table 8: Potential Environmental Effects During Construction And Decommissioning

Construction / Decommissioning Event	Impact Tier (Direct-Indirect)	Potential Impact Requiring Assessment
Geotechnical investigations for engineering design process (Outside of Environmental Impact Assessment process and included within Crown Estate Lease for Development)	Primary	○ Introduction of sediment into water column ○ Temporary underwater noise
	Primary	○ Temporary obstruction for Navigation ○ Temporary disturbance to commercial fisheries
Seabed preparation for foundations and cable routes	Primary	○ Loss of benthic community in immediate vicinity of foundation and cable
	Secondary	▪ Loss of food source for fish
	Secondary	▪ Loss of food source for birds feeding on shellfish etc.
	Primary	○ Damage to any ship wreck lying in immediate vicinity of foundations or cable route
Augering of pile shafts (should piled foundations be used), preparation of seabed for gravity foundations, trenching of cables	Primary	○ Introduction of sediment into water column
	Secondary	▪ Increased turbidity
	Tertiary	○ *Changing of physical environment for fish*
	Tertiary	❖ *Reduction in effectiveness of birds diving for shellfish*
	Secondary	▪ Increased deposition of sediment downstream
	Tertiary	❖ *Smothering of benthic community downstream*

Construction / Decommissioning Event	Impact Tier (Direct-Indirect)	Potential Impact Requiring Assessment
Geotechnical investigations for engineering design process (Outside of Environmental Impact Assessment process and included within Crown Estate Lease for Development)	Primary	○ Introduction of sediment into water column ○ Temporary underwater noise
	Primary	○ Temporary obstruction for Navigation ○ Temporary disturbance to commercial fisheries
Piling/removal of turbine foundations (should piled foundations be used)	Primary Primary Primary Primary	○ Physiological/behavioural effects on fish ○ Physiological/behavioural effects on sea mammals ○ Avoidance of piling site by birds ○ Potential noise intrusion for tourists/residents onshore
Navigation exclusion zone around construction/decommissioning area	Primary Primary	○ Reduction in fishing area for commercial fisheries ○ Exclusion on-site for leisure sailing, sea angling
Boat movements, construction/decommissioning activities above sea surface	Primary Primary	○ Visual intrusion for viewers on coast looking out to sea ○ Avoidance of immediate area by birds
Spillage of hydraulic fluids, fuel etc.	Primary Secondary Secondary	○ Change in water quality ▪ Temporary effects on benthic/fish communities ▪ Potential fouling of bird feathers

Table 9: Potential Environmental Effects During Operation

Development Characteristic	Impact Tier (Direct-Indirect)	Potential Impact requiring assessment
Physical presence of turbine foundations and scour protection.	Primary Secondary Tertiary	○ Replacement of sediment with hard substrate for benthic life at foundation ▪ New benthic community on foundation ❖ *Change in food availability for fish in immediate area of foundation*
	Primary Secondary Primary Secondary Tertiary Secondary	○ Reduction in tidal flow/wave energy ▪ Increased shelter for fish downstream of foundation ○ Change in sediment transport in vicinity of wind farm ▪ Change in turbidity/deposition ❖ *Change in physical environment for fish/benthic communities* ▪ Change in coastal processes
Physical presence of turbines and substation platform	Primary Secondary Primary Primary Primary	○ Visual/landscape impacts on coastal landscapes and human receptors ▪ Effects on tourism ○ Avoidance of area by birds ○ Collision risk of birds in rotors ○ Collision risk for boats
	Secondary Primary Primary	▪ Risk of spillage of transformer coolants ▪ Risk of displaced fishing activities ○ Potential collision of low flying aircraft ○ Possible interference of TV reception
Navigation Lighting	Primary	○ Disturbance effect on birds ○ Landscape and visuals
Presence of cables on sea bed	Primary Secondary Tertiary	○ Risk of exposure of cables through normal sediment transport ▪ Non-zero magnetic fields in immediate vicinity of exposed cable ❖ *Disorientation effects on migratory fish*

Development Characteristic	Impact Tier (Direct-Indirect)	Potential Impact requiring assessment
Presence of cables on sea bed (continued)	Secondary	▪ Non-zero electric fields around exposed cables
	Tertiary	❖*Attractive/repulsive effects on elasmobranch fish*
	Primary	○ Exclusion of trawling from site
	Secondary	▪ Loss of catch for fishermen
Noise of wind turbines (subsea and aerial)	Primary	○ Avoidance of area by marine mammals
	Primary	○ Avoidance of immediate area by birds
	Primary	○ Behavioural effects on noise sensitive fish
Presence of sacrificial anodes on foundations	Primary	○ Loss of aluminium into water column
	Secondary	▪ Toxic effects on fish/benthic communities
Vessel movements for operation & maintenance	Primary	○ Visual intrusion for viewers on coast looking out to sea
	Primary	○ Avoidance of immediate area by birds
Offshore accommodation	Primary	○ Visual intrusion for viewers on coast looking out to sea
	Primary	○ Navigation obstruction
	Secondary	▪ Risk of spillage of water and waste
		▪ Risk of displaced fishing activities

5 Mitigation and Monitoring

Mitigation measures to reduce any potential environmental effects would be incorporated into the design of the wind farm through design of the layout of the turbines and the design of the individual components of the wind farm, and finally the selection of construction and decommissioning techniques.

The EIA would also provide a proposal for on-going monitoring to be undertaken, including pre-construction, construction and post-construction monitoring activities. Monitoring would be proposed for a number of elements in accordance with consultee and other expert advice.

6 Proposed Structure of the Environmental Statement

The Environmental Impact Statement would comprise three volumes:

Volume 1: Non Technical Summary
Volume 2: Full Text of the Environmental Statement
Volume 3: Volume of Appendices

The proposed contents list for the offshore elements of the Environmental Statement is included in Appendix B.

REFERENCES

BMT Cordah Ltd. (2003) : Offshore Wind Energy Generation, Phase 1 Proposals and Environmental Report

BWEA (1994) : Best Practice Guidelines for Wind Energy Development

BWEA (2002) : Best Practice Guidelines - Consultation for Offshore Wind Energy Developments

BWEA (2002) : Health and Safety Guidelines

BWEA (2001) : Wind Farm Development and Nature Conservation

CEFAS (2001) : Offshore Wind Farms, Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements

Civil Aviation Authority (2003) Proposed Amendment to the Air Navigation Order, Lighting of Wind Turbine Generators in United Kingdom Territorial Waters

Countryside Council for Wales, Brady Shipman Martin, University College Dublin (2001) : Guide to Best Practice in Seascape Assessment

DTI (2002) : Future Offshore: A Strategic Framework for the Offshore Wind Industry

DTI (2003) : Guidance Notes Offshore Wind Farms Consents Process

DTI, CAA, MOD, BWEA (2002) Wind Energy and Aviation – Interim Guidelines

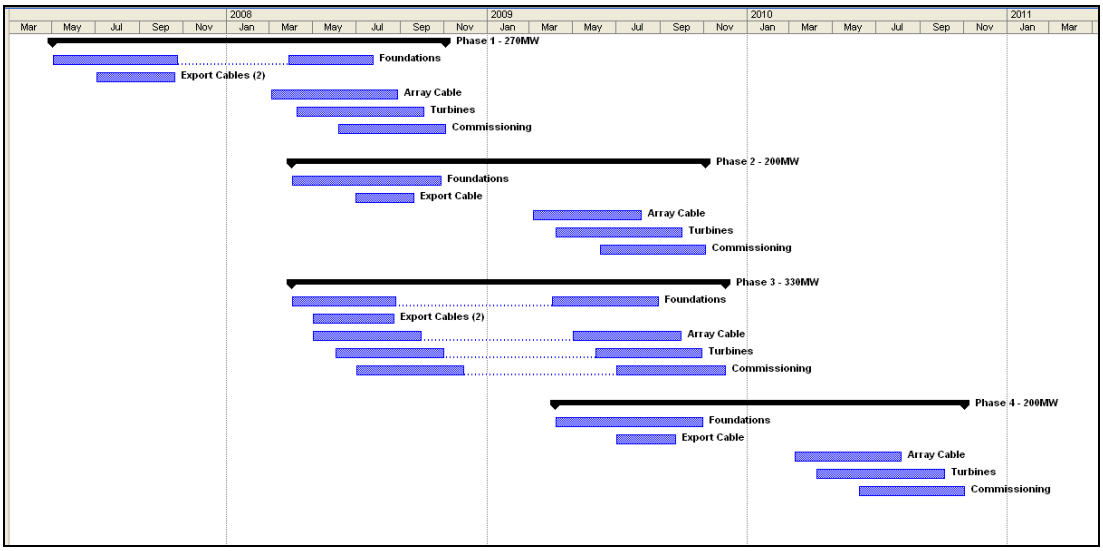
ETSU (2000) : An Assessment of the Environmental Effects of Offshore Wind Farms

Planning Policy Guidance Note 22 (1993) : Renewable Energy

Appendices

Appendix A Provisional Construction Programme

The programme provided below is for indicative purposes only.



Appendix B Proposed Contents List for the Offshore Elements of the Environmental Statement

INTRODUCTION

- Background to the Development
- Strategic Need for Wind Power
  - International
  - European
  - National
  - Local
- The Developers
- Project Consultants

APPROACH TO THE EIA

- The EIA Process
- Identification of Key Impacts
- Scope of the Environmental Assessment
- Consultation Process
- Regulatory and Planning Context
- SCHEME DESCRIPTION
- Location and Size of Development
- Turbines and Foundations
- Electrical Infrastructure and Grid Connection
- Windfarm Construction Details
- Operation and Maintenance
- Decommissioning of the Site
- Site Selection
  - Do Nothing Scenario
  - Alternative Layouts
  - Alternative Turbine Types
  - Alternative Turbine Foundations
  - Alternative Ports Considered

DESCRIPTION OF THE ENVIRONMENT

- Introduction
- Physical Aspects
  - Bathymetry
  - Seabed Surface Characteristics
  - Geology
  - Water Quality
  - Intertidal and Coastal Habitats
  - Sediment and Biota Contaminants
  - Meteorological Parameters

- Coastal and Marine Processes
- Biological Aspects
  - Designated Sites
  - Terrestrial Fauna
  - Terrestrial Habitats
  - Birds
  - Benthic Fauna
  - Marine Flora
  - Fish and Shellfish
  - Marine Mammals
- Human Environment
  - Seascape/Landscape
  - Pipelines and Cables
  - Oil and Gas Exploration and Related Activities
  - Dredging Areas
  - Marine Archaeology and Wrecks
  - Commercial Fishing and Shell-Fisheries
  - Transport, Ports, Navigation and Shipping
  - Aviation
  - Military Activity
  - Waste Disposal
  - Munitions
  - Noise
  - Other Social and Economic Factors

EVALUATION OF THE ENVIRONMENTAL EFFECTS, MITIGATION MEASURES AND MONITORING

- Introduction
- Potential Physical Effects
  - Seabed
    - *Assessment Methodology**
    - *Assessment of Effects**
    - *Mitigation Measures**
    - *Residual Impacts**
    - *Proposed Monitoring**
  - Water Quality
  - Intertidal and Coastal Habitats
  - Coastal and Marine Processes
- Potential Effects on the Biological Environment
  - Marine Designated Sites
  - Terrestrial Cable Routes
  - Birds
  - Benthic Communities

- Fish and Shellfish
- Marine Mammals

Potential Effects on the Human Environment

- Seascape/Landscape
- Pipelines and Cables
- Oil and Gas Exploration and Related Activities
- Dredging Areas
- Marine Archaeology and Wrecks
- Commercial Fishing and Shell-Fisheries
- Transport, Ports, Navigation and Shipping
- Aviation
- Military Activity
- Waste Disposal
- Munitions
- Noise

Other Social and Economic Factors

Likely Significant Effects on the Internationally Important Habitats and/or Species

SUMMARY

Summary of Mitigation Measures

- The Physical Environment
- The Biological Environment
- The Human Environment

Summary of Residual Effects

- The Physical Environment
- The Biological Environment
- The Human Environment

Summary of Monitoring Proposals

- The Physical Environment
- The Biological Environment
- The Human Environment

Statement of Environmental Management Systems

* *Subheadings included in all Assessments in Section 5*

APPENDICES (selected)

Onshore Works

To include all onshore works submission material required under the Town & Country Planning Act 1990 and Section 37 of the Electricity Act 1989.

Appendix C Distribution List of Offshore Scoping Report

Advisory Committee on Historic Wrecks
Associated British Ports
Association of Sea Fisheries Committees of England and Wales
British Broadcasting Corporation
Bradwell Marina
Brightlingsea Harbour Commissioners
Brittania Aggregates Ltd
British Chamber of Shipping
British Dredging Ltd
British Helicopter Advisory Board
British Marine Aggregates Producers Association (BMAPA)
British Marine Foundation
British Marine Industries Federation
British Ports Association
British Sub Aqua Club
British Telecom
British Waterways
Civil Aviation Authority
Canterbury City Council
Canvey Island Cleanaway Marshes Trust
Castle Point Borough Council
Castle Point Chamber of Trade
CEFAS
Colchester Borough Council
Council for British Archaeology
Council for the Protection of Rural England
Country Landowners Association
Countryside Agency
Crouch Harbour Authority
Dartford Borough Council
DEFRA - MCEU
DEFRA - Sea Fisheries Inspectorate
Department for Culture, Media and Sport
Department for Transport - Ports Division
Department of Trade and Industry
East of England Development Agency
East of England Regional Assembly
East of England Tourist Board
Eastern Sea Fisheries Committee
English Heritage
English Nature – Maritime Team
English Nature - Essex, Herts & London Team
English Tourist Board
Environment Agency
Essex Biodiversity Partnership
Essex County Council
Essex Flood Defence Committee
Essex Tourism Association
Essex Wildlife Trust
Flood Hazard Research Centre
Friends of the Earth
Government Office for East of England

Graveney Parish Council
Gravesham Chamber of Commerce
Gravesham Chamber of Trade & Industry
Greenpeace
Hanson Aggregates Marine Ltd
Harwich Haven Authority
Health and Safety Executive
Inland Waterways Association
International Chamber of Shipping
International Maritime Organisation
Joint Nature Conservation Committee
Kent and Essex Fisheries Committee
Kent Biodiversity Partnership
Kent County Council
Kent Thames-side and Medway Chambers of Commerce
Kent Wildfowlers Association.
Kent Wildlife Trust
Leigh-on-Sea Town Council
Maldon District Council
Manston Airport
Marine Conservation Society
Maritime and Coastguard Agency
Medway Council
Medway Ports Authority
Medway/Swale Estuary Partnership
Mercury Communications Ltd
MoD Defence Estates
National Farmers Union - Kent
National Federation of Fishermen's Organisations
National Federation of Sea Anglers
National Grid Transco
National Maritime Museum
NATS
NTL
Port of Felixstowe
Port of London Authority
Port of Lowestoft
Port of Ramsgate
Port of Tilbury London Ltd
Radio Communications Agency
Ramblers Association (London Office)
Renewables East
River Thames Society
RMC Marine Ltd (SCS)
RNLI
Rochford District Council
Royal Commission on the Historical Monuments of England
Royal Ocean Racing Club
Royal Society for Nature Conservation
Royal Society for the Protection of Birds
Royal Yachting Association
Sea Mammal Research Unit
Shellfish Assoc. of Great Britain
South East England Tourist Board

Southend-on-Sea Borough Council
Suffolk Coastal District Council
Swale Borough Council
Swanscombe & Greenhithe Council
Tendring District Council
Thames Estuary Partnership
Thames Landscape Strategy
Thames Salmon Trust
Thanet District Council
The Countryside Commission
The Barge Association (formerly the Dutch Barge Association)
The Sailing Barge Association
The Crown Estate
The National Trust
Thurrock District Council
Trinity House Lighthouse Service (THLS)
UK Hydrographic Office
UK Major Ports Group
UK Offshore Operators Association
United Marine Dredging Ltd
Westminster Gravels
Whale and Dolphin Conservation Society
Wildfowl and Wetlands Trust
Worldwide Fund for Nature