Department of Energy & Climate Change

Offshore Oil & Gas Licensing

27th Seaward Round

Eastern Irish Sea

Blocks 110/4b, 110/5, 110/9c, 110/10, 113/22 & 113/27d

Habitats Regulations Assessment

Appropriate Assessment

March 2013

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1 Introduction

1.1 Background and purpose

On 1st February 2012, the Secretary of State for the Department of Energy and Climate Change (DECC) invited applications for licences in the 27th Seaward Licensing Round. Applications for Traditional Seaward, Frontier Seaward and Promote Licences covering over 400 Blocks/part Blocks were received.

To comply with obligations under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), in summer 2012, 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 2012a).

In so doing, the Department has applied the Habitats Directive test (elucidated by the European Court of Justice in the case of *Waddenzee* (Case C-127/02) which test is:

> Any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives 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 61 whole or part Blocks as requiring further assessment prior to decisions on whether to grant licences (DECC 2012a). 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
- West of Shetland
- Northern Ireland
- Eastern Irish Sea
- Central English Channel

This report documents the further assessment in relation to 6 Blocks in the eastern Irish Sea (see Section 1.2).

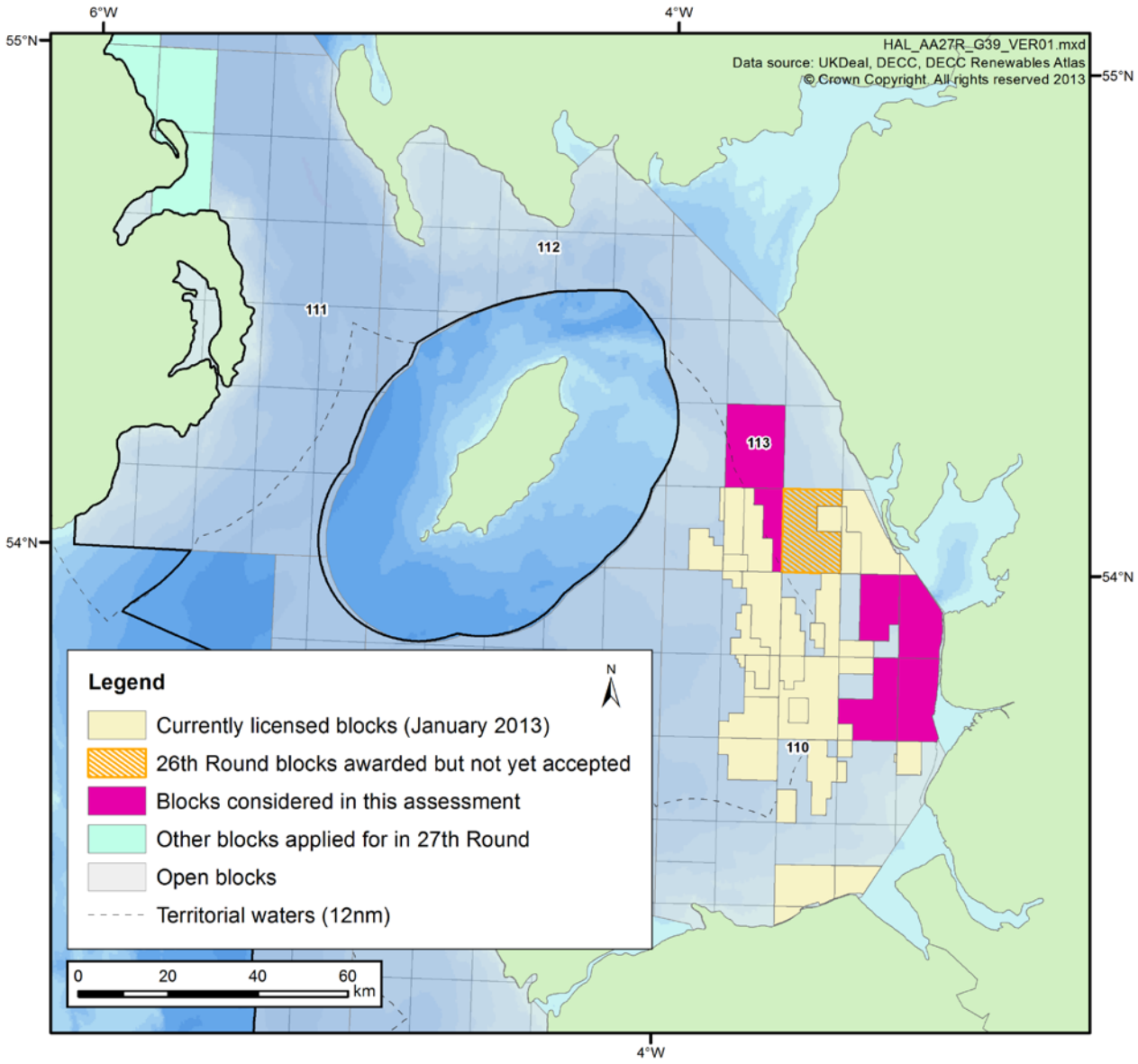
1.2 Eastern Irish Sea Blocks

The eastern Irish Sea Blocks applied for in the 27th Round considered in this document are listed below and shown in magenta in Figure 1.1.

110/4b 110/5 110/9c 110/10 113/22

113/27d

Figure 1.1: Location of Eastern Irish Sea Blocks



Note: Open blocks are currently unlicensed, although they may have been licensed in the past.

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). A variation on the Frontier Production Licence was introduced prior to the 26th Round. Designed for the particularly harsh West of Scotland environment, it is similar to the existing Frontier Licence but with an initial term of nine years with a Drill-or-Drop decision to be made by the end of the sixth year and (if the licensee chooses to drill) drilling to be completed within the remaining three years of the initial term.

- 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 Block(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 Frontier licences) are detailed in the licence applications. For some activities, such as seismic survey noise and accidental events such as 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. In 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:

110/4b – Drill or drop well

110/5 – Drill or drop well

110/9c & 110/10 – Drill or drop well

113/22 – Drill or drop well

113/27d - 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 all of the Blocks considered in this document (see Table 2.1).

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

Block	Period of concern for seismic surveys	Special Conditions†
110/4b	February - June	✓
110/5	March - May	✓
110/9c	February – June	✓
110/10	March – May	✓
113/22	January – June, December	✓

Block	Period of concern for seismic surveys	Special Conditions†
113/27d	January – June, December	✓

Note: † Activity is of concern to the MoD because the Block lies within training ranges. For further information see: Other regulatory issues (DECC 27th 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 6 Blocks, or part-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 including Special Areas of Conservation (SAC) and Special Protection Areas (SPA)) 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. In accordance with Government policy (as set out in the National Planning Policy Framework (DCLG 2012[1]) and Marine Policy Statement (HM Government 2011)), 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 2005) 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.*" This is also reflected in Scottish Planning Policy (SPP)[3] and the Northern Ireland Draft Planning Policy Statement 2 (Revised) 2011.

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
- Offshore SACs (i.e. sites located in the UK's offshore marine area[4]) in the eastern Irish Sea.
- Riverine SACs within the area for migratory fish and/or the freshwater pearl mussel.

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[1] Which states that "listed or proposed Ramsar sites...should be given the same protection as European sites." UK coastal Ramsar sites are typically coincident with SACs and/or SPAs.

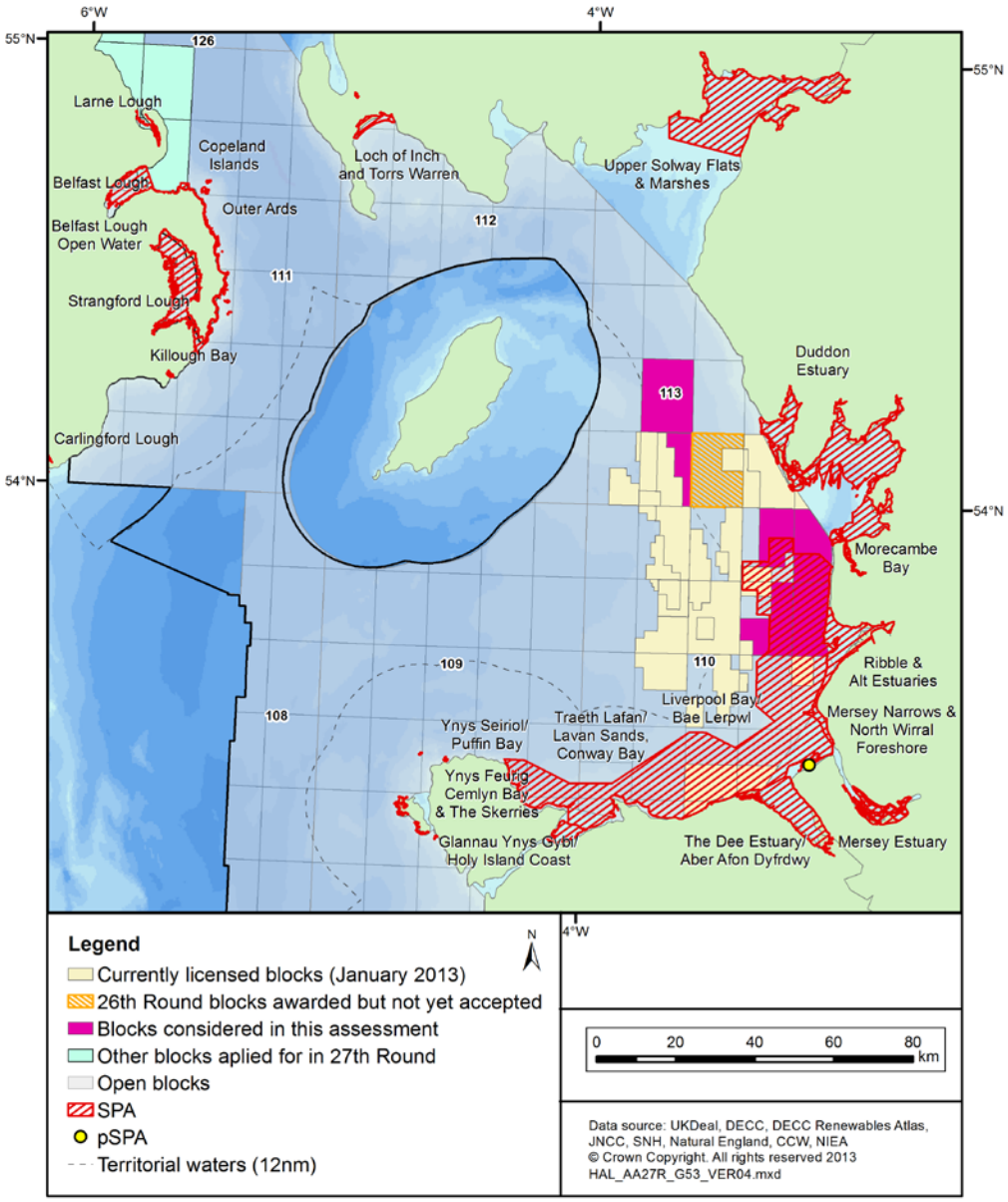
[2] Sites of Community Importance (SCIs) are more advanced in designation than cSACs in that they have been adopted by the European Commission but not yet formally designated by the government of the relevant country.

[3] Paragraph 135 of Scottish Planning Policy – http://www.scotland.gov.uk/Resource/Doc/300760/0093908.pdf. Note that a review of the SPP was announced in the Scottish Parliament on September 18, running concurrently with a review of the Scottish National Planning Framework 3.

[4] Defined (in the *Offshore Marine Conservation (Natural Habitats, & c.) Regulations, 2007 (as amended)*) as: (a) any part of the seabed and subsoil situated within the UK's Continental Shelf (the area designated under section 1(7) of the Continental Shelf Act 1964); and (b) any part of the waters within British fishery limits (except the internal waters of, and the territorial sea adjacent to, the United Kingdom, the Channel Islands and the Isle of Man).

Information gathering is in progress to inform the potential designation of further Natura 2000 sites, for instance the work of Kober *et al.* (2010). Should further sites be established in the future, these would be considered as necessary in subsequent project specific assessments. Northern Ireland Environment Agency (NIEA) have advised[5] that work has been undertaken to define an extension of Belfast Lough Open Water SPA relating to non-breeding red-throated diver and a marine extension to the Copeland Islands SPA relating to the utilisation of sea areas by the Manx Shearwater. These boundary extensions will require public consultation and have not been included on Figure 3.1 but DECC will treat such areas as fully designated. 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).

Figure 3.1: SPAs relevant to the Eastern Irish Sea AA



[5] NIEA response dated 4th September 2012 to draft 27th Round HRA screening document

The sites listed in Tables 3.1 to 3.3 and shown in Figures 3.1-3.2 are those taken forward from the block screening assessment (DECC 2012a) and have been re-screened in Appendix B in relation to the final Blocks proposed to be taken forward for licensing in the 27th Round and their related work programmes (Section 2.2). Those for which a likely significant effect was identified in the re-screening are highlighted in Tables 3.1 to 3.3 and subject to further assessment in Sections 5-8. Appendix C provides additional site details such as the status of qualifying features and related conservation objectives.

Figure 3.2: SACs relevant to the Eastern Irish Sea AA

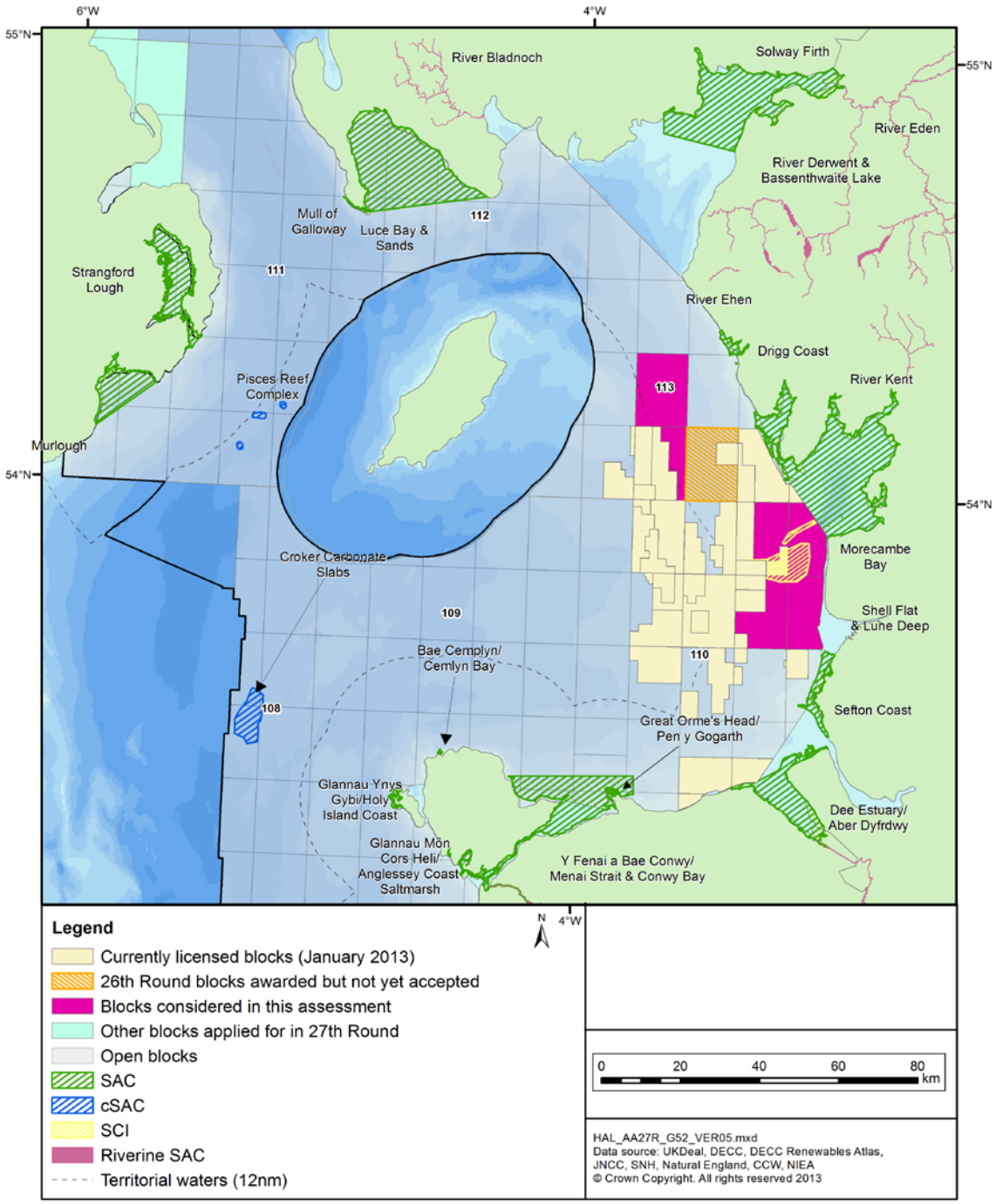


Table 3.1: SPA sites and qualifying features under Article 4.1 and 4.2, relevant to the Eastern Irish Sea AA

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

	Northern Ireland							Scotland				England							Wales		
	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	B								
Herring gull												B									
Sandwich tern	B					B		B			B	B								B	
Roseate tern	B																			B	
Common tern	B					B		B					B				B			B	
Arctic tern				B	B	B														B	
Little tern												B					B				
Hen harrier									W												
Chough																		B W			

	Northern Ireland								Scotland			England							Wales			
	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
Oystercatcher										W		W	W				W		W		
Ringed plover					W					P	P	P	P	P							
Golden plover					W	W				W		W	W	W							
Grey plover										W		W	W	W							
Lapwing													W	W							
Knot						W				W	W	W	W				W				
Sanderling										W	P	P	WP								
Dunlin										W		W	W	W							
Ruff													B								
Black-tailed godwit													W	W							
Bar-tailed godwit			W			W				W		W	W				W				
Whimbrel													P								
Curlew										W		W	W	W					W		
Redshank			W			W				W	W	W	WP	WP	W		W				
Turnstone			W		W					W		W			W						
Bewick's swan													W								
Whooper swan										W			W								

	Northern Ireland								Scotland		England								Wales			
	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
Bean goose																						
Pink-footed goose										W		W	W									
Greenland white-fronted goose									W													
Barnacle goose										W												
Canadian light-bellied brent goose	W				W	W	W	W														
Shelduck						W				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	W					
Site subject to AA*											✓	✓	✓			✓						

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

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

	Northern Ireland		Scotland		England						Wales					Offshore
Annex 1 Habitats	Strangford Lough	Murlough	Luce Bay and Sands	Mull of Galloway	Solway Firth	Drigg Coast	Morecambe Bay	Shell Flat and Lune Deep SCI	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 cSAC	Croker Carbonate Slabs cSAC
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
Site subject to AA*	✓	✓			✓	✓	✓	✓		✓						

*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 (Appendix A2). *see Appendices B and C.*

	Northern Ireland		Scotland		England						Wales						Offshore
Annex 2 Species	**Strangford Lough**	**Murlough**	**Luce Bay and Sands**	**Mull of Galloway**	**Solway Firth**	**Drigg Coast**	**Morecambe Bay**	**Shell Flat and Lune Deep SCI**	**Sefton Coast**	**Dee Estuary / Aber Dyfrdwy**	**Great Orme's Head / Pen y Gogarth**	**Y Fenai a Bae Conwy / Menai Strait and Conwy Bay**	**Bae Cemlyn / Cemlyn Bay**	**Glannau Ynys Gybi / Holy Island Coast**	**Pisces Reef Complex cSAC**	**Croker Carbonate Slabs cSAC**
Great crested newt			Q				P		Q							
Harbour seal	Q	Q														
Marsh fritillary butterfly		P														
Petalwort									P	Q						
River lamprey					P					Q						
Sea lamprey					P					Q						
Site subject to AA*	✓	✓			✓	✓	✓	✓		✓						

*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. *see Appendices B and C.*

Table 3.3: Riverine SACs designated for migratory fish and/or the freshwater pearl mussel

	Scotland	England				Wales	
	River Bladnoch	River Eden	River Derwent & Bassenthwaite	River Ehen	River Kent	River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid	Afon Gwyrfai a Llyn Cwellyn
Freshwater pearl mussel				P	Q		
Otter		P	P			Q	Q
Atlantic salmon	P	P	P	Q		P	P
Sea lamprey		P	P			Q	
River lamprey		P	P			Q	
Brook lamprey		P	P			Q	
Site subject to AA*	✓	✓	✓	✓		✓	✓

*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. *see Appendices B and C.*

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 *The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), DECC has:

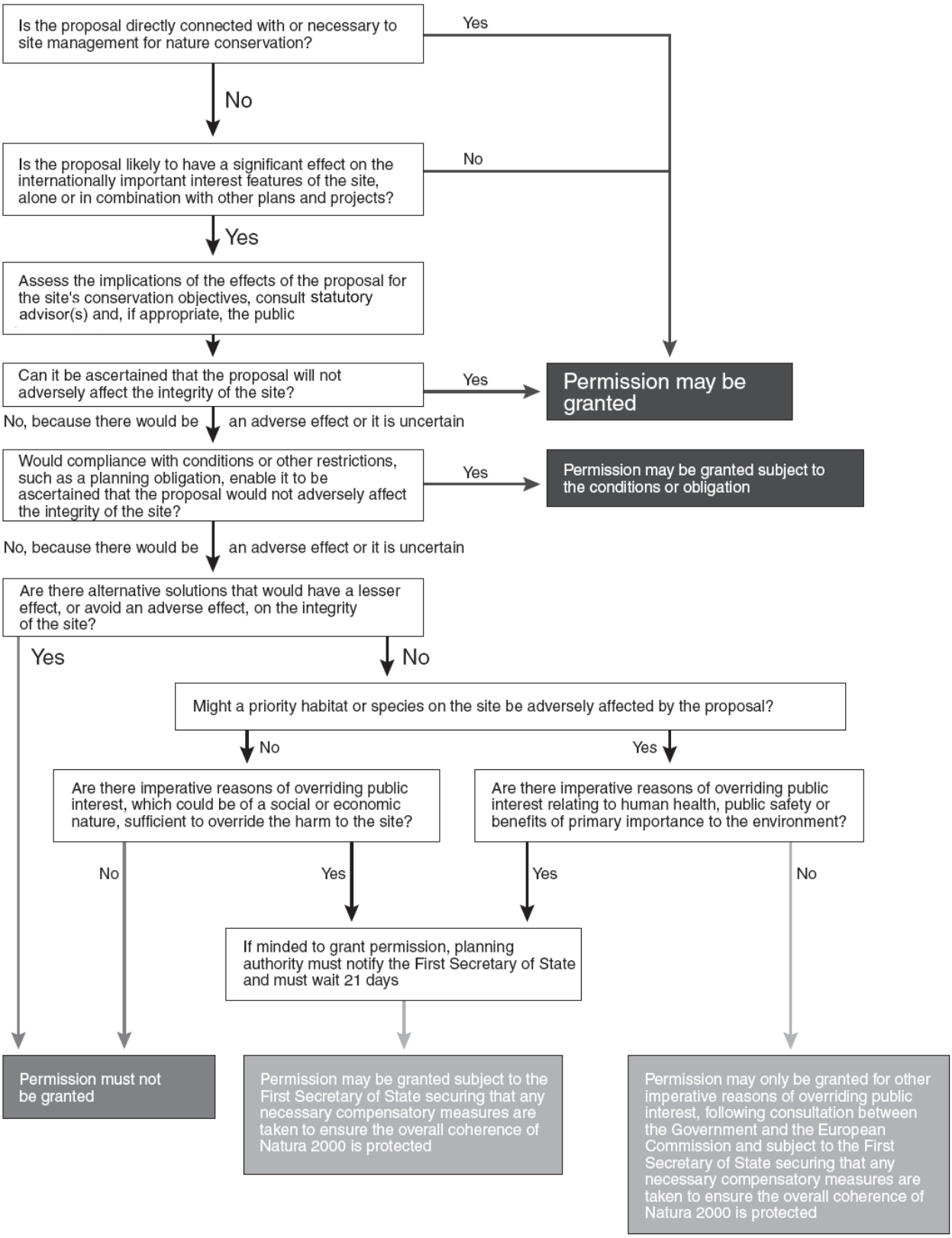
- Considered, on the basis of the precautionary principle, whether it could be concluded that the integrity of relevant European Sites would not be affected. This impact prediction involved a consideration of the cumulative and in-combination effects.
- Examined, in relation to elements of the plan where 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), so 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 overleaf.

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 (2005).

4.2 Site integrity

Site integrity is defined by the Circular 06/2005 (ODPM 2005) 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 (see Table 4.2) 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.

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 National Planning Policy Framework (DCLG 2012) and Circular 06/2005 (ODPM 2005), the English Nature Research Reports, No 704 (Hoskin & Tyldesley 2006) and the Scottish Natural Heritage Habitats Regulations Appraisal of Plans, No 1739 (Tyldesley & Associates 2012).

Appendix A lists and summarises the relevant European Sites as defined in Section 3. Appendix B then presents the results of a re-screening exercise of these sites to identify the potential for activities that could follow the licensing of the 6 Blocks in question (see work programmes in Section 2.2) to result in a likely significant effect. Where potential effects are identified in Appendix B, more detailed information on the relevant sites including their conservation objectives is provided in Appendix C.

Detailed assessments are made in Sections 5-8 of the implications for the integrity of the relevant European Sites (in terms oftheir qualifying features and species, and the site's conservation objectives) were a licence (or licences) to be granted for the six eastern Irish Sea Blocks. The assessment is based on an indication of the proposed work programmes for the Blocks and likely hydrocarbon resources (assumed to be gas province and diesel spill as worst case in terms of potential spill impact), along with the characteristics and specific environmental conditions of the relevant sites as described in the Appendices. As noted in Section 2.2, the proposed 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:

- Physical disturbance and other effects (e.g. pipeline trenching, marine discharges)
- Underwater noise (in particular, seismic surveys)

- Oil spills (including all liquid phase hydrocarbons
- 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 35[6] (formerly Regulation 33) 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 necessary as part of activity consenting.

A Natural England review of risks from ongoing activities within existing European Marine Sites (EMS) in England was undertaken to identify and prioritise action required to ensure site features were maintained or restored to favourable condition (Coyle & Wiggins 2010). Activities were scored as those which could pose a high, medium, low, or no risk to EMS features. Activities which could pose a high risk were those which have been prioritised by Natural England as potentially requiring additional management measures to avoid deterioration and disturbance in line with the obligations under Article 6(2) of the Habitats Directive. Activities which could pose a medium or low risk were considered to have existing management systems in place and/or they have less potential to pose harm to site features. The results were also separated into broad activities for further analysis, including commercial fishing; recreation; pollution; water resources; coastal defence; military; commercial vessels; illegal development; and other (includes the spread of non-natives and land management risks). Table 4.1 provides details of the risks assessed with respect to EMS of relevance to the eastern Irish Sea Blocks.

Table 4.1: Risk assessment of EMS of relevance to the eastern Irish Sea Blocks

European Marine Site	Activities assessed	Risk category			Total assessed[1]
		High	Medium	Low	
Dee Estuary	Commercial fishing, commercial vessels, recreation, pollution, water resources, coastal defence, other	0	0	43	43
Mersey Estuary	Commercial fishing, commercial vessels, recreation, pollution, other	0	6	31	37
Mersey Narrows	Commercial fishing, commercial vessels, recreation, pollution, other	0	6	35	41

[6] The Conservation of Habitats and Species Regulations 2010

European Marine Site	Activities assessed	Risk category			Total assessed[1]
		High	Medium	Low	
Morecambe Bay and Duddon	Commercial fishing, commercial vessels, coastal defence, recreation, pollution, other	0	11	28	40
Ribble Estuary	Commercial fishing, commercial vessels, recreation, pollution, other	0	4	37	41
Solway	Commercial fishing, commercial vessels, recreation, pollution, other	0	1	20	23
Drigg	Commercial fishing, recreation, pollution, other	0	0	16	16

Note:
[1]Total activities assessed includes those scored as no risk.
Source: Coyle & Wiggins (2010)

It should be noted that few sites have risks in the high category which indicate that additional management and mitigation is required. The review did not directly cover oil or chemical spills at sea, but indicated they were a continued risk to EMS, with a number of incidents taking place each year. Additionally, potential future risks to sites (e.g. that could arise from coastal developments) were not considered, limiting the study to risks from existing activities (Coyle & Wiggins 2010).

As part of the Habitats and Wild Birds Directives Implementation Review[7], Natural England and JNCC are also in the process of reviewing and updating the existing Conservation Objectives for all European Marine sites[8]. They aim to produce (where possible) quantified targets for:

- The populations and distribution of qualifying species.
- The extent and distribution of qualifying natural habitats and habitats of qualifying species.
- The structure of qualifying natural habitats and habitats of qualifying species.
- The supporting processes on which qualifying natural habitats and habitats of qualifying species rely.

The updated Conservation Objectives will be produced from April 2013, with a view to completion of all English sites within 2 years.

The current conservation objectives identified for SAC and SPA features for sites where a likely significant effect has 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 AA. The basis and primary concern of the conservation objectives are to maintain or achieve

[7] Report of the Habitats and Wild Birds Directives Implementation Review - http://www.defra.gov.uk/publications/files/pb13724-habitats-review-report.pdf
[8] Natural England website - http://www.naturalengland.org.uk/Images/action-14-announcement_tcm6-32928.pdf

favourable conservation status. Table 4.2 provides definition of conservation status based on Articles 1(e) and (i) of the Habitats Directive.

Table 4.2: 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-term 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 4.3). 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 conservation objectives would not be undermined by 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 Appendix B.

Table 4.3: High level mitigation measures identified for potential sources of effect

	High level Mitigation
Physical disturbance	Some Blocks are partly or wholly within, or abut boundaries of Natura 2000 sites. It is unlikely that any new terminals would be built as a result of developments following the 27th Round Licensing. While new pipelines could conceivably come ashore at existing terminals, either through or near to coastal SACs and SPAs, if the drill or drop wells were to progress to eventual development stage, there are well proven methods to prevent significant impacts. Such mitigation would be defined at the project level (e.g. following rig site and pipeline route surveys), and be subject to project specific EIA and HRA. Disturbance can also be caused by vessel movement or helicopter overflight, which also has available mitigation measures, such as strict use of existing shipping and aircraft routes, and timing activities to avoid sensitive periods.
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 EIA, HRAs (where necessary) and chemical risk assessments under existing permitting 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 limiting well testing to the minimum time required to satisfy test objectives and limit any flaring required to that which meets the technical requirements of processing. Rescheduling of activities, for instance by avoiding or limiting activities during months when large numbers of birds aggregate in the area, could help to reduce the risk of bird collision.
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 *Offshore 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*

High level Mitigation	
	2007. Passive acoustic monitoring (PAM) may be required as a mitigation tool. DECC will take account of the advice provided by the relevant statutory nature conservation body in determining any consent conditions. 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, the relevant SNCB (e.g. Natural England), and other relevant organisations. 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 defined 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.). Until recently, the MCA maintained four Emergency Towing Vessels (ETVs) which were stationed around the UK. However these have now been removed and the UK Government recently announced that a new ETV for the waters around the Northern and Western Isles will be stationed in Orkney up to 2015[9]. The government is also in discussions with the oil industry on the potential of a commercial call-out arrangement to use their vessels[10].
In-combination effects	The competent authorities will assess the potential for in-combination effects during HRA 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.

[9] Orkney Islands Council website - http://www.orkney.gov.uk/OIC-News/emergency-vessel-to-be-stationed-in-orkney.htm

[10] Scotland Office website - http://www.scotlandoffice.gov.uk/scotlandoffice/17322.html

5 Consideration of sites and potential physical and other effects

5.1 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 and whether these could adversely affect the integrity of these sites.

5.2 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. NB: such rigs are typically not used in the shallow water depths of the eastern Irish Sea.

- **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 and given the location of the Blocks applied for, it is anticipated that any new field developments will be 'tied back' to existing infrastructure or land in the case of Blocks which abut the coast. 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.

The use of anchors by drill rigs and pipelay vessels will produce a linear scar along the trajectory from anchor placement and recovery. A larger overall surface scrape may be expected from catenary action of anchor chains or cables though this is dependent upon water depth, anchor spread and tension of the chain or cable. Anchor handling may also cause some re-suspension of sediments. The duration of physical impact on the seabed will, however, be short due to the temporary nature of anchor placement. The time taken for the recovery of the seabed is difficult to accurately determine and is dependent on severity of impact, location, sediment type, and water depth (see Table 5.1 for recovery times following dredging activities in different habitat types).

High energy environments are characterised by clean, coarse sandy bottoms, whereas low energy environments are characterised by muddy sediments. Benthic communities that inhabit the different sediment types have adapted to different levels of recovery based on the frequency of natural disturbance in that environment. Species typical of shallow, wave exposed sandy sediments will possess the ability to recover from disturbance at a much more rapid rate. Species that inhabit deep, muddy environments are not as well adapted to physical disturbance of their habitat and it is likely they will take a significantly longer time to recover (Dernie *et al.* 2003, Snelgrove 1999).

The dredging activities described in Table 5.1 result in more severe disturbance to benthic habitats and communities than the scarring of drill rig and other anchors. Environmental Statements report a typical area that will be affected by such anchor scarring as between 1.6km^2 and 2.4km^2 (e.g. Ithaca Energy 2008, Iona Energy 2012), while it is estimated that areas affected by anchor scarring will recover within 1-5 years (DECC 2011). Anchoring and catenary scarring are not expected to result in significant changes to sediment properties and rapid recovery of faunal communities within the disturbed area may be expected through a combination of larval settlement and immigration of animals from the adjacent seabed. Infill of scars can, however, produce alteration of sediment type within the feature which is longer-term than the topographic expression of the scar, since the infill is usually of finer sediment (e.g. Robinson *et al*. 2005). Anchoring in areas of stiff clay can result in long lasting mounds of sediment.

Table 5.1: Physical and biological recovery following cessation of dredging

Habitat type	Hydrodynamics (tidal stress)	Depth (m)	Intensity; rate of dredging (t km^{-2} yr^{-1})	Area (km^2)	Recovery time (years)		Location
					Phys	Biol	
Fine sand	Strong tidal current estuaries	<20	nd	nd	nd	0.5-0.75	Bristol Channel
		<10	617,500	~1*	1-3	>1->3	Wadden Sea
	Low tidal current estuaries	Just below LW	1,045,000	~1*	1	5-10	Wadden Sea
Fine to medium sand	Seasonally strong tide & wind-driven current	20-23	2,850	1.4	>4	4	Terschelling, Netherlands
Medium sand	Strong	4	23,000	151.8	0.5	nd	Kwinte Bank, Belgium
	Seasonally strong tide & wind-driven current	16-18	950	0.5	nd	4	Torsminde, Denmark
Coarse sand	Weak-moderate	27-35	733,300	0.3	Decades	Decades	Thames estuary
Sand & sandy gravel	Weak	20-25	Up to 365,000	2.6	>5	>10	Coal Pit, Area 408, southern North Sea
	Moderate	16-25	400,000	3.1	Decades	8-9	Hastings Shingle Bank
	Weak	18-20	65,000	7.1	nd	4	Humber estuary
Gravel	Moderate-strong	12-46	75,000	107.0	~4	nd	Cross Sands, East Anglia
	Strong	15	67,000	1.5	nd	~3	Dieppe, English Channel
	Weak	30-40	nd	nd	nd	>2	Klaverbank, Dutch North Sea
Mixed: mud to gravel to cobbles	Moderate	20-30	nd	nd	>4	>4	Suffolk Coast
	Moderate-weak	28-34	80,000	6.1	Decades	nd	Southwold
	Moderate	10	150,000	1	nd	3	East of the Isle of Wight

Note: Phys – physical recovery, Biol – biological recovery
*Source: Foden et al. (2009), *: estimated value. nd: no data*

DECC 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 (Hall-Spencer *et al*. 2002). 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). The long-term effects of bottom fishing disturbance is less well understood due to the complex nature of the changes and the lack of pre-impact or control data (Frid *et al.* 2000, Bradshaw *et al.* 2002). Analysis of 101 experimental fishing impact studies undertaken by Kaiser *et al.* (2006) predicted recovery times in sand and gravel habitats after a scallop trawl as *ca.* 8 years; muddy sand as *ca.* 1.6 years and reef as *ca.* 3.2 years), with the scallop trawl being particular severe in terms of benthic disturbance (Mason 1983). Beam and otter trawling of sandy and muddy sediments exhibited a quicker recovery rate of the benthic species. However, the recovery rate

of muddy sand after beam and otter trawl is still predicted at *ca.* 0.6-0.65 years respectively (Kaiser *et al.* 2006).

Rock armouring of pipelines and cables is undertaken in some areas to protect against physical damage or scour in areas of strong tidal currents. The introduction of rock (as well as steel or concrete structures) into an area with a seabed of sand and/or gravel can provide "stepping stones" which might facilitate biological colonisation including by non-indigenous species by allowing species with short lived larvae to spread to areas where previously they were effectively excluded. However, on the UK continental shelf such "stepping stones" are already widespread and numerous, as a result of for example rock outcrops, glacial dropstones and moraines, relicts of periglacial water flows, accumulations of large mollusc shells, carbonate cemented rock etc. Rig site and pipeline route surveys in UK waters typically reveal the presence of such natural "stepping stones". Those activities that could follow licensing of the Blocks (e.g. drilling of wells) are unlikely to result in significant introduction of rock or structures to the marine environment, are temporary in nature and are therefore unlikely to undermine the conservation objectives of SACs in the area. The nature, location and extent of any subsequent further development including the installation of steel or concrete structures and protective rock dump if necessary, is not currently known and would be more appropriately assessed through project level EIA and HRA processes.

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 routine sources of potential physical damage are assessed and controlled by a range of regulatory processes, such as EIA and the Petroleum Offshore Notices for drilling and pipeline activities (PON15B and PON15C respectively) and where relevant HRAs to underpin those applications. Provisions under the Marine and Coastal Access Act (2009) include certain activities previously covered by the Food and Environment Protection Act which are now permitted through a Marine Licence. DECC is collating guidance in relation to oil and gas activities which will require a Marine Licence. Based on the results of the assessments including HRA, DECC may require additional mitigation measures to avoid or minimise any adverse effects, or where this is not possible, refuse consent.

5.3 Marine discharges

As described in previous DECC 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 is limited and does 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 or existing installations subject to substantial modifications. 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). For existing installations discharging produced water, continued discharges may be justified through a risk based approach[11], where appropriate.

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

[11] See: OSPAR Recommendation 2012/5 for a risk-based approach to the Management of Produced Water Discharges from Offshore Installations, OSPAR Guidelines in support of Recommendation 2012/5 for a Risk-based Approach to the Management of Produced Water Discharges from Offshore Installations (OSPAR Agreement: 2012-7).

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.

The physical disturbance of benthic ecosystems by water-based drill cuttings was examined in a series of mesocosm (Trannum *et al.* 2010) and field experiments (Trannum *et al.* 2011). The mesocosm experiments highlighted a potential reduction in number of taxa, abundance, biomass and diversity of macrofauna with increasing thickness of drill cuttings possibly as a result of oxygen depletion. However, comparison with the field-based experiments indicated that this was probably due to the lack of continuous water flow over the sediment surface in the mesocosm experiments (Trannum *et al.* 2011). The field experiments found that the difference in faunal composition between the controls and those treated with drill cuttings was of small magnitude 6 months after drill cuttings deposition indicating a relatively rapid recovery process following discharge of water-based drill cuttings. This corresponds with field studies where complete recovery was recorded within 1–2 years after deposition of water-based drill cuttings (Daan & Mulder 1996, Currie & Isaacs 2005).

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 are 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) made 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, HRAs (where necessary) and chemical risk assessments (e.g. PONs) under existing permitting procedures.

5.4 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 (rigs currently move between the Irish Sea to the North Sea and vice versa), 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. Wiese *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). Platform illumination has been shown to have an attractive effect on many species of migratory birds, with attraction enhanced in conditions of poor visibility such as fog, haze and drizzle (Wiese *et al.* 2001 and references therein). Responses to a recent OSPAR questionnaire seemed to indicate that the main cause of death was dehydration, starvation and exhaustion, although some birds had physical damage resulting from collisions with the infrastructure, and an even smaller number had interacted with the flare or turbine exhausts. Birds which are attracted to these light sources at night typically circle around the illuminated platform for extended periods of time (sometimes many hours) and it has been suggested that the circling increases the risk of collision leading to traumas and deaths (OSPAR 2012). It was concluded that there was evidence that conventional lighting of human-made offshore structures had an impact on birds, but it could not be concluded that the effect was significant at the population level (OSPAR 2012).

The temporary nature of drilling activities means that a drilling rig will be present for a relatively short period of time minimising the potential for significant interaction with migratory bird populations. It is also unlikely that drilling rigs will be located so close to shore as to illuminate coastal habitats and affect the foraging behaviour of waders and waterfowl (e.g. Dwyer et al. 2012). 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. Such disturbance can result in repeated disruption of bird feeding, loafing and roosting. It is considered this source of potential effect will not result in significant disturbance to the species within Natura 2000 sites or threaten the viability of populations of qualifying features at relevant sites (e.g. Liverpool Bay SPA which supports overwintering red throated diver and common scoter) because of the projected limited scale and nature of developments, and because mitigation is possible which would be identified during activity specific assessment and permitting processes. Red-throated divers and common scoters within the Liverpool Bay SPA are sensitive to 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). There is also 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 within the site are currently in operation, under construction or consented. With respect to oil and gas activities, available mitigation measures include strict use of existing shipping

and aircraft routes, timing controls on temporary activities to avoid sensitive periods. Oil and gas developments also tend to be primarily subsea infrastructure based, and therefore any disturbance at the sea surface is reduced to periods of construction and decommissioning only, with the likelihood of significant disturbance to species further reduced. It is therefore concluded that adverse effects from physical disturbance are not expected.

5.5 Implications for relevant European Sites

The re-screening process (Appendix B) identified the potential for physical disturbance and marine discharge effects at a number of relevant sites.

5.5.1 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. Block 110/10 is wholly within the Liverpool Bay SPA and Blocks 110/4b, 110/5 and 110/9c transect the SPAs boundary and this could mean that activities within the Block (e.g. rig placement and pipeline trenching if there is future development) 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 result from shipping, fishing, and offshore developments and associated activities, and also from having their routes between feeding, roosting, and sheltering areas impeded (Natural England & CCW 2009).

The greatest densities of red-throated divers in Liverpool Bay are off the Ribble Estuary, north Wales, and the north Wirral (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 noted that the Liverpool Bay SPA site is functionally linked to the Shell Flat & Lune Deep SCI, 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 (Natural England & CCW 2009).

5.5.2 Ribble and Alt Estuaries SPA

These two estuaries form part of a larger chain of western SPAs fringing the Irish Sea and together see a considerable interchange in movements of wintering birds between sites. Overall the dunes, intertidal flats and saltmarshes of the Ribble and Alt Estuaries have a relatively robust status and favourable condition. Block 110/10 abuts the SPA boundary and certain activities in or related to, this Block could potentially undermine the conservation objectives of the qualifying features through physical disturbance (e.g. noise and visual disturbance of birds foraging within and outside the site, damage or loss of habitat from smothering by drilling discharges, the installation of infrastructure and cables).

5.5.3 Morecambe Bay European Marine Site (SPA and SAC)

Morecambe Bay is the second largest embayment in Britain after the Wash and, at over 310km^2, contains the largest continuous area of intertidal mudflats and sandflats in the UK. Within the sediments are a wide range of benthic communities with particularly high numbers of various polychaete worms, bivalve molluscs and crustaceans. Every autumn internationally important numbers of migratory birds overwinter in Morecambe Bay where they feed on this resource. The site is also important for the nationally important population of breeding sandwich terns as well as the total numbers of waterfowl and seabirds which, during the summer, feed and breed around the bay. Other habitats include large areas of saltmarsh and pioneer saltmarsh and rare transitional zones between saltmarsh and freshwater and terrestrial habitats. Around the Bay, scattered areas of boulders and cobbles provide a hard substrate for dense beds of mussels and other species such as honeycomb worms (English Nature 2000a).

Block 110/5 abuts the SPA and SAC boundary and certain activities in or related to, this Block could potentially undermine the conservation objectives of the qualifying features through physical disturbance (e.g. noise and visual disturbance of birds foraging within and outside the site, damage or loss of habitat from smothering by drilling discharges, the installation of infrastructure and cables).

Although the site is subject to a range of pressures, overall the site is relatively robust and many of the pressures have only slight to local effects. The interests of the area depend largely upon the coastal processes operating within the bay and positive management is actioned through a variety of management plans, schemes, and partnerships.

5.5.4 Shell Flat and Lune Deep SCI

This site consists of two components: Shell Flat which is a crested shaped sandbank with a range of mud and sand sediments, providing important habitat for commercial fish species and birds and Lune Deep which is a unique kettle hole feature which provides contrasting habitat to the surrounding muddy communities of the Eastern Irish mudbelt. The northern flanks of Lune Deep are composed of exposed bedrock with a rugged seabed physiography. In contrast, the southern flank consists of a smooth seabed which is a sink for muddy sands (Natural England 2012).

Blocks 110/4b and 110/5 intersect the SCI and the northern edges of Blocks 110/9c and 110/10 also fall within the SCI area. Site conservation objectives could be undermined by physical disturbance (e.g. from rig placement, anchoring, pipeline trenching).

Sandbank habitats within Shell Flat & Lune Deep cSAC currently have a moderate exposure to physical damage from commercial and recreational fishing activities such as anchoring and the towing of light demersal trawling gear. Trenching for the Walney 2 windfarm cable through the north-eastern tip of Shell Flat & Lune Deep cSAC was undertaken in May 2011. The trenching and anchoring of the trenching vessel caused significant but temporary damage to a small area of the sandbank. Natural England (2012) considered the sandbanks within the Shell Flat & Lune Deep cSAC to have a low vulnerability to physical damage.

5.5.4.1 Consideration

Following licensing, the sites may be affected by a variety of activities as a result of the proposed work programme, including rig/installation placement and the drilling of a number of

wells, which can result in direct physical damage by abrasion, changes in suspended sediment disturbance and deposits of rock. All activities that may cause such disturbance would be subject to project-level assessment (e.g. EIA and HRA) and potential mitigation. Any proposed drilling activities and further seabed development in this area would require extensive survey to characterise the seabed allowing potential interactions to be assessed and mitigation to be developed. In the long-term, it is not expected that such effects would result in a reduction in the diversity, community structure and typical species of the supporting habitats and sites as a whole, resulting in deterioration in conservation status. Risks to overall site integrity from oil and gas exploration (e.g. drilling) and subsequent development activities (e.g. pipelaying) would be prevented (mitigated) by the existing legal framework for the respective activities, which includes HRA where necessary.

Contamination by introduction of synthetic and/or non-synthetic compounds has been noted as a potential threat to the sites. However, current rules effectively mean that only water based drill muds (WBM) would be discharged either on rock cuttings or as excess mud. Around 95% of the constituents of a typical WBM are naturally-occurring (and defined by OSPAR as posing little or no risk to the environment) while remaining chemicals would have low toxicity and bioaccumulation potential. There are strict regulatory controls over the use and discharge of offshore chemicals and toxic or enrichment effects are not envisaged. Dispersion of mud and cuttings is influenced by various factors. The range of cuttings particle size results in a significant variation in settling velocity, and a consequent gradient in the size distribution of settled cuttings, with coarser material close to the discharge location and finer material very widely dispersed away from the location. Extensive monitoring of the ecological effects of discharged WBM cuttings has been carried out in the North and Irish Seas (and internationally) and the consensus view is that any effects are subtle, very localised and transient. In view of the energetic hydrography of the area the sites are believed to be tolerant of sediment disturbance and discharges of drilling solids. Such materials are an insignificant contribution to the regional sediment budget and do not, in general, accumulate in particular areas.

The generic consideration (above) of physical disturbance and discharge effects of the activities that could follow licensing indicate that the likely scale and duration of effects is transient or if longer term not compromising the site conservation objectives. Activities within any of the Blocks applied for would be subject to risk assessment, mitigation and permitting measures, which would include assessment of the potential effects on the integrity of Natura 2000 sites.

5.6 Conclusions

Likely significant effects identified with regards to physical effects on the seabed, marine discharges and other disturbance effects (e.g. lighting, vessel and aircraft traffic) when aligned with project level mitigation and relevant activity permitting, will not have an adverse effect on the integrity of the Natura 2000 sites considered in this assessment. It is unlikely that any new terminals would be built as a result of developments following licensing of Blocks. While new pipelines could conceivably be constructed and come ashore at existing terminals, either through or near to coastal SACs and SPAs, there are well proven methods (e.g. pipeline route surveys to identify sensitive seabed features) 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 with mitigation, activities arising from the licensing of Blocks 110/4b, 110/5, 110/9c, 110/10, 113/22 & 113/27d will not cause an adverse effect on the integrity of the European Sites, though consent for activities will not be granted unless the operators can demonstrate that the proposed activities which may include the drilling of a number of wells and any related activity including the placement of a mobile rig, will not have an adverse effect on the integrity of European Sites.

6 Consideration of sites and potential acoustic effects

6.1 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 for all the Blocks considered in this assessment (see Table 2.1) and it is envisaged that consent would not be granted for seismic survey during these periods. 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). Relevant sites in the region include several designated for the presence of the Annex II species Atlantic salmon, sea lamprey, and river lamprey (e.g. the River Bladnoch SAC, River Eden SAC, River Derwent and Bassenthwaite SAC and the River Ehen SAC, the Solway Firth SAC, the Dee Estuary SAC and the River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid SAC).

Atlantic salmon *Salmo salar* have been shown through physiological studies to respond to low frequency sounds (below 380Hz), with best hearing (threshold 95 dB re 1 µPa) at 160Hz. Hence, their ability to respond to sound pressure is regarded as relatively poor with a narrow frequency span, a limited ability to discriminate between sounds, and a low overall sensitivity (Hawkins & Johnstone 1978, cited by Gill & Bartlett 2010). There is, however, evidence that juvenile *S. salar* smolts (as well as other salmonid species) are sensitive to very low frequency sound. 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 harbour seal *Phoca vitulina* and several seabird species, including terns and gulls.

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). Andre *et al*. (2011) indicated that controlled exposure of four cephalopod species to low-frequency sounds (exposure to 50–400Hz sinusoidal wave sweeps with 100% duty cycle and 1-second sweep period for 2 hours, received sound pressure level: 157 ± 5 dB re 1 µPa, with peak levels at 175 dB re 1 µPa) resulted in permanent and substantial alterations of the sensory hair cells of the statocysts, the structures responsible for the animals' sense of balance and position.

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 (e.g. penguins, considered as a possible proxy for auk species) 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, 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 6.5) 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 (e.g. overwintering red-throated diver and common scoter in Liverpool Bay SPA, see Section 5.4 above), although in the context of other military and civilian aircraft activities the anticipated level of Exploration and Production (E&P) related noise is insignificant. In specific cases of concern, including seasonal concerns (for instance, during moulting), mitigation through routeing restrictions could be implemented, and these will be considered at a project specific level.

6.2 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 (no seismic surveys are proposed for the work programmes although rig site surveys and well data gathering activities may use a sound

source). 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.

6.2.1 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; 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 though a source of up to 500 cubic inches is not uncommon. 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 source increases, higher frequencies are attenuated more rapidly. 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.

6.2.2 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 one 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 drilliing units used in shallower water is less because of reduced surface area contact between the water column and submerged parts of the drilling unit. 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.

6.3 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 over many 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 72h 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 (Hammond *et al.* 2006).

6.3.1 Injury and behavioural criteria

The Offshore Energy SEAs (DECC 2009, 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 6.1 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.

From Table 6.1, the ranges affected by potential auditory injury resulting from modelled seismic survey, represent a small proportion of the marine areas used by seals 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.

Table 6.1: 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)

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.

6.4 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. Mandatory HRA procedures will allow further consideration of the nature, timing and location of any planned activities and mitigation measures, deemed

necessary to be defined (including conditions attached to consents/permits or potentially consent/permit refusal). The re-screening process (Appendix B) identified the potential for acoustic disturbance in the following sites:

6.4.1 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, 2011). 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). Over the period 2009-2010, some seals were found to spend the entire time within Strangford Lough, while others never entered the Lough at all or spent the entire time transiting up and down the Narrows. Some individuals travelled to distant haul out sites in the Irish Sea, indicating that seals in Strangford Lough/Narrows are not ecologically isolated from the remaining Northern Ireland population (Royal Haskoning 2011).

6.4.1.1 Consideration

Deep geological seismic survey is not proposed for any of the work programmes for the Blocks although individual rig site surveys are likely to be undertaken which may require some seismic activity. However, to inform the assessment a simple calculation 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. 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, where 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, 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 resulting from reflection, refraction and diffraction in the propagating medium. Frequency dependence due to destructive interference also forms an important part of the weakening of a noise signal.

From Table 6.1, the range within which auditory damage to seals could occur is 63m of the seismic operations (assuming 15logR). The onset of significant behavioural disturbance resulting from a single pulse (i.e. TTS-onset) is estimated to occur within 159m (Southall *et al.* 2007). Strangford Lough SAC and Murlough SAC are approximately 111km and 122km respectively from the nearest Block (113/22), giving a propagation loss (assuming 15logR) of

around 76dB at the boundary of both sites, or a received sound level of *ca*. 154dB re 1μPa p-p[12] for a typical seismic survey. This level is considerably lower than the injury criteria proposed by Southall *et al.* (2007) in 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 SACs. 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 6.5). Additionally, no deep geological seismic surveys are planned as part of the work programmes for any of the Blocks under consideration. Any future seismic survey plans would be subject to an extensive source- and site-specific assessment of the potential for adverse effects, including HRA.

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 marine mammals at these 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. affect the distribution of species or supporting habitats, result in significant disturbance to the species or affect the viability of the population).

Periods of concern for seismic have been identified for all of the Blocks which vary in length but fall between January and June, and December with respect to fish spawning (see Table 2.1). There is a presumption of refusal for the activity concerned during these periods. However, it may be possible to agree appropriate mitigation measures at the project level to minimise potential adverse effects, to the extent that the objection can be withdrawn.

Noise levels associated with other activities potentially resulting from licensing of the Blocks such as rig site survey, drilling, vessel movements, pipe-laying operations, are of a considerably lower magnitude than those resulting from deep geological seismic survey, and are not expected to have an adverse effect on the integrity of the relevant SAC sites.

6.4.2 Migratory fish

The potential for acoustic disturbance effects was identified for the following SACs due to the presence of Atlantic salmon as a qualifying feature: Dee Estuary SAC, River Bladnoch SAC, River Eden SAC, River Derwent & Bassenthwaite SAC, River Ehen SAC, River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid SAC and Afon Gwyrfai a Llyn Gwellyn SAC. Salmonids play a critical role in the life cycle of the freshwater pearl mussel *Margaritifera margaritifera*, which is also a qualifying feature in the River Kent SAC and River Ehen SAC. Any potential impacts on

[12] 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). Figures are rounded to the nearest whole number.

viability of the Atlantic salmon population, its distribution or supporting habitats, should also be considered in the context of the freshwater pearl mussel. River and sea lamprey are qualifying features in a number of SACs (Solway Firth SAC, River Eden SAC, River Derwent and Bassenthwaite Lake SAC and the Dee Estuary SAC).

No deep geological seismic survey is proposed in the work programmes. Noise levels associated with other activities potentially resulting from licensing of the Blocks such as rig site survey, drilling and vessel movements, are of a considerably lower magnitude than those resulting from deep geological seismic survey, and are not expected to have an adverse effect on the integrity of the riverine SACs.

6.5 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) which may be supported by an Environmental Assessment to enable an accurate assessment of the environmental effects of the survey. Consultations with Government Departments and other interested parties as standard are conducted prior to issuing consent, and JNCC, Marine Scotland (MS), Cefas (and possibly others) 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 HRA.

The major operational control over seismic surveys in the UK is 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 1995 (Northern Ireland), *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. European Protected Species (EPS) 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 survey being undertaken 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[13] and stipulate, whenever possible, the implementation of several best practice measures, 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).

Passive acoustic monitoring (PAM) may be used as a mitigation tool where JNCC and country conservation agencies deem it appropriate. Periods of concern for seismic survey have been identified for all of the Blocks considered in this AA (see Table 2.1), within which there would be a presumption against such activity taking place.

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[14] 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.

[13] 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.
[14] JNCC's response to the 26th Seaward licensing Round.

6.6 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 (see Defra 2010). 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. Noise levels suggested to cause injury to fish would not extend beyond a few tens of metres around the noise source.

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 deep 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 HRA may be required to assess the potential for adverse effects on the integrity of sites 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 adverse effects on the integrity of other SACs in the vicinity of the Blocks will result.

- 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 neither previous activities, nor those associated with proposed licensing will undermine the conservation objectives 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 adversely affect the site integrity of European Sites.

7 Consideration of potential effects from oil spills on relevant sites

7.1 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 not credible to conclude that an oil spill will never occur as a result of 27th Round licensing, in spite of the regulatory controls and other preventative measures in place.

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. Several reports into the cause of the incident and implications for activities on the UKCS have been produced, with a number of recommendations being integrated into UK guidance (e.g. DECC 2012b). As part of the investigation UK regulators contacted 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 were implications for safety at offshore operations on the UK continental shelf. The independent, UK based, Maitland review panel (Maitland 2011) evaluated the recommendations emerging from these reports and considered their relevance to the oil and gas industry on the UKCS. They assessed to what extent modifications or improvements to the UK regulatory regime could be informed by lessons learnt from the Deepwater Horizon incident.

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

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[15] 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 'offshore environmental' inspectors in its Aberdeen office. This has increased the number of annual environmental inspections of mobile drilling rigs.

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. 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. OSPRAG was active for 16 months, before reaching conclusions that recommended the setting up of a number of bodies with responsibility for ensuring drilling operations in UK waters remain robust and fit for purpose. The Oil Spill Response Forum (under guidance of Oil and Gas UK) will keep the oil spill toolkit, including subsea dispersants and spill modelling, under review. The Well Life Cycle Practices Forum will have responsibility for drilling and well engineering management functions. Regular interaction between Oil and Gas UK and OPOL (Offshore Pollution Liability Association Limited) will be maintained to exchange views on financial responsibilities. Additionally, in June 2012, Oil and Gas UK issued draft guidelines on financial responsibility for well operations in the UKCS, including assessment methodology for potential costs of well control, pollution remediation and compensation.

4. In May 2011 exercise 'Sula' was undertaken to test the UK's capacity to respond to a deepwater drilling related oil spill to the West of Shetland. A tier 2/3 deployment demonstration took place in Sullom Voe, Shetland alongside a separate Emergency Equipment Response Deployment (EERP), designed to test the dispersion of free flowing oil from a well, clearing of a well head of debris and the placement of a capping device to close off the flow from a well. An independent assessment of the deployments concluded that the ability to deploy all the equipment mobilised for the exercises (including surveillance equipment, aerial and surface dispersant application, containment and

[15] See: DECC (2012). Offshore Oil & Gas in the UK: Government Response to an Independent Review of the Regulatory Regime, December 2012.

recovery and shoreline response) was proven and all the onshore equipment was seen in fully operational conditions with the oil spill response team fully conversant in its use.

5. 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. These were combined in supplementary guidance issued by DECC[16] with OPEP guidance updated in July 2012[17].

6. The EU has asked companies operating in EU waters to provide assurances that they are ensuring safe practice and that they are able to take on full responsibilities for environmental and other damage if an incident were to occur.

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 27th Round, including the recent Offshore Energy SEA2. 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*).

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 (Section 7.3) by activities resulting from the proposed licensing of the 6 Blocks in the 27th 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.

7.2 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

[16] DECC website https://www.gov.uk/oil-and-gas-offshore-environmental-legislation#supplementary-guidance-issued-following-the-deepwater-horizon-incident

[17] Guidance notes to operators of UK offshore oil and gas installations (including pipelines) on Oil Pollution Emergency Plan requirements https://www.gov.uk/oil-and-gas-offshore-emergency-response-legislation

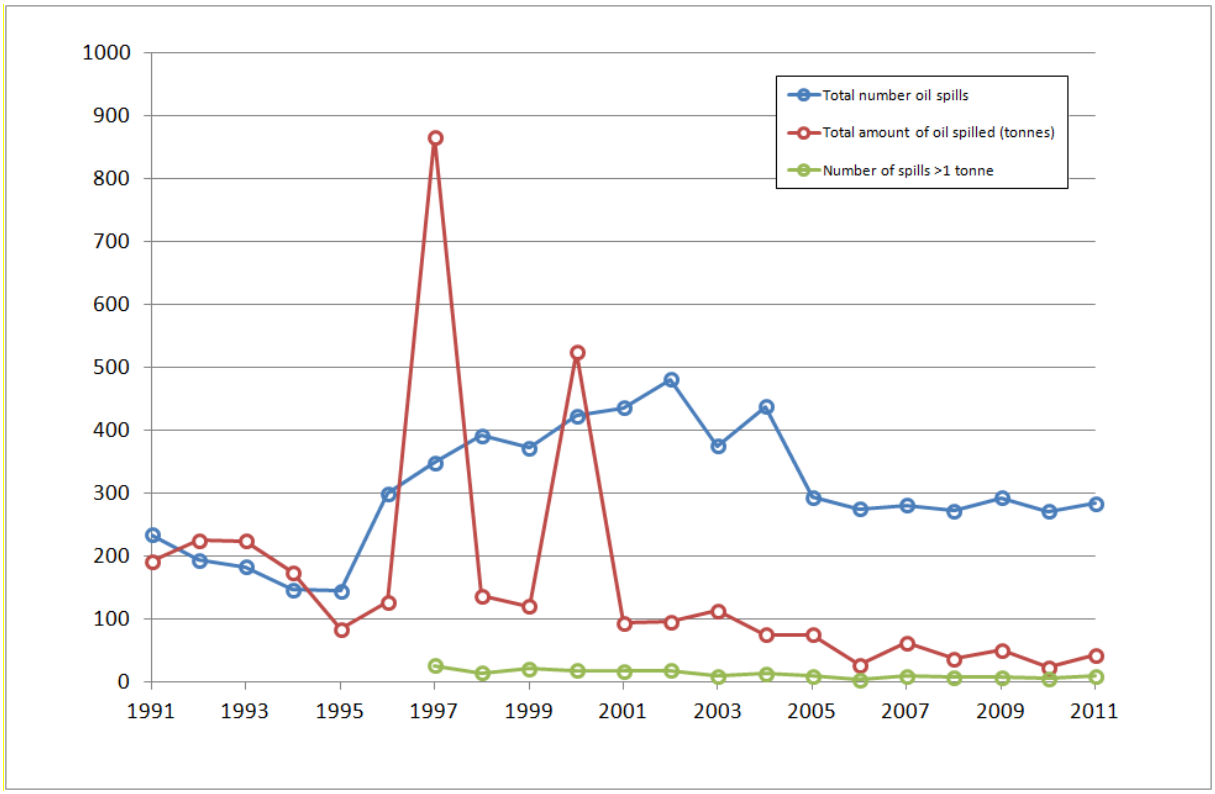
have been from West Vanguard (1985) and Ocean Odyssey (1988), both involving gas and not resulting in significant pollution.

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 (>1,000 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.

7.2.1 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[18] (Figure 7.1). Discharges, spills and emissions data from offshore installations are also reported by OSPAR (e.g. OSPAR 2009).

Figure 7.1: Number and volume of reported oil spills from UKCS oil and gas installations over the period 1991-2011



Source: DECC website

[18] Oil and chemical discharge notifications (accessed January 2013) https://www.gov.uk/oil-and-gas-uk-field-data#oil-spills

DECC data indicates 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.

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. Dixon 2011). This includes all spills reported by POLREP reports by the MCA and PON1 reports to DECC – note that notifications of spills through the PON1 process are now being reported on the DECC website on a monthly basis[19]. The review noted a 6.1% reduction was evident in the total number of reports by offshore oil and gas installations during 2010 which was the lowest annual total recorded since 2006, concluding that a combination of technical, operations and regulatory measures effectively contributed to the decrease. Of these discharges, 65% were fuel, lubrication or hydraulic oils; additionally, of the discharges with volume information, 95% were less than 455 litres. It is recorded in DECC data that the total number of oil spills, the related spill volume and those greater than 1 tonne all slightly increased in 2011 (Figure 7.1), however the total quantity of oil spilled remains low and is in keeping with the general spill trend since 2001.

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 2011 was 0.000001 tonnes). 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 2011 totalled 2,508 tonnes (DECC website[20]).

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).

Following the recent gas release and evacuation of personnel from Total E&P UK's Elgin production facilities, DECC convened a Government Interest Group (GIG) to enable interested parties, such as DECC, the Secretary of State's Representative, the Health and Safety

[19] https://www.gov.uk/oil-and-gas-uk-field-data#oil-spills
[20] Oil discharged with produced water 2005 – 2011 https://www.gov.uk/oil-and-gas-uk-field-data#oil-discharged-with-produced-water

Executive, the Scottish Government and the Maritime and Coastguard Agency, to share information about the incident and to discuss issues such as the operator's plans to stop the release. A GIG update[21] with respect to the environmental aspects of the incident indicated that the vast majority of the release was methane gas entering the atmosphere, but that some of the condensate and associated liquid components impacted the sea surface. This resulted in a silvery sheen with occasional smaller patches of brown weathered material. In line with the reduction in the release rate (from a peak of approximately 200,000m^3/day), the extent of the sea surface contamination significantly reduced and stabilised at consistently less than 5km^2, compared with earlier estimates of approximately 20km^2; and the quantity estimates also significantly reduced and stabilised at consistently less than 2 tonnes, compared with earlier estimates of approximately 20 tonnes (DECC 2012c).

7.2.2 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 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.* 1,000 tonnes would disperse naturally in about 8 hours and travel some 24km in conditions of a constant unidirectional 30 knot wind.

With respect to the recent Elgin gas release, the observed sea surface contamination (described above) was in line with modelling data derived for potential condensate spills, which predicted that there would be an equilibrium point when input was matched by natural loss as a result of evaporation and dispersion in the water column, with approximately 50% of the condensate evaporating within approximately 24 hours under conditions relevant to the Elgin release. The brown weathered material also appeared to disperse naturally and, during periods when the wind strength and wave height increased, this enhanced dispersion of the condensate and weathered material in the water column, reducing the quantity of material remaining on the sea surface (DECC 2012c).

Coincident with these weathering processes, surface and dispersed oil will be transported as a result of tidal (and other) currents, wind and wave action. Generally the slick front will be wind-driven on a vector equivalent to current velocity plus approximayely 3% of wind velocity. 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 of north west England. 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.

7.2.3 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

[21] National Archives website – http://webarchive.nationalarchives.gov.uk/20121217150421/http://og.decc.gov.uk/en/olgs/cms/environment/about_the_offs/elgin_gig/elgin_gig.aspx

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 (Hampton *et al*. 2003, Camphuysen 2007).

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 7.1 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.

Table 7.1: Monthly seabird vulnerability to surface pollution in relevant 27th Round Blocks

Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
113/22	3	3	2	2	3	4	3	2	2	3	2	2	4
113/27	3	3	2	2	3	4	3	3	2	3	2	2	4
110/4	2	3	2	2	2	4	3	2	2	2	2	2	4
110/5	1	3	1	2	2	4	3	2	2	1	2	2	2
110/9	1	1	1	2	2	3	3	3	2	2	2	1	2
110/10	1	1	1	2	2	2	3	3	2	1	2	1	1

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

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.

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, although based on hydrocarbon types present or used in operations, this is unlikely to be significant in the eastern Irish Sea. However, 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).

With respect to the recent Elgin gas release, sampling and monitoring programmes to date indicate that it is considered unlikely that the incident has had any significant impact on marine organisms in the water column, and likely that any impact on seabed marine organisms will be restricted to the area immediately surrounding the platform, an area that has already been impacted by routine discharges relating to previous drilling operations. Any hydrocarbons entering the water column would have been widely dispersed, and rapidly broken down by marine bacteria. Whilst the location and nature of the release, and the comparatively small area affected, indicated that the potential impact on marine mammals and seabirds was likely to be insignificant, Total have instructed a specialist contractor to undertake bespoke aerial surveys to quantify and potentially identify any marine mammals or seabirds in a 200km^2 area around the Elgin facilities (DECC 2012c).

Those coastal and marine Annex I habitats which are most sensitive to oil spills are identified in Table 7.2, below. Generally, sheltered habitats of lower exposure to wave energy are considered most vulnerable; oil may persist for long periods in such environments.

7.3 Implications for relevant European Sites

The re-screening process (Appendix B) identified the potential for oil spill effects at relevant Natura 2000 sites. 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 any hydrocarbons to be recovered from licensing Blocks in the eastern Irish Sea are likely to be gas, no significant hydrocarbon release is likely, and such a release would be restricted to diesel or lube oil equivalent to the inventory of these on any rig or vessel. Specific to gas hydrocarbon fields, OPEP guidance indicates that such potential worst case diesel spills should be modelled both stochastically and deterministically. Detailed potential effects of such a release on Natura 2000 sites will be considered at this stage.

7.3.1 Special Areas of Conservation

The ecological sensitivity of the qualifying features of relevant sites to oil spills varies and post-incident monitoring guidelines produced as part of the "PREMIAM: Pollution Response in Emergencies Marine Impact Assessment and Monitoring" project (Law *et al.* 2011), provide information on the sensitivity and vulnerability of relevant habitats and species. Additionally, where available Regulation 35 advice is provided on a site specific basis which considers the sensitivity of a given site to activities such as oil and gas exploration and production. 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** - With respect to subtidal rock, the lack of substrata that could retain persistent oil contamination means that any impacts are only likely to be due to the acute effects of the dispersed oil, unless chronic oiling seeps down from an intertidal oil source. Generally considered unusual for notable quantities of dispersed oil from spills to reach depths greater than 10m, but there are known cases where this has happened (Law *et al.* 2011). Therefore 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

- **Submerged sandbanks** – Dispersed oil in water and oil bound to shoreline sediments can make its way down to the seabed and contaminate subtidal sediments. Impacts to seabed sediment fauna have been described after a number of oil spills, but normally only in shallow depths where oil in water concentrations were particularly high or close to sandy beaches (Law *et al.* 2011). Therefore not generally vulnerable to surface oil pollution, except possibly following application of chemical dispersants (generally not permitted in waters shallower than 20m).

- **Lagoons, dunes** – Sites above Mean High Water Springs not generally vulnerable to surface oil pollution, except possibly to wind-blown oil or evaporated hydrocarbons. No cases of oil or chemical spills contaminating lagoons in UK or north-west Atlantic coasts have been found. Most UK lagoons are not very vulnerable to marine spills and their vulnerability will be dependent on the frequency and route by which seawater enters the lagoon. For those with narrow entrances, relatively simple to protect them by damming or booming (Law *et al.* 2011).

- **Sea cliffs, sea caves** – The vulnerability of rocky shores is mainly dependent on the wave exposure. Exposed rocky shores are normally considered to be one of the least vulnerable habitats to oil spills, because the oil is quickly removed by wave action. Sheltered rocky shores are often more vulnerable and sensitive, particularly if they include lots of rockpools and crevices (Law *et al*. 2011). 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 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*). 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 7.2 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 (given the vulnerability of their qualifying features and location with respect to the Blocks, see Appendix B) are listed. Due to the limited distance which may be travelled by spilled diesel oil (up to *ca.* 24km), potential oil spill effects relate to a limited number of sites. Note that several sites are represented in more than one risk category.

Table 7.2: Annex I habitat types and Annex II species potentially vulnerable to oil spills

Mudflats and sandflats
Number of physical and biological characteristics of sediment shores that can influence their vulnerability and sensitivity, including wave exposure, shore topography, sediment composition, height of water table, presence of large burrows, abundance and diversity of infauna, and use of the shore by birds for feeding and roosting. Wave-exposed clean sandy shores are often considered to have a low vulnerability and sensitivity due to the natural cleaning of the waves and the relatively poor fauna in the sediment (Law *et al.* 2011). 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 (relevant Block):** Drigg Coast SAC (113/22, 113/27d), Morecambe Bay SAC (110/4b, 110/5, 110/10)
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 (relevant Block):** Drigg Coast SAC (113/22, 113/27d), Morecambe Bay SAC (110/4b, 110/5, 110/10)
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. Generally considered to be very vulnerable to oil spills, because they form in the upper part of sheltered muddy shores where oil becomes concentrated. Once oil gets into a marsh it is trapped by the vegetation where it becomes difficult to remove and causes long-term contamination (Law *et al.* 2011). **Sites potentially at (relevant Block):** Drigg Coast SAC (113/22, 113/27d), Morecambe Bay SAC (110/4b, 110/5, 110/10)
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 (relevant Block):** Morecambe Bay SAC (110/4b, 110/5, 110/10)
Cetaceans
Sites comprise a variety of marine habitats utilised by cetaceans for foraging and other activities, with extensive areas beyond the site boundary also utilised. Much of the evidence of cetacean injuries is circumstantial, but it seems likely that individuals are occasionally exposed to oil from large spills, sometimes being attracted to the spill area by the response activity. While their skin is not thought to be particularly sensitive to oil, any accidental ingestion or breathing of oily fumes could cause physiological stress (Law *et al.* 2011). **Sites potentially at risk:** None
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). Toxic effects from oil vapours and aerosols can have severe effects on respiration and the nervous system and can result in death. If seals are trapped near the source of a spill, they may be seriously affected; particularly if the oil is light with a large proportion of aromatic hydrocarbons. Seal pups are likely to be more sensitive than the adults, and pups trapped on beaches when oil comes ashore will be more vulnerable (Law *et al.* 2011).

Sites potentially at risk: None

Migratory fish

Fish are at greatest risk from contamination by oil spills when the water depth is very shallow. Below 10m, in open waters, the likelihood that contaminant concentrations will be high enough to affect fish populations is very small, even if chemical dispersants are used to disperse oil. In shallow or enclosed waters however, high concentrations of freshly dispersed oil may kill some fish and have sublethal effects on others. Juvenile fish, larvae and eggs are most sensitive to the oil toxicity (Law *et al*. 2011) – note that likely hydrocarbons are gas reducing possible spills to that of diesel, for which dispersant would not be used.

Sites potentially at risk: None

7.3.1.1 Drigg Coast SAC

(Annex I qualifying habitats: estuaries, Atlantic decalcified fixed dunes (*Calluno-Ulicetea*), dunes with *Salix repens* ssp. *argentea (Salicion arenariae*), 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* (`white dunes`), fixed dunes with herbaceous vegetation (`grey dunes`), humid dune slacks)

The estuary complex is one of the most natural and least developed in the UK, with little industry and virtually no artificial coastal defences. The estuary complex is fed by the Rivers Irt, Mite and Esk which discharge through a mouth that has been narrowed by large sand and shingle spits on which the Drigg and Eskmeals dune systems have developed. 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 there is an excellent zonation of saltmarsh habitats from pioneer through to upper marsh and some of the least disturbed transitions to terrestrial habitats, particularly to sand dune, shingle and freshwater swamp (English Nature 2000b).

English Nature (2000b) indicated that both the intertidal mudflat and sandflat communities and saltmarsh communities of the Drigg Coast SAC were highly sensitive to toxic contamination from introduction of synthetic and non-synthetic compounds such as PCBs and heavy metal based compounds. However, there was a relatively low exposure to activities which could introduce non-synthetic compounds (e.g. heavy metals, hydrocarbons) (English Nature 2000).

7.3.1.2 Morecambe Bay SAC

(Annex I qualifying habitats: estuaries, mudflats and sandflats not covered by seawater at low tide, large shallow inlets and bays, perennial vegetation of stony banks, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes`), fixed dunes with herbaceous vegetation (`grey dunes`), humid dune slacks, sandbanks which are slightly covered by sea water all the time, coastal lagoons, reefs, embryonic shifting dunes, Atlantic decalcified fixed dunes (*Calluno-Ulicetea*), dunes with *Salix repens* ssp. *argentea (Salicion arenariae)*

Annex II qualifying species: Great crested newt *Triturus cristatus)*

See Section 5.5.3 for a summary description of the Morecambe Bay SAC. English Nature (2000a) indicated that the introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons) may cause deterioration of the large shallow inlets and bay, intertidal mudflats and sandflats and saltmarsh habitats. It was noted that saltmarshes were very sensitive to oil, even at relatively low levels, mainly by virtue of their ability to trap sediments, and that acute events such as oil spills could be particularly damaging to saltmarsh plants. English Nature (2000b) indicated that based on their exposure to activities and their sensitivity, the habitats were moderately vulnerable to the introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons).

Consideration

Given that the potential hydrocarbon resource in the Blocks is gas, the potential for the conservation objectives of the qualifying features of the Drigg Coast SAC and Morecambe Bay SAC to be undermined by a spill is extremely remote. However, the possibility of spills of diesel fuel or lubricants cannot be discounted and is addressed through existing regulatory mechanisms.

The likelihood of a large oil spill is extremely low (blowout occurrence frequency in the range of 1/1,000-10,000 well years, see Section 7.2). All of the work programmes indicate a drill or drop well. Therefore, following examination of existing seismic information a decision will be made by the prospective licensee to drill a well or relinquish the Blocks. As the location and design of any proposed well is not known, a detailed assessment of the potential for effects from an accidental spill cannot be made at this time.

Following licensing, specific activities require permitting (see Section 7.4) and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and HRA 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 well will not have an adverse effect on the integrity of relevant SACs. As stated previously, as the recoverable resources are gas, no significant oil spill can be expected in the case of a blowout.

7.3.2 Special Protection Areas

Table 7.3 provides information on those SPA types which are potentially vulnerable to oil spills. As the eastern Irish Sea is a gas province, and crude oil spills unlikely, 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 (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 7.3 - 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. Seabirds feeding or resting on the sea surface are vulnerable to water-borne pollution, and the period when they will be most vulnerable is when large numbers of birds are aggregated on the water – including during the breeding season, when they are aggregated inshore, and, for species of auk, during the autumnal moult, when gatherings of flightless birds form rafts on the water (see Section 7.2.3). Vulnerability to pollutants will also be affected by the condition of the birds, so winter food shortages could increase the vulnerability of many birds (Law *et al.* 2011). **Sites potentially at risk:** None
Petrel, tern, skua or gull breeding populations
Designated for breeding terns and other seabirds, which generally forage over sea areas adjacent to (or in some cases at considerable distance from) breeding sites. **Sites potentially at risk (relevant Block):** Duddon Estuary SPA (110/4b, 110/5), Morecambe Bay SPA (110/4b, 110/5, 110/10) Ribble & Alt Estuaries SPA (110/10)
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. Seaduck form non-breeding concentrations in certain shallow coastal areas, spending most of the time on the water, diving in shallow areas for bivalve shellfish, and are therefore very vulnerable to oil spills (Law *et al.* 2011). **Sites potentially at risk (relevant Block):** Duddon Estuary SPA (110/4b, 110/5), Morecambe Bay SPA (110/4b, 110/5, 110/10) Ribble & Alt Estuaries SPA (110/10)
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. Waterfowl appear to have a relatively low vulnerability to the direct effects of oil spills. The primary concern for waterfowl during oil spills is the effects of the oil and the clean-up on their feeding and roosting resources. Avoidance of oiled sediment flats, which can be exacerbated by disturbance from clean-up activity, drives the birds away to find feeding and roosting areas elsewhere (Law *et al.* 2011). **Sites potentially at risk (relevant Block):** Duddon Estuary SPA (110/4b, 110/5), Morecambe Bay SPA (110/4b, 110/5, 110/10) Ribble & Alt Estuaries SPA (110/10)
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 (110/4b, 110/5, 110/9c, 110/10)

7.3.2.1 Consideration

The qualifying features of the sites listed in Table 7.3 are potentially vulnerable to a large oil spill due to both coastal and wider foraging, and for some species, time spent at the sea surface (see Section 7.2), which could result in significant disturbance to species. Additionally, such a large spill could result in damage to supporting habitats including intertidal areas utilised by a variety of wintering waterfowl and waders (e.g. Duddon Estuary SPA, Morecambe Bay SPA and Ribble and Alt Estuaries SPA). Blowout occurrence frequency is in the range of 1/1000-10,000 well years (see Section 7.2) and the eastern Irish Sea basin is a gas province, which negates the possibility of a significant crude oil spill. Spill scenarios are restricted to accidental spills of diesel fuel or lubricants. All of of the proposed work programmes indicate a drill or drop well. Therefore, following examination of existing seismic information a decision will be made by the prospective licensee to drill a well or relinquish the Block. As the location and design of proposed drill or drop wells is not known, a detailed assessment of the potential for effects from an accidental spill cannot be made at this time.

Following licensing, specific activities require permitting (see Section 7.4) and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and HRA 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 well will not have an adverse effect on the integrity of the SPAs listed in Table 7.3. As stated previously, as the recoverable resources are gas, no significant oil spill can be expected in the case of a blowout.

7.4 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 relevant Devolved Authority, the Joint Nature Conservation Committee, the relevant inshore statutory nature conservation body, e.g. Natural England, and other relevant organisations. An OPEP will only be approved following consultation and satisfactory operator response to any comments. Approval of an OPEP does not constitute approval of the operations covered by the plan. Operators are responsible for ensuring compliance with all other regulatory requirements. 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 MCA is responsible for a National Contingency Plan and until recently, maintained four Emergency Towing Vessels (ETVs) which were stationed around the UK. However, these have now been removed and the UK Government recently announced that a new ETV for the waters around the Northern and Western Isles will be stationed in Orkney up to 2015. The government is also in discussions with oil industry on the potential of a commercial call-out arrangement to use their vessels. 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. 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 2012b) 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[22] 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 7.1). Oil & Gas UK established the Oil Spill

[22] 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).

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. 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.

In relation to OPEPs, the assessment and approval process and the toolkit of response measures which UKCS operators can draw upon have been strengthened by a more robust approach to oil spill trajectory modelling which includes worst case scenario planning and the availability of the new OSPRAG capping device which is now built and ready for deployment. The Oil Spill & Emergency Response Review Group (OSERRG) also recommended that a new forum, the Oil Spill Response Forum (OSRF), be set up to 'further develop and maintain an effective, robust and sustainable oil spill response capability for upstream operations on the UKCS'. This includes workgroups on oil pollution emergency planning, subsea dispersant injection, shoreline response and science and new technology.

OSPRAG's technical review group reviewed 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.

Whilst the indemnity and insurance group of OSPRAG concluded that to date the current OPOL level of US $250 million is appropriate, draft guidance issued by Oil & Gas UK in June 2012 outlines a new process by which operators assess the potential cost of well control, pollution remediation and compensation, with a subsequent requirement to demonstrate to DECC financial capability to address these potential consequences.

7.5 Conclusions

Individual European Sites have been categorised in terms of potential vulnerability, based on location in relation to known hydrocarbon prospectivity (gas) of the proposed licence Blocks (assumed to be gas, with a worst case spill of diesel in terms of potential spill impacts) and therefore the nature and magnitude of credible risks. 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 creates an offence of such spills to enable 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 HRA 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 mitigation measures, DECC considers that that exploration and production activities that could follow the licensing of Blocks 110/4b, 110/5, 110/9c, 110/10, 113/22, 113/27d, in so far as they may cause oil spills, 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 adversely affect the site integrity of Natura 2000 sites.

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 2009, 2011; see also OSPAR 2000, 2010).

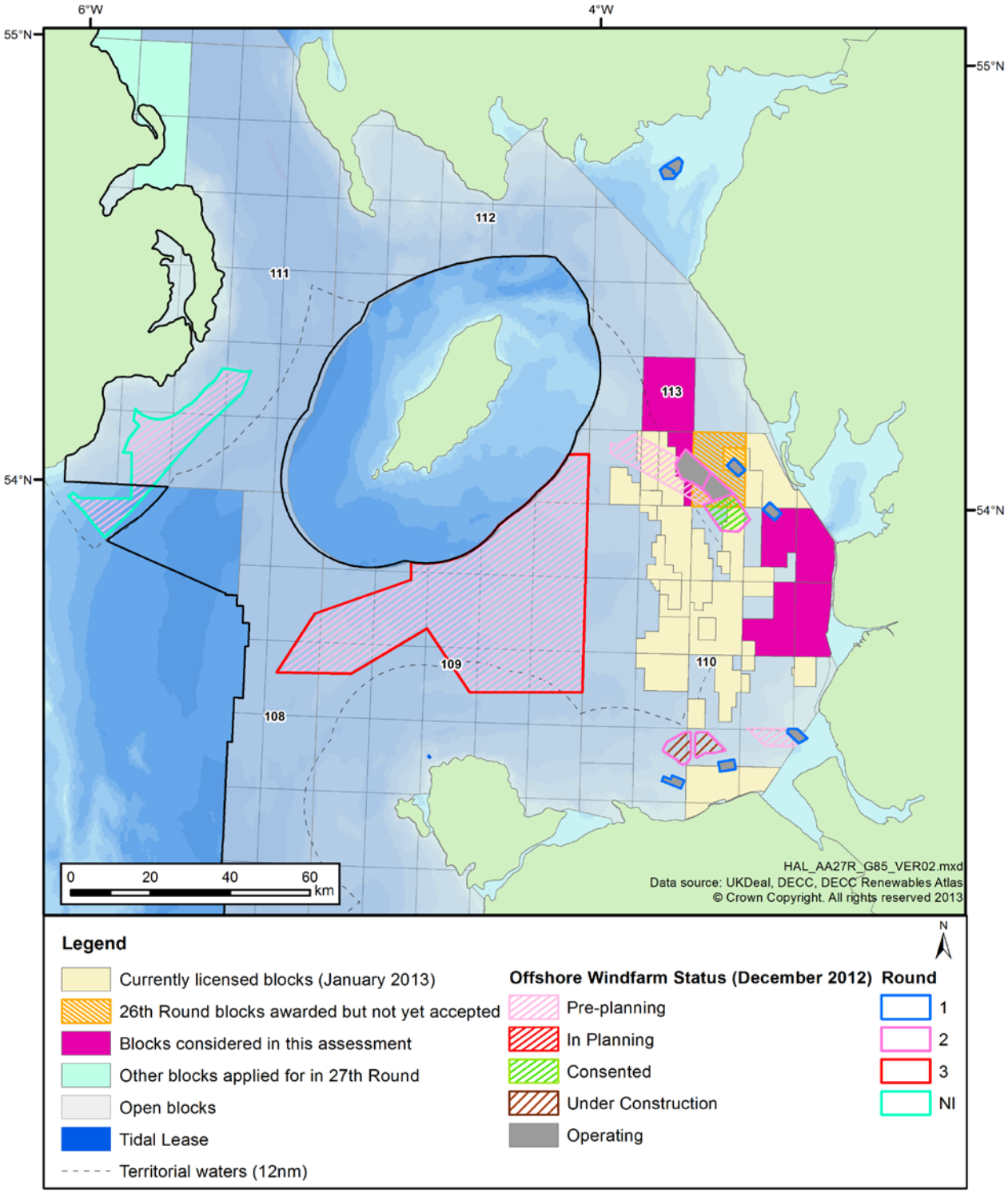
8.1 Underwater Noise

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". Oil and gas activities across the region (including both shelf waters and deeper waters to the north and west) are limited 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 2GW of offshore wind energy in the region to be distributed off the north Wales coast and at various sites off the Cumbrian coast (Figure 8.1). 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, a development area which covers 2,200 km^2. In March 2012, Centrica and Dong Energy announced they had formed a joint venture called Celtic Array Limited to develop offshore wind farms in the Irish Sea Zone. Following a two year appraisal programme, they identified three potential development areas within the Irish Sea where they considered offshore windfarm development could be feasible – these areas lie to the west of the Blocks considered in this AA. The first project from this joint venture is the Rhiannon Wind Farm, the boundary of which lies approximately 19km north east of Anglesey and 34km south east of the Isle of Man; the offshore scoping report for this development was submitted to the Planning Inspectorate in July 2012. The consenting of developments in this region will be subject to detailed project-specific EIA and HRA.

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 (Figure 8.1). The developers, Marine Current Turbines and RWE npower Renewables are targeting 2013/2014 for the start of commissioning (Marine Current Turbines website). A public exhibition of the potential development was put on display at the Holyhead Town Hall in June of 2012.

Figure 8.1 – Relevant marine renewable energy development in the area



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 2009, 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.

In relation to offshore pile-driving, standard conditions on consents for Round 2 (and anticipated for Round 3) offshore wind farms include various protocols to minimise the potential for acoustic disturbance of marine life, including the use of soft start, MMOs and PAM. For future developments, additional measures are likely to be required in areas where EIA suggests that high cetacean densities or site fidelity may occur; these may include technical measures such as pile sleeves (see Nehls *et al*. 2007). The "Statutory nature conservation agency protocol for minimising the risk of disturbance and injury to marine mammals from piling noise" (August 2010) 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, gas storage) 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 likely number and scale of activities proposed by the work programmes (see Section 2.2) 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 HRA.

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. Task Group 11 reported on underwater noise and other forms of energy (though note that at present only noise is considered), and developed three possible indicators of underwater sound (Tasker *et al*. 2010). 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. The EC decided in 2010 that guidance was needed to help member states implement the indicators. Established in 2010, the Technical Sub Group (TSG) Noise focussed on clarifying the purpose, use and limitation of the indicators and described methodology that would be unambiguous, effective and practicable (Van der Graaf *et al.* 2012).

A UK Government consultation was undertaken on proposals for characteristics of GES for the UK's seas and for more detailed targets and indicators of GES (HM Government 2012a)[23]. The report recognises that there was insufficient data to provide a quantitative assessment of

[23] Note that proposed GES characteristics, targets and indicators were subject to consultation in March 2012, with a Government response expected in November/December 2012.

the current status and trends of underwater noise due to the lack of monitoring studies. However, increases in construction levels were likely to have contributed to localised increases in noise levels. The document indicates that further research, monitoring and investigation were necessary to fully understand the effects of noise at an individual and population level, the risks and significance of sound inputs to the environment, and appropriate options for mitigation. However, currently there is no evidence to suggest that current levels of noise in UK waters were having an impact at the population level on cetaceans or other noise sensitive animals (HM Government 2012a).

Following consultation a Government (HM Government 2012b) response defined the UK characteristics of Good Environmental Status for noise (covering impulsive sound, caused primarily by activities such as oil and gas seismic activity and pile driving for wind farms) as:

- Loud, low and mid frequency impulsive sounds and continuous low frequency sounds introduced into the marine environment through human activities do not have adverse effects on marine ecosystems: Human activities potentially introducing loud, low and mid frequency impulsive sounds into the marine environment are managed to the extent that no significant long term adverse effects are incurred at the population level or specifically to vulnerable/threatened species and key functional groups. Continuous low frequency sound inputs do not pose a significant risk to marine life at the population level, or specifically to vulnerable/threatened species and key functional groups e.g. through the masking of biologically significant sounds and behavioural reactions.

It was recognised in the consultation document (HM Government 2012a) that setting a specific target representing GES was difficult, given current uncertainties. Due to the high level of uncertainty about the effects of noise, it has not been possible for experts to recommend a specific target for either impulsive sounds or ambient sounds which they believe to be equivalent to GES. Instead, an operational target has been developed for impulsive sounds and a surveillance indicator developed for ambient sounds (HM Government 2012b):

- To establish a 'noise registry' to record, assess and manage the distribution and timing of anthropogenic sound sources measured over the frequency band 10Hz to 10kHz, exceeding the energy source level 183 dB re 1 μPa^2 m^2s; or the zero to peak source level of 224 dB re 1 μPa^2 m^2 over the entire UK hydrocarbon licence block area.

- Surveillance indicator to monitor trends in the ambient noise level within the 1/3 octave bands 63 and 125Hz (centre frequency) (re 1µPa RMS; average noise level in these octave bands over a year) measured by observation stations.

It is anticipated that monitoring data arising from the latter ambient noise surveillance indicator will help to develop an appropriate target for 2018. The noise registry would likely be managed by JNCC and require a degree of coordination from regulating authorities around the UK. It would enable a better understanding of the potential for cumulative and in-combination effects, and allow for some adjustment in the scheduling of activities if it appeared significant adverse impacts may arise (HM Government 2012a, b).

DECC is cognisant of the ongoing efforts to determine an indicator, descriptor of good environmental status and targets for noise. DECC will review the results of the ongoing process closely with respect to the consenting of relevant activities which may result from the

draft plan/programme, as well as other activities which generate noise in the marine environment.

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/positioning of drilling 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).

In general, cumulative effects are likely to be dominated by trawling, with potential scour and physical damage from cable laying and other activities associated with potential offshore wind developments which are likely to be more important in the future.

Given the forecast scale of activity within this oil and gas licensing round, 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 are an important consideration at the project level for any large offshore wind developments that are planned for the Irish Sea and will likely form an important part of associated HRAs.

8.2.3 Marine discharges

As described in Section 5.3 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. Previous discharges of WBM cuttings in the UKCS have been shown to disperse rapidly and to have minimal ecological effects (Section 5.3). 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).

The planning for the Gateway Gas Storage Project is currently underway, with a licence having been granted for the project in 2010. The project will consist of an offshore underground natural gas storage facility (consisting of 24 underground storage caverns, created by a solution mining process (leaching)) pipelines to transport the gas and an onshore gas compression facility. The offshore storage facility site will be located in the eastern Irish Sea, to the west of Shell Flat. The construction, operation and maintenance of the site, along with the associated vessel traffic could increase the potential exposure to spills, introduction of other non-synthetic compounds and large volume saline discharges.

8.3 Conclusions

Available evidence (see e.g. UKBenthos database and OSPAR 2000) for the eastern Irish Sea 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 HRA 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 110/4b, 110/5, 110/9c, 110/10, 113/22 and 113/27d with those from existing and planned activities will not adversely affect the integrity of the relevant European Sites.

9 Overall conclusion

Taking account of all the matters discussed, 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 110/4b, 110/5, 110/9c, 110/10, 113/22, 113/27d (considered further in Sections 5-8). 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.gov.uk/oil-and-gas-offshore-environmental-legislation and https://www.gov.uk/oil-and-gas-petroleum-operations-notices) which apply to developer activities which could follow plan adoption. Where necessary, project-specific HRA based on detailed project proposals 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 HRA 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. JNCC[24] note that, "*The legal list of qualifying species, for which a Special Protection Area (SPA) has been selected and is managed, is given on the relevant SPA citation (available from the country agency concerned). A review of the UK network of SPAs was co-ordinated by JNCC in the late 1990s. Following formal submission to, and agreement by, relevant Ministers, the results were published in 2001. This Review revised the list of qualifying species at some SPAs.*

However, it is taking some time to revise all the relevant SPA citations in the light of these agreed changes to the affected lists of qualifying species. Where there is mismatch between species listed in extant citations and listed in the 2001 Review for the same sites, there has been confusion as to the "correct" list of qualifying species to be used at any site for the purposes of management, assessment and development control.

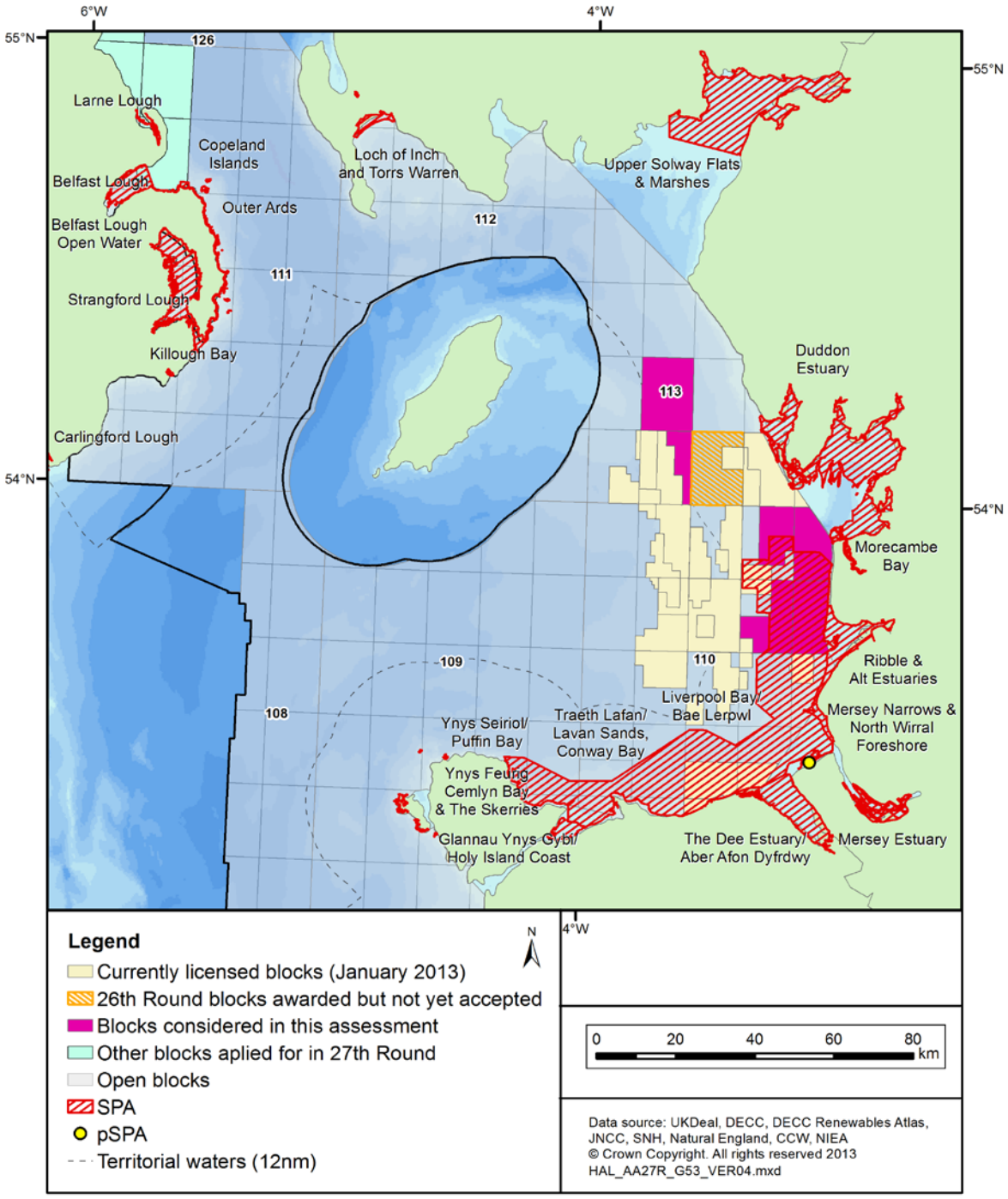
The individual site accounts in 2001 Review should be taken as the definitive list of qualifying species at the SPA concerned. However, at sites where there remain differences between that list of qualifying species and the extant site citation, then the relevant country agency should be contacted for further guidance."

A review of SPA sites was undertaken to identify where a mismatch between the qualifying species lists existed. Each country agency (NE, SNH, CCW, NIEA) was contacted to clarify those features which should be considered. The species listed in Table A.1 reflect the outcome of this review.

[24] http://jncc.defra.gov.uk/page-5485 (accessed: October 2012)

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[25]
Northern Ireland				
Larne Lough SPA	395.94	Breeding: Common tern Roseate tern Sandwich 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	Overwinter: Ringed plover Turnstone Canadian light-bellied brent goose	N/A
Strangford Lough SPA	15580.79	Breeding: Arctic tern Common tern Sandwich tern Over winter: Bar-tailed godwit Golden plover	Over winter: Knot Canadian light-bellied brent goose Redshank Shelduck	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	Over winter: Canadian light-bellied brent goose	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	Over winter: Waterfowl

[25] - 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[25]
			Teal Turnstone Scaup Goldeneye Grey plover Shelduck On passage: Ringed plover	
England				
Duddon Estuary SPA	6806.3	Breeding: Sandwich tern	Over winter: Knot Pintail Redshank On passage: Ringed plover Sanderling	Over winter: Waterfowl
Morecambe Bay SPA	37404.6	Breeding: Sandwich tern Little tern Over winter: Bar-tailed godwit Golden plover	Breeding: Herring gull Lesser black-backed gull On passage: Ringed plover Sanderling 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	Breeding: Seabirds Over winter: Waterfowl

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[25]
			Curlew Cormorant Grey plover Shelduck Redshank Lapwing On passage: Sanderling Ringed plover Whimbrel Redshank	
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	Over winter: Waterfowl
Mersey Narrows and North Wirral Foreshore pSPA	2089.41		Over winter: Redshank Turnstone	Over winter: Waterfowl
Liverpool Bay / Bae Lerpwl marine SPA	170,292.94	Over winter: Red-throated diver	Over winter: Common scoter	Over winter: Waterfowl
The Dee Estuary / Aber Afon Dyfrdwy SPA	13084.85	Breeding: Common tern Little tern Over winter: Bar-tailed godwit On passage: Sandwich tern	Over winter: Pintail Knot Oystercatcher Shelduck Redshank Black-tailed godwit Curlew Dunlin Grey plover Teal On passage: Redshank	Over winter: Waterfowl
Wales				
Glannau Ynys Gybi / Holy Island Coast SPA	608.04	Breeding: Chough Over winter: Chough		
Traeth Lafan / Lavan Sands, Conway Bay	2642.98		Over winter: Oystercatcher	

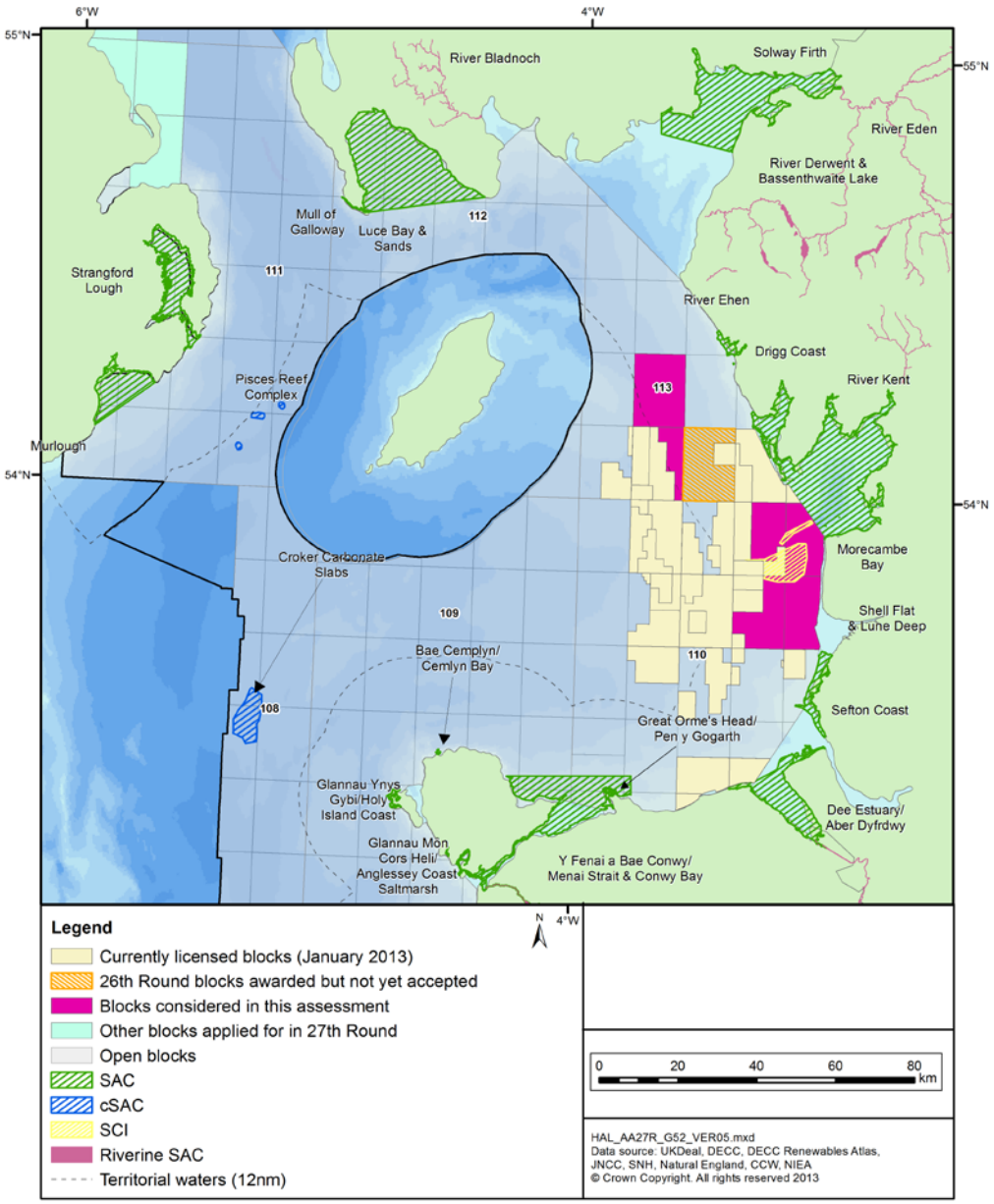
Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[25]
SPA			Curlew On passage: Great crested grebe	
Ynys Feurig, Cemlyn Bay and the Skerries SPA	85.98	Breeding: Roseate tern Common tern Arctic tern Sandwich tern		
Ynys Seiriol / Puffin Bay SPA	31.33		Breeding: 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 SCI	10565	Sandbanks Reefs	N/A	N/A	N/A
Sefton Coast SAC	4563.97	Coastal dunes	Coastal dunes	Petalwort *Petalophyllum ralfsii*	Great crested newt *Triturus cristatus*
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*
Wales					
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
Glannau Môn Cors heli/Anglesey Coast: Saltmarsh SAC	1058	Salt marshes and salt meadows	Estuaries Mudflats and sandflats	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 cSAC	697.35	Reefs	N/A
Croker Carbonate Slabs cSAC	6591	Submarine structures made by leaking gases	N/A

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.

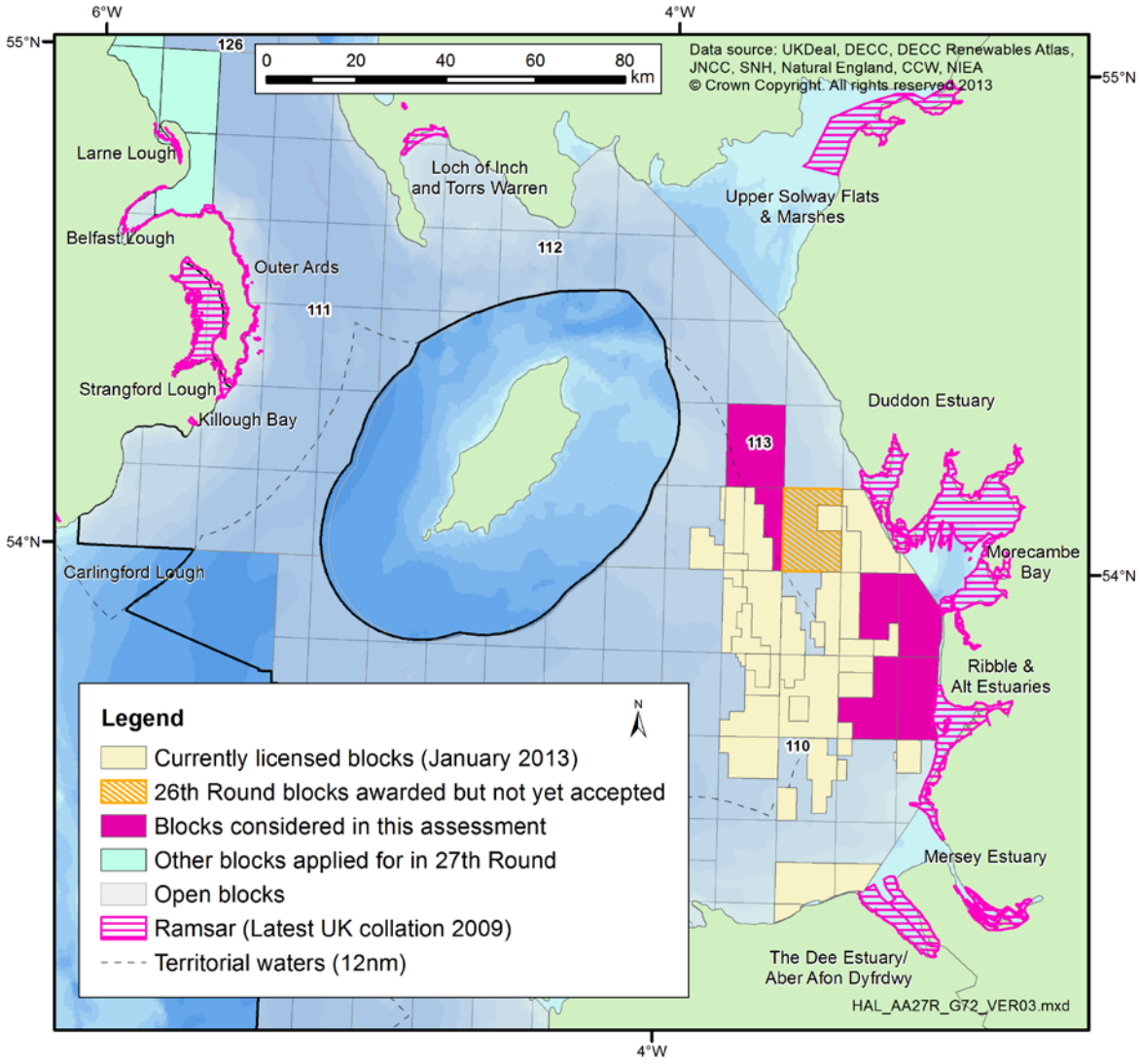
Table A.4: Relevant riverine and freshwater SACs designated for migratory fish and/or the freshwater pearl mussel

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	✓	
River Dee + Bala Lake/Afon Dyffrdwy a Llyn Tegid		AS, SL, RL
Wales		
Afon Gwyrfai a Llyn Cwellyn		AS

[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 below.

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
	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 – Re-screening tables for the identification of likely significant effects on the sites

In the original screening assessment, the implications of geophysical survey, drilling and physical effects were considered in a generic way for all Blocks applied for in the 27th Round (DECC 2012) for sites where there was a foreseeable possibility of interactions[26]. Subsequent to the publication of the screening assessment (DECC 2012), proposed work programmes for the Blocks have been confirmed by the applicant companies (see below), or in some cases applications made for Blocks have been withdrawn.

Proposed work programmes for the Blocks from the range of licence applications received are as follows, (see also Section 2.2 for details):

- 110/4b – Drill or drop well
- 110/5 – Drill or drop well
- 110/9c & 110/10 – Drill or drop well
- 113/22 – Drill or drop well
- 113/27d – Drill or drop well

In light of the proposed work programmes, and confirmation of those Blocks proposed to be taken forward for licensing, those sites initially identified in the screening document as having a foreseeable interaction with offshore oil and gas activities are re-screened below. The potential for likely significant effects on relevant Natura 2000 sites (listed in Appendix A) is considered in the table below and where relevant, the location of further appropriate assessment is clearly signposted. More information on the conservation objectives and status of those sites identified as requiring consideration in the AA is provided in Appendix C.

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 considered under the following broad headings:

[26] Coastal and marine sites along the coasts of the United Kingdom and in territorial waters, Offshore sites (i.e. those largely or entirely beyond 12nm from the coast), Riverine sites designated for migratory fish and/or the freshwater pearl mussel, sites designated for breeding red-throated divers, sites in the waters of other member states at or adjacent to the UK median line.

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

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	-	✓	-	-	-	-	-	**Qualifying features:** Breeding terns and overwintering geese **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Belfast Lough	✓	✓	✓	-	-	-	-	**Qualifying features**: Overwintering waders and waterfowl **Consideration of likely significant effects**: Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Belfast Lough Open Water	-	✓	-	-	-	-	-	**Qualifying features:** Overwintering great crested grebe **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Copeland Islands	✓	-	-	-	-	-	-	**Qualifying features:** Breeding tern and Manx shearwater

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
								Consideration of likely significant effects: Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Outer Ards	✓	✓	-	-	-	-	-	**Qualifying features:** Breeding tern and overwintering waders **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Strangford Lough	✓	✓	-	-	-	-	-	**Qualifying features:** Breeding terns, overwintering waterfowl and waders **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Killough Bay	-	✓	-	-	-	-	-	**Qualifying features:** Overwintering geese **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Carlingford Lough	✓	✓	-	-	-	-	-	**Qualifying features:** Breeding terns and overwintering geese **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
								activities and site negates likely significant effect
SCOTLAND								
Loch of Inch and Torrs Warren	-	✓	-	-	-	-	-	**Qualifying features:** Overwintering geese and hen harrier **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Upper Solway Flats and Marshes	-	✓	✓	-	-	-	-	**Qualifying features:** Overwintering waders and waterfowl **Consideration of likely significant effects**: Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
ENGLAND								
Duddon Estuary	✓	✓	✓	✓	-	-	✓	**Qualifying features:** Breeding tern, on passage overwintering waterbirds and waders **Consideration of likely significant effects:** 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 Blocks 110/4b or 110/5, weathered spilled diesel oil could theoretically affect the qualifying features although mitigation would be possible. Potential in-combination effects with renewable energy developments in the eastern and central Irish Sea. **Appropriate Assessment:** See Sections 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Morecambe Bay	✓	✓	✓	✓	✓	-	✓	**Qualifying features:** Breeding terns, gulls and seabirds, on passage

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
								and overwintering waterbirds and waders **Consideration of likely significant effects:** Block 110/5 abuts the SPA boundary and certain activities in or related to, this Block could potentially undermine the conservation objectives of the qualifying features through physical disturbance (e.g. noise and visual disturbance of birds foraging within and outside the site, damage or loss of habitat from smothering by drilling discharges, the installation of infrastructure and cables). In the unlikely event of a major diesel oil spill from Block 110/4b, 110/5 or 110/10, weathered spilled diesel oil could theoretically affect the qualifying features although mitigation would be possible. Potential in-combination effects with renewable energy developments in the eastern and central Irish Sea. **Appropriate Assessment:** See Sections 5.5, 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Ribble and Alt Estuaries	✓	✓	✓	✓	✓	-	✓	**Qualifying features:** Breeding tern, gulls, ruff and seabirds, on passage and overwintering waterbirds and waders **Consideration of likely significant effects:** Block 110/10 abuts the SPA boundary and certain activities in or related to, this Block could potentially undermine the conservation objectives of the qualifying features through physical disturbance (e.g. noise and visual disturbance of birds foraging within and outside the site, damage or loss of habitat from smothering by drilling discharges, the installation of infrastructure and cables). In the unlikely event of a major diesel oil spill from Block 110/10, weathered spilled diesel oil could theoretically affect the qualifying features although mitigation would be possible. Potential in-combination effects with renewable energy developments in the eastern and central Irish Sea. **Appropriate Assessment:** See Sections 5.5, 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
								HRA once project plans are known.
Mersey Narrows and North Wirral Foreshore pSPA	-	✓	-	-	-	-	-	**Qualifying features:** Overwintering waders and waterfowl **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Mersey Estuary	-	✓	✓	-	-	-	-	**Qualifying features:** Overwintering and passage waders, and waterfowl **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Liverpool Bay / Bae Lerpwl	-	✓	-	✓	✓	-	✓	**Qualifying features:** Overwintering red throated diver, common scoter and waterfowl **Consideration of likely significant effects:** Blocks 110/4b, 110/5 and 110/9c intersect the SPA and Block 110/10 is wholly within the SPA area. The western edge of Blocks 110/5 and 110/10 abut the coastal fringes of the SPA site. Site conservation objectives may be undermined by physical disturbance (e.g. rig placement, pipeline trenching), emissions or discharges from routine operations. Disturbance of the qualifying features by vessel movements or helicopter overflights is also possible although mitigation would be possible. In the unlikely event of a major diesel oil spill from any of the above Blocks, weathered spilled diesel oil could theoretically affect the qualifying features although mitigation would be possible. Potential in-combination effects with renewable energy developments in the eastern and central Irish Sea.

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
								Appropriate Assessment: See Sections 5.5, 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
The Dee Estuary	✓	✓	✓	-	-	-	-	**Qualifying features:** Breeding terns, overwintering and passage waders and waterfowl **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
WALES								
Traeth Lafan / Lavan Sands, Conway Bay	-	✓	-	-	-	-	-	**Qualifying features:** Overwintering and passage waterbirds **Consideration of likely significant effects**: Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Ynys Seiriol / Puffin Island	✓	-	-	-	-	-	-	**Qualifying features:** Breeding cormorant **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Ynys Feurig, Cemlyn Bay and The Skerries	✓	-	-	-	-	-	-	**Qualifying features:** Breeding tern **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
								activities and site negates likely significant effect
Glannau Ynys Gybi / Holy Island Coast	✓	✓	-	-	-	-	-	**Qualifying features:** Breeding and overwintering choughs **Implications for conservation objective**: Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect

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	✓	✓	-	-	✓	✓	**Qualifying features:** Mudflats and sandflats, coastal lagoons, inlets and bays, reefs, vegetation of drift lines and stony banks, salt marshes and salt meadows, harbour seals **Consideration of likely significant effects:** 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) outside the site boundaries although mitigation would be possible and no seismic proposed. Potential in-combination effects with renewable energy developments in the eastern and central Irish Sea (offshore wind) and Strangford Narrows (tidal) areas. **Appropriate Assessment:** See Sections 6.4 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Murlough	✓	✓	-	-	✓	✓	**Qualifying features:** Coastal dunes, sandbanks, mudflats and sandflats, salt marshes and salt meadows, coastal dunes, marsh fritillary butterfly and harbour seal **Consideration of likely significant effects:** 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) outside the site boundaries although mitigation would be possible and no seismic proposed. Potential in-combination effects with renewable energy developments in the eastern

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							and central Irish Sea (offshore wind). **Appropriate Assessment:** See Sections 6.4 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
SCOTLAND							
Mull of Galloway	✓	-	-	-	-	-	**Qualifying features:** Sea cliffs **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Luce Bay and Sands	✓	✓	-	-	-	-	**Qualifying features:** Inlets and bays, coastal dunes, sandbanks, mudflats and sandflats, reefs, great crested newt **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Solway Firth	✓	✓	-	-	✓	-	**Qualifying features:** Sandbanks, estuaries, mudflats and sandflats, salt marshes and salt meadows, reefs, vegetation of stony banks, coastal dunes, sea and river lamprey. **Consideration of likely significant effects:** 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), outside the site boundaries although mitigation would be possible and no seismic proposed. **Appropriate Assessment:** See Section 6.4. Further, project specific

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							mitigation measures would be defined by subsequent HRA once project plans are known.
ENGLAND							
Drigg Coast	✓	-	✓	-	-	-	**Qualifying features:** Estuaries, coastal dunes, mudflats and sandflats, salt marshes and salt meadows, coastal dunes. **Consideration of likely significant effects:** Site conservation objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major diesel oil spill Blocks 113/22 and 113/27d, weathered spilled diesel oil could theoretically affect the qualifying features although mitigation would be possible. **Appropriate Assessment:** See Section 7.3. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Morecambe Bay	✓	✓	✓	✓	-	-	**Qualifying features:** 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. **Consideration of likely significant effects:** Block 110/5 abuts the edge of the SAC area. Site conservation objectives may be undermined by physical disturbance (e.g. rig placement, pipeline trenching), emissions or discharges from routine operations. In the unlikely event of a major diesel oil spill from Blocks 110/4b, 110/5 and 110/10, weathered spilled diesel oil could theoretically affect habitat features (e.g. estuaries, inlets and bays, mudflats and sandflats, salt marshes), although mitigation would be possible. **Appropriate Assessment:** See Sections 5.5 and 7.3. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Shell Flat and Lune Deep SCI	✓	-	-	✓	-	✓	**Qualifying features:** Sandbanks, reefs

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							Consideration of likely significant effects: Blocks 110/4b and 110/5 intersect the SCI and the northern edges of Blocks 110/9c and 110/10 also fall within the SCI area. Site conservation objectives may be undermined by physical disturbance (e.g. rig placement, pipeline trenching), emissions or discharges from routine operations. Potential in-combination effects with potential gas storage project, located just to the west of Shell Flat, through its construction, operation and maintenance phases, as well as associated vessel traffic would increase the potential exposure to spills and other introductions of non-synthetic compounds. **Appropriate Assessment:** See Sections 5.5 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Sefton Coast	✓	✓	-	-	-	-	**Qualifying features:** Coastal dunes, petalwort and great crested newt **Consideration of likely significant effects:** Due to nature of the qualifying features, site conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Dee Estuary / Aber Dyfrdwy	✓	✓	-	-	✓	✓	**Qualifying features:** Estuaries, mudflats and sandflats, salt marshes and salt meadows, vegetation of drift lines, sea cliffs and coastal dunes, sea and river lamprey, petalwort **Consideration of likely significant effects:** 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), outside the site boundaries although mitigation would be possible and no seismic proposed. Potential in-

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							combination effects with renewable energy developments in the eastern and central Irish Sea (offshore wind). **Appropriate Assessment:** See Sections 6.4 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
WALES							
Great Orme's Head / Pen y Gogarth	✓	-	-	-	-	-	**Qualifying features:** Sea cliffs, heaths and grasslands **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Y Fenai a Bae Conwy / Menai Strait and Conwy Bay	✓	-	-	-	-	-	**Qualifying features:** Sandbanks, mudflats and sandbanks, reefs, inlets and bays and sea caves **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Bae Cemlyn / Cemlyn Bay	✓	-	-	-	-	-	**Qualifying features:** Coastal lagoons, vegetation of stony banks **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Glannau Ynys Gybi / Holy Island Coast	✓	-	-	-	-	-	**Qualifying features:** Sea cliffs and heaths **Implication for conservation objectives:** Site is remote from blocks and

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Glannau Môn Cors heli/Anglesey Coast Saltmarsh	✓	-	-	-	-	-	**Qualifying features:** Salt marshes and salt meadows, estuaries, mudflats and sandflats **Implication for conservation objectives:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect

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	✓	-	-	-	-	-	**Qualifying features:** Reefs **Implication for conservation objectives:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Croker Carbonate Slabs	✓	✓	-	-	-	-	**Qualifying features:** Submarine structures made by leaking gases **Consideration of likely significant effects:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect

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]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
SCOTLAND							
River Bladnoch	-	✓	-	-	✓	-	**Qualifying features:** Atlantic salmon **Implication for conservation objectives**: Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) may cause temporary acoustic disturbance to the qualifying feature outside the site boundaries although mitigation would be possible and no seismic proposed. **Appropriate Assessment:** See Section 6.4. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
ENGLAND							
River Eden	✓	✓	-	-	✓	-	**Qualifying features:** Sea and river lamprey, Atlantic salmon **Implication for conservation objectives:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) could cause temporary acoustic disturbance to qualifying features, outside the site boundaries although mitigation would be possible and no seismic proposed. **Appropriate Assessment:** See Section 6.4. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
River Derwent & Bassenthwaite Lake	✓	✓	-	-	✓	-	**Qualifying features:** Sea and river lamprey, Atlantic salmon **Implication for conservation objectives:** Site is remote from blocks and

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) could cause temporary acoustic disturbance to qualifying features, outside the site boundaries although mitigation would be possible and no seismic proposed. **Appropriate Assessment:** See Section 6.4. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
River Ehen	-	✓	-	-	✓	-	**Qualifying features:** Atlantic salmon, freshwater pearl mussel **Implication for conservation objectives:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) could cause temporary acoustic disturbance to qualifying features, outside the site boundaries although mitigation would be possible and no seismic proposed. The gills of migratory salmonids provide an essential mode of dispersal for the larvae of the freshwater pearl mussel; despite the potential for temporary acoustic disturbance of such salmonids outside of the site boundaries, adverse effects on conservation objectives are highly unlikely. **Appropriate Assessment:** See Section 6.4. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
River Kent	-	✓	-	-	-	-	**Qualifying features:** Freshwater pearl mussel **Implication for conservation objectives:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect

Site name	Features present[1]		Vulnerability to Effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
WALES							
River Dee and Bala Lake/Afon Dyffrdwy a Llyn Tegid	-	✓	-	-	✓	-	**Qualifying features:** Sea and river lamprey, Atlantic salmon, brook lamprey, bullhead, otter **Implication for conservation objectives:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) could cause temporary acoustic disturbance to qualifying features, outside the site boundaries although mitigation would be possible and no seismic proposed. **Appropriate Assessment:** See Section 6.4. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Afon Gwyrfai a Llyn Cwellyn	-	✓	-	-	✓	-	**Qualifying features:** Atlantic salmon **Implication for conservation objectives:** Site is remote from blocks and its conservation objectives would not be undermined or affected by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) could cause temporary acoustic disturbance to qualifying features, outside the site boundaries although mitigation would be possible and no seismic proposed. **Appropriate Assessment:** See Section 6.4. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.

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

As part of the 2012 Habitats and Wild Birds Directives Implementation Review[27], it was concluded that conservation objectives should be up-to- date, accessible and allow applicants to assess the impact of their proposed development against them, and that Natural England, with the JNCC, should publish a new approach[28] to the information contained in Conservation Objectives, together with a statement of how their delivery will be prioritised. In the first instance, a set of high level conservation objectives have been applied to all English terrestrial sites (including those with marine components, though not wholly within inshore and offshore waters). It is these conservation objectives which have been used in the Appropriate Assessment, and which are reproduced for each relevant site below.

These high level objectives will be built upon, including the application of (where possible) quantified targets relating to:

- The populations and distribution of qualifying species
- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure of qualifying natural habitats and habitats of qualifying species
- The supporting processes on which qualifying natural habitats and habitats of qualifying species rely

A consultation on this approach is due to take place in autumn 2012 and new conservation objectives are to be set from April 2013, with a view to completing these within 2 years.

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[27] Report of the Habitats and Wild Birds Directives Implementation Review, 2012 (http://www.defra.gov.uk/publications/files/pb13724-habitats-review-report.pdf)

[28] Announcement on 'New Approach' to information contained in European site Conservation Objectives (http://www.naturalengland.org.uk/Images/action-14-announcement_tcm6-32928.pdf)

C1 Coastal and marine Special Protection Areas

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:*** **On passage:** Ringed plover *Charadrius hiaticula*, 628 individuals representing at least 1.3% of the Europe/Northern Africa – wintering population (5 year peak mean 1991/2-1995/6) Sanderling Calidris alba, 1,055 individuals representing at least 1.1% of the Eastern Atlantic/Western & Southern Africa – wintering population (5 year peak mean 1991/2-1995/6) **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) 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:	
With regard to the individual species and/or assemblage of species for which the site has been classified (the Qualifying Features listed above), avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive. Subject to natural change, to maintain or restore: • The extent and distribution of the habitats of the qualifying features	

Site Name: Duddon Estuary SPA
• The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The populations of the qualifying features • The distribution of the qualifying features within the site

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)

Little tern *Sterna albifrons*, 26 pairs representing at least 1.1% of the breeding population in Great Britain (count as at 1994).

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

Golden plover *Pluvialis apricaria*, 4,094 individuals representing at least 1.6% of the wintering population in Great Britain (5 year mean for 1991/92 to 1995/96)

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

During breeding season:
Herring gull *Larus argentatus*, 11,000 pairs representing at least 1.2% of the breeding Northwestern Europe (breeding) and Iceland/Western Europe – breeding population (5 year mean 1992 to 1996).

Lesser black-backed gull *Larus fuscus*, 22,000 pairs representing at least 17.7% of the breeding Wesern Europe/Mediterranean/Western Africa population (5 year mean 1992 to 1996).

Over winter:
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)

Site Name: Morecambe Bay SPA

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)

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)

On passage:
Ringed plover *Charadrius hiaticula*, 693 individuals representing at least 1.4% of the Europe/Northern Africa – wintering population (5 year peak mean for 1991/92 to 1995/96)

Sanderling *Calidris alba*, 2,466 individuals representing at least 2.5% of the Eastern Atlantic/Western & Southern Africa – wintering population (count as at May 1995).

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:

With regard to the individual species and/or assemblage of species for which the site has been classified (the Qualifying Features listed above), avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive.

Subject to natural change, to maintain or restore:

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The populations of the qualifying features
- The distribution of the qualifying features within the site

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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)

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)

Site Name: Ribble and Alt Estuaries SPA

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*, common tern *Sterna hirundo*

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 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*, Whooper swan *Cygnus cygnus*, Bewick's swan *Cygnus columbianus*, common scoter *Melanitta nigra*

Site Name: Ribble and Alt Estuaries SPA

Conservation objectives:

With regard to the individual species and/or assemblage of species for which the site has been classified (the Qualifying Features listed above), avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive.

Subject to natural change, to maintain or restore:

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The populations of the qualifying features
- The distribution of the qualifying features within the site

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.

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 (i.e. the five-year peak mean between 2001/02 – 2006/07);

Site Name: Bae Lerpwl / Liverpool Bay marine SPA
• 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	Grid Ref J559577 (centre point) Latitude 54º26'40"N Longitude 05º35'40"W
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 features: Mudflats and sandflats not covered by seawater at low tide, coastal lagoons *priority feature, large shallow inlets and bays, reefs
Secondary features: 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
Primary features: None
Secondary features: Harbour seal *Phoca vitulina*

Conservation objectives:

To maintain each feature in favourable condition. For each feture there are a number of component objectives which are outlined below:

Feature	Global Status	Component Objective
Large shallow inlet and bay	A	Maintain the extent of the large shallow inlet and bay Allow the natural processes which determine the development, structure, function and extent of the large shallow inlet and bay, to operate appropriately Maintain and enhance, as appropriate, the species diversity within this habitat.
Coastal lagoons	B	Maintain the extent of the coastal lagoons Allow the natural processes which determine the development, structure, function and extent of the coastal lagoons, to operate appropriately Maintain and enhance, as appropriate, the species diversity within this habitat.
Mudflats and sandflats not covered by sea water at low tide	B	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.
Reefs	B	Maintain the extent of the reefs Allow the natural processes which determine the development, structure, function and extent of the reefs, to operate appropriately Maintain and enhance, as appropriate, the species diversity within this habitat.
Annual vegetation of drift lines	C	Maintain and enhance the extent of annual vegetation of drift lines subject to natural processes

Site Name: Strangford Lough SAC		
		Allow the natural processes which determine the development and extent of annual vegetation of drift lines to operate appropriately Maintain and enhance, as appropriate, the species diversity within this community including the presence of notable species
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	C	To maintain or extend, as appropriate, the area of saltmarsh, subject to natural processes To maintain or enhance, as appropriate, the composition of the saltmarsh communities To maintain transitions between saltmarsh communities and to other adjoining habitats To permit the continued operation of formative and controlling natural processes acting on the saltmarsh communities
Perennial vegetation of stony banks	C	Maintain and enhance the extent of perennial vegetation of stony banks subject to natural processes Allow the natural processes which determine the development and extent of perennial vegetation of stony banks to operate appropriately Maintain and enhance, as appropriate, the species diversity within this community including the presence of notable species
Salicornia and other annuals colonising mud and sand	C	Maintain and enhance the extent of *Salicornia* and other annuals colonising mud and sand subject to natural processes Allow the natural processes which determine the development and extent of *Salicornia* and other annuals colonising mud and sand, to operate appropriately Maintain and enhance, as appropriate, the species diversity within this habitat.
Phoca vitulina	C	Maintain and enhance, as appropriate, the harbour seal population Maintain and enhance, as appropriate, physical features used by harbour seals within the site

Site Name: Murlough SAC

Location	Grid Ref: J445313 (centre point) Latitude 54º12'40"N Longitude 05º47'00"W
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 features: Fixed dunes with herbaceous vegetation (grey dunes)*priority feature, Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)*priority feature
Secondary features: 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 features: Marsh fritillary butterfly *Euphydryas aurinia*
Secondary features: Harbour seal *Phoca vitulina*

Conservation objectives:

To maintain each feature in favourable condition. For each feature there are a number of component objectives which are outlined below:

Feature	Global Status	Component Objective
Atlantic decalcified fixed dunes (Calluno-Ulicetea)	A	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 cSAC 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*)	C	Maintain or extend, as appropriate, the area of saltmarsh, subject to natural processes Maintain or enhance, as appropriate, the composition of the saltmarsh communities Maintain transitions between saltmarsh communities and to other adjoining habitats Permit the continued operation of formative and controlling natural processes acting on the saltmarsh communities
Dunes with *Salix repens ssp. Argentea* (*Salicion arenariae*)	C	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 cSAC where there is possibility of restoring fixed dune with *Salix repens – to be determined*
Embryonic shifting dunes	C	Maintain or enhance the extent of embryonic shifting dunes subject to natural processes

Site Name: Murlough SAC		
		Allow the natural processes which determine the development and extent of embryonic shifting dunes to operate appropriately
Fixed dunes with herbaceous vegetation (grey dunes)	B	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 cSAC 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.
Mudflats and sandflats not covered by seawater at low tide	C	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	C	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)	C	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
Eurodryas aurinia	B	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*
Phoca vitulina	C	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	Grid Ref: NY144648 (central point) Latitude 54º58'15"N Longitude 03º20'12"W
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 features: Sandbanks which are slightly covered by seawater all the time, estuaries, mudflats and sandflats not covered by seawater at low tide, *Salicomia* and other annuals colonising mud and sand, Atlantic salt measows (Glauco-puccinellietalia maritimae)
Secondary features: Reefs, perennial vegetation of stony banks, fixed dunes with herbaceous vegetation *priority feature

Annex II Species
Primary features: Sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatillis*
Secondary features: none

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

England

Site Name: Drigg Coast SAC	
Location	Grid Ref: SD071960 (central point) Latitude 54º21'02"N Longitude 03º25'47"W
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 features: Estuaries, Altlantic decalcified fixed dunes (*Calluno-Ulicetea*) *priority feature, dunes with *Salix repens spp. argentea* Secondary features: 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** Primary features: None Secondary features: None	
Conservation objectives:	
For Annex I habitats With regard to the individual species and/or assemblage of species for which the site has been classified (the Qualifying Features listed above), avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive. Subject to natural change, to maintain or restore: • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The populations of the qualifying features • The distribution of the qualifying features within the site	

Site Name: Morecambe Bay SAC	
Location	Grid Ref: SD371697 (central point) Latitude 54º07'09"N Longitude 02º57'42"W
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 features: 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 features: 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
Primary features: Great crested newt *Triturus cristatus*
Secondary features: None

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 maninatined 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: Shell Flat and Lune Deep SCI	
Location	Grid Ref: Lat 53.857ºN Long 3.217ºW (central point) Latitude 53º51'50"N Longitude 03º12'14"W
Area (ha)	10,565
Summary	The Shell Flat component of the Shell Flat and Lune Deep site is a crescent shaped sandbank comprising a range of mud and sand sediments. Shell Flat has a typical sandy substrate biological community. Shell Flat is the only sandbank feature identified within the outer Shell Flat site and is known to provide important habitat for commercial fish species and bird populations. Lune Deep and the area immediately to the north support mixed faunal turf communities over a cobble/rock substrate. These areas provide habitat for erect hydroids and bryozoans with some areas having erect sponges which form the biotope *Flustra foliacea* and *Haliclona oculata* with a rich faunal turf on tide-swept circalittoral mixed substrata. The reef habitat present in the area represents a good example of boulder and bedrock reef, with the largest proportions of rock found along the unique kettle hole feature known as Lune Deep. The northern edges of Lune Deep are characterised by heavily silted cobble and boulder slopes, subject to strong tidal currents with a dense hydroid and bryozoan turf. This unique enclosed deep hole provides a contrasting habitat to the surrounding muddy communities of the Eastern Irish Mudbelt. The northern flanks of Lune Deep are composed of exposed bedrock with a rugged seabed physiography. In cntrast, the southern flank consists of a smooth seabed which is a sink for muddy sands.
Qualifying features for which the site is designated:	
Annex I Habitat Primary features: Sandbanks which are slightly covered by seawater all the time, reefs Secondary features: None **Annex II Species** Primary features: None Secondary features: None	
Conservation objectives:	
For Annex I Habitats, Subject to natural change, maintain the qualifying habitats (described above) all the time in favourable condition. Favourable condition of the sandbank will be determined through assessment that the following are maintained in the long term in the site: • The extent of the habitat • Diversity of the habitat and its component species • Community structure of the habitat (e.g. population structure of individual notable species and their contribution to the functioning of the ecosystem) • Natural environmental quality (e.g. water quality, suspended sediment levels etc,) • Natural environmental processes (e.g. biological and physical processes that occur naturally in the environment, such as water circulation and sediment deposition should not deviate from baseline at designation)	

Site Name: Dee Estuary / Aber Dyfrdwy SAC	
Location	Grid Ref: SJ191819 (central point) Latitude 53º19'39"N Longitude 03º12'53"W
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 features: 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 features: 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
Primary features: None
Secondary features: 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
- 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

Site Name: Dee Estuary / Aber Dyfrdwy SAC
• 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

C3 Riverine Special Areas of Conservation

Scotland

Site Name: River Bladnoch SAC	
Location	Grid Ref: NX347604 (central point) Latitude 54º54'30"N Longitude 04º35'00"W
Area (ha)	300
Summary	The River Bladnoch supports a high-quality salmon population in south-west Scotland, which unusually for rivers in this area still supports a spring run of salmon. The river drains a moderate-sized catchment with both upland and lowland areas, and this variety is reflected in the river's ecological and water quality characteristics. Whilst there are problems in the river's headwaters arising from acidification, national and local initiatives are both reducing and ameliorating the worst effects of this pollution source.
Qualifying features for which the site is designated:	
Annex I Habitat Primary features: None Secondary features: None **Annex II Species** Primary features: Atlantic salmon *Salmo salar* Secondary features: None	
Conservation objectives:	
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 features and to ensure for the qualifying species that the following are maintained in the long term: • Population of the species, including range of genetic types, as a viable component of the site • Distribution of the species within 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: River Eden SAC	
Location	Grid Ref: NY462237 (central point) Latitude 54º36'19"N Longitude 02º49'58"W
Area (ha)	2463.23
Summary	The Eden is an outstanding floristically rich, northern river on sandstone and hard limestone. The diversity of aquatic plants is amongst the highest of all rivers in Britain. The aquatic flora includes uncommon species and those at the geographical limit of their British distribution. Some of the headwaters of the Eden comprise one of the most important British sites for the native white-clawed crayfish. The river is also of high invertebrate interest for species associated with river shingles and sandbanks. The fish fauna includes Atlantic salmon, bullhead and all three species of lamprey found in British rivers.
Qualifying features for which the site is designated:	
Annex I Habitats Primary features: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*, water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, *Alnion incanae*, *Salicion albae*) * Priority feature Secondary features: None **Annex II Species** Primary features: White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*, sea lamprey *Petromyzon marinus*, brook lamprey *Lampetra planeri*, river lamprey *Lampetra fluviatillis*, Atlantic salmon *Salmo salar*, bullhead *Cottus gobio*, otter *Lutra lutra*	

Site Name: River Eden SAC

Secondary features: None

Conservation objectives:

To maintain*, in favourable condition, the river habitat for:

- Ranunculus communities
- Populations of Atlantic salmon and bullhead
- Population of sea, river and brook lamprey
- Populations of white-clawed crayfish

And the river and adjoining land as habitat for:

- Population of otter

And to maintain* the following features in favourable condition:

- Residual alluvial woodland
- Oligotrophic to mesotrophic standing waters of plains to sub-alpine levels.

*Maintenance implies restoration if the feature is not already in favourable condition.

Site Name: River Derwent and Bassenthwaite Lake SAC

Location	Grid Ref: NY262207 (central point) Latitude 54º34'35"N Longitude 03º08'32"W
Area (ha)	1,832.96
Summary	The Derwent-Cocker is the largest oligotrophic, or nutrient poor, river in England that still retains high water quality and a natural channel. This low nutrient status is reflected in the abundance of bryophytes and the absence of a number of other plant species found in more nutrient rich rivers. There is, however, a natural succession of plant communities from source to mouth reflecting a slight increase in nutrient status downstream. Both rivers flow through two lakes, Derwentwater and Bassenthwaite on the Derwent and Buttermere and Crummock Water on the Cocker. These lakes have hydrological buffering effect which helps stabilise the flow regimes. The nationally rare plant floating water plantain occurs in Derwentwater. In places around Derwentwater a transition from open water to wet woodland, fen and swamp is present. The fish fauna of the Rivers Derwent and Cocker include salmon and sea, brook and river lampreys. Derwentwater has populations of the nationally rare fish vendace. Apart from Derwentwater, in Britain vendance is only known from Bassenthwaite Lake in the same catchment. Crummock Water has Arctic charr, a nationally scare member of the trout family found in oligotrophic lakes, The Derwent catchment supports otters.

Qualifying features for which the site is designated:

Annex I Habitats
Primary features: Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*,
Secondary features: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

Annex II Species
Primary features: Marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia*, sea lamprey *Petromyzon marinus*, brook lamprey *Lampetra planeri*, river lamprey *Lampetra fluviatillis*, Atlantic salmon *Salmo salar*, otter *Lutra lutra*, floating water-plantain *Luronium natans*
Secondary features: None

Conservation objectives:

The Conservation Objectives for this site are subject to natural change, to maintain the following habitats and geological features in fabourable condition (*), with particular reference to any dependant component special interest features (habitats, vegetation types, species, species assemblages etc), for which the land is designated (SSSI, SAC, SPA, Ramsar).

Habitat Types represented (Biodiversity Action Plan categories)
Rivers and Streams
Standing Open Water (oligotrophic to mesotrophic)
Fen, marsh and swamp
Wet woodland

Site Name: River Derwent and Bassenthwaite Lake SAC

Species represented

- Flaoting water plantain *Luronium natans*
- Vascular plant assemblage
- Atlantic salmon *Salmo salar*
- River lamprey *Lampetra fluviatillis*
- Brook lamprey *Lampetra planeri*
- Sea lamprey *Petromyzon marinus*
- Vendace *Coregonus albula*
- Arctic charr *Salvelinus alpinus*
- Otter *Lutra lutra*
- Invertebrate assemblage of fast flowing water
- Invertebrate assemblage of mineral marsh and open water
- Invertebrate assemblage of litter-rich fluctuating wetlands

(*) or restored to favourable condition if features are judged to be unfavourable

Site Name: River Ehen SAC

Location	Grid Ref: NY031144 (central point) Latitude 54º30'55"N Longitude 03º29'51"W
Area (ha)	24.39
Summary	The River Ehen is on the western fringe of the Lake District. It forms the outfalls from Ennerdale Water and flows some 20km before reaching the Irish Sea at Sellafield. For much of its upper length the River Ehen is classed as an oligotrophic, or nutrient-poor river flowing over bryophyte-dominated substrates of shingle, pebbles and rock. Between Ennerdale Water and the confluence with the River Keekle at Cleater Moor the Ehen meanders across a narrow floodplain with extensive areas of riparian woodland and trees. This stretch of the river supports outstanding populations of the freshwater mussel *Margaritifera margaritifera*. Collectively, this is the largest known population of this species in England and the only one showing recent recruitment.

Qualifying features for which the site is designated:

Annex I Habitats
Primary features: None,
Secondary features: None

Annex II Species
Primary features: Freshwater pearl mussel *Margaritifera margaritifera*
Secondary features: Atlantic salmon *Salmo salar*

Conservation objectives:

The Conservation Objectives for this site are subject to natural change, to maintain the following habitats and geological features in fabourable condition (*), with particular reference to any dependant component special interest features (habitats, vegetation types, species, species assemblages etc), for which the land is designated (SSSI, SAC, SPA, Ramsar).

Habitat Types represented (Biodiversity Action Plan categories)
Rivers and Streams (supporting freshwater pearl mussel)

Species represented

- Freshwater pearl mussel *Margaritifera margaritifera*
- Atlantic salmon *Salmo salar*

(*) or restored to favourable condition if features are judged to be unfavourable

Wales

Site Name: River Dee & Bala Lake / Afon Dyffrdwy a Llyn Tegid SAC	
Location	Grid Ref: SJ423503 (central point) Latitude 53º02'50"N Longitude 02º51'40"W
Area (ha)	1308.93
Summary	The SAC extends from the western extremity of Llyn Tegid, taking in the entire lake and its banks to its outfall into the River Dee. It then takes in the river and its banks downstream to where it joins the Dee Estuary. A number of the Dee tributaries are also included in the SAC boundary. The river enters the Cheshire plain at Erbistock and below Chester Weir the river is largely estuarine in character. However, there is a tidal influence as far upstream as Farndon, as high tides regularly exceed the weir's height. There is a range of protected aquatic and emergent plan communities within the SAC and the presence of these not only provide a good indication of the overall quality of the river but also provide important habitats for fish and invertebrates. The protected fish species in the SAC are both resident all year round; bullhead and brook lamprey and migratory; Atlantic salmon, sea and river lamprey.

Qualifying features for which the site is designated:

Annex I Habitats
Primary features: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
Secondary features: None

Annex II Species
Primary features: Atlantic salmon *Salmo salar*, floating water plantain *Luronium natans*
Secondary features: Sea lamprey *Petromyzon marinus*, brook lamprey *Lampetra planeri*, river lamprey *Lampetra fluviatillis*, bullhead *Cottus gobio*, otter *Lutra lutra*

Conservation objectives:

With regard to the natural habitats and/or species for which the site has been designated (the qualifying features listed below): avoid the deterioration of the qualifying natural habitats and the habitats of qualifying species, and the significant disturbance of those qualifying species, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving favourable conservation status of each of the qualifying features.

Subject to natural change, to maintain or restore:

- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure and function (including typical species) of qualifying natural habitats and habitats of qualifying species
- The supporting processes on which qualifying natural habitats and habitats of qualifying species rely
- The population of qualifying species
- The distribution of qualifying species within the site

Qualifying features:

- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- Rivers with floating vegetation often dominated by water-crowfoot
- Sea lamprey *Petromyzon marinus*
- Brook lamprey *Lampetra planeri*
- River lamprey *Lampetra fluviatillis*
- Atlantic salmon *Salmo salar*
- Bullhead *Cottus gobio*
- Otter *Lutra lutra*
- Floating water-plantain *Luronium natans*

(*) or restored to favourable condition if features are judged to be unfavourable

Site Name: Afon Gwyrfai a Llyn Cwellyn SAC	
Location	Grid Ref: SH547561 (central point) Latitude 53º04'59"N Longitude 04º10'15"W
Area (ha)	114.29
Summary	The site comprises the Afon Gwyrfai and Llyn Cwellyn: the Gwyrfai flows out of Llyn y Gader near Rhyd Ddu and passes through Llyn Cwellyn on its way to the sea. It also includes a tributary of the Gwyrfai, the Afon Treweunydd and the small lake it flows from on the slopes of Snowdon. Sporadically throughout its course, the SAC is abutted by semi-natural wetland riparian habitat. Lyyn Cwellyn is an excellent example of a deep (maximum depth of 37m, average depth of 23m) oligotrophic lake formed during the last Ice Age. Its nutrient poor waters support a range of typical macrophytes and one of the best populations of floating water plantain in the UK. The river is particularly noted for its excellent salmon population, for which it is considered to be one of the best supporting rivers in the UK. It is also notable for its otter population and in addition to the lake, the river supports a discrete community of floating water plantain and water-crowfoot Ranunculus spp, with other associated vegetation including bryophyte assemblages occurring in various sectors of the river.

Qualifying features for which the site is designated:

Annex I Habitats
Primary features: Oligortophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea, water courses of plain to montane levels with the *Ranuncullion fluitantis* and *Callitricho-Batrachion* vegetation
Secondary features: None

Annex II Species
Primary features: Atlantic salmon *Salmo salar*, floating water plantain *Luronium natans*
Secondary features: Otter *Lutra lutra*

Conservation objectives:

There is one conservation objective for each feature and each conservation objective is a composite statement representing a site-specific description of what is considered to be the favourable conservation status of the feature.

Each conservation objective consists of the following two elements:

- Vision for the feature
- Performance indicators

Annex I Habitats:

Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the Isoteo-Nanojuncetea
The vision for this feature is for it to be in favourable conservation status, where all of the following conditions are satisfied:

- Water quality of the lake is within parameters which are suitable to support the characteristic flora and fauna
- The lake shows a characteristic vegetation zonation from the shore to the deeper water
- The lake has a macrophyte flora which includes many of the characteristic species including *Littorella uniflora*, *Lobelia dortmanna*, *Isoetes lacustris*, *Luronium natans* and *Subularia aquatica*, together with a diverse range of associates including *Myriophyllum alterniflorum*, *Callitriche hamulata*, *Nitella flexilis* and *Potamogeton berchtoldii*
- *Nitella gracilis* and *Luronium natans* to be present as characteristic plants

Performance indicators for the feature condition:

- Extent of oligotrophic to mesotrophic standing waters
- Condition of oligotrophic to mesotrophic standing waters

Performance indicators for factors affecting the feature:

- Abstraction
- Recreational activity

Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
The vision for this feature is for it to be in favourable conservation status, where all of the following conditions are satisfied:

- The conservation objective for the water course as defined must be met
- The extent of this feature within its potential range in this SAC should be stable or increasing
- The extent of the sub-communities that are represented within this feature should be stable or increasing
- The conservation status of the feature's typical species should be favourable
- All known, controllable factors, affecting the achievement of these conditions are under control (many factors may

Site Name: Afon Gwyrfai a Llyn Cwellyn SAC

be unknown or beyond human control)

Performance indicators for the feature condition:

- Distribution within catchment
- Typical species
- Plant community reproduction
- Bank and riparian zone vegetation
- Species indicative of eutrophication
- Alien/introduced species

Performance indicators for factors affecting the feature:

- Water quality
- Flow
- Light levels
- Changes to substrate

Annex II Species

Atlantic salmon *Salmo salar*

The vision for this feature is for it to be in favourable conservation status, where all of the following conditions are satisfied:

- The conservation objective for the water course as defined must be met
- The population of the feature in the SAC is stable or increasing over the long term
- The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches where predominately suitable habitat for each life stage exists over the long term. Suitable habitat is defined in terms of near-natural hydrological and geomorphological processes and forms e.g. suitable flows to allow upstream migration, depth of water and substrate type at spawning sites and ecosystem structure and functions. Suitable habitat need not be present throughout the SAC but where present must be secured for the foreseeable future. Natural factors such as waterfalls may limit the natural range of individual species. Existing artificial influences on natural range that cause an adverse effect on site integrity, such as physical barriers to migration, will be assessed.
- The Gwyrfai will continue to be a sufficiently large habitat to maintain the feature's population in the SAC on a long-term basis

Performance indicators for the feature condition:

- Adult run size
- Juvenile densities

Performance indicators for factors affecting the feature:

- Water-Biological quality
- Water – Chemical quality
- Flow
- Illegal fish poaching
- Invasive alien species
- Coarse woody debris

Floating water-plamtain *Luronium natans*

The vision for this feature is for it to be in favourable conservation status, where all of the following conditions are satisfied:

- The conservation objective for the water course as defined must be met
- Llyn Cwellyn will continue to support a peripheral floating water-plantain assemblage, as well as a deeper water assemblage, with a characteristic zonation of vegetation from the shore at two areas of the lake
- Floating water-plantain will continue to flourish in the Afon Gwyrfai and will continue to occur in every selected section
- All factors affecting the achievement of these conditions are under control

Performance indicators for the feature condition:

- Specie and extent and abundance
- Sufficient habitat

Performance indicators for factors affecting the feature:

- Water quality (flow)
- Water quality
- Dredging
- Competition from other aquatic species

Otter *Lutra lutra*

The vision for this feature is for it to be in favourable conservation status, where all of the following conditions are satisfied:

- The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC, as determined by natural levels of prey abundance and associated territorial

Site Name: Afon Gwyrfai a Llyn Cwellyn SAC

behaviour

- The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches that are potentially suitable to form part of a breeding territory and/or provide routes between breeding territories. The size of breeding territories may vary depending on prey abundance.
- The population size should not be limited by the availability of suitable undistributed breeding sites. Where these are insufficient they should be created through habitat enhancement and where necessary the provision of artificial holts. No otter breeding site is subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance are managed.
- The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat and underpasses, ledges, fencing etc at road bridges and other artificial barriers.
- All factors affecting the achievement of these conditions are under control.

Performance indicators for the feature condition:

- Population distribution
- Breeding activity
- Actual and potential breeding sites

Performance indicators for factors affecting the feature:

- Water quality (flow)
- Water quality
- Food availability and riparian habitat
- Invasive alien species
- Coarse woody debris
- Illegal fish poaching
- Diffuse and point source pollution
- Agricultural operations
- Forestry operations
- River engineering
- Recreation
- Deposition atmospheric pollution
- Climate change

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