DEPARTMENT OF ENERGY & CLIMATE CHANGE

Offshore Oil & Gas Licensing

26th Seaward Round

Eastern Irish Sea

Blocks 113/28, 113/29a, 110/07d & 110/08b

Appropriate Assessment

URN 11D/903: November 2011

CONTENTS

1 Introduction

1.1 Background and purpose

On 27th January 2010, the Secretary of State for the Department of Energy and Climate Change (DECC) invited applications for licences in the 26th Seaward Licensing Round.

To comply with obligations under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) (OPAR 2001), in summer 2010, the Secretary of State undertook a screening assessment to determine whether the award of any of the Blocks applied for would be likely to have a significant effect on a relevant European conservation site, either individually or in combination with other plans or projects (DECC 2010).

In so doing, the amplification of the Habitats Directive test provided by the European Court of Justice in the Waddenzee case (Case C-127/02) was used, as follows:

> Any plan or project not directly connected with or necessary to the management of a site must be subject to an Appropriate Assessment if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects.
>
> Where a plan or project not directly connected with or necessary to the management of the site is likely to undermine the site's conservation objectives, it must be considered likely to have a significant effect on that site. The assessment of that risk must be made in the light, inter alia, of the characteristics and specific environmental conditions of the site concerned by such a plan or project.

An initial screening assessment (including consultation with the statutory agencies/bodies), identified 99 whole or part Blocks as requiring further assessment prior to decisions on whether to grant licences. Because of the wide distribution of these Blocks around the UKCS, the Appropriate Assessments (AA) in respect of each potential licence award, are contained in seven regional reports as follows:

- Southern North Sea
- Outer Moray Firth
- Central North Sea
- Fair Isle Channel
- Northern Ireland
- Eastern Irish Sea
- Central English Channel

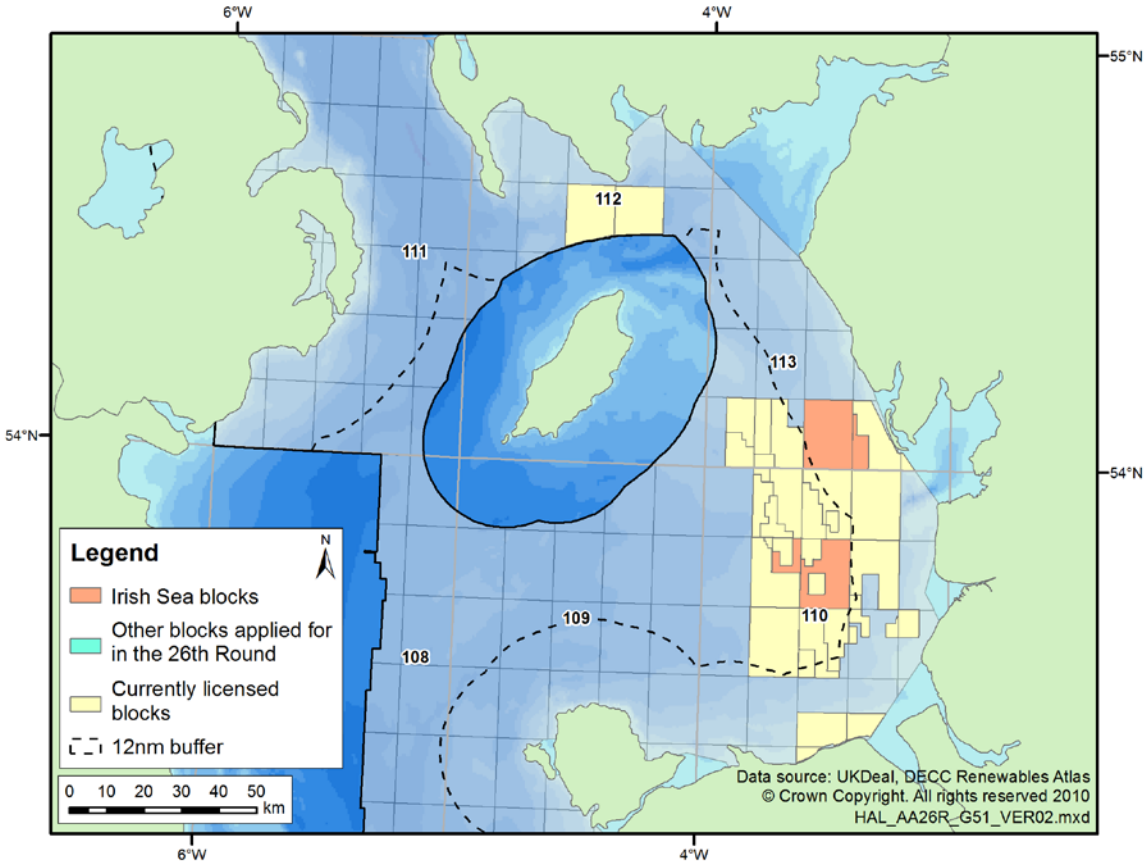
This report documents the further assessment in relation to 4 Blocks in the eastern Irish Sea (see Section 1.2).

1.2 Eastern Irish Sea Blocks

The eastern Irish Sea Blocks applied for in the 26th Round considered in this document are listed below and shown in dark orange in Figure 1.1.

110/07d
110/08b
113/28
113/29a

Figure 1.1: Location of Eastern Irish Sea Blocks



2 Licensing and activity

2.1 Licensing

The exclusive rights to search and bore for and get petroleum in Great Britain, the territorial sea adjacent to the United Kingdom and on the UK Continental Shelf (UKCS) are vested in the Crown and the *Petroleum Act 1998* (as amended) gives the Secretary of State the power to grant licences to explore for and exploit these resources. The main type of offshore Licence is the Seaward Production Licence. Offshore licensing for oil and gas exploration and production commenced in 1964 and has progressed through a series of Seaward Licensing Rounds. A Seaward Production Licence may cover the whole or part of a specified Block or a group of Blocks. A Licence grants exclusive rights to the holders "to search and bore for, and get, petroleum" in the area covered by the Licence. A Licence does not confer any exemption from other legal/regulatory/fiscal requirements.

There are three types of Seaward Production Licences:

- Traditional Production Licences are the standard type of Seaward Production Licences and run for three successive periods or Terms. Each Licence expires automatically at the end of each Term, unless the licensee has made enough progress to earn the chance to move into the next Term. The Initial Term lasts for four years and the Licence will only continue into a Second Term of four years if the agreed Work Programme has been completed and if 50% of the acreage has been relinquished. The Licence will only continue into a Third Term of 18 years if a development plan has been approved, and all the acreage outside that development has been relinquished.

- Frontier Production Licences are a variation of the Traditional Production Licence with longer terms. A Frontier Production Licence has a longer Initial Term (six years as opposed to four) with the objective of allowing companies to screen larger areas. After 3 years, the licensee must relinquish 75% of the licensed acreage. At the end of the Initial Term, the exploration Work Programme must have been completed and the licensee must relinquish 50% of what is left (i.e. leaving one eighth of the original licensed area).

- In the 21st Round (2002) the Department introduced Promote Licences. The general concept of the Promote Licence is that the licensee is given two years after award to attract the technical, environmental and financial capacity to complete an agreed Work Programme. In effect, DECC will defer (not waive) its financial, technical and environmental checks until the preset Check Point. Promote licensees are not allowed to carry out field operations until they have met the full competence criteria. The way this is implemented is that each Promote Licence carries a "Drill-or-Drop" Initial Term Work Programme. The Licence will therefore expire after two years if the licensee has not made a firm commitment to DECC to complete the Work Programme (e.g. to drill a well). By the same point, it must also have satisfied DECC of its technical, environmental and financial capacity to do so.

The model clauses and terms and conditions which are attached to Licences are contained in Regulations.

It is noted that the environmental management capacity and track record of applicants is considered by DECC, through written submissions and interviews, before licences are awarded.

2.2 Activity

As part of the licence application process, applicant companies provide DECC with details of work programmes they propose in the first term to further the understanding or exploration of the Blocks(s) in question. These work programmes are considered with a range of other factors in DECC's decision on whether to license the Blocks and to whom. There are three levels of drilling commitment:

- A **Firm Drilling Commitment** is a commitment to the Secretary of State to drill a well. Applicants are required to make firm drilling commitments on the basis that, if there were no such commitment, the Secretary of State could not be certain that potential licensees would make full use of their licences. However, the fact that a licensee has been awarded a licence on the basis of a "firm commitment" to undertake a specific activity should not be taken as meaning that the licensee will actually be able to carry out that activity. This will depend upon the outcome of all relevant environmental assessments.

- A **Contingent Drilling Commitment** is also a commitment to the Secretary of State to drill a well, but it includes specific provision for DECC to waive the commitment in light of further technical information.

- A **Drill or Drop (D/D) Drilling Commitment** is a conditional commitment with the proviso, discussed above, that the licence is relinquished if a well is not drilled.

Note that Drill-or-Drop and Contingent work programmes (subject to further studies by the licensees) will probably result in a well being drilled in less than 50% of the cases.

It is made clear in the application guidance that a Production Licence does not allow a licensee to carry out all petroleum-related activities from then on. Field activities, such as seismic survey or drilling, are subject to further individual controls by DECC, and a licensee also remains subject to controls by other bodies such as the Health and Safety Executive. It is the licensee's responsibility to be aware of, and comply with, all regulatory controls and legal requirements.

The proposed work programmes for the first four-year period (six years in the case of Frontiers licences) are detailed in the licence applications. For some activities, such as seismic survey noise and oil spills, the impacts can occur some distance from the licensed Blocks and the degree of activity is not necessarily proportional to the size or number of Blocks in an area. For the case of direct physical disturbance, the licence Blocks being applied for are relevant, although there may still be pipelines that cross unlicensed Blocks should any significant development ensue after the initial four-year exploratory period.

The approach used here has been to take the proposed activity for a given Block as being the maximum of any application for that Block, and to assume that all activity takes place as a result of the structuring of licences. The Blocks comprising individual licences and estimates of work commitments for the Blocks derived by DECC from the range of applications received are as follows:

- 110/7d – Drill or drop well

- 110/8b – Drill or drop well
- 113/28, 113/29a – Submit a Development Plan within one year and a drill or drop well

On past experience, less activity actually takes place than is bid at the licence application stage. A proportion of Blocks awarded may be relinquished without any field activities occurring.

Activity after the initial term is much harder to predict, as this depends on the results of the initial phase, which is, by definition, exploratory. Typically less than half the wells drilled reveal hydrocarbons, and of that half, less than half again will yield an amount significant enough to warrant development. Depending on the expected size of finds, there may be further drilling to appraise the hydrocarbons (appraisal wells). Discoveries that are developed may require further drilling, wellhead infrastructure, pipelines and possibly production facilities such as platforms, although most recent developments are tiebacks to existing production facilities rather than stand alone developments.

The extent and timescale of development, if any, which may ultimately result from the licensing of these Blocks is therefore uncertain and would be subject to further project level assessment (incorporating Habitats Regulations Assessment (HRA) where appropriate) prior to any consent being issued.

DECC has issued guidance on Block specific issues and concerns and these concerns will affect DECC's decision whether or not to approve particular activities. The guidance indicates seasonal concerns for seismic activity for the Blocks considered in this document (see Table 2.1 below and Section 7.1).

Table 2.1: Seasonal and other concerns related to Blocks considered in this Appropriate Assessment

Block	Period of concern for seismic surveys	Period of concern for drilling	Spawning sites*	Special Conditions†
110/7d	January – June, December	-	-	✓
110/8b	January - June	-	-	✓
113/28	January - June	-	-	✓
113/29a	February - June	-	-	✓

*Note: * seabed surveys should be undertaken before any drilling activity to confirm whether there are any herring spawning sites within a three-nautical mile radius of the proposed drilling location, † Activity is of concern to the MoD because the Block lies within training ranges. For further information see: Other regulatory issues (DECC 26th Seaward licensing Round website).*

3 Relevant Natura 2000 Sites

The Natura 2000 sites to be considered in this assessment were identified based on their location in relation to the 4 Blocks (see Section 1.2 above) which are the subject of licence applications and in terms of the foreseeable possibility of interactions. Sites considered include designated Natura 2000 sites (also referred to as 'European Sites') and potential sites for which there is adequate information on which to base an assessment.

The sites considered are listed and mapped in Appendix A, and Appendix B presents the results of a screening exercise of these sites to identify the potential effects of activities that could follow the licensing of the 4 Blocks in question. In accordance with Government policy (as set out in Planning Policy Statement 9 (ODPM 2005a[1])) and for Scottish sites, the revised guidance updating Scottish office Circular No. 6/1995 (Scottish Government 2000), the relevant sites considered include classified and potential SPAs, designated and candidate SACs and Sites of Community Importance[2] (SCIs). Guidance in relation to sites which have not yet been submitted to the European Commission is given by Circular 06/2005 (ODPM 2005b) which states that: "*Prior to its submission to the European Commission as a cSAC, a proposed SAC (pSAC) is subject to wide consultation. At that stage it is not a European site and the Habitats Regulations do not apply as a matter of law or as a matter of policy. Nevertheless, planning authorities should take note of this potential designation in their consideration of any planning applications that may affect the site.*", which can be augmented for Scottish sites by the amended Scottish Government Circular 6/1995, "*...potential SPAs and potential SACs should be treated in the same way as classified SPAs,,,"* (i.e. that pSACs attract the same legal protection as designated sites).

The relevant sites are detailed in Appendix A and include:

- Coastal and marine Natura 2000 sites along the west coast of the UK from the Mull of Galloway, southwest Scotland, to Anglesey, north Wales, and the east coast of Northern Ireland from Larne Lough to Carlingford Lough.
- Riverine SACs within the area for migratory fish and/or the freshwater pearl mussel.

Information gathering is in progress to inform the potential designation of further Natura 2000 sites, for instance the work of Kober *et al.* (2010) and survey work being undertaken on the south coast with a view to the identification of SPAs for the Balearic Shearwater (*Puffinus mauretanicus*). Should further sites be established in the future, these would be considered as necessary in subsequent project specific assessments.

Summaries of sites, together with their features of interest, and location maps are given in Appendix A (Maps A.1 to A.3 and Tables A.1 to A.5). This information is summarised in Figures 3.1-3.2 and Tables 3.1-3.3, below.

[1] Which states that "Listed Ramsar sites, also as a matter of policy, should receive the same protection as designated SPAs and SACs". UK coastal Ramsar sites are typically coincident with SACs and/or SPAs.

[2] Sites of Community Importance (SCIs) are more advanced in designation than cSACs in that they have been adopted by the European Commission but not yet formally designated by the government of the relevant country.

Figure 3.1: SPAs Relevant to this Appropriate Assessment

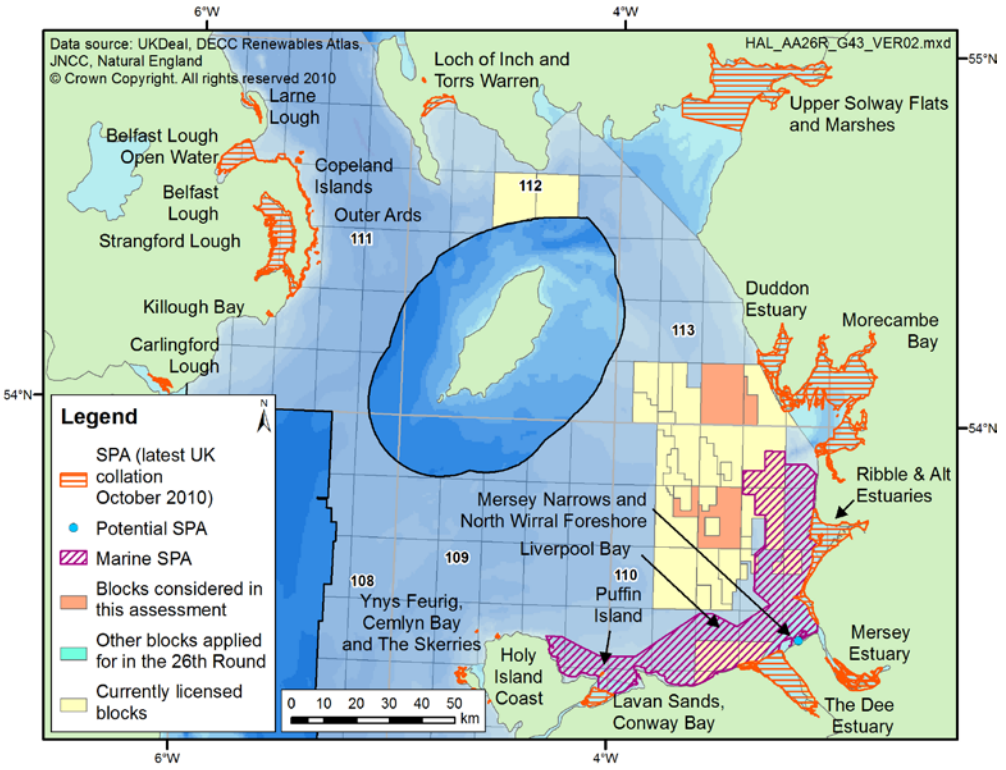


Figure 3.2: SACs Relevant to this Appropriate Assessment

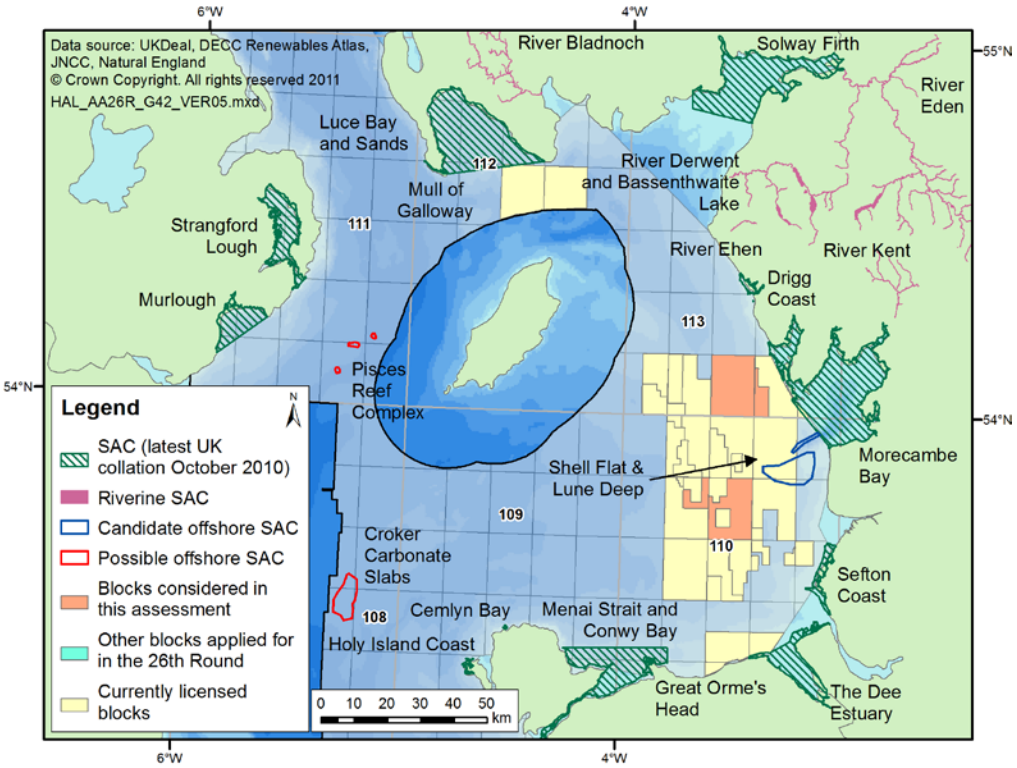


Table 3.1: SPA sites and qualifying features under Article 4.1 and 4.2, relevant to the Eastern Irish Sea AA

	Larne Lough	Belfast Lough Open Water	Belfast Lough	Copeland Islands	Outer Ards	Strangford Lough	Killough Bay	Carlingford Lough	Loch of Inch & Torrs Warren	Upper Solway Flats and Marshes	Duddon Estuary	Morecambe Bay	Ribble and Alt Estuaries	Mersey Estuary	Mersey Narrows and North Wirral Foreshore pSPA	Liverpool Bay / Bae Lerpwl marine	The Dee Estuary / Aber Afon Dyfrdwy	Glannau Ynys Gybi / Holy Island Coast	Traeth Lafan / Lavan Sands, Conway Bay	Ynys Feurig, Cemlyn Bay and the Skerries	Ynys Seiriol / Puffin Bay
Red-throated diver																W					
Great crested grebe		W												W					W		
Manx shearwater				B																	
Cormorant													W								B
Black-headed gull													B								
Lesser black-backed gull													B								
Sandwich tern						B		B			B	B								B	
Roseate tern	B																			B	
Common tern	B					B		B					B							B	
Arctic tern				B	B	B														B	
Hen harrier									W												
Chough																		B W			
Oystercatcher										W		W	W				W		W		
Ringed plover												P	P	P							
Golden plover					W					W			W	W							
Grey plover										W		W	W	W							

	Larne Lough	Belfast Lough Open Water	Belfast Lough	Copeland Islands	Outer Ards	Strangford Lough	Killough Bay	Carlingford Lough	Loch of Inch & Torrs Warren	Upper Solway Flats and Marshes	Duddon Estuary	Morecambe Bay	Ribble and Alt Estuaries	Mersey Estuary	Mersey Narrows and North Wirral Foreshore pSPA	Liverpool Bay / Bae Lerpwl marine	The Dee Estuary / Aber Afon Dyfrdwy	Glannau Ynys Gybi / Holy Island Coast	Traeth Lafan / Lavan Sands, Conway Bay	Ynys Feurig, Cemlyn Bay and the Skerries	Ynys Seiriol / Puffin Bay
Lapwing													W	W							
Knot						W				W	W	W	W				W				
Sanderling										W			WP								
Dunlin										W		W	W	W							
Ruff													B								
Black-tailed godwit													W	W							
Bar-tailed godwit			W							W		W	W				W				
Whimbrel													P								
Curlew										W		W	W	W					W		
Redshank			W			W				W	W	W	WP	WP			W				
Turnstone			W							W		W									
Bewick's swan													W								
Whooper swan										W			W								
Bean goose																					
Pink-footed goose										W		W	W								
Greenland white-fronted goose									W												
Barnacle goose										W											
Canadian light-bellied brent goose	W					W	W														

	Larne Lough	Belfast Lough Open Water	Belfast Lough	Copeland Islands	Outer Ards	Strangford Lough	Killough Bay	Carlingford Lough	Loch of Inch & Torrs Warren	Upper Solway Flats and Marshes	Duddon Estuary	Morecambe Bay	Ribble and Alt Estuaries	Mersey Estuary	Mersey Narrows and North Wirral Foreshore pSPA	Liverpool Bay / Bae Lerpwl marine	The Dee Estuary / Aber Afon Dyfrdwy	Glannau Ynys Gybi / Holy Island Coast	Traeth Lafan / Lavan Sands, Conway Bay	Ynys Feurig, Cemlyn Bay and the Skerries	Ynys Seiriol / Puffin Bay
Shelduck										W		W	W	W			W				
Wigeon													W	W							
Teal										W			W	W							
Pintail										W	W	W	W	W			W				
Shoveler										W											
Scaup										W			W								
Common scoter													W			W					
Goldeneye										W											
Assemblage			W			W				W	W	B W	B W			W	W				

Note: B = Breeding, W = Over Wintering, P = On Passage, see Appendix C for more details.

Table 3.2: SAC sites and qualifying features under Annex 1 and Annex 2, relevant to the Eastern Irish Sea AA

Annex 1 Habitats	Strangford Lough	Murlough	Luce Bay and Sands	Mull of Galloway	Solway Firth	Drigg Coast	Morecambe Bay	Shell Flat and Lune Deep cSAC	Sefton Coast	Dee Estuary / Aber Dyfrdwy	Great Orme's Head / Pen y Gogarth	Y Fenai a Bae Conwy / Menai Strait and Conway Bay	Bae Cemlyn / Cemlyn Bay	Glannau Ynys Gybi / Holy Island Coast	Pisces Reef Complex pSAC	Croker Carbonate Slabs pSAC
Coastal dunes		P, Q	P		Q	P, Q	P, Q		P, Q	Q						
Coastal lagoons	P						Q						P			
Estuaries					P	P	P			Q						
Grasslands											P					
Heaths											P			P, Q		
Inlets and bays	P		P				P					Q				
Mudflats and sandflats	P	Q	Q		P	Q	P			P		P				
Reefs	P		Q		Q		Q	P				P			P	
Salt marshes and salt meadows	Q	Q			P	Q	P			P						
Sandbanks		Q	Q		P		Q	P				P				
Sea caves												Q				
Sea cliffs				P						Q	Q			P		
Vegetation of drift lines	Q									Q						
Vegetation of stony banks	Q				Q		P						Q			
Submarine structures made by leaking gases																P

Annex 2 Species	Strangford Lough	Murlough	Luce Bay and Sands	Mull of Galloway	Solway Firth	Drigg Coast	Morecambe Bay	Shell Flat and Lune Deep cSAC	Sefton Coast	Dee Estuary / Aber Dyfrdwy	Great Orme's Head / Pen y Gogarth	Y Fenai a Bae Conwy / Menai Strait and Conway Bay	Bae Cemlyn / Cemlyn Bay	Glannau Ynys Gybi / Holy Island Coast	Pisces Reef Complex pSAC	Croker Carbonate Slabs pSAC
Grey seal																N Q
Harbour seal	Q	Q														
Harbour porpoise																N Q
Sea lamprey					P					Q						
River lamprey					P					Q						

Note: P = Primary feature, Q = Qualifying feature, see Appendix C for more details – note that primary and qualifying (secondary) features are treated equally within this assessment. Annex 1 habitats follow nomenclature shown in Box A.2 (AppendixA2).

Table 3.3: Species of riverine SACs designated for migratory fish and/or the freshwater pearl mussel

	River Bladnoch	River Eden	River Derwent & Bassenthwaite	River Ehen	River Kent
Freshwater pearl mussel				P	Q
Otter		P	P		
Atlantic salmon	P	P	P	Q	
Sea lamprey		P	P		
River lamprey		P	P		
Brook lamprey		P	P		

Note: P = Primary feature, Q = Qualifying feature, see Appendix C for more details – note that primary and qualifying (secondary) features are treated equally within this assessment.

4 Assessment of the effects of the plan on site integrity

4.1 Process

In carrying out this AA so as to determine whether it is possible to grant licences in accordance with Regulation 5(1) of OPAR 2001 (as amended), DECC has:

- Considered, on the basis of the precautionary principle, whether it could be concluded that the integrity of relevant European Sites would not be affected. This impact prediction involved a consideration of the cumulative and in-combination effects.

- Examined, in relation to elements of the plan where it was not possible to conclude that the integrity of relevant sites would not be affected, whether appropriate mitigation measures could be designed which cancelled or minimised any potential adverse effects identified.

- Considered the comments received from statutory advisers and others on the draft AA

- Completed the AA, including DECC's conclusion on whether or not it is possible to go ahead with the plan.

In considering the above, DECC used the clarification of the tests set out in the Habitats Directive in line with the ruling of the ECJ in the *Waddenzee* case (Case C-127/02), namely that:

- Prior to the grant of any licence all activities which may be carried out following the grant of such a licence, and which by themselves or in combination with other activities can affect the site's conservation objectives, are identified in the light of the best scientific knowledge in the field.

- A licence can only be granted if DECC has made certain that the activities to be carried out under such a licence will not adversely affect the integrity of that site (i.e. cause deterioration to a qualifying habitat or habitat of qualifying species, and/or undermine the conservation objectives of any given site). That is the case where no reasonable scientific doubt remains as to the absence of such effects.

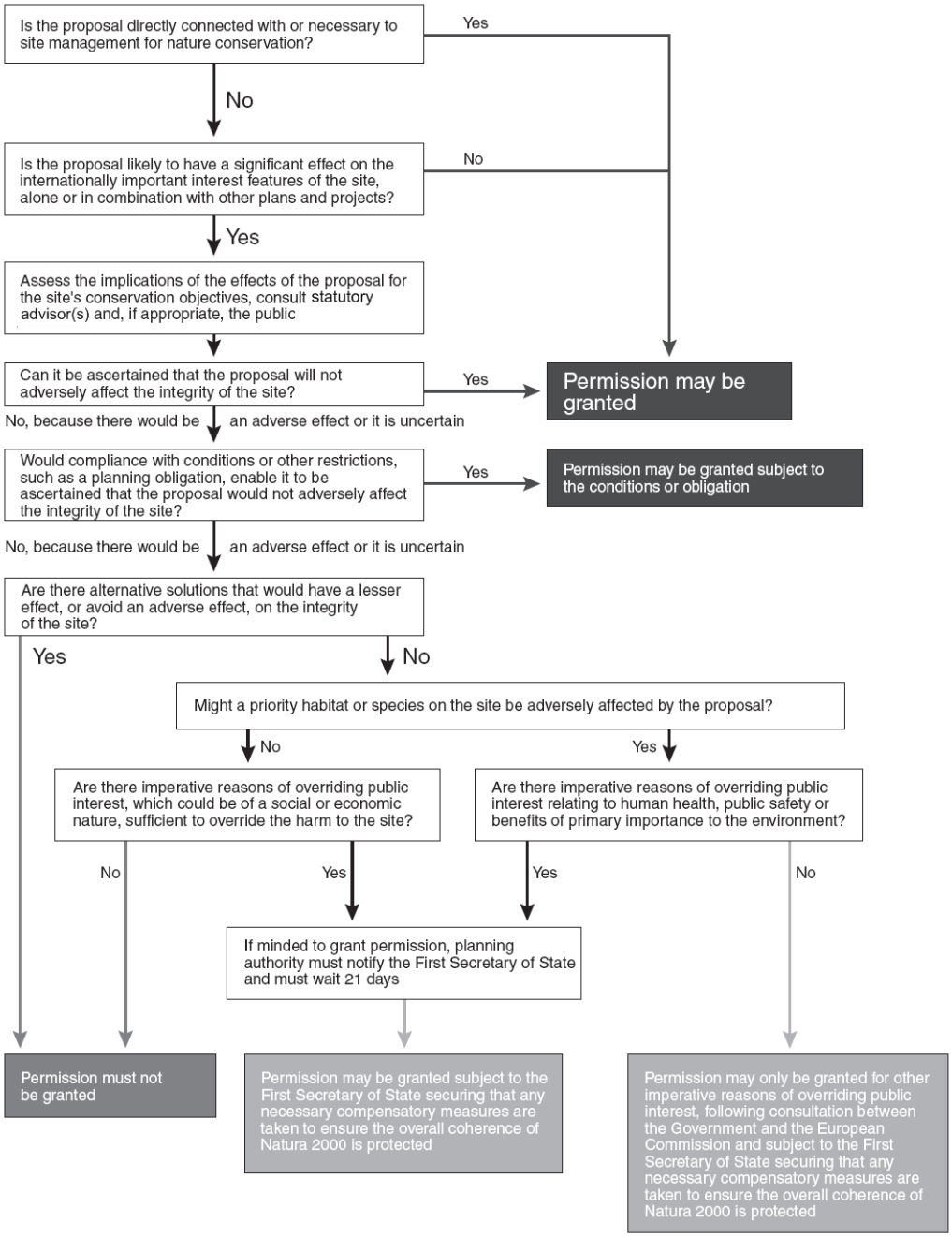
A flowchart summarising the process is shown in Figure 4.1.

4.2 Site integrity

Site integrity is defined by the ODPM Circular 06/2005 to accompany PPS9 (ODPM 2005b) as follows: "The integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified." As clarified by Section 4.6.3 of the EC Guidance (2000), the integrity of a site relates to the site's conservation objectives. These objectives are assigned at the time of designation to ensure that the site continues, in the long-term, to make an appropriate contribution to achieving favourable conservation

status for the qualifying interest features. For example, it is possible that a plan or project will adversely affect the integrity of a site only in a visual sense or only habitat types or species other than those listed in Annex I or Annex II. In such cases, the effects do not amount to an adverse effect for purposes of Article 6(3), provided that the coherence of the network is not affected. The AA must therefore conclude whether the proposed activity adversely affects the integrity of the site, in the light of its conservation objectives. For sites where the potential for adverse affects has been identified, their conservation objectives are listed in with a site-by-site consideration in Appendix C.

Figure 4.1: Summary of procedures under the Habitats Directive for consideration of plans or projects affecting Natura 2000 sites



Note: 'Statutory advisor(s)' refers to the relevant statutory Government advisor(s) on nature conservation issues. Source: After ODPM (2005b).

4.3 Assessment

The approach to ascertaining the absence or otherwise of adverse effects on the integrity of a European Site is set out in Section 4.1 above. This assessment has been undertaken in accordance with the European Commission Guidance (EC 2000), and with reference to various other guidance and reports including the Habitats Regulations guidance notes (e.g. SEERAD 2000), the Planning and Policy Statement note 9 (ODPM 2005a & b), the English Nature Research Reports, No 704 (Hoskin & Tyldesley 2006) and the Scottish Natural Heritage Habitats Regulations Appraisal of Plans, No 1739 (Tyldesley & Associates 2010).

Appendix A lists and summarises the relevant European Sites as defined in Section 3. Appendix B presents the results of a screening exercise of these sites to identify the potential for likely significant effects of activities that could follow the licensing of the 4 Blocks in question. Where potential effects are identified, more detailed information on the relevant sites is provided in Appendix C.

Detailed assessments are made in Sections 5-9 of the implications for the integrity of the relevant European Sites and their qualifying features and species, were licences for the four eastern Irish Sea Blocks to be granted. The assessment is based on an indication of the potential work programmes for the blocks and likely hydrocarbon resources, along with the characteristics of the relevant sites as described in the Appendices. As noted in Section 2.2, the potential work programme is taken as the maximum of any application for that Block; however, on past experience, less activity actually takes place than is bid at the licence application stage. Activities which may be carried out following the grant of a licence, and which by themselves or in combination with other activities can affect the conservation objectives of relevant European Sites are discussed under the following broad headings:

- Oil spills (including all liquid phase hydrocarbons)
- Physical disturbance and other effects (e.g. pipeline trenching, marine discharges)
- Underwater noise (in particular, seismic surveys)
- In-combination effects (e.g. cumulative and synergistic and secondary/indirect effects).

Use has been made of advice prepared by the conservation agencies under the various Habitats Regulations, since this typically includes advice on operations that may cause deterioration or disturbance to relevant features or species. Advice given under Regulation 33 (now Regulation 35 of the 2010 Regulations) includes an activities/factors matrix derived from MarLIN (www.marlin.ac.uk) where applicable. Several of the “probable” effects highlighted in the MarLIN matrices are not inevitable consequences of oil and gas exploration and production, since through the regulatory Environmental Impact Assessment (EIA) and permitting processes they are mitigated by timing, siting or technology requirements (or a combination of one or more of these). There is a requirement that these options would be evaluated in the environmental assessments as part of activity consenting.

The conservation objectives identified for SAC and SPA features for sites where the potential for effects have been identified are listed in Appendix C and referred to where relevant throughout the document. These objectives, in relation to the specific qualifying features of each site, and the conservation status of these features, have been considered during this Appropriate Assessment. The basis and primary concern of the conservation objectives are to maintain or achieve favourable conservation status. Table 4.1 provides definition of conservation status based on Articles 1(e) and (i) of the Habitats Directive.

Table 4.1: Definition of favourable conservation status for sites defined in the Habitats Directive

For habitats	Conservation status of a natural habitat means the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as 'favourable' when: • its natural range and areas it covers within that range are stable or increasing • the specific structure and functions which are necessary for its long-ter • m maintenance exist and are likely to continue to exist for the foreseeable future • the conservation status of its typical species is favourable (see below)
For species	Conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations. The *conservation status* will be taken as 'favourable' when: • population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and • the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and • there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis

A set of high level mitigation measures have been identified with regards to each of the broad sources of effect listed above (see Table 4.2). These mitigation measures, which are discussed in more detail in sections 5-8, should *inter alia* help to avoid the deterioration of any qualifying habitats, and habitats supporting species, and seek to prevent undermining any of the conservation objectives for a given site in relation to the features for which it is designated. These high-level mitigation measures can be partly interpreted as "...conditions or other restrictions such as a planning obligation, [compliance with which would] enable it to be ascertained that the proposal would not adversely affect the integrity of the site." (see Figure 4.1, above), though also represent other non-statutory guidance etc. with regards to the avoidance of significant effects on sites. Where it is considered that no effect can arise from any of the given sources of effect for a particular species or habitat (e.g. due to animal behaviour and/or the location/characteristics of a particular habitat), certain sites may be screened out of the assessment, and these are listed in the relevant section (5-8) where this is the case (also see Appendix B).

Table 4.2: High level mitigation measures identified for potential sources of effect

	High level Mitigation
Physical disturbance	All blocks under consideration are at least several kilometres offshore and remote from Natura 2000 sites. While new pipelines could conceivably come ashore at existing terminals, either through or near to coastal SACs and SPAs, there are well proven methods to prevent significant impacts – such mitigation would be defined at the project level, and be subject to project specific EIA and HRA.
Marine Discharges	Discharges from offshore oil and gas facilities have been subject to increasingly stringent regulatory controls over recent decades, and oil and other contaminant concentrations in the major streams (drilling wastes and produced water) have been substantially reduced or eliminated. Discharges would be considered in detail in project-specific Environmental Statements, AAs (where necessary) and chemical risk assessments under existing permitting

High level Mitigation	
	procedures.
Other effects	The IMO International Convention for the Control of Ballast Water and Sediment, serves to mitigate against the possible introduction of invasive alien species through shipping ballast, which may degrade sensitive local habitats and communities. Measures include the mid-ocean exchange of ballast water (with ultra-violet irradiation of ballast a proposed alternative). The potential for collision of birds with offshore infrastructure, increased by attraction of birds to lights, may be mitigated by controlling well test and routine flaring during production and by avoiding or limiting activities during months when large numbers of birds aggregate in the area.
Underwater noise	Application for consent to conduct seismic and other geophysical surveys – PON14 Seismic operators are required, as part of the application process, to justify that their proposed activity is not likely to cause a disturbance etc. under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) and *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended). It is a condition of consents issued under Regulation 4 of the *Petroleum Activities (Conservation of Habitats) Regulations 2001* (& 2007 Amendments) for oil and gas related seismic surveys that the JNCC, *Guidelines for minimising the risk of disturbance and injury to marine mammals from seismic surveys,* are followed. European Protected Species (EPS) disturbance licences can also be issued under the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007*. DECC will expect that passive acoustic monitoring (PAM) will be routinely used as a mitigation tool. Potential disturbance of certain species may be avoided by the seasonal timing of noisy activities, and periods of seasonal concern for individual Blocks on offer have been highlighted (see Section 2.2) for which licensees should expect to affect DECC's decision whether or not to approve particular activities.
Oil Spills	Oil Pollution Emergency Plans (OPEPs): regulatory requirements on operators to prepare spill prevention and containment measures, risk assessment and contingency planning – these are reviewed by DECC, MCA, JNCC, MMO, and relevant SNCB. Additional conditions imposed by DECC, through block-specific licence conditions (i.e. "Essential Elements"), and seasonal periods of concern for drilling, within which there is a presumption for drilling activity to be refused unless appropriate mitigation measures can be agreed (defined at the project level). Project level mitigation through permitting/HRA of specific activities (including conditions attached to consents/permits or potentially consent/permit refusal). MCA is responsible for a National Contingency Plan and maintains four Emergency Towing Vessels stationed around the UK which remain on standby at sea, in addition to aerial spraying and surveillance aircraft based at Coventry and Inverness and counter-pollution equipment (booms, adsorbents etc.). The MCA presently has four Emergency Towing Vessels stationed around the UK

High level Mitigation	
	which remain on standby at sea[3].
In-combination effects	The competent authorities will assess the potential for in-combination effects during Habitats Regulations Assessments of project specific consent applications; this process will ensure that mitigation measures are put in place to ensure that subsequent to licensing, specific projects (if consented) will not result in adverse effects on integrity of European sites.

[3] The future of these vessels is presently subject to debate as a new funding stream is required for their maintenance, with the present contract terminated in 2011. The role of these vessels may be filled by a commercial alternative (see: http://www.parliament.uk/business/committees/committees-a-z/commons-select/transport-committee/inquiries/coastguard/).

5 Consideration of potential effects from oil spills on relevant sites

5.1 Overview of spill effects and context

Oil spills can have potentially adverse environmental effects, and are accordingly controlled by a legal framework aimed at minimising their occurrence, providing for contingency planning, response and clean up, and which enables prosecutions. It is however, not credible to conclude that in spite of the regulatory controls and other preventative measures, an oil spill will never occur as a result of 26th Round licensing.

In April 2010, a major incident occurred in the US Gulf of Mexico. During drilling of an exploratory well in deep water approximately 50 miles offshore Louisiana, there was an explosion and fire on the semi-submersible drilling rig, Deepwater Horizon. The rig was drilling in a water depth of 5,000ft with the oil reservoir at 18,000ft. UK regulators have been in contact with their counterparts in the United States (the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE)) to understand the cause of the incident and whether there are implications for safety at offshore operations on the UK continental shelf.

The Health and Safety Executive (HSE) is responsible for regulating the risks to health and safety arising from work in the offshore industry on the UKCS. Inspectors from HSE's Offshore Division undertake offshore inspections of well control/integrity arrangements and related safety issues, and also review well designs and procedures. In the UK a safety case regime exists with specific safeguards including:

- The *Offshore Installations (Safety Case) Regulations 2005* require written safety cases and risk assessments to be prepared by the operator, and then approved by HSE, for all mobile offshore drilling rigs operating in the UK.
- A system of well notification, where the HSE reviews well design and procedures.
- A requirement for the design and construction of a well to be examined by an independent and competent specialist.
- A scheme of independent verification of offshore safety critical equipment such as blowout preventers to ensure they are fit for purpose.
- Checks that workers involved in well operations have received suitable information, instruction, training and supervision.
- Offshore inspections of well control and integrity arrangements, and related safety issues, by specialist inspectors from HSE's Offshore Division.
- Weekly drilling reports submitted to HSE by operators.

A review has been carried out by DECC which has found that the existing system is fit for purpose, but in light of the Deepwater Horizon spill the regime is being strengthened further:

1. DECC has increased the oversight of drilling operations through the recruitment of additional inspectors in its Aberdeen office. This will allow the Department to carry out double inspections (i.e. inspections carried out by 2 inspectors) for more complex

drilling operations and it will also allow annual inspections of all mobile and fixed oil and gas installations, once all of the new inspectors are recruited and have completed relevant training.

2. In light of the Gulf of Mexico incident, DECC has reviewed the indemnity and insurance requirements for operating in the UK Continental Shelf.
3. DECC has issued letters (dated: 23rd December 2010, 21st July 2011, 20th September 2011) to all UK operators specifying a number of requirements and expectations regarding oil pollution prevention, response, emergency plans and consenting.
4. Industry trade association Oil and Gas UK established a group comprised of regulators, industry and trade union representatives (the Oil Spill Prevention and Response Advisory Group - OSPRAG) to examine the UK's strengths and weaknesses in responding to a Gulf like incident. DECC participated in this group. OSPRAG's work is documented in their final report, *Strengthening UK Prevention and Response*, published September 2011 and the Secretary of State is examining its findings closely.

As a result of the Deepwater Horizon incident a UK Parliamentary Select Committee Inquiry into the safety and environmental regulations and spill prevention and response provisions of oil and gas operations on the UKCS was held which reported in January 2011 (Energy and Climate Change Committee 2011). The report includes a series of recommendations regarding regulatory oversight, spill prevention, response and understanding. However, the Committee report did not conclude that a moratorium on drilling, even in deep water, was justified in the UK.

In January 2011 the US Government National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling released an extensive report (National Commission 2011) into the disaster, citing systematic management failures by the main companies involved and shortcomings in the US government regulatory regime as the principal sources of blame. A series of general recommendations are included in the report regarding spill prevention, response and understanding.

DECC (along with other parts of government) have considered the implications of these various findings and implemented a series of actions in response.

The potential for oil spills associated with exploration and production, the consequences of accidental spillages, and the prevention, mitigation and response measures implemented have been assessed and reviewed in successive SEAs covering the UKCS area under consideration in the 26th Round, including the recent Offshore Energy SEA2 (DECC 2011). Previous SEAs have concluded that given the UK regulatory framework and available mitigation and response, in relation to objective risk criteria (such as existing exposure to risk as a result of shipping), the incremental risk associated with exploration and production (E&P) is moderate or low.

A large number of site- and activity-specific risk assessments have also been carried out as a component of Environmental Assessments and under the relevant legislation implementing the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) (see the *Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998*).

Direct mortality of seabirds in the event of oil spill is highly relevant in the context of coastal breeding site classified as SPAs (and possible SPA extensions). Waterbird vulnerability to surface pollution has been quantified for each month on a block-by-block basis by JNCC in terms of the Offshore Vulnerability Index (OVI) (see Table 5.1), and seasonal concerns in

relation to drilling have been identified for a number of Blocks considered in this AA (see Table 2.1) for which there would be a presumption against such activity taking place.

The following section provides a high-level overview of risks, regulation, contingency planning and response capabilities; followed by an assessment of risks presented to relevant European Sites by activities resulting from the proposed licensing of the 4 Blocks in the 26th Round. As risks tend to be generic between sites, these have been categorised based on ecological sensitivity and an evaluation of spill probability and severity.

5.2 Spill risk

Risk assessment, under the terms of OPRC, includes considerations of probability and consequence, generally comprising an evaluation of: historical spill scenarios and frequency, fate of spilled oil, trajectory of any surface slick, and potential ecological effects. These considerations are discussed below.

The eastern Irish Sea is a gas province and so, although blowout risk cannot be excluded, it would not result in significant oil spillage. The only significant blowouts on the UKCS to date have been from West Vanguard (1985) and Ocean Odyssey (1988), both involving gas and not resulting in significant pollution.

Potential risks of oil spills are mitigated in the eastern Irish Sea by the nature of the hydrocarbons present (natural gas). Spill risk is therefore associated mainly with transfer and storage of fuel and lubricating oils. Modelling, and field experiments and experience indicates that even very large diesel spills (> 1000 tonnes) in the UK disperse naturally within 8 to 9 hours, travelling some 24km under worst case conditions (constant 30 knot onshore wind). This allows a distinction in terms of relative risk, to be made between Blocks in the eastern Irish Sea gas province and those in other areas.

5.2.1 Historical spill scenarios and frequency

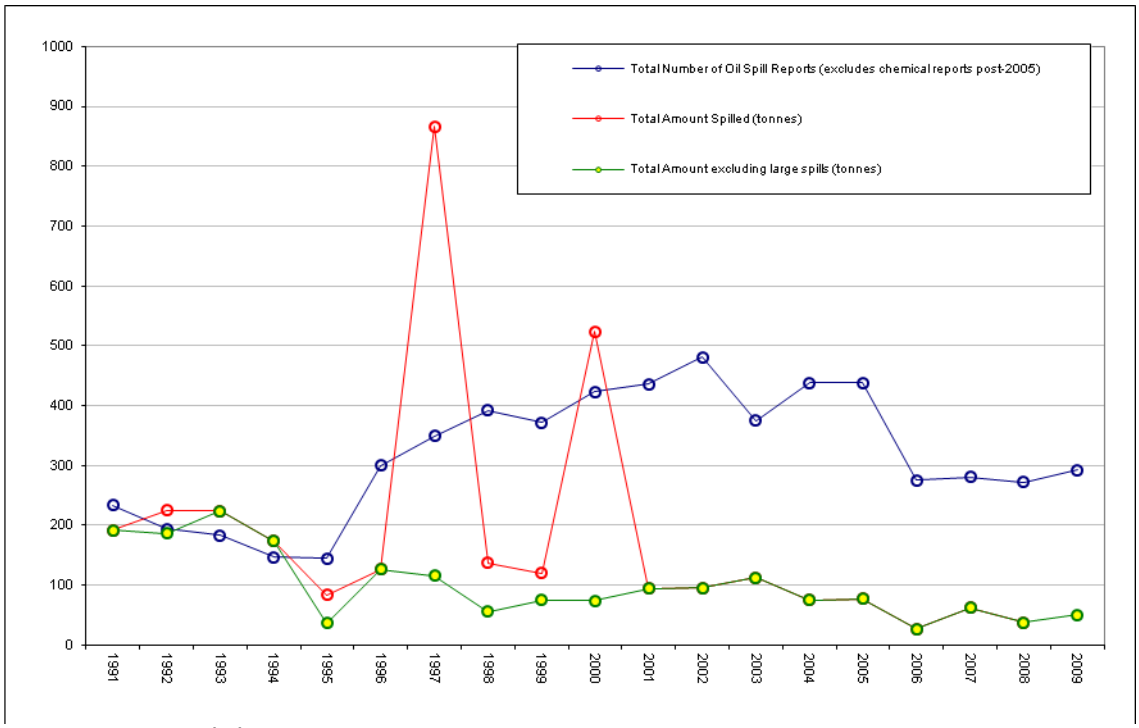
Oil spills on the UKCS have been subject to statutory reporting since 1974 under PON1 (formerly under CSON7); annual summaries of which were initially published in the "Brown Book" series, now superseded by on-line data available from the DECC website[4] (Figure 5.1). Discharges, spills and emissions data from offshore installations are also reported by OSPAR (e.g. OSPAR 2009).

DECC data indicate that the most frequent types of spill from mobile drilling rigs have been organic phase drilling fluids (and base oil), diesel and crude oil. Topsides couplings, valves and tank overflows; and infield flowlines and risers are the most frequent sources of spills from production operations, with most spills being <1 tonne. A large proportion of reported oil spills in recent years (since about 1990) have resulted from process upsets (leading to excess oil in produced water). Estimated spill risk from UKCS subsea facilities was equivalent to a risk of 0.003 spills/year for an individual facility, with almost all reported spills less than a tonne (<5bbl) in size.

Well control incidents (i.e. "blowouts" involving uncontrolled flow of fluids from a wellbore or wellhead) have been too infrequent on the UKCS for a meaningful analysis of frequency based on historic UKCS data. A review of blowout frequencies cited in UKCS Environmental Statements as part of the OESEA2 gives occurrence values in the range 1/1,000-10,000 well-years.

[4] Oil and chemical discharge notifications (accessed October 2010) https://www.og.decc.gov.uk/information/bb_updates/chapters/Table_chart3_1.htm

Figure 5.1: Number and volume of reported oil spills from UKCS oil and gas installations over the period 1991-2009



Source: DECC website

An annual review of reported oil and chemical spills in the UKCS – covering both vessels and offshore installations – is made on behalf of the Maritime and Coastguard Agency (MCA) by the Advisory Committee on Protection of the Sea (e.g. ACOPS 2008 as reported in Dixon 2009). This includes all spills reported by POLREP reports by the MCA and PON1 reports to DECC. The number of accidental discharges attributed to oil and gas installations during 2008 showed a reduction of 6.5% over the previous year's total. Of these discharges, 65% were fuel, lubrication or hydraulic oils; additionally, of the discharges with volume information, 95% were less than 455 litres.

Since the mid-1990s, the reported number of spills has increased, consistent with more rigorous reporting of very minor incidents (e.g. the smallest reported spill in 2003 was 0.0001 litres). However, the underlying trend in spill quantity (excluding specifically-identified large spills) suggests a consistent annual average of around 100 tonnes. In comparison, oil discharged with produced water from the UKCS in 2009 totalled 2,900 tonnes (DECC website[5]).

Historic major spill events from UKCS production facilities include the 1986 Claymore pipeline leak (estimated 3,000 tonnes), 1988 Piper Alpha explosion (1,000 tonnes), 1996 Captain spill (685 tonnes) and 2000 Hutton TLP spill (450 tonnes). Although potentially significant at a local scale, these volumes are minor when compared to other inputs of oil to the marine environment, such as riverine inputs (OSPAR 2000, 2010).

[5] Oil discharged with produced water 2005 – 2009
https://www.og.decc.gov.uk/information/bb_updates/chapters/Table3_2.htm

5.2.2 Trajectory and fate of spilled oil

The main oil weathering processes following a surface oil spill are spreading, evaporation, dispersion, emulsification, dissolution, oxidation, sedimentation and biodegradation. The anticipated reservoir hydrocarbon type in the eastern Irish Sea Blocks is gas, therefore spills of crude oil are not considered a risk. Diesel spills generally evaporate and disperse without the need for intervention. A major diesel spill of *ca.* 1000 tonnes would disperse naturally in about 8 hours and travel some 24km in conditions of a constant unidirectional 30 knot wind.

Coincident with these weathering processes, surface and dispersed oil will be transported as a result of tidal (and other) currents, wind and wave action. Although strong winds can come from any direction and in any season, the predominant winds in the UK are from the southwest which for the eastern Irish Sea Blocks would push spilled oil north and east towards the coast. To support environmental assessments of individual drilling or development of gas projects, modelling is carried out for diesel oil releases. Representative modelling cases from various parts of the UKCS have been reviewed by successive SEAs.

5.2.3 Potential ecological effects

The most vulnerable components of the ecosystem to oil spills in offshore and coastal environments are seabirds and marine mammals, due to their close association with the sea surface. Seabirds are affected by oil pollution in several ways, including oiling of plumage resulting in the loss of insulating properties and the ingestion of oil during preening. Pollution of the sea by oil, predominantly from merchant shipping, can be a major cause of seabird mortality. Although locally important numbers of birds have been killed on the UKCS directly by oil spills from tankers, for example common scoter off Milford Haven following the Sea Empress spill in 1996, population recovery has generally been rapid. Chronic pollution resulting from illegal dumping or tank washing probably has a greater chronic impact on seabirds than accidental spills from shipping casualties.

The Offshore Vulnerability Index (OVI) developed by JNCC (Williams *et al*. 1994) is used to assess the vulnerability of bird species to surface pollution; it considers four factors:

- the amount of time spent on the water
- total biogeographical population
- reliance on the marine environment
- potential rate of population recovery

Vulnerability scores for offshore areas (see Table 5.1 below) are determined by combining the density of each species of bird present with its vulnerability index score. Of the species commonly present offshore in UK offshore waters, gannet, skuas and auk species may be considered to be most vulnerable to oil pollution due to a combination of heavy reliance on the marine environment, low breeding output with a long period of immaturity before breeding, and the regional presence of a large percentage of the biogeographic population. In contrast, the aerial habits of the fulmar and gulls, together with large populations and widespread distribution, reduce vulnerability of these species. Vulnerability is seasonal, with a general trend of high vulnerability in coastal areas adjacent to colonies during the breeding season. In winter, vulnerability in inshore waters can also be very high in some areas.

Table 5.1: Monthly seabird vulnerability to surface pollution in relevant 26th Round Blocks

Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
110/7	2	1	2	2	3	3	3	3	2	3	2	1	3
110/8	1	1	1	2	2	3	3	3	2	2	2	1	2
113/28	2	3	2	2	2	4	3	2	2	2	2	2	4
113/29	2	3	2	3	2	4	3	2	2	2	2	2	4

Note: 1 = very high, 2 = high, 3 = moderate, 4 = low.
Source: JNCC (1999).

Fortunately, there is little experience of major oil spills in the vicinity of seabird colonies in the UK. Census of seabird colonies in southwest Wales following the *Sea Empress* spill concluded that only guillemot and razorbill populations were impacted by the spill (Baines & Earl 1998). The *Sea Empress* spill occurred in February, when seabird numbers at colonies were relatively low, but the density of wintering birds including common scoter was high. Some species, particularly puffins, Manx shearwaters and storm petrels, had not returned to the area to breed and so avoided significant impact. Around 7,000 oiled birds were washed ashore following the spill, although it is likely that the total number of birds killed was several times higher than this (SEEEC 1998). Examination of seabird corpses suggested that most died directly from oil contamination rather than, for example, food chain effects. Over 90% of the oiled birds were of three species – common scoter, guillemot and razorbill. Counts of the breeding populations confirmed the impact on guillemots and razorbills. There were 13% fewer guillemots and 7% fewer razorbills counted at breeding colonies in the area in 1996 compared with 1995, while numbers for both species increased at nearby colonies. The SEEEC (1998) report concluded that by the 1997 breeding season, numbers had recovered significantly. Banks *et al*. (2008) report the results of annual surveys of common scoter within Carmarthen Bay, an area partially affected by the spilled oil. While numbers were greatly reduced following the spill, and changes in distribution suggested the use of potentially sub-optimal foraging zones, rapid revival was observed with numbers increasing to pre-spill levels and a return to previous distributions within three winters of the event. At ten years following the incident, numbers of common scoter were not different to those recorded immediately before the spill (Banks *et al*. 2008).

As the major breeding areas for most wildfowl and wader species are outside the UK (in the high Arctic for many species), population dynamics are largely controlled by factors including breeding success (largely related to short-term climate fluctuations, but also habitat loss and degradation) and migration losses. Other significant factors include lemming abundance on Arctic breeding grounds (e.g. white-fronted goose). Variability in movements of wintering birds, associated with winter weather conditions in continental Europe, can also have a major influence on annual trends in UK numbers, as can variability in the staging stops of passage migrants.

Oil spill risks to marine mammals have been reviewed by successive SEAs and their supporting technical reports (e.g. Hammond *et al*. 2008).

Generally, marine mammals are considered to be less vulnerable than seabirds to fouling by oil, but they are at risk from hydrocarbons and other chemicals that may evaporate from the surface of an oil slick at sea within the first few days. Symptoms from acute exposure to volatile hydrocarbons include irritation to the eyes and lungs, lethargy, poor coordination and difficulty with breathing. Individuals may then drown as a result of these symptoms.

Grey and harbour seals come ashore regularly throughout the year between foraging trips and additionally spend significantly more time ashore during the moulting period (February-April in grey seals and August-September in harbour seals) and particularly the pupping season (October-December in grey seals and June-July in harbour seals). Animals most at risk from oil coming ashore on seal haulout sites and breeding colonies are neonatal pups, which rely on their prenatal fur and metabolic activity to achieve thermal balance during their first few weeks of life, and are therefore more susceptible than adults to external oil contamination.

Direct mortality of seals as a result of contaminant exposure associated with major oil spills has been reported, e.g. following the Exxon Valdez oil spill in Alaska in 1989. Animals exposed to oil over a period of time developed pathological conditions including brain lesions. Additional pup mortality was reported in areas of heavy oil contamination compared to un-oiled areas.

Coastal otter populations are also vulnerable to fouling by oil, should it reach nearshore habitats. They are closely associated with the sea surface and reliant upon fur, rather than blubber, for insulation.

Benthic habitats and species may be sensitive to deposition of oil associated with sedimentation, or following chemical dispersion. The proportion of a surface spill that is deposited to the seabed might be expected to increase as a result of high turbulence and suspended solids concentrations in the water column, both associated with storm conditions in shallow water. Studies of macrobenthic infauna following the Braer spill (Kingston *et al*. 1995), which occurred under such conditions, found no significant changes in benthic community structure, as characterised by species richness, individual abundance and diversity, which could be related to the areas of seabed affected by the spill. This may have been because Braer oil was of low toxicity, or because the sampling programme was carried out too soon after the spill to enable the full effects of its impact to be detected. In recognition of this as part of the DECC SEA programme further sampling of the study area has been conducted, ten years after the spill, results from which have indicated a substantial decline in sediment hydrocarbon concentrations.

In contrast, evidence from the Florida barge spill (Buzzards Bay, Massachusetts, September 1969, in which 700m^3 of diesel fuel were released) suggests that in certain circumstances, contamination from oil spills could be long-term. Monitoring immediately following the spill suggested rapid recovery (reviewed by Teal & Howarth 1984), while subsequent studies (sampling in 1989) indicated that substantial biodegradation of aromatic hydrocarbons in saltmarsh sediments had occurred (Teal *et al.* 1992). However, thirty years after the spill, significant oil residues remain in deep anoxic and sulphate-depleted layers of local salt marsh sediments (Reddy *et al.* 2002, Peacock *et al.* 2005). The ecological consequences of this residual contamination are unclear, although there is potential for remobilisation of sediment-bound contaminants through bioturbation or storm events (in which case, aerobic biodegradation would be expected to be rapid).

Those coastal and marine Annex I habitats which are most sensitive to oil spills are identified in Table 5.2, below. Generally, sheltered habitats of lower exposure to wave energy are considered most vulnerable; oil may persist for long periods in such environments.

5.3 Implications for relevant European Sites

Relevant sites have been screened in Appendix B and all sites where the potential for effects were identified are listed in detail in Appendix C. The identification of potential effects from oil spills on specific European Sites considers the following factors:

- Oil spill probability and severity (taking into account distance from blocks under offer, and probable hydrocarbon type)
- The ecological sensitivity of the qualifying feature(s) to oil spills
- Connected with the above, in what way an oil spill would have an immediate effect on the conservation objectives of SACs and SPAs as listed in Appendix C, and any long-term implications of a spill on these objectives

It should be noted that at a project level, DECC requirements for the preparation of OPEPs and ES submissions include, amongst other mitigation and response criteria, the modelling of a worst case blowout scenario considering a specific release location, crude oil type and historic metocean conditions as well an unlikely 30 knot onshore wind, over a release time of 10 days. As the Irish Sea is a gas province, large spills of crude oil are not likely, and so such modelling will largely be restricted to other possible hydrocarbons (i.e. diesel). Detailed potential effects of such a release on Natura 2000 sites will be considered at this stage.

5.3.1 Special Areas of Conservation

The ecological sensitivity of the qualifying features of relevant sites to oil spills varies. For several Annex I habitats and Annex II species it is considered that any potential source of effect is unlikely to degrade the qualifying habitat or habitat of species, or undermine the conservation objectives of related sites. These include:

- **Submerged reefs and sandbanks** – not generally vulnerable to surface oil pollution, except possibly following application of chemical dispersants (generally not permitted in waters shallower than 20m) – it is not expected that the extent, distribution or functioning of these habitats would be significantly affected, and therefore similarly, those of any species associated with, or relying on the functioning of these habitats, such that conservation objectives would be undermined.
- **Lagoons, dunes** – sites above Mean High Water Springs not generally vulnerable to surface oil pollution, except possibly to wind-blown oil or evaporated hydrocarbons. Lagoons typically have periodic connections to the sea; such connections can be protected from the ingress of surface pollutants.
- **Sea cliffs, sea caves** – generally not considered sensitive due to wave reflection and rapid recovery (e.g. Gundlach & Hayes 1978) – it is not expected that the extent, distribution or functioning of these habitats would be significantly affected by any possible spill, and therefore similarly, those of any species associated with, or relying on the functioning of these habitats such that conservation status would be detrimentally affected.
- **Terrestrial and freshwater aquatic species** – the potential for significant effects on the conservation objectives of these species and their supporting habitats is essentially negated by their distribution, as these features do not utilise marine or estuarine environments. For sites considered in this assessment, these include: freshwater pearl mussel (*Margaritifera margaritifera*), and non-coastal otter populations (*Lutra lutra*). It should be noted that salmonids play a critical role in the life cycle of the freshwater pearl mussel, and potential indirect effects of this association are considered in the assessment below.

Table 5.2 provides information on those categories of Annex I habitats and Annex II species which may have their conservation objectives undermined in the event of being impacted by an oil spill - those sites for which such potential effects from oil spills has been identified (see Appendix B) are listed. Due to the limited distance which may be travelled by spilled diesel oil (up to *ca.* 24km), the potential for oil spill effects relate to a limited number of Blocks only; these are listed alongside the relevant site. Note: several sites are represented in more than one risk category.

Table 5.2: Annex I habitat types and Annex II species potentially vulnerable to oil spills

Mudflats and sandflats
Particularly vulnerable in sheltered areas where wave energy is low. The biological communities associated with these sites are related to the degree of sheltering and subsequent sediment type; sheltered sites with fine, muddy sediments may support a high diversity and abundance of invertebrates and waterfowl. **Sites potentially at risk:** Drigg Coast SAC (113/28, 113/29a), Morecambe Bay SAC (113/28, 113/29a)
Estuaries
Complexes of several subtidal and intertidal habitats with varying freshwater influence. The sediments of estuaries support various biological communities, while the water column provides an important habitat for free-living species, such as fish, and juvenile stages of benthic plants and animals. Estuaries often contain several different Annex I habitats. **Sites potentially at risk:** Drigg Coast SAC (113/28, 113/29a), Morecambe Bay SAC (113/28, 113/29a)
Saltmarshes
Comprise intertidal mud and sandflats colonised by vegetation due to protection from strong wave action. Pioneering saltmarsh vegetation exists where tidal flooding is frequent, with progression to more diverse, stable communities in upper reaches where tidal flooding is less frequent. Upper reaches can be valuable for plants, invertebrates and wintering or breeding waterfowl. **Sites potentially at risk:** Drigg Coast SAC (113/28, 113/29a), Morecambe Bay SAC (113/28, 113/29a)
Inlets and Bays
Large indentations of the coast, and generally more sheltered from wave action than the open coast. They are relatively shallow, with water depth rarely exceeding 30m, and support a variety of subtidal and intertidal habitats and associated biological communities. **Sites potentially at risk:** Drigg Coast SAC (113/28, 113/29a), Morecambe Bay SAC (113/28, 113/29a)
Bottlenose dolphins
Sites comprise a variety of marine habitats utilised by bottlenose dolphins (*Tursiops truncatus*) for foraging and other activities, with extensive areas beyond the site boundary also utilised. Vulnerable to oil spills due to their dependence on the sea surface for breathing. **Sites potentially at risk:** None.

(Contd. overleaf)

Seals
Designated sites comprise coastal habitats (beaches, estuaries, sandflats and rocky shores) supporting important breeding colonies of harbour seals (*Phoca vitulina*) and/or grey seals (*Halichoerus grypus*). Seals spend considerable periods of time at these sites during the breeding season and during the moult. Seals forage for prey in surrounding waters and also travel considerable distances beyond the boundaries of sites (particularly grey seals). **Sites potentially at risk:** None
Coastal otters
Sites contain shallow, inshore coastal areas utilised by important populations of otter (*Lutra lutra*) for feeding. **Sites potentially at risk:** None
Atlantic salmon
Though not generally vulnerable to surface oil pollution due to the absence or paucity of time spent at the water's surface, available evidence suggests that smolts utilise shallow water depths (1-6m) and that adults show varying behaviour, swimming generally close to the surface (0- 40m depth), with occasional deeper dives – e.g. Holm *et al.* (2005) noted dive depths of between 85 and 280m (Malcolm *et al.* 2010). As salmonids play a critical role in the life cycle of the freshwater pearl mussel, any significant impact on populations of Atlantic salmon may also affect those of the pearl mussel. **Sites potentially at risk:** River Bladnoch, River Eden, River Derwent & Bassenthwaite, River Ehen.

5.3.1.1 Consideration

The conservation features of the sites listed in Table 5.2 are potentially vulnerable to a large diesel spill due to the proximity of Blocks 113/28 and 113/29a to coastal SACs (see Table 5.2).

The proposed work programmes indicate three potential drill or drop wells. Therefore, following examination of existing seismic information, decisions will be made by the prospective licensees to drill a well or relinquish the block. As the location and design of the proposed drill or drop wells is not known, a detailed assessment of the potential for effects cannot be made at this time. Modelling, field experiments and experience indicates that even very large diesel spills (> 1000 tonnes) in the UK disperse naturally within 8 to 9 hours, travelling some 24km under worst case conditions (constant 30 knot onshore wind).

Following licensing, specific activities require permitting (see Section 5.4) and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and Habitats Regulations Assessment procedures which will allow mitigation measures to be defined (including conditions attached to consents/permits or potentially consent/permit refusal). In all cases, rigorous spill prevention, response and other mitigation measures are required of operators and monitored by the regulator for offshore exploration and production.

Consent for activities will not be granted unless the operator can demonstrate that the proposed activities which may include the drilling of a number of wells will not have an adverse affect which could undermine the conservation objectives of the qualifying features of relevant SACs.

5.3.2 Special Protection Areas

Table 5.3 provides information on those SPA types which are potentially vulnerable to oil spills. Those sites where the potential for effects from diesel oil spills has been identified

(see Appendix B) are listed. Due to the limited distance which may be travelled by spilled diesel oil, the potential for oil spill effects relate to a limited number of Blocks only; these are listed alongside the relevant site. Note: several sites are represented in more than one risk category.

Table 5.3 - SPA types potentially vulnerable to oil spills

Cliff-breeding seabird colonies
Designated for colonial breeding seabirds (including auks, fulmar, kittiwake, cormorant, and gannet) which nest either on, or generally associated with sea cliffs. Birds extensively utilise adjacent coastal waters for a variety of activities, and also forage beyond site boundaries. **Sites potentially at risk:** None
Petrel, tern, skua or gull breeding populations
Designated for breeding seabirds, which generally forage over sea areas adjacent to (or in some cases at considerable distance from) breeding sites. **Sites potentially at risk:** Duddon Estuary SPA (113/28, 13/29a), Morecambe Bay SPA (113/28, 13/29a), Ribble & Alt Estuaries (110/8b)
Red-throated diver breeding populations utilising coastal waters
Inland sites designated for breeding red-throated diver (*Gavia stellata*) which forage in neighbouring coastal waters. **Sites potentially at risk:** None
Open coastline supporting wintering waders and seaduck
Contain coastal and intertidal habitats which support a variety of wintering waders and seaduck, often in large aggregations. The birds feed on wetlands and the surrounding shallow waters. **Sites potentially at risk:** Duddon Estuary SPA (113/28, 13/29a), Morecambe Bay SPA (113/28, 113/29a)
Firths, lochs and estuaries supporting wintering waterfowl
Contain enclosed and semi-enclosed coastal and intertidal habitats (particularly wetlands) supporting a variety of wintering waterfowl and waders, often in large aggregations. Some species (e.g. seaducks) feed beyond the boundaries of sites. **Sites potentially at risk:** Duddon Estuary SPA (113/28, 13/29a), Morecambe Bay SPA (113/28, 113/29a)
Marine areas supporting aggregations of non-breeding seabirds
Shallow (typically <20m) marine areas supporting large numbers of seabirds such as divers and seaduck outside of the breeding season. **Sites potentially at risk (relevant Block):** Liverpool Bay SPA (110/7d, 110/8b, 113/28, 13/29a)

5.3.2.1 Consideration

The conservation features of the sites listed in Table 5.3 are potentially vulnerable to a large diesel spill due to the proximity of some of the Blocks to coastal SPAs (see Table 5.3).

The proposed work programmes indicate three potential drill or drop wells. Therefore, following examination of existing seismic information, decisions will be made by the prospective licensees to drill a well or relinquish the block. As the location and design of the proposed drill or drop wells is not known, a detailed assessment of the potential for effects cannot be made at this time. Modelling, field experiments and experience indicates that even very large diesel spills (> 1000 tonnes) in the UK disperse naturally within 8 to 9 hours, travelling some 24km under worst case conditions (constant 30 knot onshore wind).

Following licensing, specific activities require permitting (see Section 5.4) and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and Habitats Regulations Assessment procedures which will allow mitigation measures to be defined (including conditions attached to consents/permits or potentially consent/permit refusal). In all cases, rigorous spill prevention, response and other mitigation measures are required of operators and monitored by the regulator for offshore exploration and production.

Consent for activities will not be granted unless the operator can demonstrate that the proposed activities which may include the drilling of a number of wells will not have an adverse affect which could undermine the conservation objectives of the qualifying features of relevant SPAs.

5.4 Regulation and mitigation

Spill prevention and mitigation measures are implemented for offshore exploration and production inter alia through the *Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation) Regulations 1998* and the *Offshore Installations (Emergency Pollution Control) Regulations 2002*. The required measures include spill prevention and containment measures, risk assessment and contingency planning. Under the Regulations, all operators of an offshore installation or oil handling facility must have an Oil Pollution Emergency Plan, OPEP) in place. The plans are reviewed by DECC, MCA and relevant environmental consultees, such as the Marine Management Organisation or relevant Devolved Authority, the Joint Nature Conservation Committee and the relevant inshore statutory nature conservation body, e.g. Natural England, before approval by DECC. OPEPs set out the arrangements for responding to incidents with the potential to cause marine pollution by oil, with a view to preventing such pollution or reducing or minimising its effect. Additional conditions can be imposed by DECC, through block-specific licence conditions (i.e. “Essential Elements”).

Offshore, primary responsibility for oil spill response lies with the relevant Operator, although the Secretary of State’s Representative may intervene if necessary. The Maritime and Coastguard Agency is responsible for a National Contingency Plan. The MCA maintains a contractual arrangement for provision of aerial spraying and surveillance, with aircraft based at Coventry and Inverness. Within two days, aircraft can deliver sufficient dispersant to treat a 16,000 tonne spill within 50 miles of the coast anywhere around the UK. MCA holds 1,400 tonnes of dispersant stockpiled in 14 locations around the UK, in addition to counter-pollution equipment (booms, adsorbents etc.) which can be mobilised within 2-12 hours depending on incident location. It is, however, unlikely that dispersants would be used in the event of a spill in the Eastern Irish Sea, as the oil would be likely diesel, which rapidly disperses without intervention. DECC is a partner in undertaking regular aerial surveillance operations of offshore installations, as a deterrent measure.

For activities in proximity to sensitive shorelines, the Department’s guidance (DECC 2009a) requires that the risk of shoreline contamination be determined through an appropriate risk assessment, and operators with oil spill scenarios that could impact the shoreline must have access to appropriate oil spill response resources suitable for shoreline clean-up operations. Additional resources are required for installations operating in any Block wholly or partly within 25 miles of the coastline dependent on the hydrocarbon inventory and the oil pollution incident scenarios identified, including:

- The presence near the facility at all times of a vessel:

  - with the capability of spraying dispersant within 30 minutes of an oil pollution incident notification
  - has a stock of dispersant sufficient to deal with an oil pollution incident of 25 tonnes, and if required, have the capability (equipment and capacity) of recovering any oil likely to be lost from the installation under a Tier 1[6] scenario
- In the event of a Tier 2 incident, Tier 2 resources must be available on scene within half the time taken for the oil to reach shore in 30 knot wind conditions
- Details of resources to deal with a Tier 3 incident (i.e. an oil pollution incident that cannot be controlled by Tier 1 or 2 resources), including sources transport and delivery system
- A Shoreline Protection Strategy Plan

UK oil spill contingency planning and response capabilities have been reviewed and revised following the Deepwater Horizon spill (see Section 5.1). Oil & Gas UK established the Oil Spill Prevention and Response Advisory Group (OSPRAG) to provide a focal point for the sector's review of the industry's practices in the UK, in advance of the conclusion of investigations into the Gulf of Mexico incident. The Group had four specialist review groups whose remit was to focus on:

- technical issues including first response for protection of personnel;
- oil spill response capability and remediation including national emergency response measures;
- indemnity and insurance requirements;
- pan-North Sea regulations and response mechanisms.

The Oil Spill Response Group (OSRG) of OSPRAG was established to review the UK's oil spill response capability and industry co-ordination with the national response mechanism. Its areas of focus were spill scenarios and modelling, review of physical response capability, sensitivity and protection mapping in relation to clean up and restoration, Oil Pollution Emergency Plans (OPEPs) and exercising OPEPs. An early action of the OSRG was to facilitate planning for an early exercise of the NCP (see above).

OSPRAG's technical review group has completed its review of the UK offshore oil and gas industry's practices in the following areas: well examination verification and primary well control, blow-out preventers (BOPs) and competency, behaviours and human factors. This work concluded that there is a high degree of confidence in the UK regulatory regime and that it drives the right safety and environmental behaviours. The Well Life Cycle Practices Forum (WLCPF) will advance recommendations made by OSPRAG and facilitate the dissemination of lessons from Macondo and other similar events, with a specific focus (among others) on BOP issues, including liaison with the HSE on the recommendation made by the House of Commons Select Committee that it examines the case for prescribing the equipment of BOPs on the UKCS with two blind shear rams.

[6] Oil pollution incidents are classified according to the response levels they are most likely to require and not the volume of oil pollution, unless this is supported by a location specific risk assessment. For example, if a pollution incident requires the use of resources from a regional centre, this would be used to classify the necessary response level, irrespective of its size.
For consistency with the National Contingency Plan, the following Tier definitions apply:
- Tier 1 Local (within the capability of the operator on site);
- Tier 2 Regional (beyond the in-house capability of the operator);
- Tier 3 National (requiring national resources).

5.5 Conclusions

Individual European Sites have been categorised in terms of potential vulnerability, based on location in relation to known hydrocarbon prospectivity of the proposed licence blocks and therefore the nature and magnitude of credible risks, given the nature of operations and expected hydrocarbons. Two categories of vulnerability were identified:

- Those sites considered to be at potential risk, with the possibility of impacts in the event of a significant spill of diesel or lube oil (i.e. where site conservation objectives are at risk of being undermined/where present conservation status may be negatively affected).
- Many sites are considered not to be at risk from oil spills associated with activities in the Blocks, due to their distance from the Blocks and relative sensitivity of the features.

The incremental risk associated with activities resulting from the proposed licensing (i.e. additional to existing risk; primarily associated with shipping and other maritime activities) is very low. This results from the combination of low probability and low severity (since most spills would be relatively small and of diesel oil). The activities which could reasonably be expected to follow from the proposed licensing would not have a significant effect on the existing risks associated with other activities.

Oil spills can have potentially adverse effects, and are controlled in direct proportion to this by a legal framework that minimises their occurrence, provides for contingency planning, response and clean up, and which enables prosecutions. It is not possible to say that in spite of the regulatory controls and other preventative measures, an oil spill will never occur as a result of activities which may follow licensing; however, as oil spills are not intended activities, a risk-based assessment is appropriate.

Following licensing, specific activities require permitting (see section above) and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and Habitats Regulations Assessment procedures which will allow mitigation measures to be defined (including conditions attached to consents/permits or potentially consent/permit refusal). In all cases, rigorous spill prevention, response and other mitigation measures are required of operators and monitored by the regulator for offshore exploration and production.

Given the availability of prevention and mitigation measures which are applied prior to consenting any activity including project specific safety, oil spill risk assessment, response, inspection and other monitoring, and the requirement for project specific Habitats Regulations Assessment, DECC considers that the granting of Seaward Production Licences for Blocks 110/7d, 110/8b, 113/28 and 113/29a would not adversely affect the integrity of European Sites.

Consent for activities will not be granted unless the operator can demonstrate that the proposed activities, which may include the drilling of a well, will not have an adverse affect on the site integrity of Natura 2000 sites.

6 Consideration of sites and potential physical and other effects

6.1 Introduction

Several activities associated with oil and gas exploration and production can lead to physical disturbance, damage, alteration or contamination of seabed habitats and geomorphological features, with consequent effects on benthic communities. The prime potential sources of effect are summarised below, followed by a consideration of the foreseeable effects on European Sites assessed to be at potential risk.

6.2 Physical damage at the seabed

The main sources of physical disturbance of the seabed from oil and gas activities are:

- **Anchoring of semi-submersible rigs**. Semi-submersible rigs use anchors to hold position, typically between 8 and 12 in number at a radius depending on the water depth, and cause seabed disturbance from the anchors and chain or cables, and in cohesive sediments, leave 'anchor mounds' after their retrieval.

- **Placement of jack-up rigs**. Jack-up rigs, normally used in shallower water, leave three or four depressions from the feet of the rig (the spud cans) around 15-20m in diameter. In locations with an uneven seabed, material such as grout bags may be placed on the seabed to stabilise the rig feet.

- **Drilling of** wells **and wellhead removal**. The surface hole sections of exploration wells are typically drilled riserless, producing a localised (and transient) pile of surface-hole cuttings around the surface conductor. After installation of the surface casing (which will result in a small quantity of excess cement returns being deposited on the seabed), the blowout preventer (BOP) is positioned on the wellhead housing. These operations (and associated activities such as ROV operations) may result in physical disturbance of the immediate vicinity (a few metres) of the wellhead. When an exploration well is abandoned, the conductor and casing are plugged with cement and cut below the mudline (sediment surface) using a mechanical cutting tool deployed from the rig and the wellhead assembly is removed. The seabed "footprint" of the well is therefore removed.

- **Production platform jacket installation**. Limited physical footprint similar to a drilling rig, but present on site for longer period. Physical disturbance associated with platform removal during decommissioning is comparable to that of installation.

- **Subsea** template **and manifold installation**. Limited physical footprint at seabed, smaller than a drilling rig, but present on site for longer period. Physical disturbance associated with subsea template and manifold removal during decommissioning is comparable to that of installation.

- **Pipeline,** flowline **and umbilical installation, trenching and potentially, placement of rock armour**. Anticipated hydrocarbons in this area of the Irish Sea are gas. Large pipes (greater than 16" diameter) do not have to be trenched according to a general industry agreement as they will not be moved by fishing gear, but they may still need to be trenched for reasons of temperature loss or upheaval buckling (due to buoyancy). Trenches may require several passes before they are of the required depth, or it may be impossible to achieve the required depth due to obstructions, in which case rock is usually placed on the pipeline (rock dump) to protect and stabilise it.

Oil and gas SEAs have compared the physical disturbance effects of oilfield activities to those of fishing and natural events in shallow water (e.g. storm wave action), and concluded that oilfield effects are typically minor on a regional scale. It is generally accepted that the principal source of human physical disturbance of the seabed and seabed features is bottom trawl fishing. Trawl scarring is a major cause of concern with regard to conservation of shelf and slope habitats and species (e.g. Witbaard & Klein 1993, de Groot and Lindeboom 1994, Kaiser *et al*. 2002a, Kaiser *et al*. 2002b, Gage *et al*. 2005). On the basis that seabed disturbance is qualitatively similar to the effects of severe storms, sand and gravel habitat recovery from the processes of anchor scarring, anchor mounds and cable scrape is likely to be relatively rapid (1-5 years) in most shallower and exposed (as opposed to sheltered) areas.

The broad distribution of large scale biotopes of conservation importance is relatively well understood in the region (e.g. see McBreen *et al.* 2011). Within the boundaries of designated and potential SACs the occurrence of habitats of interest is usually known with greater precision. The proximity of the Liverpool Bay SPA to Block 110/8b could mean that activities within the block (e.g. pipeline trenching) could cause some disturbance to the sandbank habitat which supports prey species for the wintering common scoter and red-throated diver protected by the designation. Based on the extent of supporting sandbank habitat and the distribution and extent of likely activities, the overall exposure to physical loss can be considered to be low as it would only occur if the activity e.g. pipeline trenching was to extend across the Block boundary into the SPA. Overall the vulnerability of the red-throated diver and common scoter within the Liverpool Bay SPA and associated habitats to physical loss and damage is considered to be low to moderate (Natural England & CCW 2009).

The routine sources of potential physical damage are controlled by a range of statutory measures including Consent to Locate, PON15B, Environmental Statement, Pipeline Works Authorisation, and, where relevant, AA. Provisions under the Marine and Coastal Access Act (2009) include certain activities previously covered by the Food and Environment Protection Act; guidance on these is pending. Based on the results of the assessments including AA, DECC may require additional mitigation measures to avoid or minimise any adverse effects, or where this is not possible, refuse consent.

6.3 Marine discharges

As described in previous oil and gas SEAs, marine discharges from exploration and production activities include produced water, sewage, cooling water, drainage, drilling wastes and surplus water based mud (WBM), which in turn may contain a range of hydrocarbons in dissolved and suspended droplet form, various production and utility chemicals, metal ions or salts (including Low Specific Activity radionuclides).

Most studies of produced water toxicity and dispersion, in the UK and elsewhere (see E&P Forum 1994, OLF 1998, Riddle *et al*. 2001, Berry & Wells 2004) have concluded that the

necessary dilution to achieve a No Effect Concentration (NEC) would be reached at <10 to 100m and usually less than 500m from the discharge point. However, under some circumstances (e.g. strong stratification: Washburn *et al.* 1999), a plume concentration sufficient to result in sub-lethal effects may persist for >1,000m (Burns *et al*. 1999).

Monitoring with caged mussels in the Netherlands and Norwegian sectors of the North Sea has shown that mussels exposed to produced water discharges may accumulate PAH and show biological responses up to 1,000m from the discharge. Concentrations of PAHs and alkyl phenols and measured biological responses in wild fish such as cod and haddock caught in the vicinity of offshore installations from Norwegian waters in 2002 and 2005 showed a mixed pattern mostly with no increased concentrations, but some elevated biological responses suggesting past exposure. Exposure of cod sperm cells to environmentally relevant concentrations (100, 200, 500 ppm) of produced water from the Hibernia platform, Newfoundland, did not result in a strong toxicity to the cells (only subtle changes were observed) or a significant change in fertilisation rate (Hamoutene *et al.* 2010).

The OSPAR QSR (2010) noted that results from water column monitoring are complex to interpret, particularly for wild fish for which it is not possible to link observed biological responses to a specific exposure source. Monitoring data are limited and do not yet allow conclusions to be drawn on the significance of observed responses for marine life and ecosystems. However, OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations includes a presumption against the discharge to sea of produced water from new developments. Only under certain circumstances (e.g. injection pump maintenance) may the effluent be routed to sea. Any produced water discharged will be treated since it is still required to meet legal quality standards in terms of oil in water concentration (DECC 2011).

Drilling wastes are a major component of the total waste streams from offshore exploration and production, with typically around 1,000 tonnes of cuttings resulting from an exploration or development well. Water-based mud cuttings are discharged at, or relatively close to sea surface during “closed drilling” (i.e. when steel casing and a riser is in place), whereas surface hole cuttings will be discharged at seabed during “open-hole” drilling. Use of oil based mud systems, for example in highly deviated sections or in water reactive shale sections, would require the onshore disposal or reinjection of a proportion of waste material (DECC 2011).

In contrast to historic oil based mud discharges, effects on seabed fauna of the discharge of cuttings drilled with WBM and of the excess and spent mud itself are usually subtle or undetectable, although the presence of drilling material at the seabed close to the drilling location (<500m) is often detectable chemically (e.g. Cranmer 1988, Neff et al. 1989, Hyland *et al.* 1994, Daan & Mulder 1996). Considerable data has been gathered from the North Sea and other production areas, indicating that localised physical effects are the dominant mechanism of ecological disturbance where water-based mud and cuttings are discharged (DECC 2011).

Currie & Isaacs (2005) reported that water based drilling muds and associated cuttings modified population densities of benthic infaunal species at sampling sites up to 200m from an exploration well in the Minerva field, Australia. The most pronounced effects were evident within 100m of the well-head, where declines in density of most abundant species exceeded 70% immediately following drilling. However, effects on the community structure at sites 100 and 200m from the wellhead did not persist beyond four months as natural species recruitment swamped residual effects over the same period. In contrast, benthic communities at the well-head site remained modified 11 months after drilling, in spite of

recoveries in species diversity and abundance. This persistent community difference was likely due to the physical modification of the sediment at this site by drill cuttings discharge.

OSPAR (2009) concluded that the discharge of drill cuttings and water-based fluids may cause some smothering in the near vicinity of the well location. The impacts from such discharges are localised and transient, but may be of concern in areas with sensitive benthic fauna, for example corals and sponges.

In addition to these mainly platform-derived discharges, a range of discharges is associated with operation of subsea infrastructure (hydraulic fluids), pipeline testing and commissioning (treated seawater), and support vessels (sewage, cooling and drainage waters). Discharges from offshore oil and gas facilities have been subject to increasingly stringent regulatory controls over recent decades, and oil concentrations in the major streams (drilling wastes and produced water) have been substantially reduced or eliminated. Amendments to the Offshore Chemical Regulations (2002) in 2011 mean that additional activities are now captured within a permit. The effects of marine discharges are judged to be negligible in the context of proposed licensing and the Natura 2000 sites in the area and are not considered further here. They would also be considered in detail in project-specific Environmental Statements, AAs (where necessary) and chemical risk assessments under existing permitting procedures.

6.4 Other effects

Through the transport and discharge of vessel ballast waters (and associated sediment), and to a lesser extent fouling organisms on vessel/rig hulls, non-native species may be introduced to the marine environment. Should these introduced species survive and form established breeding populations, they can exert a variety of negative effects on the environment. These include: displacing native species by preying on them or out-competing them for resources such as prey and habitat; irreversible genetic pollution through hybridisation with native species; increased occurrence of toxic algal blooms. The economic repercussions of these ecological effects can also be very significant. In response to these risks, a number of technical and procedural measures have been proposed (such as the use of ultraviolet radiation to treat ballast water) or introduced such as a mid-ocean exchange of ballast water (the most common mitigation against introductions of non-native species). International management of ballast waters is addressed by the International Maritime Organisation (IMO) through the International Convention for the Control and Management of Ships Ballast Water & Sediments, which was ratified in 30 States in 2005. The Convention includes Regulations with specified technical standards and requirements (IMO Globallast website). Further oil and gas activity is unlikely to change the risk of the introduction of non-native species as the vessels typically operate in a geographically localised area, de-ballasting is unlikely to take place in these areas and the risk from hull fouling is low, given the geographical working region and scraping of hulls for regular inspection.

The potential effects of light on birds have been raised in connection with offshore oil and gas over a number of years (e.g. Weise *et al.* 2001). As part of navigation and worker safety, oilfield installations and associated vessels are lit at night and the lights will be visible at distance (some 10-12nm in good visibility). Furthermore, the flaring of hydrocarbons generates a bright light which may also be visible over a considerable distance. Platform illumination and flares have been shown to have an attractive effect on many species of seabird; this attraction is enhanced by conditions of poor visibility such as fog, haze and drizzle (Weise *et al.* 2001 and references therein). Bird mortality resulting from collisions with the structure and flare (leading to incineration) is the primary concern, although any such mortality will be several orders of magnitude lower than that of natural or other

anthropogenic mortality (e.g. predation by domestic cats) and is not considered to be significant at a population-level. The lights on installations and vessels are primarily non-flashing so the strong behavioural effects noted by Bruderer *et al.* (1999) in response to a strong searchlight being switched on and off are not anticipated. Potential effects can be mitigated through the control or avoidance of well test and routine flaring during production, and timing controls can be used since drilling and construction are temporary activities. It is therefore concluded that light effects will not affect site integrity, nor undermine the conservation objectives of sites with qualifying mobile species which could potentially interact with illuminated platforms and vessels.

Physical disturbance of seaduck and other waterbird flocks by vessel and aircraft traffic associated with hydrocarbon exploration and production is possible, particularly in SPAs established for shy species. Red throated divers and common scoters within the Liverpool Bay SPA are sensitive to non physical (noise and visual) disturbance by both commercial and recreational activities, for example disturbance by moving vessels - large flocks of common scoter were observed being put to flight at a distance of 2km from a 35m vessel, though smaller flocks were less sensitive and put to flight at a distance of 1km (Kaiser *et al*. 2005). Larger vessels would be expected to have an even greater disturbance distance (Kaiser *et al*. 2005). However as oil and gas developments tend to be primarily subsea infrastructure based then any disturbance at the sea surface is reduced to periods of construction and decommissioning only, and therefore, the likelihood of adverse impacts on species are further reduced. There is evidence that red-throated divers and common scoters are displaced by the presence of offshore wind farm turbines and the associated activities of construction and maintenance vessels (Natural England & CCW 2009). A number of wind farms in the site are currently in operation, under construction or consented.

6.5 Implications for relevant European Sites

Physical disturbance e.g. from the physical presence of infrastructure and survey or maintenance vessels was considered to have the potential to result in significant effects on SPAs if the Blocks were within or immediately adjacent to sites designated for birds potentially vulnerable to physical disturbance, including common scoter and red-throated diver (Liverpool Bay SPA).

6.5.1 Liverpool Bay / Bae Lerpwl SPA

Advice from Natural England & CCW (2009) indicates that significant disturbance of red-throated diver and common scoter attributable to human activities can result in reduced food intake and/or increased energy expenditure. The proximity of the Liverpool Bay SPA to Block 110/8b could mean that activities within the block (e.g. pipeline trenching) could cause some disturbance to the sandbank habitat which supports prey species for the wintering common scoter and red-throated diver protected by the designation. Disturbance impacts could potentially come from shipping, fishing, and offshore developments and associated activities, and also from having their routes between feeding, roosting, and sheltering areas impeded.

The greatest densities of red-throated divers in Liverpool Bay are off the Ribble Estuary, North Wales, and the North Wirral Foreshore (Webb *et al.* 2006). The most important areas for the common scoter are Shell Flat to Formby (off Blackpool), Colwyn Bay, and Conwy Bay with birds present from August to May, and the most significant numbers present during August to March (Natural England & CCW 2009). Overall the vulnerability of the red-throated diver and common scoter within the Liverpool Bay SPA and associated habitats to physical loss and damage is considered to be low to moderate (Natural England & CCW 2009).

It is considered this source of potential effect will not result in significant effects because of the projected limited scale and nature of developments (i.e. three drill or drop wells – see Section 2.2) and because mitigation, which would be identified during activity specific assessment and permitting processes, is possible. Available mitigation measures include strict use of existing shipping and aircraft routes, and timing controls on temporary activities to avoid sensitive periods. These mitigation measures would aim to reduce or rule out sources of physical disturbance which would undermine the conservation objectives of the site (see Appendix C), i.e. those which could threaten the viability of the population of qualifying species and their supporting habitats, or which could cause disturbance to aggregations of birds (e.g. red throated diver, waterfowl and seabirds) and their movement between feeding and resting areas (e.g. common scoter). It is noted that this site is functionally linked to the Shell Flat & Lune Deep cSAC, with sandbanks supporting populations of prey species for qualifying features of the Liverpool Bay SPA. Based on the extent of supporting sandbank habitat in these sites and the distribution and extent of likely activities, the overall exposure to physical loss can be considered to be low as it would only occur if the activity (e.g. pipeline trenching) was to extend across the Block boundary into these sites. It is therefore concluded that adverse effects from physical disturbance are not expected.

6.5.2 Duddon Estuary SPA and Morecambe Bay SPA

The potential for disturbance to foraging terns from activities in Block 113/28 and 113/29a were considered. However, in view of the distance of the Blocks from the SPAs and likely tern feeding grounds (nearshore), and the potential for mitigation through timing of operations, significant effects on site integrity were discounted.

6.6 Conclusions

Any potentially damaging activities that could occur following licensing of Blocks 110/7d, 110/8b, 113/28 and 113/29a would be subject to statutory risk assessment, mitigation and permitting measures, which would include assessment of the potential effects on the integrity of Natura 2000 sites. It is unlikely that any new terminals would be built as a result of developments following 26th Round Licensing. While new pipelines could conceivably come ashore at existing terminals, either through or near to coastal SACs and SPAs, there are well proven methods to prevent significant impacts. There is a legal framework, via e.g. EIA regulations and those implementing the Habitats Directive, to ensure that there are no adverse effects on the integrity of Natura 2000 sites.

Taking into account the information presented above and in the Appendices, it is concluded that activities arising from the licensing of Blocks 110/7d, 110/8b, 113/28 and 113/29a will not cause an adverse effect on the integrity of the European Sites, though consent for activities will not be granted unless the operator can demonstrate that the proposed activities which may include the drilling of a well will not have an adverse affect on the integrity of European Sites.

7 Consideration of sites and potential acoustic effects

7.1 Overview of effects of acoustic disturbance

Of all marine organisms, marine mammals are regarded as the most sensitive to acoustic disturbance. This is due to their use of acoustics for echolocation and vocal communication and their possession of lungs which are sensitive to rapid pressure changes. Most concern in relation to seismic noise disturbance has been related to cetacean species. However, some pinnipeds are known to vocalise at low frequencies (100-300Hz) (Richardson *et al*. 1995), suggesting that they have good low frequency hearing and are therefore sensitive to acoustic disturbance. Otters in coastal habitats may also experience acoustic disturbance from seismic exploration or piling. However, they generally occupy shallow, inshore areas where the propagation of seismic noise is very limited.

DEFRA identified periods of concern for seismic activity (see Table 2.1) and it is envisaged that consent would not be granted for seismic survey during this period. Many species of fish are highly sensitive to sound and vibration (review in MMS 2004). Exposure to high sound pressure levels has been shown to cause long-term (>2 months) damage to sensory cells in fish ears (Hastings *et al*. 1996, McCauley *et al*. 2003). Other reported effects include threshold shifts (hearing loss), stress responses and other behaviour alterations (review in Popper *et al*. 2003). A number of field studies have observed displacement of fish and reduced catch rates, suggested to be attributable to behavioural responses to seismic exploration (e.g. Skalski *et al*. 1992, Engås *et al*. 1996, Hassel *et al*. 2004, Slotte *et al*. 2004). Specific to Atlantic salmon, Knudsen *et al*. (1994) showed that a source of intense low frequency sound (10Hz) within a river acted as an acoustic barrier to young salmon, with fish being displaced to an area where the intense sound was absent. While lamprey and Atlantic salmon are the only qualifying fish species of relevant European Sites in the eastern Irish Sea area, numerous fish species present in the region provide important components of the diet of qualifying species of other relevant European Sites, such as bottlenose dolphin *Tursiops truncatus*, harbour seal *Phoca vitulina* and several seabird species.

There are currently no UK Natura 2000 sites with mobile marine invertebrates as qualifying features. However, as with fish, invertebrates such as crabs and squid may form an important component of the diet of qualifying species of relevant European Sites, for example harbour seal. The study of effects of seismic noise on invertebrates is limited, and it has been suggested that no reliable conclusions can be made that negative effects exist or not (Moriyasu *et al.* 2004). Recent studies into the effects of seismic exploration on crustaceans have shown no significant long term effects on physiology, behaviour or catch rates (Christian *et al*. 2003, DFO 2004, Parry & Gason 2006). Due to their well developed nervous system, cephalopods such as squid may be more sensitive to seismic noise than other invertebrates; however, evidence for effects of seismic noise on them is very limited (review in Moriyasu *et al*. 2004).

Direct effects on seabirds because of seismic exploration noise could occur through physical damage, or through disturbance of normal behaviour. Diving seabirds (e.g. auks) may be most at risk of acute trauma. The physical vulnerability of seabirds to sound pressure is unknown, although McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic in some species (penguins) would be high, hence only at short ranges would individuals be adversely affected. Mortality of seabirds has not been

observed during extensive seismic operations in the North Sea and elsewhere. A study has investigated seabird abundance in Hudson Strait (Atlantic seaboard of Canada) during seismic surveys over three years (Stemp 1985). Comparing periods of shooting and non-shooting, no significant difference was observed in abundance of fulmar, kittiwake and thick-billed murre (Brünnich's guillemot). Impact on prey species (e.g. fish) could undermine conservation objectives for sites through a deterioration in conservation status, for instance this may represent an indirect disturbance to qualifying species, or a temporary deterioration of the functioning of the habitats which support qualifying species, though mitigation measures are available (see Section 7.4) the implementation of which will also be assessed in detail once project plans are available.

Airborne noise, for example from helicopter overflights, could potentially disturb birds in coastal SPAs, although in the context of other military and civilian aircraft activities the anticipated level of E&P related noise is insignificant. In specific cases of concern, mitigation through routeing restrictions could be implemented.

7.2 Noise sources and propagation

Compared to the noise derived from seismic surveys and piling, noise from other oil and gas activities is relatively minor; previous DECC SEAs have assessed noise in some detail, and the following discussion is focussed on seismic noise as the primary concern. The potential for significant effect is therefore largely related to the anticipated type, extent and duration of seismic survey associated with proposed licensing (although no seismic survey is proposed by the work programmes). The range over which noise propagates (and effects may result) varies with water depth, density stratification, substrate and other factors, and is therefore area-specific.

7.2.1 Seismic survey

With the exception of explosives and modern military sonar (and possibly windfarm monopile piling), airgun arrays used for seismic surveys are the highest energy man made sound sources in the sea. The proposed work programme for the Blocks does not include undertaking a 2D or 3D seismic survey. However, prior to the drilling of a proposed drill or drop well, a rig site survey would be required to determine the presence of shallow gas deposits or any other potential hazard prior to locating a drilling rig. Rig site surveys utilise much reduced source level in comparison to deep seismic; a typical equipment spread includes analogue sidescan sonar (100/500kHz), hull-mounted single beam echo sounder, multibeam swathe bathymetry and subbottom profiler. For some high resolution digital surveys a small airgun source of 150-200 cubic inches may be used. The area covered by rig site surveys is small (a few km^2) and the surveys are of short duration (<5 days).

The offshore energy SEA process has reviewed general aspects of noise propagation. Most environmental assessments of noise disturbance in deeper water use simple spherical propagation models to predict sound pressure levels at varying distances from source. However, additional signal modification and attenuation may result from a combination of reflection from sub-surface geological boundaries, sub-surface transmission loss due to frictional dissipation and heat; and scattering within the water column and sub-surface due to reflection, refraction and diffraction in the propagating medium. In shallow water, reflection of high frequency signals from the seabed results in approximately cylindrical propagation and therefore higher received spectrum levels than for spherically propagated low frequency signals (which penetrate the seabed).

In general, as distance from the array increases, higher frequencies are attenuated more rapidly and beyond a few kilometres, the main contribution is in the 2kHz region. Finally

beyond around 12km it will be the main low-frequency pulse of around 250Hz that has the main contribution. However, local propagation effects may have significant influence: for example frequency dependence due to destructive interference also forms an important part of the weakening of a noise signal. Simple models of geometric transmission loss may therefore be unreliable in relatively shallow water; in areas of complex seabed topography and acoustic reflectivity; where vertical density stratification is present in deep water; and where the noise does not originate from a point source. In the St George's Channel, Goold and Fish (1998) recorded 8kHz sounds above background levels at a range of 8km from the source, even in a high noise environment.

7.2.2 Other activities

Pile-driving of foundations may generate high source levels and has been widely recognised as a potential concern, in particular for large offshore wind developments where many piles may be installed sequentially over long time scales (as reviewed in DECC 2011). Brandt *et al.* (2011) reporting on piling operations at the Horns Rev II site off the Danish west coast, indicated that during 1 pile driving event, the peak noise level reached 196 dB re 1 µPa, the sound exposure level (SEL) reached a maximum of 176 dB re 1 μPa^2 s and the M-weighted SEL (see below) reached 170 dB re 1 μPa^2 s at 720m distance. At a distance of 2,300m, peak levels reached 184 dB re 1 µPa, SEL 164 dB re 1 μPa^2 s and M-weighted SEL reached 157 dB re 1 μPa^2 s. Pile-driving also occurs in connection with oil and gas facilities, although the pile diameters are smaller than wind turbine monopiles and typically result in lower source levels and durations.

Available measurements indicate that drilling activities produce mainly low-frequency continuous noise from several separate sources on the drilling unit (Richardson *et al*. 1995, Lawson *et al*. 2001). The primary sources of noise are various types of rotating machinery, with noise transmitted from a semi-submersible rig to the water column through submerged parts of the drilling unit hull, risers and mooring cables, and (to a much smaller extent) across the air-water interface. Noise transmission from jack-up rigs used in shallower water is less because of limited coupling with the water column. Under some circumstances, cavitation of thruster propellers is a further appreciable noise source, as may be the use of explosive cutting methods (e.g. for conductor removal).

Measured farfield sound pressure of around 170dB re 1µPa, in the frequency range 10-2000Hz (Davis *et al.* 1991) is probably typical of drilling from a semi-submersible rig and is of the same order and dominant frequency range as that from large merchant vessels (e.g. McCauley 1994). Drilling noise has also been monitored west of Shetland, in the vicinity of the Foinaven and Schiehallion developments (Swift & Thompson 2000). High and variable levels of noise were initially believed to result from drilling related activity on two semi-submersible rigs operating in the area. However, subsequent analysis found more direct correlation between the use of thrusters and anchor handlers, during rig moves, and high levels of noise (Swift & Thompson 2000). Further measurements of drilling and pipelay noise in the North Sea have been undertaken (Nedwell & Needham 2001, Nedwell *et al*. 2001, Nedwell *et al*. 2002). Drilling duration may range from a few weeks for an exploration well, to years in the case of a large development programme.

Pipelay operations will result mainly in continuous noise (associated with rotating machinery), with relatively little impulse or percussive noise in comparison to many other marine construction activities. The overall source levels resulting from pipelay operations on the UKCS have not been measured, however, near-field cumulative sound levels associated with pipelay for the Clair field development were predicted to be a maximum of 177dB (Lawson *et al*. 2001), with a duration of weeks or months.

Although there is little published data, noise emission from production platforms is thought to be qualitatively similar to that from ships, and is produced mainly by rotating machinery (turbines, generators, compressors) (Richardson *et al*. 1995).

A further source of noise associated with all stages of the offshore oil industry is helicopter overflights. There is relatively little quantitative information on the transmission of helicopter airborne noise to the marine environment (Richardson *et al*. 1995). Measurements of an airsea rescue helicopter over the Shannon estuary (Berrow *et al*. 2002) indicated that due to the large impedance mismatch when sound travels from air to water, the penetration of airborne sound energy from the rotor blades was largely reflected from the surface of the water with only a small fraction of the sound energy coupled into the water.

7.2.3 Effects thresholds

Richardson *et al.* (1995) defined a series of zones of noise influence on marine mammals, which have been generally adopted by SEAs and EAs undertaken in relation to previous Licensing Rounds. Similarly, data on marine mammal responses have been exhaustively reviewed (e.g. Richardson *et al*. 1995, Gordon *et al*. 1998, Lawson *et al*. 2001, Simmonds *et al*. 2003, Nowacek *et al*. 2007, Weilgart 2007, Southall *et al*. 2007). Four zones are recognised which will generally occur at increasing sound level: (1) the zone of audibility; (2) zone of responsiveness; (3) zone of masking; (4) zone of hearing loss, discomfort or injury. Potential acute effects include physical damage, noise-induced hearing loss (temporary and permanent threshold shifts, TTS and PTS respectively) and short-term behavioural responses. Postulated chronic effects (for which evidence is almost entirely absent) include long term behavioural responses, exclusion, and indirect effects. The most likely physical/physiological effects are generally considered to be shifts in hearing thresholds and auditory damage.

There is now a reasonable body of evidence to quantify noise levels associated with both seismic survey and pile-driving, and to understand the likely propagation of such noise within the marine environment. There is less clarity about the potential effects on marine mammals (and other receptors including fish), particularly in relation to distinguishing a significant behavioural response from an insignificant, momentary alteration in behaviour. Consequently, recent expert assessments have recommended that onset of significant behavioural disturbance resulting from a single pulse is taken to occur at the lowest level of noise exposure that has a measurable transient effect on hearing. A similar approach can be taken to multi-pulsed sounds although the evidence base is small and contradictory.

Behavioural responses to anthropogenic noise have generally been studied by visual or acoustic monitoring of abundance. Visual monitoring of cetaceans during seismic surveys has been carried out for several years throughout the UKCS. Statistical analysis of 1,652 sightings during 201 seismic surveys, representing 44,451 hours of observational effort, was reported by Stone (2003) and Stone & Tasker (2006). Sighting rates of white-sided dolphins, white-beaked dolphins, *Lagenorhynchus* spp., all small odontocetes combined and all cetaceans combined were found to be significantly lower during periods of shooting on surveys with large airgun arrays. In general, small odontocetes showed the strongest avoidance response to seismic activity, with baleen whales and killer whales showing some localised avoidance, pilot whales showing few effects and sperm whales showing no observed effects.

Brandt *et al.* (2011) reported on the spatial and temporal scale of behavioural responses of harbour porpoises to construction noise at the Horns Rev II offshore wind farm site. Porpoise acoustic activity (measured by passive acoustic monitoring devices (T-PODs)) was reduced by 100% during 1h after pile driving and stayed below normal levels for 24 to 72 h

at a distance of 2.6km from the construction site. This period gradually decreased with increasing distance. A negative effect was detectable out to a mean distance of 17.8km. At 22km it was no longer apparent, instead, porpoise activity temporarily increased. This might indicate that porpoises at this distance showed no behavioural reaction to pile driving. Animals moving away from the construction site might have caused porpoise abundance and thus porpoise acoustic activity to temporarily increase as animals aggregated there. Out to a distance of 4.7km, the recovery time was longer than most pauses between pile driving events. Consequently, porpoise activity and possibly abundance were reduced over the entire 5 month construction period.

Both harbour and grey seals have shown short-term avoidance behaviour during controlled exposure experiments with small airguns (Thompson *et al*. 1998). In both cases seals abandoned foraging sites and swam away from airguns but returned to forage in the same areas on subsequent days. By contrast, Harris *et al.* (2001) making observations from a seismic vessel operating in a shallow lagoon system in the Canadian Arctic, found no significant change in sightings rate between firing and non firing periods. Mean radial distance to sightings did increase, suggesting some local avoidance behaviour.

7.2.4 Injury and behavioural criteria

The Offshore Energy SEAs (DECC 2009b, 2011) reviewed recent data and recommendations for injury and behavioural criteria for noise assessment in marine mammals, although with emphasis on pulse noise from high-energy deep seismic survey and pile-driving. The OESEA utilised injury criteria proposed by Southall *et al*. (2007) composed both of unweighted peak pressures and M-weighted sound exposure levels which are an expression for the total energy of a sound wave. The M-weighted function also takes the known or derived species-specific audiogram into account. For three functional hearing categories of cetaceans, proposed injury criteria are an unweighted 230dB re 1µPa p-p for all types of sounds and an M-weighted sound exposure level of 198 or 215dB re 1 $\mu Pa^2 \cdot s$ for pulsed and non-pulsed sounds respectively. For pinnipeds, the respective criteria are 218dB 1µPa p-p for all types of sound and 186 (pulsed) or 203 (non-pulse) dB re 1 $\mu Pa^2 \cdot s$ (M-weighted). These proposals are based on the level at which a single exposure is estimated to cause onset of permanent hearing loss (PTS), by extrapolating from available data for TTS.

Southall *et al*. (2007) concluded that developing behavioural criteria was challenging, in part due to the difficulty in distinguishing a significant behavioural response from an insignificant, momentary alteration in behaviour. Consequently, they recommended that onset of significant behavioural disturbance resulting from a single pulse is taken to occur at the lowest level of noise exposure that has a measurable transient effect on hearing (i.e. TTS-onset). These criteria for single pulses are an unweighted 224dB re 1µPa p-p and an M-weighted sound exposure level of 183dB re 1 $\mu Pa^2 \cdot s$ for three functional hearing categories of cetaceans, and 212dB re 1µPa (p-p) and 171dB re 1 $\mu Pa^2 \cdot s$ (M-weighted) for pinnipeds.

For multiple pulse and non-pulse (i.e. continuous) sources, Southall *et al*. (2007) were unable to derive explicit and broadly applicable numerical threshold values for delineating behavioural disturbance, and suggested that a context-based approach to deriving noise exposure criteria for behavioural responses will be necessary.

Based on the criteria developed by Southall *et al*. (2007), and the data reported by Lucke *et al*. (2009), indicative spatial ranges of injury and disturbance for cetaceans and pinnipeds may be calculated as indicated in Table 7.1 below. Calculated ranges for the Southall *et al*. (2007) criteria suggest that there is negligible risk of auditory damage to cetaceans, and a low to moderate risk of seals being within the required range (63m assuming modified

cylindrical spreading) of seismic operations. Modified cylindrical spreading is usually considered to occur in water depths <1.5x range, i.e. spherical spreading (20logR) will occur to a range of 60m in a water depth of 40m.

Table 7.1: Indicative spatial ranges of various injury and disturbance indicators for cetaceans and pinnipeds

	Cetaceans seismic	**Pinnipeds** seismic
Nominal vertical source level (dB p-p)	260	260
Horizontal array correction	-15	-15
Effective horizontal source level	245	245
Injury sound pressure level (multiple pulses; dB p-p)	230	218
Required propagation loss	15	27
Deep water (20logR) distance (m)	**5.6**	**22.4**
Shallow water (15logR) distance (m)	**10.0**	**63.1**
Behavioural response sound pressure level (single pulse; dB p-p)	224	212
Required propagation loss	21	33
Deep water (20logR) distance (m)	**11.2**	**44.7**
Shallow water (15logR) distance (m)	**25.1**	**158.5**
MTTS (4kHz) response sound pressure level in porpoise (single pulse; dB p-p)	200	
Required propagation loss	45.3	
Deep water (20logR) distance (m)	**184**	
Shallow water (15logR) distance (km)	**1.05**	

Source: Southall et al. (2007), Lucke et al. (2009)

The ranges affected by potential auditory injury resulting from modelled seismic survey, which assume a much larger source level than will be used for proposed site survey in the Blocks, represent a small proportion of the marine areas used by seals (and cetaceans) associated with European Sites in the region. Larger proportions of the overall ranges may be affected by noise levels possibly associated with behavioural modification, although the ecological significance of such postulated effects have not been demonstrated. It is acknowledged here that injury and disturbance do not necessarily lead to an adverse impact on the integrity of a European site under the Habitats Directive, and indeed disturbance licences can be granted for certain levels of activity, without site integrity being compromised. Therefore, disturbance effects both within and beyond site boundaries are not expected to have consequent effects on site integrity.

Popper *et al*. (2006) suggested interim criteria for injury of fish exposed to pile driving operations, although note that the majority of the evidence base for such criteria is derived from studies of seismic and explosive noise sources. A peak sound pressure level of 208dB re 1µPa for single pulses is proposed. This is supported by the findings of Popper *et al*. (2005) who showed that TTS onset (physiological fatigue and not damage) in three species of fish exposed to seismic air-gun pulses occurred within the range of 205-210dB re 1 µPa (p-p). Popper *et al*. (2006) considered available data as too sparse to set clear-cut science-based criteria for behavioural disturbance of fish or auditory masking from pile driving.

7.3 Implications for relevant European Sites

As discussed above, it is considered that marine mammals and migratory fish are the only qualifying species which may potentially be affected (in terms of conservation status) by acoustic disturbance. It is noted that effects on fish which are also prey species (e.g. for marine mammals and birds), and may therefore result in the undermining of conservation objectives of qualifying species, are unlikely from noise sources associated with oil and gas activities, with noise levels suggested to cause injury to fish not extending beyond a few tens of metres around the noise source. The screening process (Appendix B) identified the potential for acoustic disturbance in the following sites:

7.3.1 Strangford Lough SAC and Murlough SAC

(Annex II species: harbour seal *Phoca vitulina*)

A thermal imaging survey of the entire coast of Northern Ireland during the moult in August 2002 counted 1,248 harbour seals, of which 180 seals were in Strangford Lough and 299 seals in the Murlough SAC (Duck 2006). Recent data from Strangford Lough suggest that harbour seal counts have declined by 3% per annum (95% CI: 1-5%) producing a 35% decline over the period 1994 to 2006 (SCOS 2007). Aerial surveys by SMRU of seals in Strangford Lough as part of the Seagen environmental monitoring programme also noted a gradual decline in seal numbers between 2006 and 2010 (Royal Haskoning 2010). Recent tracking studies of seals tagged within Strangford Lough have suggested that the population feeds mainly in the Irish Sea and that seals that occur within the Lough also regularly haul out at sites out-with the Lough (AECOM & Metoc 2009).

7.3.1.1 Consideration

Simple calculations of sound propagation can be made to estimate the likely maximum received sound levels at the boundaries of relevant European Sites should a typical seismic survey occur in any one of the Blocks applied for. Most environmental assessments of noise disturbance use simple spherical propagation models of the form SPL = SL – 20log(R), where SL = source level, R = source-receiver range, to predict sound pressure levels (SPL) at varying distances from source. Cylindrical spreading, SPL = SL – 10log(R), is usually assumed in shallow water, depth < R. However, several workers have measured or modelled additional signal modification and attenuation due to a combination of reflection from sub-surface geological boundaries, sub-surface transmission loss due to frictional dissipation and heat; and scattering within the water column and sub-surface due to reflection, refraction and diffraction in the propagating medium (see SEA 4 Environmental Report). In shallow water, reflection of high frequency signals from the seabed results in approximately cylindrical propagation and therefore higher received spectrum levels than for spherically propagated low frequency signals (which penetrate the seabed). Attenuation of signal with distance is frequency dependent, with stronger attenuation of higher frequencies with increasing distance from the source. Frequency dependence due to destructive interference also forms an important part of the weakening of a noise signal.

Strangford Lough SAC and Murlough SAC are approximately 135km and 138km respectively from the nearest Block (110/7d), giving a propagation loss (assuming 15logR) of around 77dB, or a received sound level of 153dB re 1µPa p-p[7] for a typical seismic survey. This level is considerably lower than the injury criteria proposed by Southall *et al.* (2007) in

[7] Assumes a source level of 250dB re 1µPa peak-to-peak, a correction factor of -20dB to compensate for horizontal array effects, and a propagation loss of 15log(R). Figure is rounded to the nearest whole number.

pinnipeds for both pulsed and non-pulsed sounds, and also below those proposed for the onset of TTS (postulated as significant behavioural disturbance) for pulsed sounds.

Noise levels suggested to cause auditory damage in phocids are rapidly attenuated with distance from source, and would therefore not propagate into the SAC and have very limited potential for spatial overlap with seals foraging beyond the boundary of the SAC. Furthermore, distances over which hearing damage may occur are well within the effective range of the mitigation measures which would be employed to minimise damage to marine mammals (see Section 7.4). Additionally, any future seismic survey plans would be subject to an extensive source- and site-specific assessment of the potential for adverse effects, including AA.

If significant ecological effects on prey species were to occur, even at considerable distances from Strangford Lough and Murlough SACs, these may influence the breeding populations of the sites. However, noise levels suggested to cause injury to fish (the primary prey species of seals) would not extend beyond a few tens of metres around the noise source. The range over which non-injurious disturbance effects on fish might occur is not possible to define, although available evidence suggests that the extent of any such disturbance of prey species is highly unlikely to undermine the conservation objectives in relation to harbour seals from relevant SACs in the region (e.g.to maintain, and enhance as appropriate, population numbers, the distribution of seals and the physical features that they use within the site/to maintain the population in favourable condition, subject to natural change).

7.3.2 Dee Estuary/ Aber Dyfrdwy SAC

(Annex II species: river lamprey *Petromyzon marinus*, sea lamprey *Lampetra fluviatilis*)

Sea lamprey migrate into fresh water to spawn in April and May. Larvae metamorphose in rivers from July-September before migrating to sea; the timing of migration varies from river to river. Relatively little is known about their marine distribution, where they have been recorded in both shallow coastal and deep offshore waters and attached to a variety of host species (Maitland 2003). Young river lamprey use the estuarine water of the Dee Estuary as a nursery before migrating upstream to freshwater to spawn in several rivers upstream. Significant propagation of underwater noise into shallow enclosed and semi-enclosed bays and estuaries is not expected; therefore, the potential for effects is restricted to sea lamprey occupying marine areas.

7.3.2.1 Consideration

Noise levels suggested to cause injury to fish would not extend beyond a few tens of metres around the noise source. The range over which non-injurious disturbance effects on fish might occur is not possible to define, although available evidence suggests that it is unlikely to affect site integrity. Furthermore, the potential for impact can be mitigated through timing of seismic survey to avoid the period of lamprey entry into the rivers; consequently, significant effects on this qualifying feature can be avoided.

In recent years, sightings of bottlenose dolphins have been more frequently recorded off the north Wales coast - primarily around Anglesey but also closer to Liverpool Bay (Pesante *et al*. 2008). Sightings are most frequent from November to January. Recent photo-identification studies have shown that the majority of these individuals have previously been observed in the Cardigan Bay area during summer months. Their occurrence off the north Wales coast may, therefore, be linked to their status as features of the Lleyn Peninsula and the Sarnau SAC and the Cardigan Bay SAC. The SAC sites themselves are acoustically shielded from seismic surveys in the Blocks by Anglesey and the north Wales coast. Winter

abundance of bottlenose dolphins off the north Wales coast is currently unknown; observations from land over the period 2001-2007 have recorded a total of 72 sightings with a mean group size of 18 individuals over the period November-January (Pesante *et al*. 2008).

Simple calculations of sound propagation can be made to estimate the likely maximum received sound levels at given distances from the Blocks applied for, should a typical seismic survey occur (although none currently proposed). In the case of bottlenose dolphin recorded off the north Wales coast, the minimum distance to the nearest Block (110/8b) is approximately 35.5km, giving a propagation loss (assuming 15logR) of around 68dB, or a received sound level of 162dB re 1μPa p-p for a typical seismic survey. This level is considerably lower than the injury criteria proposed by Southall *et al.* (2007) in cetaceans and pinnipeds for both pulsed and non-pulsed sounds, and also below those proposed for the onset of TTS (postulated as significant behavioural disturbance) for pulsed sounds. Seismic survey occurring in the Blocks will be audible to bottlenose dolphins occurring in the eastern Irish Sea off the north Wales coast. The exact effects which this may have are unknown, although available evidence suggests that significant effects at a population or individual level are unlikely. Weather conditions typically restrict seismic survey activity to summer months. Sightings data indicate that bottlenose dolphin occurrence in this area is limited during summer months, supported by increased sightings further south off the coast of west Wales.

If significant ecological effects on bottlenose dolphin prey species were to occur, these may influence the population of the designated sites. However, noise levels suggested to cause injury to fish would not extend beyond a few tens of metres around the noise source. The range over which non-injurious disturbance effects on fish might occur is not possible to define, although available evidence suggests that the extent of any such disturbance of prey species is highly unlikely to undermine the conservation objectives in relation to bottlenose dolphins from relevant SACs in the region (e.g. detrimentally affect conservation status by negatively affecting the distribution of species or it supporting habitats, or resulting in significant disturbance to the species or the long-term viability of the population).

The proposed work programmes for the Blocks does not include seismic survey. Noise levels associated with other activities potentially resulting from licensing of the Blocks such as a rig site survey, drilling, vessel movements, pipe-laying operations, are of a considerably lower magnitude than those resulting from seismic survey, and are not expected to have significant effects on relevant qualifying species.

7.4 Regulation and mitigation

Both planning and operational controls cover acoustic disturbance resulting from activities on the UKCS, specifically including geophysical surveying and pile-driving. Application for consent to conduct seismic and other geophysical surveys is made using *Petroleum Operations Notice No 14* (PON14) supported by an Environmental Narrative to enable an accurate assessment of the environmental effects of the survey. Consultations with Government Departments and other interested parties are conducted prior to issuing consent, and JNCC may request additional risk assessment, specify timing or other constraints, or advise against consent. Any proposed activity with a potentially significant acoustic impact on a designated SAC or SPA would also be subject to -the requirement for Appropriate Assessment.

The major operational control and mitigation over seismic surveys in the UK are through JNCC's *Guidelines for minimising the risk of disturbance and injury to marine mammals from*

seismic surveys (August 2010 revision reflects amendments (2007 and 2009 amendments) to the *Conservation (Natural Habitats &c.) Regulations 1994* (Habitat Regulations, HR) for England and Wales and the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (Offshore Marine Regulations, OMR, as amended in 2009 and 2010)). It is a condition of consents issued under Regulation 4 of the *Petroleum Activities (Conservation of Habitats) Regulations 2001* (& 2007 Amendments) for oil and gas related seismic surveys that the JNCC Seismic Guidelines are followed. Disturbance licences can also be issued under the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007*.

The guidelines require visual monitoring of the area by a dedicated Marine Mammal Observer (MMO) prior to seismic testing to determine if cetaceans are in the vicinity, and a slow and progressive build-up of sound to enable animals to move away from the source. Passive Acoustic Monitoring (PAM) may also be required. Seismic operators are required, as part of the application process, to justify that their proposed activity is not likely to cause a disturbance etc. under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) and *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended). This assessment should consider all operational activities including shooting during hours of darkness or in poor visibility.

In their latest guidelines, JNCC (2010) advise that operators adopt mitigation measures which are appropriate to minimise the risk of an injury or disturbance offence[8] and stipulate, whenever possible, the implementation of several best practice measure, including:

- If marine mammals are likely to be in the area, only commence seismic activities during the hours of daylight when visual mitigation using Marine Mammal Observers (MMOs) is possible.
- Only commence seismic activities during the hours of darkness, or low visibility, or during periods when the sea state is not conducive to visual mitigation, if a Passive Acoustic Monitoring (PAM) system is in use to detect marine mammals likely to be in the area, noting the limitations of available PAM technology (seismic surveys that commence during periods of darkness, or low visibility, or during periods when the observation conditions are not conducive to visual mitigation, could pose a risk of committing an injury offence).
- Plan surveys so that the timing will reduce the likelihood of encounters with marine mammals. For example, this might be an important consideration in certain areas/times, e.g. during seal pupping periods near Special Areas of Conservation for harbour seals or grey seals.
- Provide trained MMOs to implement the JNCC guidelines.
- Use the lowest practicable power levels to achieve the geophysical objectives of the survey.
- Seek methods to reduce and/or baffle unnecessary high frequency noise produced by the airguns (this would also be relevant for other acoustic energy sources).

DECC will expect that passive acoustic monitoring (PAM) will be routinely considered for use as a mitigation tool. Periods of seasonal concern for seismic survey are also identified for a number of Blocks considered in this AA (see Table 2.1), for which there would be a presumption against such activity taking place.

[8] Defined under Regulation 39 1(a) and 1(b) (respectively) of the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended) or Regulation 40 of *The Conservation of Habitats and Species Regulations 2010* in territorial waters.

In addition to marine mammal sensitivities, disturbance to populations of Atlantic salmon and other qualifying anadromous species can be mitigated through timing of seismic survey to avoid migratory periods and consequently significant disturbance can be avoided. In particular JNCC[9] highlight the sensitive post-smolt migration period for Atlantic salmon between April and May, and that mitigation, including a presumption against seismic survey at this time, is considered.

7.5 Conclusions

Significant effects arising from acoustic disturbance were only considered possible for SACs with marine mammals and fish as a qualifying feature. Although seismic survey, drilling and other oil industry noise is detectable by marine mammals, waterbirds and their prey, there is no evidence that such noise presents a risk to the viability of populations in UK waters and specifically not within designated Natura 2000 sites. This would require direct mortality, behavioural response with implications for reproductive success (e.g. disturbance at fixed breeding locations) or reduced long-term ecological viability (e.g. sustained displacement from foraging grounds). In the localised areas of Natura 2000 sites designated for marine mammals, acoustic disturbance from seismic survey activity resulting from proposed licensing (although none currently proposed by the work programmes) would be intermittent and there is no evidence that cumulative effects of previous survey effort have been adverse. Despite considerable scientific effort, no causal link, or reasonable concern in relation to population viability has been found.

For the Blocks under consideration, calculations considering the direct linear range to the SAC boundaries, and important areas beyond SAC boundaries used by qualifying features, and the source level of a typical seismic survey suggest that received noise levels within all these areas will fall below relevant effects criteria as defined by Southall *et al*. (2007).

Bearing in mind the information presented above and in the Appendices, it is concluded at the currently available level of definition, the proposed licensing of the Blocks would not be expected to cause an adverse effect on the integrity of the European Sites (see Section 4.2), taking account of the following:

- No geological seismic survey is proposed by the work programmes although rig site surveys may be required prior to locating a drilling rig. Should a rig site survey be proposed in the Blocks, further Habitats Regulations Assessment may be required to assess the potential for significant effects on site integrity once the area of survey, source size, timing and proposed mitigation measures are known and can form the basis for a definitive assessment.
- It is considered reasonable to conclude that no effects will result with significant influence on the integrity of qualifying species within the other SACs in the vicinity of the Blocks.
- The utilisation of areas outside the designated SAC boundaries is not well understood, but the known extensive range of grey and harbour seals, and available population monitoring indicates that activities associated with proposed licensing will not have significant influence on the integrity of qualifying species.

Consent for activities will not be granted unless the operator can demonstrate that the proposed activities which may include a rig site survey will not have an adverse affect on the site integrity of European Sites.

[9] JNCC's response to the 26th Seaward licensing Round.

8 In-combination effects

Potential incremental, cumulative, synergistic and secondary effects from a range of operations, discharges, emissions (including noise), and accidents were considered in the Offshore Energy SEAs (DECC 2009b, 2011; see also OSPAR 2000, 2010).

8.1 Underwater noise

Seismic survey (although none are currently proposed as part of the work programmes) and other noise producing activities that might follow the proposed licensing are anticipated to be widely separated in space and time. Therefore, any acoustic disturbance to marine mammals causing displacement from foraging areas will be short-term and infrequent. SMRU (2007) note that "The effects of repeated surveys are not known, but insignificant transient effects may become important if potentially disturbing activities are repeated and/or intensified". As noted in Section 7, the number of seismic surveys is substantially less than historic peaks and as a result significant in-combination effects with oil and gas activities in existing licensed blocks are not foreseen.

Other noise producing activities which are likely to occur within the eastern Irish Sea include those associated with the development of marine renewable energy. Offshore wind energy is expected to undergo large-scale development in the region over the next decade. In addition to the 5 operational offshore wind farms and 2 under construction in the eastern Irish Sea (approx 840MW combined capacity), consent has been granted to a further 2.0GW of offshore wind energy in the region to be distributed off the north Wales coast and at various sites off the Cumbrian coast. Following the Offshore Energy SEA, The Crown Estate has entered a Round 3 zonal development agreement for the generation of up to 4.2GW of offshore wind energy respectively from an Irish Sea zone. The consenting of developments in this region will be subject to detailed project-specific EIA and Habitats Regulations Assessments. The Crown Estate have also recently awarded exclusivity agreements to various consortia of wind energy developers for several areas within Scottish territorial waters, including two areas off the Solway Firth and Wigtown Bay of 61km^2 (300MW) and 51km^2 (280MW) respectively. Consenting of any development within this area will also be subject to the conclusions of an SEA, project-specific EIA and Habitats Regulations Assessment.

An application for a small tidal energy scheme (10MW), the Skerries Tidal Stream Array, has been submitted and could consist of up to 9 turbines to be located between the Skerries and Carmel Head about 1km off the Anglesey coast. The developers, Marine Current Turbines and RWE npower Renewables are targeting 2013/2014 for the start of commissioning (Marine Current Turbines website).

While the operation, maintenance and decommissioning of marine renewable energy developments will introduce noise into the marine environment, these are typically of low intensity. The greatest noise levels arise during the construction phase, and it is these which have the greatest potential for acoustic disturbance effects (see Faber Maunsell & Metoc 2007, DECC 2009b, DECC 2011). Pile-driving of mono-pile foundations is the principal source of construction noise, which will be qualitatively similar to pile-driving noise resulting from harbour works, bridge construction and oil and gas platform installation. Mono-pile foundations are the most commonly used for offshore windfarm developments at present.

The "Statutory nature conservation agency protocol for minimising the risk of disturbance and injury to marine mammals from piling noise" (JNCC 2009) outlines a protocol for the mitigation of potential underwater noise impacts arising from pile driving during offshore wind farm construction.

In addition to those activities which may follow licensing of the eastern Irish Sea Blocks under consideration and future marine renewable energy development, there are a variety of other existing (e.g. oil and gas production, wind turbine deployments, fishing, shipping, military exercise areas, aggregate extraction) and planned (e.g. oil and gas exploration and production) noise-producing activities in overlapping or adjacent areas. Despite this, DECC is not aware of any projects or activities which are likely to cause cumulative or synergistic effects that when taken in-combination with the activities discussed above would adversely affect the integrity of the relevant European Sites. This is due to the presence of effective regulatory mechanisms in place to ensure that operators, DECC and other relevant consenting authorities take such considerations into account during activity permitting. In respect of oil and gas activities and other developments with the potential to affect Natura 2000 sites, these mechanisms also include project specific Habitats Regulations Assessments.

The Marine Strategy Framework Directive (2008/56/EC) (MSFD) requires that the European Commission (by 15 July 2010) should lay down criteria and methodological standards to allow consistency in approach in evaluating the extent to which Good Environmental Status (GES) is being achieved. ICES and JRC were contracted to provide scientific support for the Commission in meeting this obligation. A total of 10 reports have been prepared relating to the descriptors of GES listed in Annex I of the Directive.

Task Group 11 reported on underwater noise and other forms of energy (Tasker *et al*. 2010). The Task Group developed three possible indicators of underwater sound. In no case was the Task Group able to define precisely (or even loosely) when Good Environmental Status occurs on the axes of these indicators. This is partly to do with insufficient evidence and recognised scientific challenges but also to no fully accepted definition of when, for example, a behavioural change in an organism is not good.

DECC is cognisant of the ongoing MSFD Task Group 11 work to determine criteria for an indicator relating to high amplitude, low and mid-frequency impulsive anthropogenic sounds including those from pile driving, seismic surveys and some sonar systems. DECC will review the findings of this Task Group closely with respect to consenting of relevant activities which may result from the draft plan/programme, as well as other activities which generate noise in the marine environment. The establishment of noise criteria and the consenting of activities will require a coordinated approach across different industries and activities, possibly through the future marine planning system.

8.2 Other potential in-combination effects

8.2.1 Physical damage/change to features and habitats

Potential sources of physical disturbance to the seabed, and damage to biotopes, associated with oil and gas activities were identified by the OESEA2 as anchoring of semi-submersible rigs; wellhead placement and recovery; production platform jacket installation and piling; subsea template and manifold installation and piling; pipeline, flowline and umbilical installation and trenching and decommissioning of infrastructure (DECC 2011).

Of particular relevance would be any damage to shallow sandbank habitats (both within and outside designated areas such as the Solway Firth SAC) as these are potentially important foraging areas for marine mammals.

In general, cumulative effects are likely to be dominated by trawling, with potential scour and physical damage from cable laying associated with potential offshore wind developments likely to be more important in the future. However, these developments will not be sited in areas where bottlenose dolphins are frequently recorded and therefore are unlikely to have a significant impact on foraging areas.

Given the forecast scale of activity, it is likely that there will be considerable spatial and temporal separation between disturbance "footprints" and a low probability of incremental overlap of affected areas. Recovery of affected seabed through sediment mobility, and faunal recovery and recolonisation is expected to be rapid (less than five years) where the source of effects is transient (e.g. anchoring).

8.2.2 Physical presence

Physical presence of offshore infrastructure and support activities may also potentially cause behavioural responses in fish, birds and marine mammals. Previous SEAs have considered the majority of such interactions resulting from interactions with offshore oil and gas infrastructure (whether positive or negative) to be insignificant; in part because the number of surface facilities is relatively small (of the order of a few hundred) and because the majority are at a substantial distance offshore.

The larger numbers of individual surface or submerged structures associated with offshore wind developments, the presence of rotating turbine blades and considerations of their location and spatial distribution (e.g. in relation to coastal breeding or wintering locations for waterbirds and important areas for marine mammals), indicate a higher potential for physical presence effects. Potential displacement and barrier effects will likely be an important consideration at the project level for any large offshore wind developments planned for the area and will likely form an important part of associated Habitats Regulations Assessments.

8.2.3 Marine discharges

As described in Section 6.3, most studies of produced water toxicity and dispersion, in the UK and elsewhere have concluded that the necessary dilution to achieve a No Effect Concentration (NEC) would be reached at <10 to 100m and usually less than 500m from the discharge point. Given the relatively low number and separation of existing oil and gas installations and the presumption against the discharge to sea of produced water from new developments, there is unlikely to be a cumulative effect from multiple produced water discharges.

Previous discharges of WBM cuttings in the UKCS have been shown to disperse rapidly and to have minimal ecological effects (Section 6.3). Dispersion of further discharges of mud and cuttings could lead to localised accumulation in areas where reduced current allows the particles to settle on the seabed. However, in view of the scale of the region, the water depths and currents, and probability of reinjection of drill cuttings from any major field development, this is considered unlikely to be detectable and to have negligible cumulative ecological effect (DECC 2011).

8.3 Conclusions

Available evidence (see UKBenthos database and OSPAR 2000, 2010) indicates that past oil and gas activity and discharges has not lead to adverse impacts on the integrity of European sites in the area. The current controls on terrestrial and marine industrial activities, including oil and gas operations that could follow licensing, can be expected to prevent significant in-combination effects affecting relevant European sites.

The competent authorities will assess the potential for in-combination effects during Habitats Regulations Assessments of project specific consent applications; this process will ensure that mitigation measures are put in place to ensure that subsequent to licensing, specific projects (if consented) will not result in adverse effects on integrity of European sites. Therefore, bearing this in mind, it is concluded that the in-combination of effects from activities arising from the licensing of Blocks 110/7d, 110/8b, 113/28 and 113/29a with those from existing and planned activities will not cause an adverse effect on the integrity of the relevant European Sites.

9 Consideration of sites not yet submitted to the EC

The Pisces Reef Complex pSAC is being considered for their Annex 1 reef habitats and the Croker Carbonate Slabs pSAC as an example of submarine structures made by leaking gases. Neither site is adjacent to the blocks applied for, and emissions or discharges from routine operations would not result in a detrimental change to the extent, physical structure, diversity, community structure and typical species representative of reefs or submarine structures made by leaking gases, nor compromise the maintenance or restoration of these features for their respective sites. Licensing of the blocks would not result in any activities that would hinder efforts to maintain the qualifying Annex I habitat features in favourable condition.

The Mersey Narrows and North Wirral Foreshore pSPA is located at the mouths of the Mersey and Dee estuaries and comprises intertidal habitats at Egremont foreshore, man-made lagoons at Seaforth Nature Reserve and the extensive intertidal flats at North Wirral Foreshore. The site supports important numbers of wintering waterfowl and waders and has clear links in terms of bird movements with the nearby Dee Estuary SPA, Ribble and Alt Estuaries SPA, and (to a lesser extent) Mersey Estuary SPA. The site is approximately 33km from the nearest Block (110/8b) and would not be affected by emissions or discharges from routine operations or accidental spills.

Following licensing, specific activities require permitting and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and Habitats Regulations Assessment procedures which will allow mitigation measures to be defined (including conditions attached to consents/permits or potentially consent/permit refusal). Consent for activities will not be granted unless the operator can demonstrate that the proposed activities will not have an adverse affect on the site integrity of relevant sites not yet submitted to the EC.

10 Overall conclusion

Taking account of all the matters discussed above, the Secretary of State is able to grant consent to the plan/programme (as defined) under the Habitats Directive and award the licences covering Blocks 110/7d, 110/8b, 113/28 and 113/29a. This is because there is certainty, within the meaning of the ECJ Judgment in the ***Waddenzee*** case, that implementation of the plan will not adversely affect the integrity of relevant European Sites, taking account of the mitigation measures that can be imposed through existing permitting mechanisms on the planning and conduct of activities.

These mitigation measures are incorporated in respect of habitat, diadromous fish, bird and marine mammal interest features through the range of legislation and guidance (see https://www.og.decc.gov.uk/environment/environ_leg_index.htm and https://www.og.decc.gov.uk/regulation/pons/index.htm) which apply to developer activities which could follow plan adoption. These mitigation measures include, where necessary, project-specific Appropriate Assessments based on detailed project proposals which would be undertaken by the competent authority before the granting of a permit/consent. The competent authority needs to be satisfied that the proposed activity will not result in adverse effects on the integrity of European sites.

Even where a site/interest feature has been screened out in the plan level assessment, or where a conclusion of no adverse effect on integrity has been reached at plan level, project level assessment will be necessary if, for example, new European sites have been designated after the plan level assessment; new information emerges about the nature and sensitivities of interest features within sites, new information emerges about effects including in-combination effects; or if plan level assumptions have not been met at the project level.

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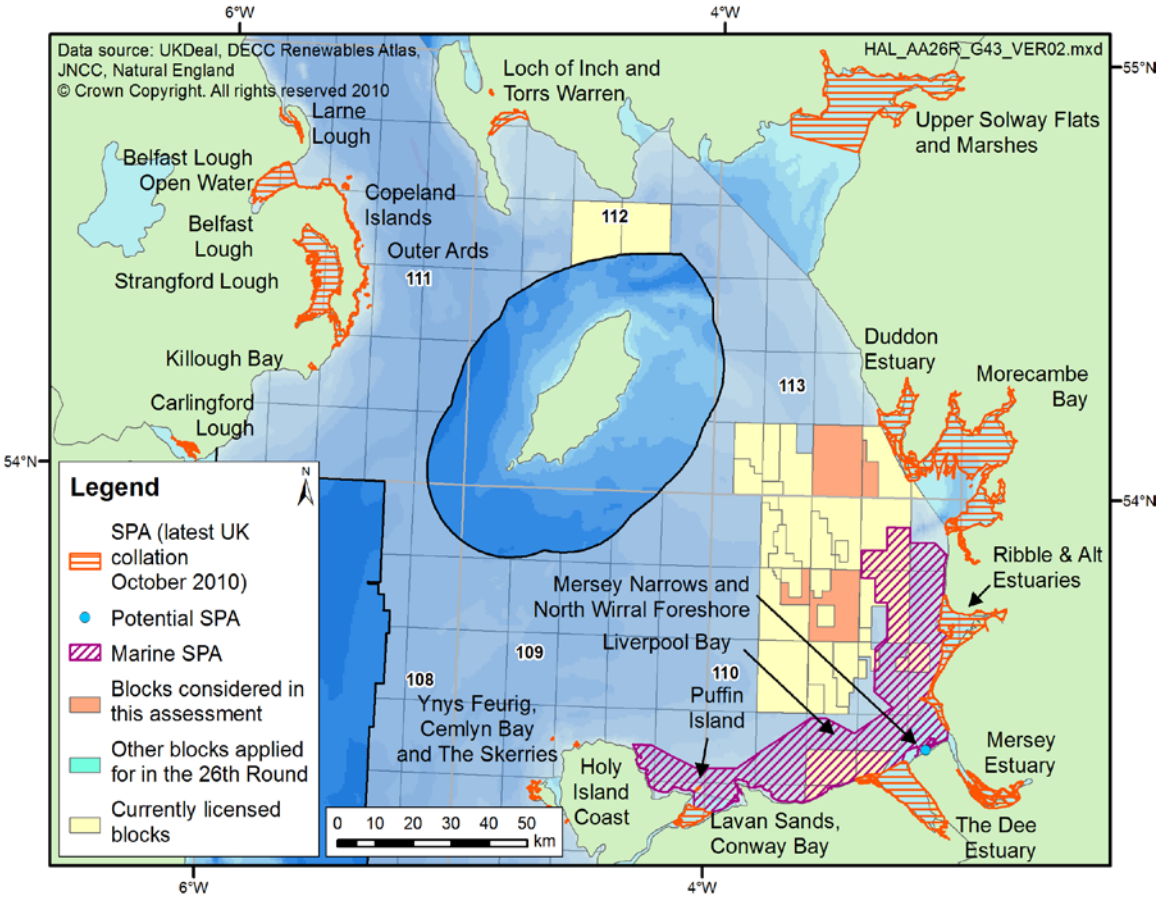
Appendix A - The sites

The migratory and/or Annex I bird species for which SPAs are selected in the UK are listed in Box A.1, and the SPAs and their qualifying features are given in Table A.1 and their locations shown in the Map A.1.

A1 Coastal and Marine Special Protection Areas

Map A.1: Location of Special Protection Areas



Box A.1: Migratory and/or Annex I bird species for which SPAs are selected in UK

Divers and grebes
Red-throated diver Gavia stellata
Black-throated diver Gavia arctica
Little grebe Tachybaptus ruficollis
Great crested grebe Podiceps cristatus
Slavonian grebe Podiceps auritus

Seabirds
Fulmar Fulmarus glacialis
Manx shearwater Puffinus puffinus
Storm petrel Hydrobates pelagicus
Leach's petrel Oceanodroma leucorhoa
Gannet Morus bassanus
Cormorant Phalacrocorax carbo carbo
Shag Phalacrocorax aristotelis
Guillemot Uria aalge
Black guillemot Cepphus grylle
Razorbill Alca torda
Puffin Fratercula arctica

Gulls, terns and skuas
Arctic skua Stercorarius parasiticus
Great skua Catharacta skua
Mediterranean gull Larus melanocephalus
Black-headed gull Larus ridibundus
Common gull Larus canus
Lesser black-backed gull Larus fuscus
Herring gull Larus argentatus
Great black-backed gull Larus marinus
Kittiwake Rissa tridactyla
Sandwich tern Sterna sandvicensis
Roseate tern Sterna dougallii
Common tern Sterna hirundo
Arctic tern Sterna paradisaea
Little tern Sterna albifrons

Crakes and rails
Spotted crake Porzana porzana
Corncrake Crex crex
Coot Fulica atra
Bittern *Botaurus stellaris*

Birds of prey and owls
Honey buzzard Pernis apivorus
Red kite Milvus milvus
Marsh harrier Circus aeruginosus
Hen harrier Circus cyaneus
Golden eagle Aquila chrysaetos
Osprey Pandion haliaetus
Merlin Falco columbarius
Peregrine Falco peregrinus
Short-eared owl Asio flammeus

Other bird species
Capercaillie Tetrao urogallus
Nightjar Caprimulgus europaeus
Woodlark Lullula arborea
Fair Isle wren Troglodytes troglodytes fridariensis
Aquatic warbler Acrocephalus paludicola
Dartford warbler Sylvia undata
Chough Pyrrhocorax pyrrhocorax
Scottish crossbill Loxia scotica

Waders
Oystercatcher Haematopus ostralegus
Avocet Recurvirostra avosetta
Stone curlew Burhinus oedicnemus
Ringed plover Charadrius hiaticula
Dotterel Charadrius morinellus
Golden plover Pluvialis apricaria
Grey plover Pluvialis squatarola
Lapwing Vanellus vanellus
Knot Calidris canutus
Sanderling Calidris alba
Purple sandpiper Calidris maritima
Dunlin Calidris alpina alpina
Ruff Philomachus pugnax
Snipe Gallinago gallinago
Black-tailed godwit Limosa limosa (breeding)
Black-tailed godwit Limosa limosa islandica (non-breeding)
Bar-tailed godwit Limosa lapponica
Whimbrel Numenius phaeopus
Curlew Numenius arquata
Redshank Tringa totanus
Greenshank Tringa nebularia
Wood sandpiper Tringa glareola
Turnstone Arenaria interpres
Red-necked phalarope Phalaropus lobatus
Little egret Egretta garzetta

Waterfowl
Bewick's swan Cygnus columbianus bewickii
Whooper swan Cygnus cygnus
Bean goose Anser fabalis
Pink-footed goose Anser brachyrhynchus
Russian white-fronted goose Anser albifrons albifrons
Greenland white-fronted goose Anser albifrons flavirostris
Icelandic greylag goose Anser anser
Greenland barnacle goose Branta leucopsis
Svalbard barnacle goose Branta leucopsis
Dark-bellied brent goose Branta bernicla bernicla
Light-bellied brent goose Branta bernicla hrota
Shelduck Tadorna tadorna
Wigeon Anas penelope
Gadwall Anas strepera
Teal Anas crecca
Mallard Anas platyrhynchos
Pintail Anas acuta
Shoveler Anas clypeata
Pochard Aythya ferina
Tufted duck Aythya fuligula
Scaup Aythya marila
Eider Somateria mollissima
Long-tailed duck Clangula hyemalis
Common scoter Melanitta nigra
Velvet scoter Melanitta fusca
Goldeneye Bucephala clangula
Red-breasted merganser Mergus serrator
Goosander Mergus merganser

Table A.1: SPAs and their Qualifying Features

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[10]
Northern Ireland				
Larne Lough SPA	395.94	Breeding: Common tern Roseate tern	Over winter: Canadian light-bellied brent goose	N/A
Belfast Lough Open Water SPA	5592.99	N/A	Over winter: Great crested grebe	N/A
Belfast Lough SPA	432.14	Over winter: Bar-tailed godwit	Over winter: Redshank Turnstone	Overwinter: Waterfowl
Copeland Islands SPA	201.52	Breeding: Arctic tern	Breeding: Manx shearwater	N/A
Outer Ards SPA	1410.41	Breeding: Arctic tern Over winter: Golden plover	N/A	N/A
Strangford Lough SPA	15580.79	Breeding: Arctic tern Common tern Sandwich tern	Over winter: Knot Canadian light-bellied brent goose Redshank	Over winter: Waterfowl
Killough Bay SPA	104.23	N/A	Over winter: Canadian light-bellied brent goose	N/A
Carlingford Lough SPA	827.12	Breeding: Common tern Sandwich tern	N/A	N/A
Scotland				
Loch of Inch & Torrs Warren SPA	2111.04	Over winter: Greenland white-fronted goose Hen harrier	N/A	N/A
Upper Solway Flats and Marshes SPA	30706.26	Over winter: Bar-tailed godwit Barnacle goose Golden plover Whooper swan	Over winter: Curlew Dunlin Sanderling Knot Oystercatcher Pink-footed goose Pintail Redshank Shoveler Teal Turnstone Scaup Goldeneye Grey plover Shelduck	Over winter: Waterfowl

[10] - A seabird assemblage of international importance. The area regularly supports at least 20,000 seabirds. Or
- A wetland of international importance. The area regularly supports at least 20,000 waterfowl.

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[10]
England				
Duddon Estuary SPA	6806.3	Breeding: Sandwich tern	Over winter: Knot Pintail Redshank	Over winter: Waterfowl
Morecambe Bay SPA	37404.6	Breeding: Sandwich tern	On passage: Ringed plover Over winter: Curlew Dunlin Grey plover Knot Oystercatcher Pink-footed goose Pintail Redshank Shelduck Turnstone Bar-tailed godwit	Breeding: Seabird Over winter: Waterfowl
Ribble and Alt Estuaries SPA	12412.31	Breeding: Common tern Ruff Over winter: Bewick swan Whooper swan Bar-tailed godwit Golden plover	Breeding: Lesser black-backed gull Black-headed gull Over winter: Pintail Teal Wigeon Pink-footed goose Scaup Sanderling Dunlin Knot Oystercatcher Black-tailed godwit Common scoter Curlew Cormorant Grey plover Shelduck Redshank Lapwing On passage: Sanderling Ringed plover Whimbrel Redshank	Breeding: Seabirds Over winter: Waterfowl

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[10]
Mersey Estuary SPA	5023.35	Over winter: Golden plover	Over winter: Pintail Teal Wigeon Dunlin Black-tailed godwit Curlew Grey plover Great crested grebe Shelduck Redshank Lapwing On passage: Ringed plover Redshank	
Mersey Narrows and North Wirral Foreshore pSPA	2089.41			
Wales				
Liverpool Bay / Bae Lerpwl marine SPA	170,292.94	Over winter: Red-throated diver	Over winter: Common scoter	Non-Breeding: Waterfowl
The Dee Estuary / Aber Afon Dyfrdwy SPA	13084.85	Over winter: Bar-tailed godwit	Over winter: Pintail Knot Oystercatcher Shelduck Redshank	Over winter: Waterfowl
Glannau Ynys Gybi / Holy Island Coast SPA	608.04	Breeding: Chough Over winter: Chough		
Traeth Lafan / Lavan Sands, Conway Bay SPA	2642.98		Over winter: Oystercatcher Curlew On passage: Great crested grebe	
Ynys Feurig, Cemlyn Bay and the Skerries SPA	85.98	Breeding: Roseate tern Common tern Arctic tern Sandwich tern		
Ynys Seiriol / Puffin Bay SPA	31.33		Breeding: Cormorant	

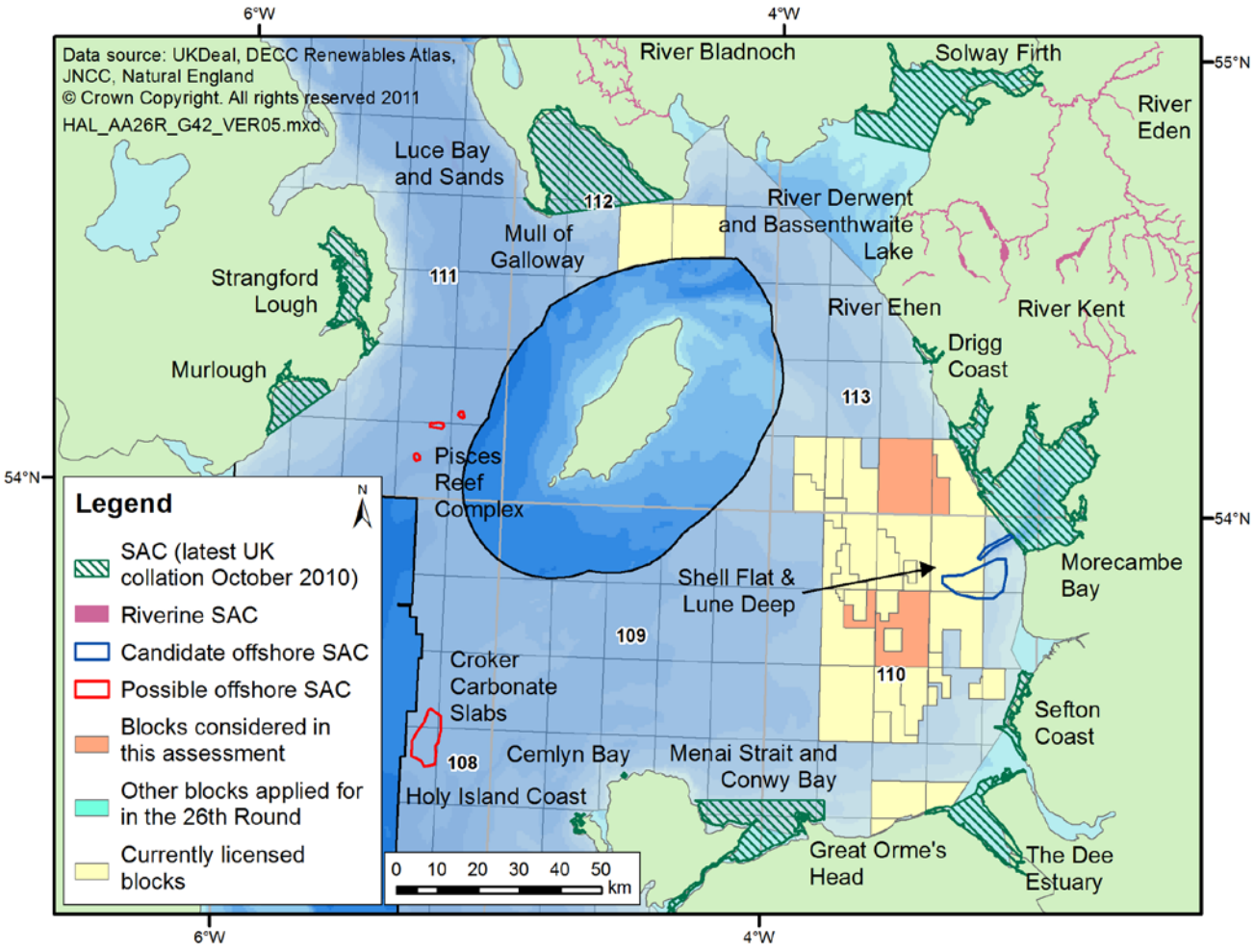
A2 Coastal and Marine Special Areas of Conservation

This section includes coastal or nearshore marine (within 12nm boundary) Special Areas of Conservation (SAC) sites which contain one or more of the Annex I coastal habitats listed in Box A.2 (below) or examples of Annex II qualifying marine species.

Abbreviations for the Annex 1 habitats used in SAC site summaries (Tables A.2, A.3 and A.4 and Map A.2) are listed in Box A.2.

Relevant offshore (out with or crossing the 12nm boundary) SACs are included on Map A.2 and described in Section A3. Riverine/freshwater SACs which are designated for migratory fish and/or freshwater pearl mussel are included on Map A.2 and considered in Section A4.

Map A.2: Location of coastal, marine and offshore Special Areas of Conservation



Box A.2: Annex 1 Habitat Abbreviations Used in Site Summaries

Annex I Habitat (abbreviated)	Annex I Habitat(s) (full description)
Bogs	Active raised bogs * Priority feature Blanket bogs * Priority feature Bog Woodland * Priority feature Degraded raised bogs still capable of natural regeneration Depressions on peat substrates of the Rhynchosporion Transition mires and quaking bogs
Caves	Caves not open to the public
Coastal dunes	Atlantic decalcified fixed dunes (Calluno-Ulicetea) Coastal dunes with Juniperus spp. Decalcified fixed dunes with Empetrum nigrum Dunes with *Hippophae rhamnoides* Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) Embryonic shifting dunes Fixed dunes with herbaceous vegetation (`grey dunes`) * Priority feature Humid dune slacks Shifting dunes along the shoreline with Ammophila arenaria (`white dunes`)
Coastal lagoons	Coastal lagoons *Priority feature
Estuaries	Estuaries
Fens	Alkaline fens Calcareous fens with Cladium mariscus and species of the Caricion davallianae * Priority feature Petrifying springs with tufa formation (Cratoneurion) * Priority feature
Forest	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) * Priority feature Old sessile oak woods with Quercus robur on sandy plains *Tilio-Acerion* forests of slopes, screes and ravines * Priority feature Killarney fern *Trichomanes speciosum* Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (*Quercion robori-petraeae* or *Ilici-Fagenion*) *Asperulo-Fagetum* beech forests Old acidophilous oak woods with *Quercus robur* on sandy plains
Grasslands	Alpine and subalpine calcareous grasslands Calaminarian grasslands of the Violetalia calaminariae Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion

Annex I Habitat (abbreviated)	Annex I Habitat(s) (full description)
	caeruleae) Semi-natural dry grasslands and scrubland facies: on calcareous substrates (Festuco-Brometalia) (important orchid sites) * Priority feature Species-rich Nardus grassland, on siliceous substrates in mountain areas (and submountain areas in continental Europe) * Priority feature
Heaths	Alpine and Boreal heaths Dry Atlantic coastal heaths with *Erica vagans* European dry heaths Northern Atlantic wet heaths with Erica tetralix
Inlets and bays	Large shallow inlets and bays
Limestone pavements	Limestone pavements * Priority feature
Machairs	Machairs
Mudflats and sandflats	Mudflats and sandflats not covered by seawater at low tide
Reefs	Reefs
Rocky slopes	Calcareous rocky slopes with chasmophytic vegetation
Running freshwater	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
Salt marshes and salt meadows	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) Salicornia and other annuals colonising mud and sand *Spartina* swards (*Spartinion maritimae*)
Sandbanks	Sandbanks which are slightly covered by sea water all the time
Scree	Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii) Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)
Scrub (mattoral)	Juniperus communis formations on heaths or calcareous grasslands
Sea caves	Submerged or partially submerged sea caves
Sea cliffs	Vegetated sea cliffs of the Atlantic and Baltic coasts
Standing freshwater	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. Mediterranean temporary ponds Natural dystrophic lakes and ponds Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea
Vegetation of drift lines	Annual vegetation of drift lines
Vegetation of stony banks	Perennial vegetation of stony banks

Table A.2: Coastal SACs and their Qualifying Features

Site Name	Area (ha)	Annex 1 Habitat Primary	Annex 1 Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
Northern Ireland					
Strangford Lough SAC	15398.54	Mudflats and sandflats Coastal lagoons Inlets and bays Reefs	Vegetation of drift lines Vegetation of stony banks Salt marshes and salt meadows	N/A	Harbour seal *Phoca vitulina*
Murlough SAC	11902.03	Coastal dunes	Sandbanks Mudflats and sandflats Salt marshes and salt meadows Coastal dunes	Marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia*	Harbour seal *Phoca vitulina*
Scotland					
Luce Bay and Sands SAC	48759.28	Inlets and bays Coastal dunes	Sandbanks Mudflats and sandflats Reefs	N/A	Great crested newt *Triturus cristatus*
Mull of Galloway SAC	136.39	Sea cliffs	N/A	N/A	N/A
Solway Firth SAC	43636.72	Sandbanks Estuaries Mudflats and sandflats Salt marshes and salt meadows	Reefs Vegetation of stony banks Coastal dunes	Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis*	N/A
England					
Drigg Coast SAC	1397.44	Estuaries Coastal dunes	Mudflats and sandflats Salt marshes and salt meadows Coastal dunes	N/A	N/A

Site Name	Area (ha)	Annex 1 Habitat Primary	Annex 1 Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
Morecambe Bay SAC	61506.22	Estuaries Mudflats and sandflats Inlets and bays Vegetation of stony banks Salt marshes and salt meadows Coastal dunes	Sandbanks Coastal lagoons Reefs Coastal dunes	Great crested newt *Triturus cristatus*	N/A
Shell Flat and Lune Deep cSAC	10565	Reefs Sandbanks		N/A	
Sefton Coast SAC	4563.97	Coastal dunes	Coastal dunes	Petalwort *Petalophyllum ralfsii*	Great crested newt *Triturus cristatus*
Wales					
Dee Estuary / Aber Dyfrdwy SAC	15805.07	Mudflats and sandflats Saltmarshes and salt meadows	Estuaries Vegetation of drift lines Sea cliffs Coastal dunes	N/A	Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Petalwort *Petalophyllum ralfsii*
Great Orme's Head / Pen y Gogarth SAC	302.63	Heaths Grasslands	Sea cliffs	N/A	N/A
Y Fenai a Bae Conwy / Menai Strait and Conway Bay SAC	26482.67	Sandbanks Mudflats and sandflats Reefs	Inlets and bays Sea caves	N/A	N/A
Bae Cemlyn / Cemlyn Bay SAC	43.43	Coastal lagoons	Vegetation of stony banks	N/A	N/A
Glannau Ynys Gybi / Holy Island Coast SAC	464.27	Sea cliffs Heaths	Heaths	N/A	N/A

A3 Offshore Special Areas of Conservation

The locations of relevant offshore Special Areas of Conservation are detailed on Map A.2 above.

Table A.3: Offshore SACs and their Qualifying Features

Site Name	Area (ha)	Annex I Habitat	Annex II Species
Pisces Reef Complex pSAC	697.35	Reefs	N/A
Croker Carbonate Slabs pSAC	6591	Submarine structures made by leaking gases	Harbour porpoise (non-qualifying) *Phocoena phocoena* Grey seal (non-qualifying) *Halichoerus grypus*

A4 Riverine and Freshwater Special Areas of Conservation

The following riverine and freshwater SACs designated for migratory fish and/or the freshwater pearl mussel are also considered. The locations of relevant Special Areas of Conservation are detailed on Map A.2 above.

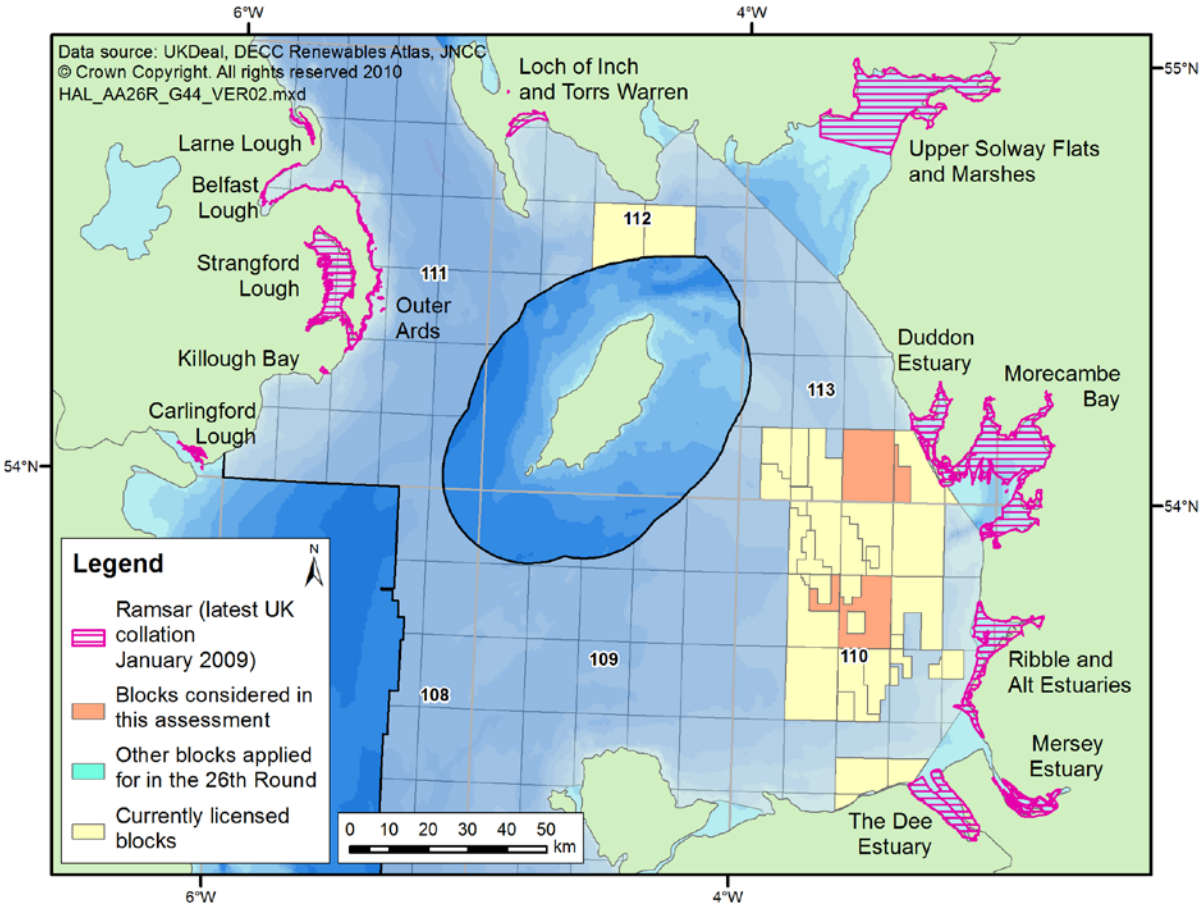
Table A.4: Relevant riverine and freshwater SACs designated for migratory fish and/or the freshwater pearl mussel

Site Name	Freshwater pearl mussel *Margaritifera margaritifera*	Migratory fish[1]
Scotland		
River Bladnoch		AS
England		
River Eden		SL, RL, AS
River Derwent & Bassenthwaite Lake		SL, RL, AS
River Ehen	✓	AS
River Kent	✓	-

[1] *SL - Sea lamprey Petromyzon marinus, RL - River lamprey Lampetra fluviatilis, AS - Atlantic salmon Salmo salar*

A5 RAMSAR Sites

Map A.3: Location of coastal Ramsar sites



The coastal Ramsar sites are also SPA.s and/or SACs (although site boundaries are not always strictly coincident and a Ramsar site may comprise one or more Natura 2000 sites), see tabulation overleaf.

Table A.5: Coastal Ramsar sites and corresponding Natura 2000 sites

Ramsar Name	SPA Name	SAC Name
Belfast Lough	Belfast Lough	
	Belfast Lough Open Water	
	Outer Ards	
Carlingford Lough	Carlingford Lough	
Duddon Estuary	Duddon Estuary	Morecambe Bay
	Morecambe Bay	
Killough Bay	Killough Bay	
Larne Lough	Larne Lough	
Loch of Inch and Torrs Warren	Loch of Inch and Torrs Warren	Luce Bay and Sands
Mersey Estuary	Mersey Estuary	
Morecambe Bay	Duddon Estuary	Morecambe Bay
Outer Ards	Belfast Lough	Strangford Lough
	Outer Ards	
	Strangford Lough	
Ribble and Alt Estuaries	Ribble and Alt Estuaries	Sefton Coast
Strangford Lough	Outer Ards	
	Strangford Lough	Strangford Lough
The Dee Estuary	The Dee Estuary / Aber Afon Dyfrdwy	The Dee Estuary / Aber Afon Dyfrdwy
Upper Solway Flats and Marshes	Upper Solway Flats and Marshes	River Eden
		Solway Firth

Appendix B – Screening tables for the identification of Likely Significant effects on the sites

B1 Coastal and marine Special Protection Areas

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
NORTHERN IRELAND								
Larne Lough	-	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Belfast Lough	✓	✓	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Belfast Lough Open Water	-	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Copeland Islands	✓	-	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Outer Ards	✓	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Strangford Lough	✓	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Killough Bay	-	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Carlingford Lough	✓	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
SCOTLAND								
Loch of Inch and Torrs Warren	-	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Upper Solway Flats and Marshes	-	✓	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
ENGLAND								
Duddon Estuary	✓	✓	✓	✓	✓	-	✓	Site conservation objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major diesel oil spill from Block 113/28 or 113/29a, weathered spilled diesel oil could theoretically affect the features present (breeding terns, wintering and passage waterbirds), although mitigation would be possible. Potential for physical disturbance of terns foraging outside of the site. It is noted that this site could potentially be influenced by renewable energy developments in the eastern and central Irish Sea (offshore wind); however, mitigation is possible. Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Morecambe Bay	✓	✓	✓	✓	✓	-	✓	Site conservation objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major diesel oil spill from Block 113/28 or 113/29a, weathered spilled diesel oil could theoretically affect the features present (breeding seabirds, wintering and passage waterbirds), although mitigation would be possible. Potential for physical disturbance of seabirds foraging outside of the site. It is noted that this site could potentially be influenced by renewable energy developments in the eastern and central Irish Sea (offshore wind); however, mitigation is possible. Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
Ribble and Alt Estuaries	✓	✓	✓	✓	-	-	✓	Site conservation objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major diesel oil spill from Block 110/8b, weathered spilled diesel oil could theoretically affect the features present (breeding terns and gulls, wintering waterfowl), although mitigation would be possible. It is noted that this site could potentially be influenced by renewable energy developments in the eastern and central Irish Sea (offshore wind); however, mitigation is possible. Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
Mersey Narrows and North Wirral Foreshore pSPA	-	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Mersey Estuary	-	✓	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Liverpool Bay / Bae Lerpwl	-	✓	-	✓	✓	-	✓	Site conservation objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major diesel oil spill from any of the Blocks, weathered spilled diesel oil could theoretically affect the features present (wintering red-throated diver and common scoter), although mitigation would be possible. Physical loss of sandbank habitat would only occur if an activity e.g. pipeline trenching was to extend across the boundary of Block 110/8b into the SPA. Disturbance of the bird species by vessel movements or helicopter overflights is also possible. Available mitigation measures include strict use of existing shipping and aircraft routes, and timing controls on temporary activities to avoid sensitive periods. It is noted that this site could potentially be influenced by renewable energy developments in the eastern and central Irish Sea (offshore wind); however, mitigation is possible. Mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
The Dee Estuary	✓	✓	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
WALES								
Traeth Lafan / Lavan Sands, Conway Bay	-	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Ynys Seiriol / Puffin Island	✓	-	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Ynys Feurig, Cemlyn Bay and The Skerries	✓	-	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Glannau Ynys Gybi / Holy Island Coast	✓	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.

Notes: [1] ✓ denotes feature present; [2] ✓ denotes vulnerability to effect

B2 Coastal and marine Special Areas of Conservation

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
NORTHERN IRELAND							
Strangford Lough	✓	✓	-	-	✓	✓	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance to the species feature (harbour seal) when beyond the site boundary, although mitigation is possible. It is noted that this site could potentially be influenced by renewable energy developments in the eastern and central Irish Sea (offshore wind) and Strangford Narrows (tidal) areas; however, mitigation is possible. Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
Murlough	✓	✓	-	-	✓	✓	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance to the species feature (harbour seal) when beyond the site boundary, although mitigation is possible. It is noted that this site could potentially be influenced by renewable energy developments in the eastern and central Irish Sea (offshore wind); however, mitigation is possible. Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
SCOTLAND							
Mull of Galloway	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Luce Bay and Sands	✓	✓	✓	✓	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Solway Firth	✓	✓	-	-	✓	✓	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance to the species features (migratory fish), although mitigation is possible. It is noted that this site could potentially be influenced by renewable energy developments in the Solway Firth, Wigtown Bay and the wider eastern and central Irish Sea (offshore wind); however, mitigation is possible and would be defined by subsequent Habitats Regulations Assessment once project plans are known.
ENGLAND							
Drigg Coast	✓	-	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major fuel oil spill from Block 113/28b, weathered spilled fuel oil could theoretically affect several habitat features (estuaries, mudflats and sandflats, salt marshes), although mitigation would be possible. Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Morecambe Bay	✓	✓	✓	-	-	-	Site conservation objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major fuel oil spill from Block 113/28b, weathered spilled fuel oil could theoretically affect several habitat features (estuaries, inlets and bays, mudflats and sandflats, salt marshes), although mitigation would be possible. Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
Shell Flat and Lune Deep cSAC	✓	-	-	-	-	-	Due to nature of the feature present (sandbanks, reefs), site conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. Physical disturbance would only occur if an activity such as pipeline trenching was to extend over the boundary of Block 110/8 into the cSAC.
Sefton Coast	✓	✓	-	-	-	-	Due to nature of the feature present (dunes), site conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Dee Estuary / Aber Dyfrdwy	✓	✓	-	-	✓	✓	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance to the species features (migratory fish), although mitigation is possible. It is noted that this site could potentially be influenced by renewable energy developments in the eastern and central Irish Sea (offshore wind); however, mitigation is possible. Such mitigation measures would be defined by subsequent Habitats Regulations Assessment once project plans are known.
WALES							
Great Orme's Head / Pen y Gogarth	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Y Fenai a Bae Conwy / Menai Strait and Conwy Bay	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Bae Cemlyn / Cemlyn Bay	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Glannau Ynys Gybi / Holy Island Coast	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.

Notes: [1] ✓denotes feature present; [2] ✓denotes vulnerability to effect; [3] including diesel and/or lube oil

B3 Offshore Special Areas of Conservation

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
Pisces Reef Complex	✓	-	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
Croker Carbonate Slabs	✓	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.

Notes: [1] ✓ denotes feature present; [2] ✓ denotes vulnerability to effect; [3] including diesel and/or lube oil

B4 Riverine Special Areas of Conservation

Site name	Features present[1]		Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
River Bladnoch	-	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
River Eden	✓	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
River Derwent & Bassenthwaite Lake	✓	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
River Ehen	-	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.
River Kent	-	✓	-	-	-	-	Site is remote from blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills.

Notes: [1] ✓denotes feature present; [2] ✓denotes vulnerability to effect; [3] including diesel and/or lube oil

Appendix C – Detailed information on Natura 2000 sites where the potential for effects have been identified

C1 Coastal and marine Special Protection Areas

The following tables provide detailed information of the relevant sites, including full listing of their qualifying features. For Scottish sites where available, information is provided on the assessed condition of the qualifying features, as stated on the SNH sitelink website.

England

Site Name: Duddon Estuary SPA	
Location	Latitude 54º 10'39"N Longitude 03º 15'24"W
Area (ha)	6806.3
Summary	The Duddon Estuary is located north-west of Morecambe Bay on the coast of Cumbria in north-west England. It is formed where the River Duddon and the smaller Kirkby Pool opens into the Irish Sea. It is a complex site, mostly consisting of intertidal sand and mud-flats, important for large numbers of wintering and passage waterbirds. A range of grazed and ungrazed saltmarsh habitats occurs around the edge of the estuary, especially the sheltered inner section. The site is the most important in Cumbria for sand-dune communities including large areas of calcareous dunes at Sandscale and Haverigg Haws and contrasting acid dunes on North Walney. There are a number of settlements and industrial areas on the periphery of the site. Artificial habitats include slag banks and a flooded iron-ore working known as Hodbarrow Lagoon forms the largest coastal lagoon in north-west England. The intertidal sand- and silt-flats contain abundant invertebrates that support important numbers of wintering waterbirds, especially waders, during the migration and winter periods. Saltmarshes, sand dunes and Hodbarrow Lagoon act as important high-tide roosts for wintering waders and wildfowl. High-tide roosts are also found outside the site boundary on the landward side. The site is also of importance for breeding terns which nest in dune areas and slag banks, and feed in the shallow waters of the estuary and surrounding waters. Hodbarrow Lagoon is a key high-tide roosting site for terns.
Qualifying features for which the site is designated:	
Under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: **During the breeding season:** ***Sandwich tern Sterna sandvicensis, 210 pairs representing at least 1.5% of the breeding population in Great Britain (5 year mean, 1988-1992)*** ***Under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:*** Over winter: Knot *Calidris canutus*, 4,495 individuals representing at least 1.3% of the wintering Northeastern Canada/Greenland/Iceland/Northwestern Europe population (5 year peak mean 1991/2 - 1995/6) Pintail *Anas acuta*, 1,636 individuals representing at least 2.7% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)	

Site Name: Duddon Estuary SPA

Redshank *Tringa totanus*, 2,289 individuals representing at least 1.5% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)

The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl
Assemblage qualification: A wetland of international importance.
Over winter, the area regularly supports 78,415 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Curlew *Numenius arquata*, dunlin *Calidris alpina*, sanderling *Calidris alba*, oystercatcher *Haematopus ostralegus*, red-breasted merganser *Mergus serrator*, shelduck *Tadorna tadorna*, redshank *Tringa totanus*, knot *Calidris canutus*, pintail *Anas acuta*.

Conservation objectives:

Annex 1 bird species:
Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of the regularly occurring Annex 1 bird species, under the Birds Directive, in particular:
- Shallow coastal waters

Regularly occurring migratory bird species:
Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of the regularly occurring migratory species, under the Birds Directive, in particular:
- Intertidal mudflats and sandflat communities
- Intertidal and subtidal boulder and cobble skear communities
- Saltmarsh communities

Internationally important assemblage of waterfowl:
Subject to natural change, maintain in favourable condition the habitats for the internationally important assemblage of waterfowl under the Birds Directive, in particular:
- Intertidal mudflat and sandflat communities
- Intertidal and subtidal boulder and cobble skear communities
- Saltmarsh communities

Site Name: Ribble and Alt Estuaries SPA	
Location	Latitude 53º 42'20"N Longitude 02º 59'14"W
Area (ha)	12,412.31
Summary	The Ribble and Alt Estuaries SPA lies on the coast of Lancashire and Merseyside in north-west England. It comprises two estuaries, of which the Ribble Estuary is by far the larger, together with an extensive area of sandy foreshore along the Sefton Coast. It forms part of the chain of western SPAs that fringe the Irish Sea. There is considerable interchange in the movements of wintering birds between this site and Morecambe Bay, the Mersey Estuary, the Dee Estuary and Martin Mere. A large proportion of the SPA is within the Ribble Estuary National Nature Reserve. The site consists of extensive sand- and mud-flats and, particularly in the Ribble Estuary, large areas of saltmarsh. There are also areas of coastal grazing marsh located behind the sea embankments. The intertidal flats are rich in invertebrates, on which waders and some of the wildfowl feed. The highest densities of feeding birds are on the muddier substrates of the Ribble, though sandy shores throughout are also used. The saltmarshes and coastal grazing marshes support high densities of grazing and seed-eating wildfowl and these, together with the intertidal sand- and mud-flats, are used as high-tide roosts. Important populations of waterbirds occur in winter, including swans, geese, ducks and waders. The SPA is also of major importance during the spring and autumn migration periods, especially for wader populations moving along the west coast of Britain. The larger expanses of saltmarsh and areas of coastal grazing marsh support breeding birds during the summer, including large concentrations of gulls and terns. These seabirds feed both offshore and inland, outside the SPA. Several species of waterbirds (notably Pink-footed Goose *Anser brachyrhynchus*) utilise feeding areas on agricultural land outside the SPA boundary.

Qualifying features for which the site is designated:

Under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

During the breeding season:
Common tern *Sterna hirundo*, 182 pairs representing at least 1.5% of the breeding population in Great Britain (Count, as at 1996)

Ruff *Philomachus pugnax*, 1 pairs representing at least 9.1% of the breeding population in Great Britain (Count as at late 1980's)

Over winter:
Bar-tailed godwit *Limosa lapponica*, 18,958 individuals representing at least 35.8% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)

Bewick's swan *Cygnus columbianus bewickii*, 229 individuals representing at least 3.3% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)

Golden plover *Pluvialis apricaria*, 4,277 individuals representing at least 1.7% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)

Whooper swan *Cygnus cygnus,* 159 individuals representing at least 2.9% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)

Under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

During the breeding season:
Lesser black-backed gull *Larus fuscus*, 1,800 pairs representing at least 1.5% of the breeding Western Europe/Mediterranean/Western Africa population (Count as at 1993)

On passage:
Redshank *Tringa totanus*, 2.2% of the population (5 year mean, 1993-1997)

Ringed plover *Charadrius hiaticula*, 995 individuals representing at least 2.0% of the Europe/Northern Africa - wintering population (5 year peak mean 1991/2 - 1995/6)

Site Name: Ribble and Alt Estuaries SPA

Sanderling *Calidris alba*, 6,172 individuals representing at least 6.2% of the Eastern Atlantic/Western & Southern Africa - wintering population (3 year mean May 1993 - 1995)

Whimbrel *Numentius phaeopus*, 13.9% of the UK population (5 year mean 1993-1997)

Over winter:
Black-tailed Godwit *Limosa limosa islandica*, 819 individuals representing at least 1.2% of the wintering Iceland - breeding population (5 year peak mean 1991/2 - 1995/6)

Common scoter *Melanitta nigra*, 2.7% of the UK population (5 year mean 1993-1997)

Cormorant *Phalacrocorax carbo*, 2.4% of the UK population (5 year mean 1993-1997)

Curlew *Numenius arquata*, 1.7% of the UK population (5 year mean 1993-1997)

Dunlin *Calidris alpina alpina*, 39,952 individuals representing at least 2.9% of the wintering Northern Siberia/Europe/Western Africa population (5 year peak mean 1991/2 - 1995/6)

Grey Plover *Pluvialis squatarola*, 6,073 individuals representing at least 4.0% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)

Knot *Calidris canutus*, 57,865 individuals representing at least 16.5% of the wintering Northeastern Canada/Greenland/Iceland/Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)

Lapwing *Vanellus vanellus*, 0.8% of the UK population (5 year mean 1993-1997)

Oystercatcher *Haematopus ostralegus*, 16,159 individuals representing at least 1.8% of the wintering Europe & Northern/Western Africa population (5 year peak mean 1991/2 - 1995/6)

Pink-footed Goose *Anser brachyrhynchus*, 23,860 individuals representing at least 10.6% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean 1991/2 - 1995/6)

Pintail *Anas acuta*, 3,333 individuals representing at least 5.6% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)

Redshank *Tringa totanus*, 2,708 individuals representing at least 1.8% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)

Sanderling *Calidris alba*, 2,859 individuals representing at least 2.9% of the wintering Eastern Atlantic/Western & Southern Africa - wintering population (5 year peak mean 1991/2 - 1995/6)

Scaup *Aythya marila*, 1.0% of the UK population (5 year mean 1993-1997)

Shelduck *Tadorna tadorna*, 4,103 individuals representing at least 1.4% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)

Teal *Anas crecca*, 7,641 individuals representing at least 1.9% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)

Wigeon *Anas penelope*, 84,699 individuals representing at least 6.8% of the wintering Western Siberia/Northwestern/Northeastern Europe population (5 year peak mean 1991/2 - 1995/6)

The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 seabirds
Assemblage qualification: A seabird assemblage of international importance.
During the breeding season, the area regularly supports 29,236 individual seabirds (5 year peak mean 2001) including: Herring gull *Larus argentatus*, lesser black-backed gull *Larus fuscus*, black headed gull *Larus ridibundus*

The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl
Assemblage qualification: A wetland of international importance.
Over winter, the area regularly supports 323,861 individual waterfowl (5 year peak mean for 2001) including: Great crested grebe *Podiceps cristatus*, bar-tailed godwit *Limosa lapponica*, pink-footed goose *Anser*

Site Name: Ribble and Alt Estuaries SPA
brachyrhynchus, shelduck *Tadorna tadorna*, pintail *Anas acuta*, oystercatcher *Haematopus ostralegus*, grey plover *Pluvialis squatarola*, knot *Calidris canutus*, dunlin *Calidris alpina alpina*, curlew *Numenius arquata*, golden plover *Pluvialis apricaria*, turnstone *Arenaria interpres*, black-tailed godwit *Limosa limosa islandica*, cormorant *Phalacrocorax carbo*, wigeon *Anas penelope*, teal *Anas crecca*, mallard *Anas platyrhynchos*, eider *Somateria mollissima*, goldeneye *Bucephala clangula*, red-breasted merganser *Mergus serrator*, ringed plover *Charadrius hiaticula*, lapwing *Vanellus vanellus*, sanderling *Calidris alba*, redshank *Tringa totanus*, whimbrel *Numenius phaeopus*.
Conservation objectives:
Subject to natural change, to maintain (or restore to favourable condition if features are judged to be unfavourable) the habitats in favourable condition, with particular reference to any dependent component special interest features for which the land is designated, as individually listed above.

Site Name: Morecambe Bay SPA	
Location	Latitude 54º 07'19"N Longitude 02º 57'21"W
Area (ha)	37404.6
Summary	Morecambe Bay is located on the Irish Sea coast of north-west England. It is one of the largest estuarine systems in the UK and is fed by five main river channels (the Leven, Kent, Keer, Lune and Wyre) which drain through the intertidal flats of sand and mud. Mussel *Mytilus edulis* beds and banks of shingle are present, and locally there are stony outcrops. The whole system is dynamic, with shifting channels and phases of erosion and accretion affecting the estuarine deposits and surrounding saltmarshes. The flats contain an abundant invertebrate fauna that supports many of the waterbirds using the bay. The capacity of the bay to support large numbers of birds derives from these rich intertidal food sources together with adjacent freshwater wetlands, fringing saltmarshes and saline lagoons, as well as dock structures and shingle banks that provide secure roosts at high tide. The site is of European importance throughout the year for a wide range of bird species. In summer, areas of shingle and sand hold breeding populations of terns, whilst very large numbers of geese, ducks and waders not only overwinter, but (especially for waders) also use the site in spring and autumn migration periods. The bay is of particular importance during migration periods for waders moving up the west coast of Britain.

Qualifying features for which the site is designated:

Under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

During the breeding season:
Sandwich tern *Sterna sandvicensis*, 290 pairs representing at least 2.1% of the breeding population in Great Britain (5 year peak mean for 1992 to 1996)

Under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

Over winter:
Bar-tailed godwit *Limosa lapponica*, 2.6% of the Eastern Flyway population (5 year peak mean for 1991/92 to 1995/96)

Curlew *Numenius arquata*, 13,620 individuals representing at least 3.9% of the wintering Europe - breeding population (5 year peak mean for 1991/92 to 1995/96)

Dunlin *Calidris alpina alpina*, 52,671 individuals representing at least 3.8% of the wintering Northern Siberia/Europe/Western Africa population (5 year peak mean for 1991/92 to 1995/96)

Grey plover *Pluvialis squatarola*, 1,813 individuals representing at least 1.2% of the wintering Eastern Atlantic - wintering population (5 year peak mean for 1991/92 to 1995/96)

Knot *Calidris canutus*, 29,426 individuals representing at least 8.4% of the wintering Northeastern Canada/Greenland/Iceland/Northwestern Europe population (5 year peak mean for 1991/92 to 1995/96)

Oystercatcher *Haematopus ostralegus*, 47,572 individuals representing at least 5.3% of the wintering Europe & Northern/Western Africa population (5 year peak mean for 1991/92 to 1995/96)

Pink-footed goose *Anser brachyrhynchus*, 2,475 individuals representing at least 1.1% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean for 1991/92 to 1995/96)

Pintail *Anas acuta*, 2,804 individuals representing at least 4.7% of the wintering Northwestern Europe population (5 year peak mean for 1991/92 to 1995/96)

Redshank *Tringa totanus*, 6,336 individuals representing at least 4.2% of the wintering Eastern Atlantic - wintering population (5 year peak mean for 1989/90 to 1993/94)

Shelduck *Tadorna tadorna*, 6,372 individuals representing at least 2.1% of the wintering Northwestern Europe population (5 year peak mean for 1991/92 to 1995/96)

Site Name: Morecambe Bay SPA

Turnstone *Arenaria interpres*, 1,583 individuals representing at least 2.3% of the wintering Western Palearctic - wintering population (5 year peak mean for 1991/92 to 1995/96)

The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 seabirds
Assemblage qualification: A seabird assemblage of international importance.
During the breeding season, the area regularly supports 61,858 individual seabirds (5 year peak mean for 1991/92 to 1995/96) including: Herring gull *Larus argentatus*, lesser black-backed gull *Larus fuscus*, little tern *Sterna albifrons*, Sandwich tern *Sterna sandvicensis*.

The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl
Assemblage qualification: A wetland of international importance.
Over winter, the area regularly supports 210,668 individual waterfowl (5 year peak mean for 1991/92 to 1995/96) including: Great crested grebe *Podiceps cristatus*, bar-tailed godwit *Limosa lapponica*, pink-footed goose *Anser brachyrhynchus*, shelduck *Tadorna tadorna*, pintail *Anas acuta*, oystercatcher *Haematopus ostralegus*, grey plover *Pluvialis squatarola*, knot *Calidris canutus*, dunlin *Calidris alpina alpina*, curlew *Numenius arquata*, golden plover *Pluvialis apricaria*, turnstone *Arenaria interpres*, black-tailed godwit *Limosa limosa islandica*, cormorant *Phalacrocorax carbo*, wigeon *Anas penelope*, teal *Anas crecca*, mallard *Anas platyrhynchos*, eider *Somateria mollissima*, goldeneye *Bucephala clangula*, red-breasted merganser *Mergus serrator*, ringed plover *Charadrius hiaticula*, lapwing *Vanellus vanellus*, sanderling *Calidris alba*, redshank *Tringa totanus*, whimbrel *Numenius phaeopus*.

Conservation objectives:

Subject to natural change, to maintain in favourable condition5 the habitats of the internationally important populations of regularly occurring bird species listed on Annex 1 of the Birds Directive, in particular:

- Shingle areas

Subject to natural change, to maintain in favourable condition5 the habitats of the internationally important assemblage of waterfowl and seabirds and the internationally important populations of regularly occurring migratory species, in particular:

- Intertidal mudflat and sandflat communities
- Intertidal and subtidal boulder and cobble skear communities
- Saltmarsh communities
- Coastal lagoon communities

Note: These SPA conservation objectives focus on habitat condition in recognition that bird populations may change as a reflection of national or international trends or events. Annual counts for qualifying species will be used by English Nature, in the context of five year peak means, together with available information on UK population and distribution trends, to assess whether this SPA is continuing to make an appropriate contribution to the Favourable Conservation Status of the species across Europe.

England / Wales

Site Name: Bae Lerpwl / Liverpool Bay marine SPA	
Location	Latitude 53º 36'10"N Longitude 03º 12'34"W
Area (ha)	170,292.94
Summary	Liverpool Bay is located in the south-eastern region of the northern part of the Irish Sea, bordering north-west England and north Wales. The SPA is a broad arc from Morecambe Bay to the east coast of Anglesey. The sea bed of the SPA consists of a wide range of mobile sediments. Large areas of muddy sand stretch from Rossall Point to the Ribble Estuary, and sand predominates in the remaining areas, with a concentrated area of gravelly sand off the Mersey Estuary and a number of prominent sandbanks off the English and Welsh coasts. The tidal currents throughout the SPA are generally weak, which combined with a relatively large tidal range facilitates the deposition of sediments. The seabed and waters of the site provide an important habitat in the non-breeding season for major concentrations of red-throated divers *Gavia stellata* and sea-ducks, notably common scoter *Melanitta nigra*, which visit the area to feed on the fish, mollusc and crustacean populations. The area is also a feeding ground for breeding and passage terns.
Qualifying features for which the site is designated:	
Under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: **Over winter:** ***Red throated diver Gavia stellata, 922 individuals representing at least 5.6% of the UK population (5 year mean, 2001-2006)*** ***Under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:*** **Over winter:** Common scoter *Melanitta nigra*, 54,675 individuals representing 3.4% of the population in NW Europe (5 year mean, 2001-2006) ***The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl*** ***Assemblage qualification: A wetland of international importance.*** Over winter, the area regularly supports 55,597 individual waterfowl (5 year peak mean 2001-2006)	
Conservation objectives:	
Red-throated diver (*Gavia stellata*) To maintain the red-throated diver population and its supporting habitats in favourable condition. The interest feature red-throated diver will be considered to be in favourable condition only when all of the following conditions are met: • The 5 year peak mean population size for the red-throated diver population is no less than 922 individuals (i.e. the five-year peak mean between 2001/02 – 2006/07); • (The overall presence and abundance of prey species within the site is maintained; • (Red-throated divers are not exposed to significant human-induced mortality, and areas where they congregate in higher densities are not subject to significant disturbance. **Common scoter (*Melanitta nigra*)** To maintain the common scoter population and its supporting habitats in favourable condition. The interest feature common scoter will be considered to be in favourable condition only when all of the following conditions are met: • The 5 year peak mean population size for the common scoter population is no less than 54,675 individuals (i.e. the five-year peak mean between 2001/02 – 2006/07); • The overall presence and abundance of benthic prey species within the site is maintained, along with its associated features; • Common scoters are not exposed to significant human-induced mortality, and their aggregations are not subject to significant disturbance; • The movement of common scoters between feeding and resting areas is not significantly impeded.	

Site Name: Bae Lerpwl / Liverpool Bay marine SPA

Area being used by over 20,000 waterfowl or 20,000 seabirds in any season

To maintain the waterfowl assemblage and its supporting habitat in favourable condition:

- The interest feature waterfowl assemblage will be considered to be in favourable condition when all of the following conditions are met:
- The peak mean population size for the waterfowl assemblage is no less than 55,597 (ie the five-year peak mean between 2001/02 – 2006/07);
- Aggregations of waterfowl and seabirds at feeding and resting sites are not subject to significant disturbance.

C2 Coastal and marine Special Areas of Conservation

Northern Ireland

Site Name: Strangford Lough SAC	
Location	Latitude 54º 26'40"N Longitude 05º 35'40"E
Area (ha)	15,398.54
Summary	The intertidal mudflats and sandflats in the north of Strangford Lough represent the largest single continuous area of such habitat in Northern Ireland. There are very extensive areas of muddy sand from Newtownards to Ardmillan Bay in the west and to Greyabbey in the east. The habitat also occurs in the south-west reaches of the Lough along the northern shore of Lecale. The northern flats support luxuriant beds of the eelgrasses *Zostera noltei* and *Z. angustifolia*. Common eelgrass *Z. marina* and tasselled pondweed *Ruppia maritima* are also present, the latter being widespread but quite local in its distribution. Such extensive beds are rare in the British Isles.
Qualifying features for which the site is designated:	
Annex I Habitat Primary: Mudflats and sandflats not covered by seawater at low tide, coastal lagoons *priority feature, large shallow inlets and bays, reefs Secondary: Annual vegetation of drift lines, perennial vegetation of stony banks, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-puccinellietalia maritimae*). **Annex II Species** Secondary: Harbour seal *Phoca vitulina*	
Conservation objectives:	
For Annex I Habitats **Large shallow inlets and bays** To maintain the large shallow inlet and bay and its characteristic species and habitats in favourable condition, allowing for natural change. The physical regime of the Lough including water quality is essential to the favourable condition of the overall feature and the following selected attributes will be measured: Attributes: • extent of the feature • water clarity • water salinity and temperature • nutrient status The assessment of the biodiversity and abundance of plankton is still under consideration. All the marine SAC features will contribute to the overall condition assessment of the large shallow inlet and bay as they are all part of a single system. In addition, the favourable condition of the feature will be informed by the condition of selected attributes for the following two key contributory subfeatures: Sub-features: Subtidal gravel and sand communities Subtidal fine sand and mud communities Attributes: • extent of the sub-features • the presence of a selection of characteristic biotopes for each of the above communities at sites chosen to indicate the distribution and extent of each sub-feature • species composition of selected biotopes at monitoring sites **Coastal Lagoons** To maintain the coastal lagoons and their characteristic species and habitats in favourable condition, allowing for natural change. Attributes: • extent of the feature • the presence of a selection of characteristic biotopes at sites chosen to indicate the distribution and extent of the feature	

Site Name: Strangford Lough SAC

- species composition of selected biotopes at monitoring sites

Mudflats and Sandflats not Covered by Sea Water at Low Tide
To maintain the mudflats and sandflats not covered by sea water at low tide and their characteristic species in favourable condition, allowing for natural change. Sub-features: Intertidal sand and gravel communities Intertidal fine sand and mud communities

Attributes:
- extent of the feature and sub-features
- the presence of a selection of characteristic biotopes at sites chosen to indicate the distribution and extent of each sub-feature
- species composition of selected biotopes at monitoring sites
- substrate mobility
- substrate availability

Sub-feature: Eelgrass (*Zostera* spp.) beds

Attributes:
- distribution of *Zostera* beds
- extent of *Zostera* beds
- biomass
- density

Reefs
To maintain the reefs and their characteristic species in favourable condition, allowing for natural change.

Sub-features: Subtidal rock and boulder communities
Subtidal rocky reef communities
Intertidal rock and boulder communities

Attributes:
- extent of the feature and sub-features
- the presence of a selection of characteristic biotopes
- at sites chosen to indicate the distribution and extent of
- each sub-feature
- species composition of selected biotopes at monitoring sites

Sub-feature: Horse Mussel (*Modiolus modiolus*) beds

Attributes:
- distribution of *Modiolus* beds
- extent and percentage cover of *Modiolus* beds
- structure of *Modiolus* beds
- species index of *Modiolus* beds

Annual Vegetation of Drift Lines
To maintain the annual vegetation of drift lines and their characteristic species in favourable condition, allowing for natural change.

Attributes:
- extent of the feature
- substrate mobility
- substrate availability
- presence of characteristic species
- presence of rare and notable species

Atlantic Salt Meadows (*Glauco-puccinellietalia maritimae*)
To maintain the Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) and their characteristic species in favourable condition, allowing for natural change.

Attributes:
- extent of the feature

Site Name: Strangford Lough SAC
• substrate mobility • vegetation composition • vegetation structure ***Salicornia* and Other Annuals Colonising Mud and Sand** To maintain the *Salicornia* and other annuals colonising mud and sand and their characteristic species in favourable condition, allowing for natural change. Attributes: • extent of the feature • substrate mobility • vegetation composition • vegetation structure **Perennial Vegetation of Stony Banks** To maintain the perennial vegetation of stony banks and their characteristic species in favourable condition, allowing for natural change. Attributes: • extent of the feature • substrate mobility • vegetation structure • vegetation composition
For Annex II Species **Harbour Seal (*Phoca vitulina*)** *To* maintain the population of *Phoca vitulina* in favourable condition, allowing for natural change. Attributes: • number of adults • number of pups • mother and pup resident time • habitat availability

Site Name: Murlough SAC	
Location	Latitude 54º 12'40"N Longitude 05º 47'00"E
Area (ha)	11,902.03
Summary	Murlough is one of the most diverse and natural dune systems in Northern Ireland. The site is an ancient system with acidic sands and a long history of traditional management. A complex mosaic of different communities, some of which are very species-rich, covers the 'grey dunes'. Marram *Ammophila arenaria* and red fescue *Festuca rubra* are dominant over much of the area, while species such as common restharrow *Ononis repens* and wild thyme *Thymus polytrichus* are prevalent where the sward is shorter and more herb-rich. These grey dunes form part of a well-developed natural succession from 2110 Embryonic shifting dunes and 2120 Shifting dunes along the shoreline on the seaward side, to areas of dune heath and gorse *Ulex europaeus* scrub on the landward side.

Qualifying features for which the site is designated:

Annex I Habitat

Primary: Fixed dunes with herbaceous vegetation (grey dunes)*priority feature, Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)*priority feature

Secondary: Sandbanks which are slightly covered by seawater all the time, mudflats and sandflats not covered by seawater at low tide, Atlantic salt meadows (*Glauco-puccinellietalia maritimae*), embryonic shifting dunes, shifting dunes along the shoreline with *Ammophila arenaria*, dunes with *Salix repens spp.argentea* (*Salicion arenariae*).

Annex II Species

Primary: Marsh fritillary butterfly *Euphydryas aurinia*

Secondary: Harbour seal *Phoca vitulina*

Conservation objectives:

For Annex I Habitats

Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)

- Maintain and if feasible, expand the extent of existing decalcified fixed dune, H 11 and H10. Increase permitted into areas of rank dune grassland, not into spp-rich short turf (Grey Dune SD8)
- Maintain and enhance structural and species diversity within the H11 and H10 communities including the presence of notable species
- Seek nature conservation management over suitable areas immediately outside the SAC where there is possibility of restoring decalcified fixed dune - to be determined
- Maintain the diversity and quality of habitats associated with the decalcified fixed dunes, e.g. neutral grasslands, scrub, especially where these exhibit natural transition to decalcified fixed dune vegetation.

Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

- Maintain and expand the extent of existing Fixed dunes with Salix repens. Increase permitted into areas of rank dune grassland, NOT into spp-rich short turf (Grey Dune SD8).
- Maintain and enhance species diversity within the SD16 community including the presence of notable species.
- Seek nature conservation management over suitable areas immediately outside the SAC where there is possibility of restoring fixed dune with Salix repens - to be determined

Embryonic shifting dunes

- Maintain or enhance the extent of embryonic shifting d unes subject to natural processes
- Allow the natural processes which determine the development and extent of embryonic shifting dunes to operate appropriately

Fixed dunes with herbaceous vegetation (grey dunes)

- Maintain and expand the extent of existing species-rich fixed dune, SD8.
- Maintain and enhance species diversity within the SD8 community including the presence of notable species.
- Seek nature conservation management over suitable areas immediately outside the SAC where there is possibility of restoring fixed dune - to be determined
- Maintain the diversity and quality of habitats associated with the fixed dunes, e.g. neutral grasslands, scrub, especially where these exhibit natural transitions to fixed dune vegetation.

Site Name: Murlough SAC

Mudflats and sandflats not covered by seawater at low tide

- Maintain the extent of mudflats and sandflats not covered by sea water at low tide
- Allow the natural processes which determine the development, structure and extent of mudflats and sandflats not covered by sea water at low tide, to operate appropriately
- Maintain and enhance, as appropriate, the species diversity within this habitat.

Sandbanks which are slightly covered by sea water all the time

- Allow the natural processes which determine the development, structure and extent of sandbanks which are slightly covered by sea water all the time, to operate appropriately
- Maintain and enhance, as appropriate, the species diversity within this habitat.
- Maintain the extent and volume of sandbanks which are slightly covered by sea water all the time, subject to natural processes.

Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)

- Maintain and enhance the extent of white dunes subject to natural processes
- Allow the natural processes which determine the development and extent of white dunes to operate appropriately
- Maintain and enhance, as appropriate, the species diversity within this community

For Annex II Species

Marsh fritillary butterfly (*Eurodryas aurinia*):

- Maintain (and if feasible enhance) population numbers and distribution
- Maintain (and if feasible enhance) the extent and quality of suitable Marsh Fritillary breeding habitat, particularly suitable rosettes of the larval food plant *Succisa pratensis*

Harbour seal (*Phoca vitulina*):

- Maintain (and if feasible enhance) population numbers and distribution of harbour Seal.
- Maintain and enhance, as appropriate, physical features used by harbour Seals within the site.

Scotland

Site Name: Solway Firth SAC	
Location	Latitude 54º 58'15"N Longitude 03º 20'12"E
Area (ha)	43,636.72
Summary	The Solway is representative of sublittoral sandbanks on the coast of north-west England/south-west Scotland. The sandbanks comprise mainly gravelly and clean sands, owing in part to the very dynamic nature of the estuary. The inner estuary contains constantly changing channels, and a predominance of sand is characteristic of such high-energy systems. There is a transition to less extreme conditions in the outer estuary. The dominant species of the infaunal communities comprise different annelid worms, crustaceans, molluscs and echinoderms, depending on the nature of the substrate.
Qualifying features for which the site is designated:	
Annex I Habitat Primary: Sandbanks which are slightly covered by seawater all the time, estuaries, mudflats and sandflats not covered by seawater at low tide, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-puccinellietalia maritimae*) Secondary: Reefs, perennial vegetation of stony banks, fixed dunes with herbaceous vegetation*priority feature **Annex II Species** Primary: Sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*	
Conservation objectives:	
For Annex I Habitats To avoid deterioration of the qualifying habitats (listed above), thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest. To ensure for the qualifying habitats that the following are maintained in the long term: • Extent of the habitats on site • Distribution of the habitats within site • Structure and function of the habitats • Processes supporting the habitats • Distribution of typical species of the habitats • Viability of typical species as components of the habitats • No significant disturbance of typical species of the habitats	
For Annex II Species To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest. To ensure for the qualifying species that the following are established then maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within the site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species	

Site Name: Luce Bay and Sands SAC	
Location	Latitude 54º45'00"N Longitude 04º45'00"E
Area (ha)	48,759.28
Summary	Luce Bay and Sands represents a high-quality large shallow inlet and bay. The sediments within Luce Bay range from mixed-sized boulders, deep sediments and highly mobile fringing sands, all of which support rich plant and animal communities typical of a large embayment in south-west Scotland. Water depths in Luce Bay are shallow, ranging from 0-10m fringing the coastline and at the head of the bay. Shallow depths extend further out into the bay where the major sandbanks are located along the western and northern shores. The water deepens to 20m at the site boundary between the two headlands. Most of the intertidal area of the bay comprises small boulders, often resting on sediment. Some larger boulders on the lower shores have spaces beneath and between them which provide shelter for false Irish moss *Mastocarpus stellatus* and permit rich under-boulder communities to develop, including ascidians, sponges and crustose coralline algae. In the subtidal area mixed boulders and sediment harbour a shallow-water community of sparse kelp *Laminaria hyperborea* and sea-oak *Halidrys siliquosa*, red algae and the dahlia anemone *Urticina felina*, typical of sand-influenced hard substrata. Much of the central part of Luce Bay consists of slightly deeper-water sediments that support a rich community of polychaete worms, bivalves, echinoderms, brittlestars, particularly *Ophiura* spp. The holothurian *Labidoplax digitata* has also been recorded in the bay. At Mull of Galloway in the west and Scare Rocks near the seaward boundary of the bay, tide-swept rocky reefs support *L. hyperborea* on shallow sublittoral rocks and very rich sponge- and hydroid-dominated communities below 10m. The length of the dune front at this site, combined with its comparative inaccessibility, helps to ensure that there is an identifiable zone of embryonic shifting dune vegetation. The site also has examples of two types of shifting dune vegetation. The foredunes are morphologically less active than other sites in this part of the UK, with less sand accretion and erosion. There is a large, acidic dune system on the north side of the Solway Firth. There are a range of dune types, providing considerable diversity and complexity along with associated dune slack, fen and heath habitats. Torrs Warren-Luce Sands is the largest acidic dune system in south-west Scotland and supports extensive areas of Atlantic decalcified fixed dunes (*Calluno-Ulicetea*). . It contains a variety of dune landforms and therefore a complex mosaic of dune habitats. The dunes are relatively undisturbed and are more or less free from grazing by domestic livestock, resulting in relatively stable vegetation communities.
Qualifying features for which the site is designated:	
Annex I Habitat Primary: Large shallow inlets and bays, Embryonic shifting dunes, Shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes`), Fixed dunes with herbaceous vegetation (`grey dunes`) * Priority feature, Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) * Priority feature Secondary: Sandbanks which are slightly covered by sea water all the time, Mudflats and sandflats not covered by seawater at low tide, Reefs **Annex II Species** Primary: None Secondary: Great crested newt *Triturus cristatus*	
Conservation objectives:	
For Annex I Habitats To avoid deterioration of the qualifying habitats (listed above), thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest. To ensure for the qualifying habitats that the following are maintained in the long term: • Extent of the habitats on site • Distribution of the habitats within site • Structure and function of the habitats • Processes supporting the habitats • Distribution of typical species of the habitats • Viability of typical species as components of the habitats • No significant disturbance of typical species of the habitats	

Site Name: Luce Bay and Sands SAC

For Annex II Species

To avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest. To ensure for the qualifying species that the following are established then maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within the site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

England

Site Name: Drigg Coast SAC	
Location	Latitude 54º 21'02"N Longitude 03º 25'47"E
Area (ha)	1,397.44
Summary	Drigg is an example of a small, bar-built estuary on the north-west coast of England. It is fed by three rivers (the Irt, Mite and Esk) which discharge through a mouth that has been narrowed by large sand and shingle spits. The sediments within the estuary are largely muddy within the Rivers Irt and Mite, while those of the Esk are more sandy, particularly towards the mouth. There is a substantial freshwater influence in the upper reaches of all three rivers, with good development of associated animal communities. Within the site are some of the least-disturbed transitions to terrestrial habitats of any estuary found in the UK.
Qualifying features for which the site is designated:	
Annex I Habitat Primary: Estuaries, Altlantic decalcified fixed dunes (*Calluno-Ulicetea*) *priority feature, dunes with *Salix repens spp. argentea* Secondary: Mudflats and sandflats not covered by seawater at low tide, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-puccinellietalia maritimae*), embryonic shifting dunes, shifting dunes along the shoreline with *Ammophila arenaria*, fixed dunes with herbaceous vegetation* priority feature, humid dune slacks **Annex II Species** N/A	
Conservation objectives:	
For Annex I Habitats Subject to natural change, maintain the estuaries in favourable condition, in particular: • Intertidal mudflat and sandflat communities • Saltmarsh communities • Boulder and cobble scar communities In pursuit of the conservation objective for the estuary complex, the relevant and competent authorities for the Drigg Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance to the habitats or species for which the site has been selected, through any of the following: • Increased radionuclide toxic contamination • Nutrient and/or organic enrichment	

Site Name: Morecambe Bay SAC	
Location	Latitude 54º 07'09"N Longitude 02º 57'42"E
Area (ha)	61,506.22
Summary	Morecambe Bay in north-west England is the confluence of four principal estuaries, the Leven, Kent, Lune and Wyre (the latter lies just outside the site boundary), together with other smaller examples such as the Keer. Collectively these form the largest single area of continuous intertidal mudflats and sandflats in the UK and the best example of muddy sandflats on the west coast. The estuaries are macro-tidal with a spring tidal range of 9m. The significant tidal prisms of the estuaries result in the Bay being riven by large low-water channel systems. The Kent, Leven and Lune estuaries have been modified variously by railway embankments, flood embankments and training walls but support extensive intertidal areas. Although cobble 'skears' and shingle beaches occur at their mouths, the estuaries consist predominantly of fine sands and muddy sands. The estuaries support dense invertebrate communities, their composition reflecting the salinity and sediment regimes within each estuary. Extensive saltmarshes and glasswort *Salicornia* spp. beds are present in the Lune estuary, contrasting with the fringing saltmarshes and more open intertidal flats of the Leven and Kent estuaries.

Qualifying features for which the site is designated:

Annex I Habitat
Primary: Estuaries, mudflats and sandflats not covered by seawater at low tide, large shallow inlets and bays, reefs, perennial vegetation of stony banks, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows, shifting dunes along the shoreline with *Ammophila arenaria*, fixed dunes with herbaceous vegetation, humid dunes slacks
Secondary: sandbanks which are slightly covered by seawater all the time, coastal lagoons, reefs, embryonic shifting dunes, Atlantic decalcified fixed dunes (*Calluno-Ulicetea*), dunes with *Salix repens spp. argentea* (*Salicion arenariae*)

Annex II Species
Great crested newt *Triturus cristatus*

Conservation objectives:

For Annex I Habitats

Large shallow inlets and bays
Subject to natural change, maintain the large shallow inlets and bays in favourable condition, in particular:

- Intertidal boulder and cobble skear communities
- Subtidal boulder and cobble skear communities
- Brittlestar bed communities
- Intertidal boulder clay communities
- Coastal lagoon communities
- Intertidal mudflat and sandflat communities
- Pioneer saltmarsh communities
- Saltmarsh communities

Mudflats and sandflats not covered by seawater at low tide
Subject to natural change, maintain the mudflats and sandflats not covered by seawater at low tide (intertidal mudflats and sandflats) in favourable condition5, in particular:

- Mud communities
- Sand communities
- Eelgrass bed communities

Glasswort *Salicornia* spp and other annuals colonising mud and sand
Subject to natural change, maintain the Glasswort *Salicornia* spp and other annuals colonising mud and sand (pioneer saltmarsh) in favourable condition, in particular:

- The glasswort *Salicornia* spp communities

Atlantic salt meadows *Glauco-Puccinellietalia*
Subject to natural change, maintain the Atlantic salt meadows *Glauco-Puccinellietalia* (saltmarsh) in favourable condition, in particular:

- Low marsh communities
- Mid marsh communities

Site Name: Morecambe Bay SAC
• High marsh communities • Transitional high marsh communities
For Annex II Species Conservation objectives for species not listed in Regulation 33 advice for Morecambe Bay SAC. Assumed that, subject to natural change, the overall objective is to maintain futures in a favourable condition; avoid deterioration of the habitats of the qualifying species (listed above) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest. To ensure for the qualifying species that the following are established then maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within the site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species

England / Wales

Site Name: Dee Estuary / Aber Dyfrdwy SAC	
Location	Latitude 53º 19'39"N Longitude 03º 12'53"E
Area (ha)	15,805.07
Summary	The Dee Estuary forms the most extensive type of saltmarsh in the Dee, and since the 1980s it has probably displaced very large quantities of the non-native common cord-grass *Spartina anglica*. The high accretion rates found in the estuary are likely to favour further development of this type of vegetation. The saltmarsh is regularly inundated by the sea; characteristic salt-tolerant perennial flowering plant species include common saltmarsh-grass *Puccinellia maritima*, sea aster *Aster tripolium*, and sea arrowgrass *Triglochin maritima*. In a few areas there are unusual transitions to wet woodland habitats.

Qualifying features for which the site is designated:

Annex I Habitat
Primary: Mudflats and sandflats not covered by seawater at low tide, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-puccinellietalia maritimae*)
Secondary: Estuaries, annual vegetation of drift lines, vegetated sea cliffs of the Atlantic and Baltic coasts, embryonic shifting dunes, shifting dunes along the shoreline with *Ammophila arenaria*, fixed dunes with herbaceous vegetation*priority feature, humid dune slacks

Annex II Species
Secondary: Sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, petalwort *Petalophyllum ralfsii*

Conservation objectives:

For Annex I Habitats, the following features will be considered to be in favourable condition when:

Estuaries

- the aggregate total extent of all estuarine communities within the site is maintained
- the spatial distribution of estuarine communities within the site is maintained
- the extent of individual estuarine habitat features within the site is maintained
- the variety and relative proportions of sediment and rocky substrates within the estuary is maintained
- the variety and extent of any notable subtidal sediment communities is maintained
- the variety and extent of notable intertidal hard substrata communities is maintained
- the spatial and temporal patterns of salinity, suspended sediments and nutrients concentrations are maintained within limits sufficient to satisfy the requirements of the statements above

Mudflats and sandflats

- the total extent of mudflat and sandflat communities within the site is maintained
- the proportions of individual mudflat and sandflat communities within the site are maintained
- the topography of the intertidal flats and the dynamic processes of channel migration and sinuosity across the flats are maintained
- the abundance of typical species of the mudflat and sandflat feature within the site is maintained

***Salicornia* and other annuals colonising mud and sand**

- subject to natural processes, each of the following conditions are met
- the total extent of pioneer saltmarsh vegetation communities within the site is maintained
- the presence of pioneer saltmarsh vegetation communities as part of transitions from intertidal sediment communities to higher saltmarsh are maintained
- the abundance of the typical species of the pioneer saltmarsh vegetation communities is maintained;
- the abundance of the notable species of the pioneer saltmarsh vegetation communities is maintained.
- and, regardless of natural processes the overall extent and abundance of common cord grass *Spartina anglica* is not increasing within the pioneer saltmarsh zone

Atlantic salt meadow

- the total extent of Atlantic salt meadow vegetation communities within the site is maintained
- the proportions of individual Atlantic salt meadow vegetation communities within the site are maintained
- the zonation of Atlantic salt meadow vegetation communities2 and their transitions to fresh water and terrestrial vegetation are maintained
- the morphology of saltmarsh creeks and pans and the process of their evolution are maintained

Site Name: Dee Estuary / Aber Dyfrdwy SAC

- the extent of ungrazed areas of salt meadow within the estuary is maintained and there is no increase in grazing intensity over the rest of the salt meadow
- the relative abundance of the typical species3 of the Atlantic salt meadow vegetation communities is maintained
- the abundance of the notable species4 of the Atlantic salt meadow vegetation communities is maintained

Annual vegetation of drift lines

- the extent of coarse sediment / shingle formations capable of supporting drift line vegetation communities within the site is maintained
- the presence of annual drift line vegetation communities within the site is maintained
- the presence of the typical species of the annual drift line vegetation communities is maintained

For Annex II Species, the following features will be considered to be in favourable condition when:

***Lampetra fluviatilis* (river lamprey)**
subject to natural processes, each of the following conditions are met:

- the migratory passage of both adult and juvenile river lamprey through the Dee Estuary between Liverpool Bay and the River Dee is unobstructed by physical barriers and / or poor water quality
- the five year mean count of river lampreys recorded by the Chester Weir fish trap is no less than 55 under the monitoring regime**2** in use prior to notification [*i.e. 100% of the mean annual count during the five years for which data are available prior to notification: 1993, 1997-2000*]
- the abundance of prey species**3** forming the river lamprey's food resource within the estuary, is maintained

***Petromyzon marinus* (sea lamprey)**
subject to natural processes, each of the following conditions are met:

- the migratory passage of both adult and juvenile sea lampreys through the Dee Estuary between Liverpool Bay and the River Dee is unobstructed by physical barriers and / or poor water quality
- the five year mean count of sea lampreys recorded by the Chester Weir fish trap is no less than 18 under the monitoring regime in use prior to notification. [*i.e. 100% of the mean annual count during the five years for which data are available prior to notification: 1993, 1997-2000*]
- the abundance of prey species**3** forming the sea lamprey's food resource within the estuary, is maintained

Source: The Dee Estuary European Marine Site. Natural England & the Countryside Council for Wales' advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994, January 2010. – see document for explanatory notes on conservation objectives.

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