Department of Energy & Climate Change

Offshore Oil & Gas Licensing

27th Seaward Round

Southern North Sea

Blocks 42/5, 43/16, 42/21, 42/22, 42/23, 43/10, 43/12, 43/20f, 43/25, 44/21c, 44/13, 44/16b, 44/16c, 44/18e, 44/19a, 44/23g, 47/3j, 47/3k, 47/8e, 47/22, 47/23, 47/24, 48/4b, 48/10c, 48/18c, 48/23c, 48/24, 48/25c, 49/4b, 49/8b, 49/21d, 53/3a, 53/8

Habitats Regulations Assessment

Appropriate Assessment

March 2013

CONTENTS

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 doing so, 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

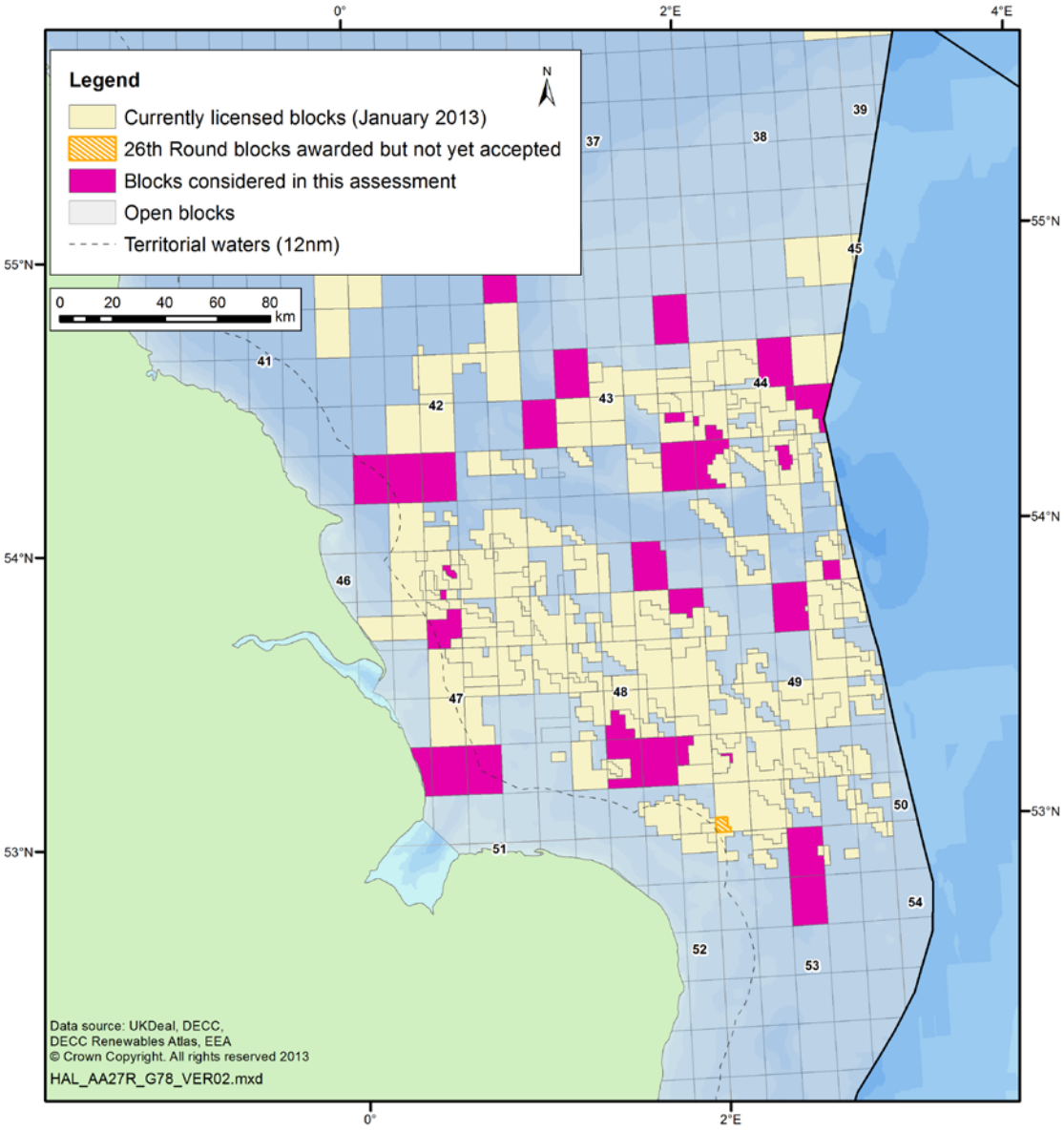
This report documents the further assessment in relation to 33 Blocks in the southern North Sea (see Section 1.2).

1.2 Southern North Sea Blocks

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

42/5	43/12	44/16c	47/8e	48/18c	49/21d
43/16	43/20f	44/18e	47/22	48/23c	53/3a
42/21	43/25	44/19a	47/23	48/24	53/8
42/22	44/21c	44/23g	47/24	48/25c	
42/23	44/13	47/3j	48/4b	49/4b	
43/10	44/16b	47/3k	48/10c	49/8b	

Figure 1.1: Location of southern North 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 listed below and grouped geographically:

Nearshore Area

42/21, 42/22 – Drill or drop well, shoot 2D seismic

42/23 – Contingent well

47/3j – Drill or drop well, shoot 3D seismic

47/3k – Firm well

47/8e – Drill or drop well, shoot 3D seismic (same survey as 47/3j)

47/22, 47/23, 47/24 – Drill or drop well

Dogger Bank Area

42/5 – Firm well

43/10 – Drill or drop well

43/12 – Contingent well

43/16 – Drill or drop well

43/20f – Drill or drop well

43/25 – Contingent well, shoot 3D seismic

44/13 – Contingent well

44/16b – Drill or drop well

44/16c – Drill or drop well

44/18e – Drill or drop well

44/19a – Firm well

44/21c – Firm well

44/23g – Drill or drop well

North Norfolk Sandbanks and Southern Area

48/4b – Drill or drop well

48/10c – Drill or drop well

48/18c – Drill or drop well

48/23c – Drill or drop well

48/24, 48/25c – Drill or drop well

49/8b – Drill or drop well

49/4b – Drill or drop well

49/21d – Drill or drop well

53/3a, 53/8 – 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. Seasonal concerns have been identified for the majority of Blocks on offer in addition to a number requiring seabed surveys prior to drilling activity taking place due to the potential presence of herring spawning sites (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	Period of concern for drilling	Spawning sites*	Special Conditions†
42/5	-	September to November (JNCC) August-October (CEFAS)	-	✓
43/16	January to May (DEFRA)	January to May and September to October (JNCC)	-	-
42/21	August to October (DEFRA)	January to February & June to December (JNCC) August to October (DEFRA)	✓	✓
42/22	August to October (DEFRA)	January to February & June to December (JNCC) August to October (DEFRA)	✓	-
42/23	January to May and August to October (DEFRA)	August to October (DEFRA), January to February and May to December, (JNCC)	✓	-
43/10	-	January to April & September to December (JNCC)	-	-
43/12	January to May (DEFRA)	January to April and September to October (JNCC) August-October (CEFAS)	-	-

Block	Period of concern for seismic surveys	Period of concern for drilling	Spawning sites*	Special Conditions†
43/20	January to May (DEFRA)	January to April and September to December (JNCC)	-	-
43/25	January to May (DEFRA)	January to May and September to December (JNCC)	-	-
44/13	-	-	-	-
44/16	January to May (DEFRA)	-	-	-
44/18, 44/19	January to May (DEFRA)	October to December (JNCC)	-	-
44/21	January to May (DEFRA)	October to December (JNCC)	-	-
44/23	January to May (DEFRA)	October to December (JNCC)	-	-
47/3	January to May and August to October (DEFRA)	August to October (DEFRA), January to February, June to December (JNCC)	✓	✓
47/8	August to October (DEFRA)	January to February & July to December (JNCC) August to October (DEFRA)	✓	✓
47/22, 47/23, 47/24	January to May (DEFRA)	August-October (CEFAS)	-	✓
48/4	January to May (DEFRA)	January to February, August to December (JNCC)	-	-
48/10	January to May (DEFRA)	January to May, July to December (JNCC)	-	-
48/18	-	-	-	-
48/23	January to May (DEFRA)	-	-	-
48/24, 48/25	-	-	-	-
49/4	January to May (DEFRA)	November to December (JNCC)	-	-
49/8	January to May (DEFRA)	October to December (JNCC)	-	-
49/21	-	-	-	-
53/3	January to May (DEFRA)	-	-	✓
53/8	January to May (DEFRA)	-	-	-

*Note: * seabed surveys should be undertaken before any drilling activity to confirm whether there are any herring spawning sites within a three-nautical mile radius of the proposed drilling location, † Activity is of concern to the MoD because the Block lies within training ranges. For further information see: Other regulatory issues (DECC 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 33 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 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.*"

The relevant sites are detailed in Appendix A and include:

- Coastal and marine Natura 2000 sites along the east coast of England from the Northumbria coast to the Deben Estuary
- Offshore Natura 2000 sites in the southern North Sea
- Riverine SACs within the area for migratory fish.

In Dutch and German offshore waters, several SACs have been identified and are sufficiently progressed in the designation process to be considered as relevant sites in the context of AA.

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. 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.4).

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 2012) and have been re-screened in Appendix B in

[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.

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 3.1: SPAs relevant to this Appropriate Assessment

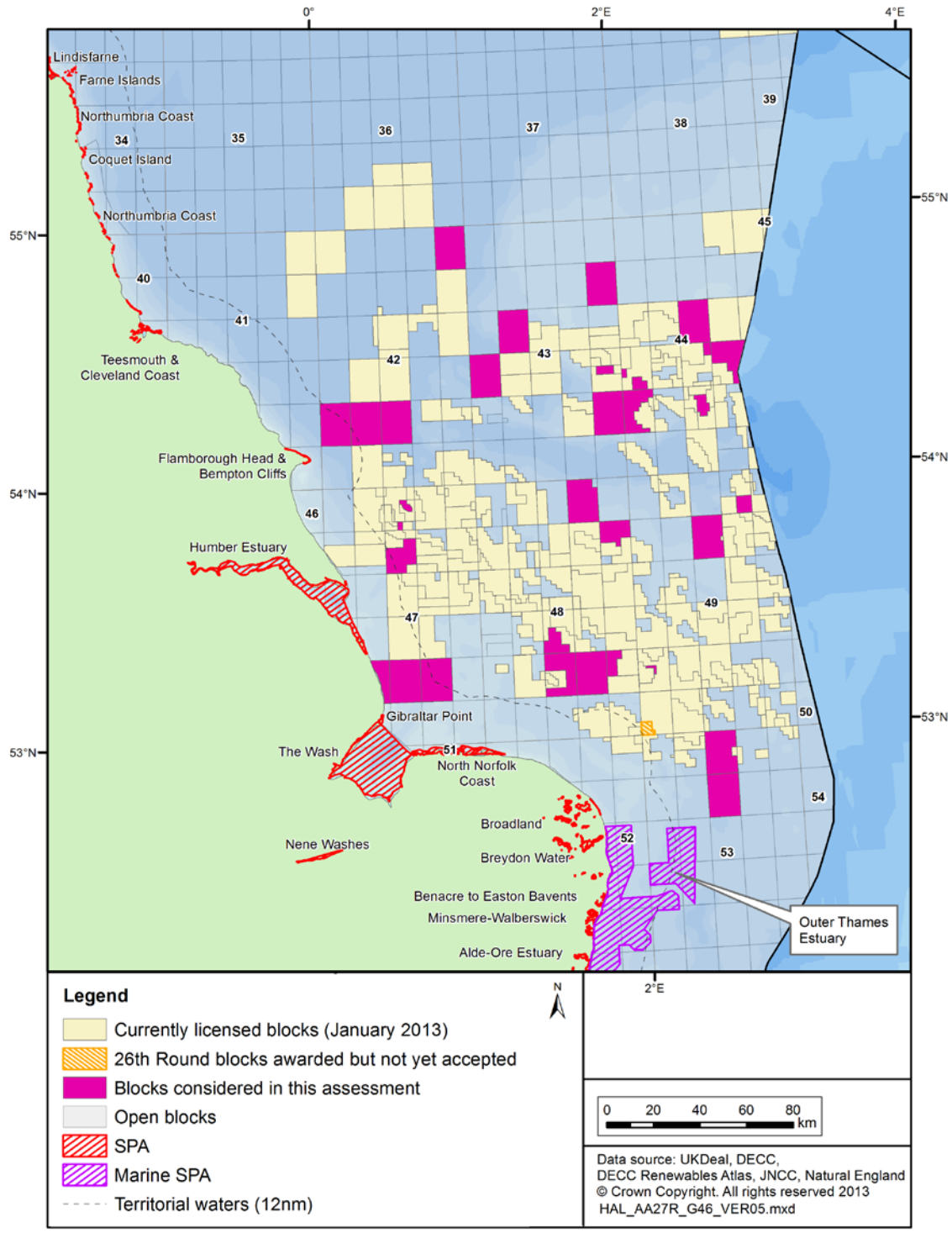


Figure 3.2: SACs relevant to this Appropriate Assessment

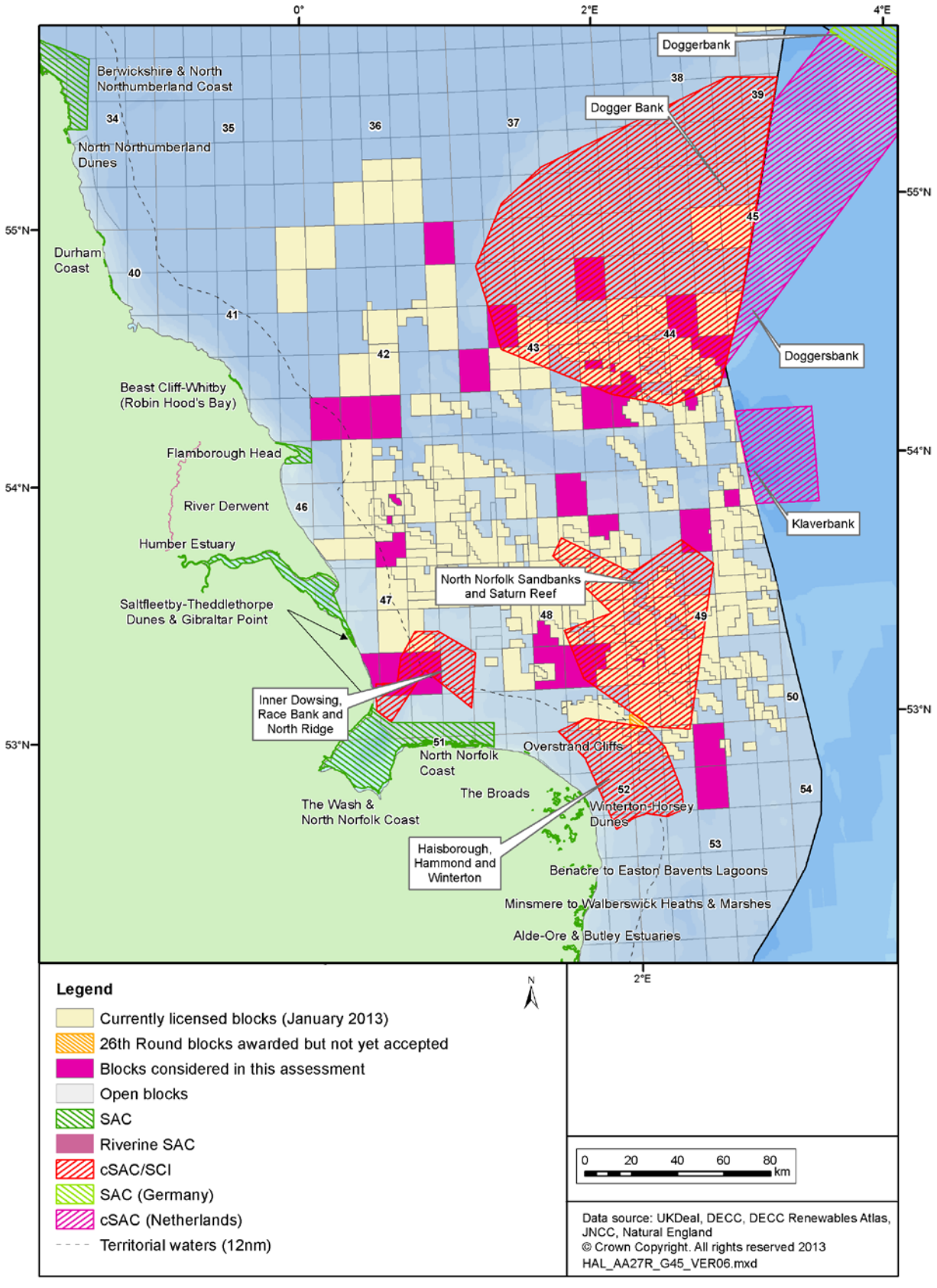


Table 3.1: SPA sites and qualifying features under Article 4.1 and 4.2, relevant to this Appropriate Assessment

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

	Lindisfarne	Farne Islands	Northumbria Coast	Coquet Island	Teesmouth and Cleveland Coast	Flamborough Head and Bempton Cliffs	Humber Estuary	Gibraltar Point	The Wash	North Norfolk Coast	Broadland	Great Yarmouth North Denes	Breydon Water	Benacre to Easton Bavents	Minsmere-Walberswick	Alde-Ore Estuary	Deben Estuary	Outer Thames Estuary
Red-throated diver																		W
Puffin		B		B														
Mediterranean gull										B								
Lesser black-backed gull																B		
Kittiwake						B												
Guillemot		B																
Sandwich tern		B		B	P					B						B		
Roseate tern		B		B						B								
Common tern		B		B					B	B			B					
Arctic tern		B		B														
Little tern	B		B		B		B	B	B	B		B		B	B	B		
Marsh harrier							B		B	B	B			B	B	B		
Hen harrier							W			W					W			
Merlin																		
Nightjar															B			
Woodlark															B			
Oystercatcher									W									
Avocet							B, W		W	B, W			W		B, W	B, W	W	
Ringed plover	P				P				P	B,								

	Lindisfarne	Farne Islands	Northumbria Coast	Coquet Island	Teesmouth and Cleveland Coast	Flamborough Head and Bempton Cliffs	Humber Estuary	Gibraltar Point	The Wash	North Norfolk Coast	Broadland	Great Yarmouth North Denes	Breydon Water	Benacre to Easton Bavents	Minsmere-Walberswick	Alde-Ore Estuary	Deben Estuary	Outer Thames Estuary
										P								
Dotterel																		
Golden plover	W						W		W	W			W					
Grey plover	W							W	W									
Knot	W				W		W, P	W	W	W								
Sanderling									P									
Purple sandpiper			W															
Dunlin							W, P		W									
Ruff							P			W	W							
Black-tailed godwit							W, P		W									
Bar-tailed godwit	W						W	W	W	W								
Curlew									W									
Redshank					W		W, P		W	B, W						W		
Turnstone			W						W									
Bewick's swan											W		W					
Whooper swan	W								W		W							
Pink-footed goose									W	W	W							
Dark-bellied brent goose									W	W								
Light-bellied Brent Goose	W																	
Greylag goose	W																	

	Lindisfarne	Farne Islands	Northumbria Coast	Coquet Island	Teesmouth and Cleveland Coast	Flamborough Head and Bempton Cliffs	Humber Estuary	Gibraltar Point	The Wash	North Norfolk Coast	Broadland	Great Yarmouth North Denes	Breydon Water	Benacre to Easton Bavents	Minsmere-Walberswick	Alde-Ore Estuary	Deben Estuary	Outer Thames Estuary
Shelduck							W		W									
Wigeon	W									W								
Gadwall											W							
Pintail									W	W								
Shoveler											W							
Bittern							B, W			B, W	B, W			B, W	B, W			
Assemblage	W	B		B	W	B	W	W	W	W	W		W			B, 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 this Appropriate Assessment

*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.*

	Coastal and Riverine SACs													Offshore SACs											
Annex 1 Habitats	Berwickshire and North Northumberland Coast	North Northumberland Dunes	Durham Coast	North York Moors	Fen Bog	Beast Cliff-Whitby (Robin Hood's Bay)	Flamborough Head	Humber Estuary	Saltfleetby - Theddlethorpe Dunes and Gibraltar Point	The Wash and North Norfolk Coast	North Norfolk Coast	Overstrand Cliffs	The Broads	Winterton-Horsey Dunes	Benacre to Easton Bavents Lagoons	Minsmere to Walberswick Heaths and Marshes	Alde, Ore and Butley Estuaries	Orfordness-Shingle Street	River Derwent	Dogger Bank cSAC	North Norfolk Sandbanks and Saturn Reef SCI	Inner Dowsing, Race Bank and North Ridge SCI	Haisborough, Hammond and Winterton SCI
Bogs				Q	P								P											
Coastal dunes		P						Q	P Q		P			P Q										
Coastal lagoons								Q		Q	P				P			P						
Estuaries								P									P							
Fens													P											
Forest													P											
Grasslands													Q											
Heaths				P												P								
Inlets and bays	P									P														
Limestone pavements																								
Machairs																								
Mudflats and sandflats	P							P		P							Q							
Reefs	P						P			P											P	P	P	
Rocky slopes																								
Running freshwater																			Q					
Salt marshes and salt meadows								Q		P	P						Q							
Sandbanks								Q		P										P	P	P	P	
Scree																								

	Coastal and Riverine SACs														Offshore SACs									
Annex 1 Habitats	Berwickshire and North Northumberland Coast	North Northumberland Dunes	Durham Coast	North York Moors	Fen Bog	Beast Cliff-Whitby (Robin Hood's Bay)	Flamborough Head	Humber Estuary	Saltfleetby - Theddlethorpe Dunes and Gibraltar Point	The Wash and North Norfolk Coast	North Norfolk Coast	Overstrand Cliffs	The Broads	Winterton-Horsey Dunes	Benacre to Easton Bavents Lagoons	Minsmere to Walberswick Heaths and Marshes	Alde, Ore and Butley Estuaries	Orfordness-Shingle Street	River Derwent	Dogger Bank cSAC	North Norfolk Sandbanks and Saturn Reef SCI	Inner Dowsing, Race Bank and North Ridge SCI	Haisborough, Hammond and Winterton SCI
Scrub (mattoral)																								
Sea caves	P						P																	
Sea cliffs			P			P	P					P												
Standing freshwater													P											
Vegetation of drift lines																P		P						
Vegetation of stony banks											P					Q		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.*

Table 3.2: SAC sites and qualifying features under Annex 1 and Annex 2, relevant to this Appropriate Assessment (contd.)

	Coastal and Riverine SACs																		Offshore SACs								
Annex 2 Species	Berwickshire and North Northumberland Coast	North Northumberland Dunes	Durham Coast	North York Moors	Fen Bog	Beast Cliff-Whitby (Robin Hood's Bay)	Flamborough Head	Humber Estuary	Saltfleetby - Theddlethorpe Dunes and Gibraltar Point	The Wash and North Norfolk Coast	North Norfolk Coast	Overstrand Cliffs	The Broads	Winterton-Horsey Dunes	Benacre to Easton Bavents Lagoons	Minsmere to Walberswick Heaths and Marshes	Alde, Ore and Butley Estuaries	Hamsford Water pSAC	Tankerton Slopes and Swalecliffe pSAC	Orfordness-Shingle Street	River Derwent	Dogger Bank cSAC	North Norfolk Sandbanks and Saturn Reef SCI	Inner Dowsing, Race Bank and North Ridge SCI	Haisborough, Hammond and Winterton SCI
Grey seal	P							Q																		
Harbour seal										P																
Otter										Q	Q		Q								Q					
Sea lamprey								Q													Q					
River lamprey								Q													P					
Fisher's Estuarine Moth																		P	P							
Ramshorn snail													P													
Desmoulin's whorl snail													P													
Petalwort		P									Q															
Fen orchid													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.
**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:

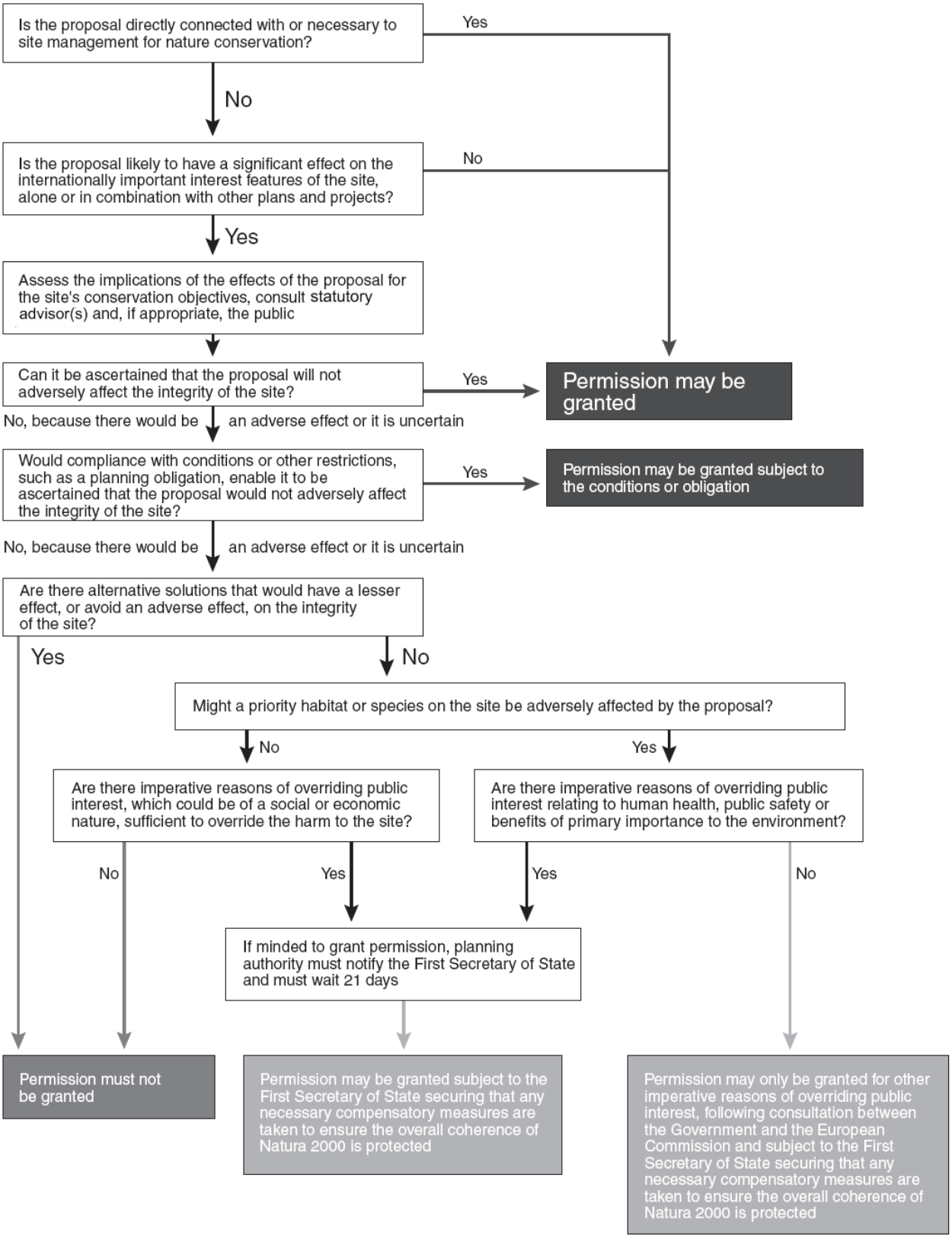
- Considered, on the basis of the precautionary principle, whether it could be concluded that the integrity of relevant European Sites would not be affected. This impact prediction involved a consideration of the cumulative and in-combination effects.
- Examined, in relation to elements of the plan where 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 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 for the qualifying interest features (see Table 4.2). 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 33 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 and their qualifying features and species, were a licence for any of the southern North Sea Blocks to be granted. The assessment is based on an indication of the proposed work programmes for the Blocks and likely hydrocarbon resources if present, 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[3] (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 southern North Sea Blocks.

Table 4.1: Risk assessment of EMS of relevance to the southern North Sea Blocks

European Marine Site	Activities assessed	Risk category			Total assessed[1]
		High	Medium	Low	
Berwickshire and North Northumberland Coast	Commercial fishing, pollution, recreation	0	6	15	21
Coquet Island	Commercial fishing, other, recreation	0	4	1	5
Tweed Estuary	Commercial fishing, pollution	0	1	10	11
Teesmouth and Cleveland	Commercial fishing, pollution, coastal defence, recreation	1	7	11	20
Northumbria Coast	Recreation	0	0	1	1
Flamborough Head	Commercial fishing, pollution, commercial vessels, recreation	1	4	17	22
Humber Estuary	Commercial fishing, pollution, commercial vessels, recreation, coastal defence	1	10	12	23

[3] The Conservation of Habitats and Species Regulations 2010

European Marine Site	Activities assessed	Risk category			Total assessed[1]
		High	Medium	Low	
The Wash & North Norfolk Coast	Commercial fishing, pollution, commercial vessels, recreation, other, military, water resources	1	19	35	56
Essex Estuaries	Coastal defence, commercial fishing	0	3	1	4
Stour and Orwell Estuaries	Coastal defence, commercial fishing, commercial vessels, recreation, water resources	0	2	20	22
Alde-Ore Estuary	Coastal defence, commercial fishing, recreation, water resources	1	1	12	14
Deben Estuary	Coastal defence, recreation, water resources	1	1	1	3
Minsmere to Walberswick	Coastal defence, recreation, water resources	1	2	4	7
Benacre to Easton (Bavents (SPA)) Lagoons (SAC)	Commercial fishing, recreation	1	1	1	3
Benfleet and Southend Marshes	Commercial fishing, coastal defence, recreation, pollution	0	3	1	4
Breydon Water	Coastal defence, recreation, water resources	0	1	0	1
Hamford Water	Commercial fishing, coastal defence, recreation, pollution	0	3	2	5
Great Yarmouth and North Denes	Coastal defence, recreation	0	0	2	2
North Norfolk Coast	Coastal defence	0	0	1	1
Thames Estuary	Commercial fishing, coastal defence, recreation, pollution, commercial vessels, other	0	1	9	12
Swale and Medway	Commercial fishing, commercial vessels, coastal defence, recreation, pollution, other	0	2	12	16
North East Kent[2]	Commercial fishing, commercial vessels, coastal defence, recreation, pollution, other	0	8	32	40

Note:
[1]Total activities assessed includes those scored as no risk.
[2]North East Kent EMS comprises the Thanet Coast SAC, Sandwich Bay SAC and Thanet Coast and Sandwich Bay SPA.
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[4], Natural England and JNCC are also in the process of reviewing and updating the existing Conservation Objectives for all European sites, including Marine sites[5]. 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 favourable conservation status. Table 4.2 provides a 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

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

[5] Natural England website - http://www.naturalengland.org.uk/Images/action-14-announcement_tcm6-32928.pdf

	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	All Blocks under consideration (with the exception of 47/22) are at least several kilometres from coastal Natura 2000 sites, though a number of Blocks are partly or entirely within the boundary of offshore SCIs or cSACswhich have been selected for seabed features (e.g. Inner Dowsing, Race Bank and North Ridge, North Norfolk Sandbanks and Saturn Reef, Dogger Bank). While new pipelines could conceivably come ashore at existing terminals, either through or near to coastal SACs and SPAs, and drilling and eventual development may take place in any of the Blocks applied for, there are well proven methods to prevent significant impacts – such mitigation would be defined at the project level (e.g. following ig site and pipeline route surveys), and be subject to project specific EIA and HRA. Potential disturbance of certain species/habitats (e.g. in relation to herring spawning which may be prey for protected marine mammals and birds) may be avoided by seabed survey prior to the commencement of drilling operations. Blocks for which herring spawning is a potential concern have been highlighted (See Section 2.2), and licensees should expect the occurrence of such a sensitivity to affect DECC's decision whether or not to approve particular activities.
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 EIAs, HRAs (where necessary) and chemical risk assessments under existing permitting procedures.

High level Mitigation	
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 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. 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).

High level Mitigation	
	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 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 from service in waters relevant to this AA. At the time of writing, commercial arrangements are in place to provide ETV capability in the Dover Straits and the south west approaches[6]. The government is also in discussions with the oil industry on the potential of a commercial call-out arrangement to use their vessels[7].
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.

[6] House of Commons Transport Committee (2012). The Coastguard, Emergency Towing Vessels and the Maritime Incident Response Group: follow up. Volume 1.
[7] 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 southern North 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 are gas and given the location of the Blocks applied for, it is anticipated that new field developments will be 'tied back' to existing infrastructure. 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 the southern North Sea 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 southern North Sea (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[8], 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

[8] 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.

DEFRA have indicated that seabed surveys should be undertaken before any drilling activity is carried out in Blocks 42/21, 42/22, 42/23, 47/3 and 47/8 (see Table 2.1), to confirm whether there are any herring spawning sites within a three-nautical mile radius of the proposed drilling location. On the basis of the survey results, DECC may refuse to grant consent, impose extra conditions on the consent, or require the drilling location to be moved.

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 other 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. As with light, 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 the sites (e.g. The Wash SPA, Humber Flats, Marshes and Coast SPA) because of the location of the SPAs and pSPAs relative to the Blocks applied for and the main ports of supply for operations within them. Gas developments and infrastructure in the area tend to be primarily subsea tie-back 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 as a result.

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. These are the Dogger Bank cSAC, North Norfolk Sandbanks and Saturn Reef SCI and Inner Dowsing, Race Bank and North Ridge SCI as each encompasses or is overlapped by a number of the Blocks applied for.

With the exception of the Inner Dowsing, Race Bank and North Ridge SCI, these sites all contain existing gas fields and several Blocks have been applied for within the indicative boundaries of these sites. A number of awards for Block licences under the 26th Round have also been made within these offshore sites. Consequently the sites may be affected by a variety of activities as a result of the proposed work programmes, including rig/installation placement and the drilling 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 assessment and potential mitigation. 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. While the Saturn Reef feature is more restricted in its spatial extent and more sensitive to physical disturbance than sandbank features, none of the Blocks under consideration overlap the documented extent of the reef feature, and any proposed seabed development in this area would require extensive survey to characterise the seabed allowing potential interactions to be assessed. Risks to overall site integrity from 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 shallow water depths and 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

Many of the Blocks under consideration in the southern North Sea are within or immediately adjacent to Natura 2000 sites. 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 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. However, any adverse effects of activities that could result from licensing are considered minor, and able to be mitigated to the point where they would not compromise site conservation objectives. There is a legal framework, via e.g. EIA regulations and those implementing the Habitats Directive, to ensure that there are no adverse effects on the integrity of Natura 2000 sites.

Taking into account the information presented above and in the Appendices, it is concluded that activities arising from the licensing of the 33 Blocks included in this assessment will not cause an adverse effect on the integrity of the European Sites, though consent for activities will not be granted unless the operator can demonstrate that the proposed activities which may include the drilling of a 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.

Periods of concern for seismic have been identified for the Blocks (see Table 2.1) and it is envisaged that consent would not be granted for seismic survey during this period. Many species of fish are highly sensitive to sound and vibration (review in MMS 2004). Exposure to high sound pressure levels has been shown to cause long-term (>2 months) damage to sensory cells in fish ears (Hastings *et al*. 1996, McCauley *et al*. 2003). Other reported effects include threshold shifts (hearing loss), stress responses and other behaviour alterations (review in Popper *et al*. 2003). A number of field studies have observed displacement of fish and reduced catch rates, suggested to be attributable to behavioural responses to seismic exploration (e.g. Skalski *et al*. 1992, Engås *et al*. 1996, Hassel *et al*. 2004, Slotte *et al*. 2004). While lamprey are the only qualifying fish species of relevant European Sites in the southern North Sea area (e.g. Humber Estuary SAC), 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*, grey seal *Halichoerus grypus* (e.g. Berwickshire and North Northumberland Coast SAC, Humber Estuary SAC) and several seabird species such as puffin, kittiwake and gull species (e.g. Coquet Island SPA, Flamborough Head and Bempton Cliffs SPA, North Norfolk Coast SPA). Impact on prey species could undermine conservation objectives for sites though a deterioration in conservation status, for instance this may represent an indirect disturbance to qualifying species, or a temporary deterioration of the functioning of the habitats which support qualifying species, though mitigation measures are available (see Section 6.5) the implementation of which will also be assessed in detail once project plans are available.

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 grey 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, 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. The acquisition of new seismic data is included in the indicative work programmes for five of the Blocks considered in this AA (42/21, 42/22, 43/25, 47/3j and 47/8e). 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 wind farm monopile piling), airgun arrays used for seismic surveys are the highest energy man made sound sources in the sea; broadband peak-to-peak (p-p) source levels of 248-259dB re 1µPa are typical of large arrays (Richardson *et al*. 1995). Airgun noise is impulsive (i.e. non-continuous), with a typical duty cycle of 0.3% (i.e. one 25ms pulse every 10s) and slow rise time (in comparison to explosive noise). These characteristics complicate both the measurement of

seismic noise "dose" and the assessment of biological effects (many of which have been studied in relation to continuous noise). Most of the energy produced by airguns is below 200Hz, although some high frequency noise may also be emitted (Goold 1996). Peak frequencies of seismic arrays are generally around 100Hz; source levels at higher frequencies are low relative to that at the peak frequency but are still loud in absolute terms and relative to background levels.

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 and beyond a few kilometres, the main contribution is in the 2kHz region. Finally beyond around 12km it will be the main low-frequency pulse of around 250Hz that has the main contribution. However, local propagation effects may have significant influence: for example frequency dependence due to destructive interference also forms an important part of the weakening of a noise signal. Simple models of geometric transmission loss may therefore be unreliable in relatively shallow water; in areas of complex seabed topography and acoustic reflectivity; where vertical density stratification is present in deep water; and where the noise does not originate from a point source. In the St George's Channel, Goold and Fish (1998) recorded 8kHz sounds above background levels at a range of 8km from the source, even in a high noise environment.

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 drilling 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 10-2,000Hz (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 EIAs 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 in the Blocks, represent a small proportion of the marine areas used by seals (and cetaceans) associated with European Sites in the region. Larger proportions of the overall ranges may be affected by noise levels possibly associated with behavioural modification, although the ecological significance of such postulated effects have not been demonstrated. It is acknowledged here that injury and disturbance do not necessarily lead to an adverse impact on the integrity of a European site under the Habitats Directive, and indeed disturbance licences can be granted for certain levels of activity, without site integrity being compromised. Therefore, disturbance effects both within and beyond site boundaries are not expected to have consequent effects on site integrity.

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 (see Section 6.5) 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 Humber Estuary SAC and The Wash and North Norfolk Coast SAC.

6.4.1 Special Areas of Conservation

6.4.1.1 Humber Estuary SAC

(Annex II species: grey seal *Halichoerus grypus*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*)

The intertidal flats at Donna Nook, at the mouth of the Humber Estuary on the north Lincolnshire coast, provide an important habitat for grey seals. During the autumn, the site supports considerable numbers of breeding seals. Pup-production estimates for the site were 2,566 (Including Blakeney Point and Horsey) for 2010 (SCOS 2011). This represents a 14.9% increase on 2008; pup production at Donna Nook has increased at approximately 14.35% over the 5 year period of 2004-2010 (SCOS 2011). Throughout the rest of the year, the intertidal flats also provide an important habitat for grey seals to haul out or rest, particularly during the spring moult.

Extensive information on the distribution of British grey seals at sea is available from models of habitat preference derived from satellite telemetry data (McConnell *et al.* 1999, Matthiopoulos *et al*. 2004, Murphy *et al*. 2008, Lonergan *et al.* 2011). At sea, movements range from short-range return trips from haul-out sites to local foraging areas, to extended journeys between distant haul-out sites. Foraging trips from haul-out sites usually last between two and five days, with seals targeting localised areas generally within 50km of haul-out sites; these areas are typically characterised by a gravel/sand seabed sediment, the preferred burrowing habitat of sandeels, an important component of grey seal diet.

While of relatively low density at a national level, models show grey seal foraging to be widely distributed off the Lincolnshire, Yorkshire and north Norfolk coasts; marine usage appears greater to the north off the Northumberland coast and over the Dogger Bank. However, it is noted that models are based on counts of seals at haul-out sites from 1996-1997; populations of grey seals have increased considerably in the Donna Nook and north Norfolk area since that time, whereas numbers on the Farnes have remained more stable. Therefore, models may underestimate grey seal foraging activity from Donna Nook and north Norfolk relative to adjacent areas to the north. Modelling of regional grey seal population estimates (Lonergan *et al.* 2011), pup production estimates (Duck & Mackey 2008, Duck 2009), and telemetry data of individual breeding females, has highlighted seasonal differences in the regional movements of breeding female grey seals between the foraging and breeding (September to December) season (Russell *et al.* 2013). For example, breeding females on the south east coast (covers Northumberland to Kent and includes Donna Nook) primarily forage in that area but individuals may also forage further north, including around Orkney, Shetland and the Hebrides (Russell *et al.* 2013).

6.4.1.2 The Wash and North Norfolk Coast SAC

(Annex II species: harbour seal *Phoca vitulina*; non-primary Annex II species: otter *Lutra lutra*)

The Wash is the largest embayment in the UK. Its extensive intertidal flats combined with those of the adjacent North Norfolk coast provide ideal breeding and haul-out conditions for harbour seal. This site is the largest colony of harbour seals in the UK, with some 7% of the

total UK population. Their overall condition has been assessed as unfavourable (recovering) due to a decline in the moult population[9].

Derived from aerial surveys of breeding colonies, the minimum number[10] of harbour seals in the Wash in 2010 was estimated at 3,086 (SCOS 2011); counts in previous recent years were 1,695 (2006), 2,124 (2005) and 2,167 (2004) (Lonergan *et al*. 2007). While a high degree of uncertainty surrounds any apparent population trends, SCOS (2010) describe the harbour seal population of the east coast of England as a whole over the period 2004-2007 as having undergone recent decline. Following the 1988 phocine distemper virus (PDV) epidemic, the population along the east coast of England (mainly in the Wash) was reduced by 52%. Numbers then slowly increased to approximately pre-1988 epidemic levels before a second PDV epidemic in 2002 resulted in a 22% decline in the Wash (Thomsen *et al*. 2005). Counts in the Wash failed to recover until observations from 2009 which represent a significant increase (SCOS 2010), with 2010 numbers now close to pre-2002 PDV epidemic levels (SCOS 2011); however, adjacent European colonies (e.g. the Wadden Sea) have experienced rapid growth since 2002. A targeted research programme has been established including increased monitoring to confirm the magnitude and geographical extent of the declines (SCOS 2008, 2010).

Recent studies of foraging at sea by harbour seals have been funded by SNH and DECC (Sharples *et al*. 2005, 2008, 2012 – see Figure 6.1). These indicate high site fidelity to haul-out sites, but ranging over substantial distances at sea. Harbour seals hauling out in the Wash forage widely throughout coastal and offshore waters of the English southern North Sea from the North Yorkshire to Sussex coasts. Animals tended to make repeated trips of relatively long distance and duration. All but one of 24 tagged seals travelled repeatedly to between 75 and 120km offshore and as far as 220km to assumed foraging patches (Sharples *et al*. 2008, 2012), though a large degree of individual variation led to an average trip distance of 86km. Foraging trips from The Wash average 8.3 days in duration (Sharples *et al.* 2008) with a general increase in trip duration expected through the non-breeding season from October to June. Animals were found to be fairly site faithful to the areas in which they foraged (Sharples *et al*. 2008, 2012).

Consideration

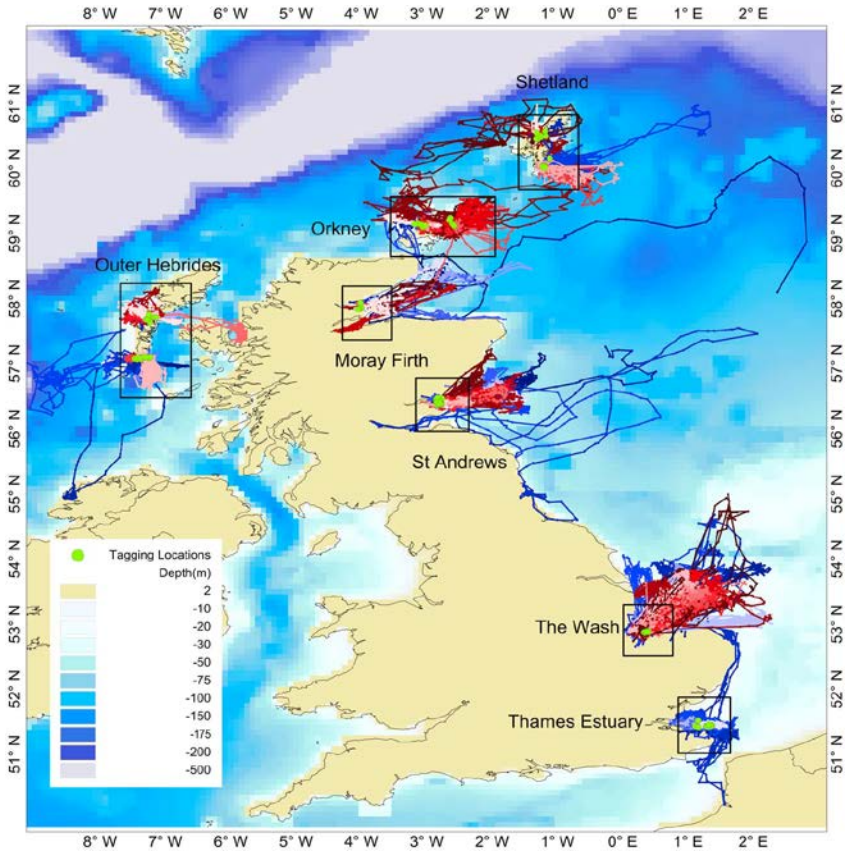
Most environmental assessments of noise disturbance use simple spherical propagation models of the form SPL = SL – 20log(R), where SL = source level, R = source-receiver range, to predict sound pressure levels (SPL) at varying distances from source. Cylindrical spreading, SPL = SL – 10log(R), is usually assumed in shallow water, depth < R. However, several workers have measured or modelled additional signal modification and attenuation due to a combination of reflection from sub-surface geological boundaries, sub-surface transmission loss due to frictional dissipation and heat; and scattering within the water column and sub-surface due to reflection, refraction and diffraction in the propagating medium (see SEA 4 Environmental Report). In shallow water, reflection of high frequency signals from the seabed results in approximately cylindrical propagation and therefore higher received spectrum levels

[9] The Wash and North Norfolk Coast European Marine Site Draft Condition Assessment, September 2008, as reviewed in 2010.
http://www.esfjc.co.uk/ems/pages/EMS%20condition%20assessment%20summary.pdf

[10] Numbers are counts of hauled-out seals from aerial surveys and provide a minimum population estimate, likely to represent approximately 60-70% of the total population.

than for spherically propagated low frequency signals (which penetrate the seabed). Attenuation of signal with distance is frequency dependent, with stronger attenuation of higher frequencies with increasing distance from the source. Frequency dependence due to destructive interference also forms an important part of the weakening of a noise signal.

Figure 6.1: Smoothed telemetry tracks of harbour seal



Note: males in shades of blue, females in shades of red. Green circles show where animals were captured and tagged.

Source: Sharples et al. (2012)

To inform the assessment, the minimum distance between the Blocks and the relevant sites has been used to provide general estimates of received sound levels (Table 6.2).

Table 6.2: Estimated received sound levels in relevant European Sites associated with a typical seismic survey

Site	Relevant qualifying Annex II species	Minimum distance (km)	Received sound level (dB re 1μPa peak-to-peak)
Humber Estuary SAC	Grey seal	17km from Block 47/8e	167
The Wash and North Norfolk Coast SAC	Harbour seal	60km from Block 47/8e	158

Site	Relevant qualifying Annex II species	Minimum distance (km)	Received sound level (dB re 1μPa peak-to-peak)
Doggerbank SAC	Harbour porpoise, harbour seal	180km from Block 43/25	152
Doggersbank cSAC	Harbour porpoise, grey seal, harbour seal	50km from Block 43/25	160
Klaverbank cSAC	Harbour porpoise, grey seal, harbour seal	50km from Block 43/25	160

Note: 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. Minimum straight line distance from the nearest Block to the site.

For the Humber Estuary SAC, the minimum direct linear range from the SAC boundary to the nearest Block in which seismic survey is proposed (Block 47/8e) is approximately 17km, giving a propagation loss (assuming 15logR) of around 63dB, or a received sound level of 167dB re 1μPa p-p for a typical seismic survey. In the case of the Wash and North Norfolk Coast SAC, the minimum direct linear range from the SAC boundary to Block 47/8e is approximately 60km, giving a propagation loss (assuming 15logR) of around 72dB, or a received sound level of 158dB re 1μPa p-p for a typical seismic survey. These levels are 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. With regard to fish, these levels are considerably lower than the levels found by Popper *et al*. (2005) to induce TTS in several fish species (also see Section 6.4.2).

Seismic survey occurring in the proposed licence Blocks (included in indicative work programmes for 42/21, 42/22, 43/25, 47/3j and 47/8e) will be audible to seals over a large area of the southern North Sea off the east coast of England characterised by moderate marine usage by foraging harbour seals associated with the Humber and The Wash and North Norfolk Coast SACs, and smaller adjacent haul-out sites. Noise levels suggested to cause auditory damage in phocids are rapidly attenuated with distance from source (see Table 6.1). For example, based on the proposed criteria of Southall *et al*. (2007) relating to pinnipeds and single pulsed sounds from a typical seismic survey, the range exceeding the injury criteria (onset of PTS) would extend to approximately 63.1m (p-p) from source, and for significant behavioural disturbance (onset of TTS) approximately 158.5m (p-p) from source – these ranges would not overlap with any relevant SACs due to their location relative to Blocks for which seismic survey is proposed. Furthermore, distances over which hearing damage may occur are well within the effective range of the mitigation measures which would be employed to minimise disturbance to marine mammals (see Section 6.5). Additionally, any future seismic survey plans would be subject to an extensive source- and site-specific assessment of the potential for adverse effects, including AA.

Available evidence suggests that significant effects at a population or individual level are unlikely. This conclusion is based on population monitoring of The Wash harbour seal population over 40 years, during which time seismic survey activity in the southern North Sea has been considerable (see e.g. SEA 3 Environmental Report, Figure 10.2). As noted above, inter-annual and longer-term population trends have varied, with known factors including

recovery from historic hunting (in the Wash until 1970) and persecution, and periodic mass mortalities associated with disease (recorded in Britain since at least 1813; Harwood & Hall 1990). No cause has yet been identified for the apparently widespread current decline in the moult population (SCOS 2008) although attention has been focused on general health/pollutant burdens, and on competition with other predators, notably grey seals. The geographical distribution of this trend does not appear to be related to sources of significant anthropogenic noise.

If significant ecological effects on prey species were to occur, even at considerable distances from the Humber Estuary or Wash and North Norfolk Coast SAC, these may influence the breeding population of the site. 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 have significant effects on relevant qualifying species.

Otters in coastal habitats may also experience acoustic disturbance from seismic exploration or construction piling. However, as they generally occupy shallow, inshore areas where the propagation of seismic noise is very limited, and as indicative work programmes for Blocks in proximity to the Wash and North Norfolk Coast SAC do not include the acquisition of new seismic data, effects are not predicted.

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

6.4.2 Migratory fish

The potential for acoustic disturbance effects was identified for the River Derwent SAC and the Humber Estuary SAC due to presence of migratory lamprey species as qualifying features, which utilise waters of the Humber Estuary as a nursery area (river lamprey) or occupy adjacent coastal and offshore marine areas for part of their life cycle (sea lamprey).

Sea lamprey inhabit both shallow coastal and deep offshore waters, but migrate into fresh water to spawn. Young river lamprey use the estuarine water of the Humber as a nursery before migrating upstream to freshwater to spawn in the River Derwent and Ouse. Significant propagation of underwater noise into shallow enclosed and semi-enclosed bays and estuaries is not expected, therefore the potential for effects is restricted to sea lamprey occupying marine areas. Considering the low densities of sea lamprey which can be expected in offshore areas, their lack of a swim bladder, and the aforementioned limited range of significant effects of seismic survey on fish, significant effects on qualifying fish species at a population or individual level are unlikely. Furthermore, the potential for impact can be mitigated through timing of seismic survey to avoid the period of lamprey entry into the rivers and consequently significant effects on this qualifying feature can be avoided.

Noise levels associated with other activities potentially resulting from the licensing of Blocks such as rig site survey, drilling, vessel movements, pipe-laying operations, are of a

considerably lower magnitude than those resulting from a deep geological seismic survey, and are not expected to have an adverse effect on the integrity of the riverine SAC sites.

6.4.3 Adjacent waters SACs

The potential for acoustic disturbance effects was identified for the Doggerbank SAC due to presence of harbour porpoise and harbour seal as qualifying Annex II species, and for the Doggersbank cSAC and the Klaverbank cSAC where harbour porpoise, grey seal and harbour seal are qualifying Annex II species (see Appendix A3). Blocks 44/19a, 50/26, 54/1, 54/6, 54/11 and 53/30, abut the UK median line, though only 44/19a abuts a European site, the Doggersbank cSAC. The indicative work programme for Block 44/19a and those adjacent to it (44/13, 44/18e), do not include the acquisition of new seismic data (see Section 2.2). The closest Block to these sites for which seismic survey is proposed is 43/25, 50km from both Doggersbank and Klaverbank cSAC, and 180km from Doggerbank SAC. At 50km distance, propagation losses (assuming 15logR) of around 70dB, or a received sound level of 160dB re 1μPa p-p for a typical seismic survey would be expected at site boundaries, reduced to a received sound level of 151dB re 1μPa p-p at 180km. These levels are 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.

Based on Southall *et al*.'s (2007) proposed criteria relating to cetaceans and pinnipeds, and single pulsed sounds from a typical seismic survey, the range exceeding the injury criteria (onset of PTS) would extend from approximately 10m (cetaceans) to 63.1m (pinnipeds) (p-p) from source, and for significant behavioural disturbance (onset of TTS), from approximately 25.1m (cetaceans) to 158.5m (pinnipeds) (p-p) from source. These ranges represent a tiny proportion of the marine areas used by seals and porpoise associated with European Sites; therefore, disturbance effects beyond site boundaries are not expected to have consequent effects on site integrity either through direct effects or on prey.

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 and Natural England, 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 of Habitats and Species Regulations 2010* (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, 2010 and 2012)). It is a condition of consents issued under Regulation 4 of the *Petroleum Activities (Conservation of Habitats) Regulations 2001* (&

2007 Amendments) for oil and gas related seismic surveys that the JNCC Seismic Guidelines are followed. Disturbance licences can also be issued under the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended).

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[11] 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).

[11] 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.

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

In addition to marine mammal sensitivities, disturbance to populations of qualifying anadromous species can be mitigated through timing of seismic survey to avoid migratory periods and consequently significant disturbance can be avoided.

Though not constituting mitigation, it should be noted that targets associated with the noise descriptor for Good Environmental Status (GES) under the Marine Strategy Framework Directive (MSFD) were subject to consultation by Defra in March 2012 (HM Government 2012a), and may have wider implications for how noise is managed in UK waters in the coming years (see Section 8.1 for more information).

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 would be intermittent and there is no evidence that cumulative effects of previous survey effort have been adverse. Despite considerable scientific effort, no causal link, or reasonable concern in relation to population viability has been found.

For the Southern North Sea Blocks under consideration, calculations considering the direct linear range to the SAC boundaries and the source level of a typical seismic survey suggest that received noise levels within relevant SACs will fall below relevant effects criteria as defined by Southall *et al*. (2007) – see Table 6.2.

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, taking account of the following:

- Should a deep geological seismic survey be proposed in the Blocks (as indicated by the work programme - note this is only for Blocks 42/21, 42/22, 43/25, 47/3j and 47/8e), further HRA would 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 deep geological seismic 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[12] 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

[12] 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[13] with OPEP guidance updated in July 2012[14].

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 33 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 southern part of the North 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

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

[14] 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

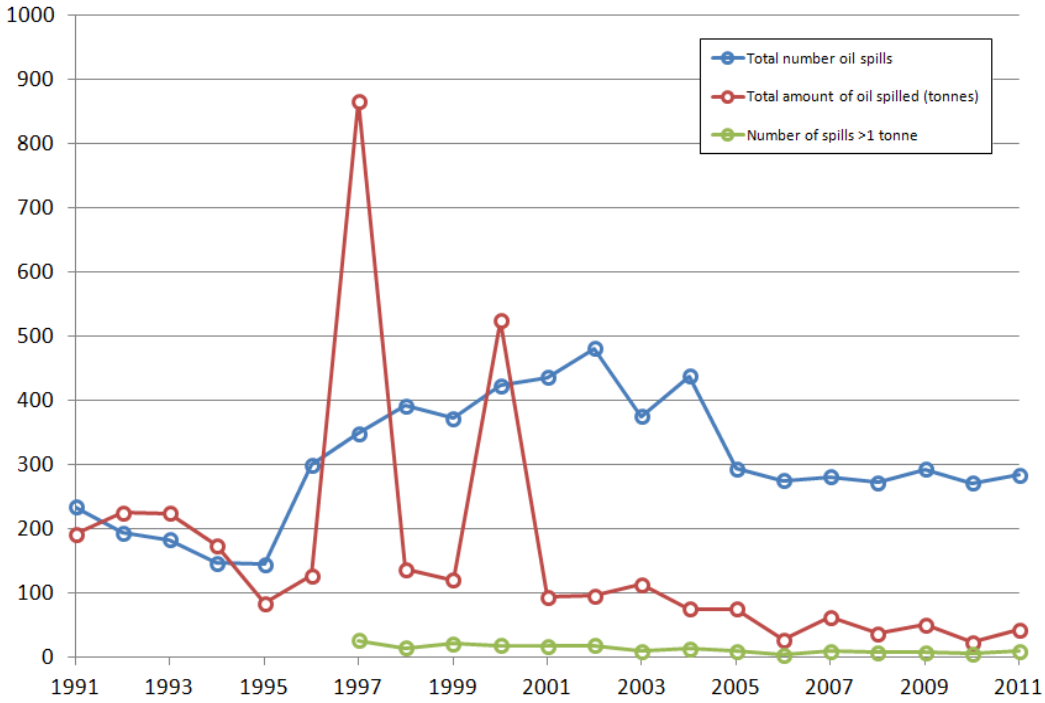
UKCS to date have been from West Vanguard (1985) and Ocean Odyssey (1988), both involving gas and not resulting in significant pollution.

Potential risks of oil spills are mitigated in the southern North Sea by the nature of the hydrocarbons present in those areas (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 southern North 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[15] (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

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

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

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[16]. 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[17]).

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

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 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

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

release. A GIG update[18] 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 southern North 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 (primarily from condensate) 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. 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 southern North Sea Blocks would push spilled oil away from the coast. To support environmental assessments of individual drilling or development of gas projects, modelling is carried out for diesel oil releases. Representative modelling cases from various parts of the UKCS have been reviewed by successive SEAs.

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 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

[18] 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

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 (e.g. sites include Flamborough Head and Bempton Cliffs SPA) 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.

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.

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
42/5	3	1	3	1	2	4	3	2	1	1	1	2	1
42/21	2	1	2	3	2	1	1	1	1	1	1	1	1
42/22	2	1	2	3	2	1	1	1	1	1	1	1	1
42/23	1	1	2	2	1	1	1	1	1	1	1	1	1
43/10	1	1	1	1	2	4	3	3	1	1	1	3	1
43/12	1	1	1	1	2	4	3	2	1	1	2	3	1
43/16	1	1	1	1	1	4	3	2	1	1	2	2	1
43/20	1	1	1	1	2	4	2	2	1	1	2	1	1
43/25	1	1	1	2	1	3	2	2	1	1	1	1	1
44/13	3	3	4	2	2	4	3	3	2	1	2	3	3
44/16	2	3	1	2	2	4	2	3	2	1	2	1	2

Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Overall
44/18	2	3	1	2	2	3	2	3	2	1	1	1	2
44/19	2	3	4	2	2	3	2	3	4	1	1	1	2
44/21	2	2	1	2	1	3	2	2	2	1	1	1	1
44/23	2	2	1	2	1	3	2	2	2	1	1	1	1
47/22	4	3	2	-	4	-	3	2	3	-	2	3	4
47/23	4	3	2	-	4	-	3	2	3	-	2	3	4
47/24	4	3	3	-	4	-	4	2	3	-	2	3	4
47/3	1	1	2	3	2	1	1	1	1	1	1	1	1
47/8	2	1	2	4	2	2	1	1	1	2	1	1	1
48/10	1	1	1	2	1		1	1	2	1	1	2	1
48/18	3	2	1	2	3	4	4	1	2	2	1	2	2
44/19	2	3	4	2	2	3	2	3	4	1	1	1	2
44/21	2	2	1	2	1	3	2	2	2	1	1	1	1
44/23	2	2	1	2	1	3	2	2	2	1	1	1	1
47/22	4	3	2	-	4	-	3	2	3	-	2	3	4
47/23	4	3	2	-	4	-	3	2	3	-	2	3	4
47/24	4	3	3	-	4	-	4	2	3	-	2	3	4
47/3	1	1	2	3	2	1	1	1	1	1	1	1	1
47/8	2	1	2	4	2	2	1	1	1	2	1	1	1
48/10	1	1	1	2	1		1	1	2	1	1	2	1
48/18	3	2	1	2	3	4	4	1	2	2	1	2	2
48/23	4	2	3	4	3	4	4	2	3	1	2	2	3
48/24	4	2	3	4	3	4	4	3	4	2	2	2	4
48/25	4	2	2	4	3	4	4	3	4	2	2	2	4
48/4	1	1	1	2	1	4	2	1	2	1	1	2	1
49/21	4	2	2	4	3	4	4	3	4	3	4	2	4
49/4	2	2	2	2	2	3	2	3	3	2	1	1	3
49/8	2	2	1	2	1	3	1	2	3	1	1	1	1
53/3	3	2	2	4	3	4	4	3	4	3	4	2	4
53/8	2	1	2	4	3	4	4	3	4	3	4	2	3

Note: 1 = very high, 2 = high, 3 = moderate, 4 = low, - = no data

Source: JNCC (1999).

Oil spill risks to marine mammals have been reviewed by successive SEAs and their supporting technical reports (e.g. Hammond *et al*. 2008, Murphy *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, together with the distance offshore, this is unlikely to be significant in the southern North 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 southern North 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** – generally not considered sensitive due to wave reflection and rapid recovery (e.g. Gundlach & Hayes 1978). 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. Habitats above the level of spring high tides are not normally vulnerable to marine oil spills (Law *et al*. 2011). For sites considered in this assessment, these include: non-coastal otter populations (*Lutra lutra*).

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 spilled diesel oil travels before dispersion (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 habitats 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):** Humber Estuary SAC (47/8e, 47/22, 47/23, 47/24), The Wash and North Norfolk Coast SAC (47/22, 47/23, 47/24, 48/23c)
Estuaries
Complexes of several subtidal and intertidal habitats with varying freshwater influence. The sediments of estuaries support various biological communities, while the water column provides an important habitat for free-living species, such as fish, and juvenile stages of benthic plants and animals. Estuaries often contain several different Annex I habitats. **Sites potentially at risk (relevant Block):** Humber Estuary SAC (47/8e, 47/22, 47/23, 47/24)
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 risk (relevant Block): Humber Estuary SAC (47/8e, 47/22, 47/23, 47/24), The Wash and North Norfolk Coast SAC (47/22, 47/23, 47/24, 48/23c)

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): The Wash and North Norfolk Coast SAC (47/22, 47/23, 47/24, 48/23c)

Harbour porpoise

Sites comprise a variety of marine habitats utilised by harbour porpoise (*Phocena phocena*) for foraging and other activities, with extensive areas beyond the site boundary also utilised. Vulnerable to oil spills due to their dependence on the sea surface for breathing. 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 (relevant Block): Doggersbank cSAC (44/13, 44/18e, 44/19a), Klaverbank cSAC (44/23g, 49/4b, 49/8b)

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 (relevant Block): Humber Estuary SAC (47/8e, 47/22, 47/23, 47/24), The Wash and North Norfolk Coast SAC (47/22, 47/23, 47/24, 48/23c), Doggersbank cSAC (44/13, 44/18e, 44/19a), Klaverbank cSAC (44/23g, 49/4b, 49/8b)

Coastal otters

Sites contain shallow, inshore coastal areas utilised by important populations of otter (*Lutra lutra*) for feeding. Some coastal otters feed in nearshore and intertidal areas, but their reliance on these habitats and associated food resources is not well established as they are also likely to feed in freshwater habitats nearby. While there was some evidence of impacts to otter populations following the 1993 Braer oil spill in south Shetland there was no recorded evidence of impacts from the 1996 Sea Empress spill to otters in Pembrokeshire. However, the difficulty of making good estimates of population size and measuring impacts makes assessment of vulnerability unreliable (Law *et al.* 2011).

Sites potentially at risk (relevant Block): The Wash and North Norfolk Coast SAC (47/22, 47/23,

47/24, 48/23c), North Norfolk Coast SAC (47/22, 47/23, 47/24, 48/23c)
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 (relevant Block):** Humber Estuary SAC (47/8e, 47/22, 47/23, 47/24)

7.3.1.1 The Wash and North Norfolk Coast SAC

(Annex I qualifying habitats: sandbanks which are slightly covered by sea water all the time, mudflats and sandflats not covered by seawater at low tide, large shallow inlets and bays, reefs, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*), coastal lagoons

Annex II qualifying species: Harbour seal *Phoca vitulina*, otter *Lutra lutra*)

Large numbers of harbour seal occur on the English east coast at The Wash and along the adjacent coastline, and utilise coastal waters surrounding these colonies (for instance see SCANS-II, 2008), with a mean foraging distance of *ca.* 85km (see Sharples *et al.* 2012 and Section 0, based on 440 trips of 24 seals). Current estimates of harbour seal population in The Wash is in the region of 4,221 for 2007-2010 (SCOS 2011). Harbour seals haul out on tidally exposed areas of rock, sandbanks or mud. Pupping occurs on land from June to July, while the moult is centred around August and extends into September. Therefore, from June to September, harbour seals are ashore more often than at other times of the year.

Advice made under Regulation 33 for the Wash and North Norfolk Coast SAC[19] (English Nature 2000 – though at the time not recognising the qualifying Annex II otter), indicates that subtidal sandbanks are generally less vulnerable to the risk of oil spills than intertidal sediment environments (which are noted to be sensitive to smothering by substances such as oil), unless the oil is dispersed during clean-up operations, or if wave action allows sediment mobility and the incorporation of oil into the sediments. In addition, the advice notes Atlantic salt meadows are sensitive to spills reaching the coast due to their ability to trap sediments, and that all *Salicornia* species are highly susceptible to inundation by spills. No specific advice is made in relation to oil spills with regards to the harbour seal.

7.3.1.2 Humber Estuary SAC

(Annex I qualifying habitats: Estuaries, mudflats and sandflats not covered by seawater at low tide Secondary features: Sandbanks which are slightly covered by seawater all the time,

[19] Note that this statutory advice (now Regulation 35 of the 2010 Regulations), is presently under review for SACs under the remit of Natural England (i.e. between 0 and 12nm). Present Regulation 33 advice is used where available.

coastal lagoons, *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'), dunes with *Hippophae rhamnoides*

Annex II qualifying species: Sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluvitilis*, grey seal *Halichoerus grypus*)

Donna Nook at the mouth of the Humber Estuary represents one of the larger English colonies of grey seal, with pup-production estimates for the site being 2,566 (Including Blakeney Point and Horsey) for 2010 (SCOS 2011). Most of the grey seal population will be on land for several weeks from October to December during the pupping and breeding season, and again in February and March during the annual moult. Densities at sea are likely to be lower during this period than at other times of the year. Animals most at risk from oil coming ashore on seal haul out sites and breeding colonies are neonatal grey seal pups, as these rely on their thicker fur for insulation during the first few weeks of their life before developing blubber and moulting into a sea-going coat. They are also restricted to their breeding colony until they are weaned, and are therefore more susceptible than adults to external oil contamination.

Interim Regulation 33 advice for the Humber (English Nature 2003) recognises that oil spills of crude oil may cause deterioration or disturbance to a number of qualifying habitats for which the site is designated (e.g. estuaries, coastal lagoons, Atlantic salt meadows, *Salicornia* and other annuals, intertidal mudflats and sandflats and subtidal sandbanks). The advice notes that smothering effects and toxicity of oil can affect lagoon and saltmarsh features, with saltmarsh plants being affected due to their ability to trap sediments. It is recommended that dispersants are not used to clean up oil spills on or close to saltmarshes due to their effects on saltmarsh plants. Eelgrasses of intertidal flats and their associated communities are also susceptible to oil spills, both from toxic effects and from smothering.

Consideration

The qualifying features of the sites listed in Table 7.2 are potentially vulnerable due to their sensitivity to oil spill. Given that the potential hydrocarbon resource in the Blocks is gas, the potential for the conservation objectives of the qualifying features of the Humber Estuary SAC and The Wash and North Norfolk Coast 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). The majority of the work programmes indicate a drill or drop well. Therefore, following examination of the seismic information to be collected a decision will be made by the prospective licensee to drill a well or relinquish the Blocks. A number of other programmes indicate either contingent (43/12, 43/23, 44/13) or firm (43/25, 44/19a, 47/3k) wells, where the commitment and therefore likelihood of wells being drilled is strong (see Section 2.2). 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 wells, 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 Migratory fish

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

The Humber Estuary SAC maintains populations of sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis* (both favourable maintained). Both the river lamprey and sea lamprey migrate up rivers to spawn and spend the larval stage buried in muddy substrates in freshwater. Once metamorphosis takes place, the adults migrate to the sea where they live as a parasite on various species of fish. Sea lampreys are thought to inhabit both shallow coastal and deep offshore waters, venturing further than river lampreys.

Following licensing, specific activities require permitting (see Section 7.4) and those considered to present a risk to European Sites and species 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 addition to those mitigation measures which are mandatory – 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 wells, will not have an adverse effect on the integrity of the relevant SAC. As stated previously, as the recoverable resources are gas, no significant oil spill can be expected in the case of a blowout.

7.3.3 Special Protection Areas

Table 7.3 provides information on those SPA types which are potentially vulnerable to oil spills. Those sites where the potential for effects from diesel oil spills has been identified (see Appendix B) are listed. Due to the limited distance which may be travelled by spilled diesel oil (up to *ca*. 24km), the potential for oil spill effects relate to a limited number of Blocks near the coast; 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 (relevant Block):** Flamborough Head and Bempton Cliffs SPA (42/21, 42/22)
Petrel, tern, skua or gull breeding populations
Designated for breeding seabirds, which generally forage over sea areas adjacent to (or in some cases at considerable distance from) breeding sites. **Sites potentially at risk (relevant Block):** Gibraltar Point SPA (47/22, 47/23, 47/24), Humber Estuary SPA (47/8e, 47/22, 47/23), The Wash SPA (47/22, 47/23, 47/24)
Red-throated diver populations utilising coastal waters
Inland sites designated for breeding red-throated diver (*Gavia stellata*) which forage in neighbouring coastal waters, or inshore sites designated for over wintering populations. **Sites potentially at risk (relevant Block):** Outer Thames Estuary SPA (53/3a, 53/8)
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):** Gibraltar Point SPA (47/22, 47/23, 47/24), The Wash SPA (47/22, 47/23, 47/24)
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):** Humber Estuary SPA (47/8e, 47/22, 47/23), The Wash SPA (47/22, 47/23, 47/24)

7.3.3.1 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 7.2.3), 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. Humber Estuary, the Wash). Blowout occurrence frequency is in the range of 1/1,000-10,000 well years (see Section 7.2) and the southern North 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. The majority 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 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 wells, will not have an adverse effect on the integrity of the SPAs within the Southern North Sea. As stated previously, as the recoverable resources are gas, no significant oil spill can be expected in the case of a blowout.Moreover, JNCC and Defra have highlighted periods of seasonal concern for drilling for a number of the Blocks under consideration in this AA (see Table 2.1), and DECC will apply a presumption that no drilling activity takes place during these periods unless agreement is reached with the body that requested the restriction, or appropriate mitigation measures can be agreed (defined at the project level).

7.3.4 Adjacent waters SACs

The potential for oil spills to impact the integrity of SACs in adjacent waters has been considered and Table 7.2 highlights those sites that could be vulnerable to oil spills and the relevant Blocks – the Dutch sites, Doggersbank cSAC (relevant qualifying features – harbour porpoise, harbour and grey seal; Blocks 44/13, 44/18e, 44/19a) and Klaverbank cSAC (harbour porpoise, harbour and grey seal; Blocks 44/23g, 49/4b, 49/8b).

The potential hydrocarbon resource in the Blocks is gas. Therefore the potential for the conservation objectives for the qualifying habitats and species to be undermined by a large oil spill, and therefore site integrity to be adversely affected, is extremely remote. However, the possibility of spills of diesel fuel or lubricants cannot be discounted and is addressed through existing regulatory mechanisms. 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 wells will not have an adverse effect on the integrity of relevant SACs in adjacent waters.

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, though these have now been removed from service in areas relevant to this AA[20]. 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

[20] 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.

  - 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[21] 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 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 OPEP's, 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.

---

[21] 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).

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 proposed licence Blocks 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 27th Round licensing in the southern North Sea; however, given the nature of the hydrocarbons that may be encountered following licensing, and as oil spills are not intended activities, a risk-based assessment is appropriate.

Following licensing, specific activities require permitting and those considered to present a risk to European Sites would be evaluated by DECC under mandatory contingency planning and 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 exploration and production activities that could follow the licensing of Blocks 42/5, 43/16, 42/21, 42/22, 42/23, 43/10, 43/12, 43/20f, 43/25, 44/21c, 44/13, 44/16b, 44/16c, 44/18e, 44/19a, 44/23g, 47/3j, 47/3k, 47/8e, 47/22, 47/23, 47/24, 48/4b, 48/10c, 48/18c, 48/23c, 48/24, 48/25c, 49/4b, 49/8b, 49/21d, 53/3a, 53/8, in so far as they may cause oil spills, will not adversely affect the integrity of European Sites.

Consent for activities will not be granted unless the operator can demonstrate that the proposed activities 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).

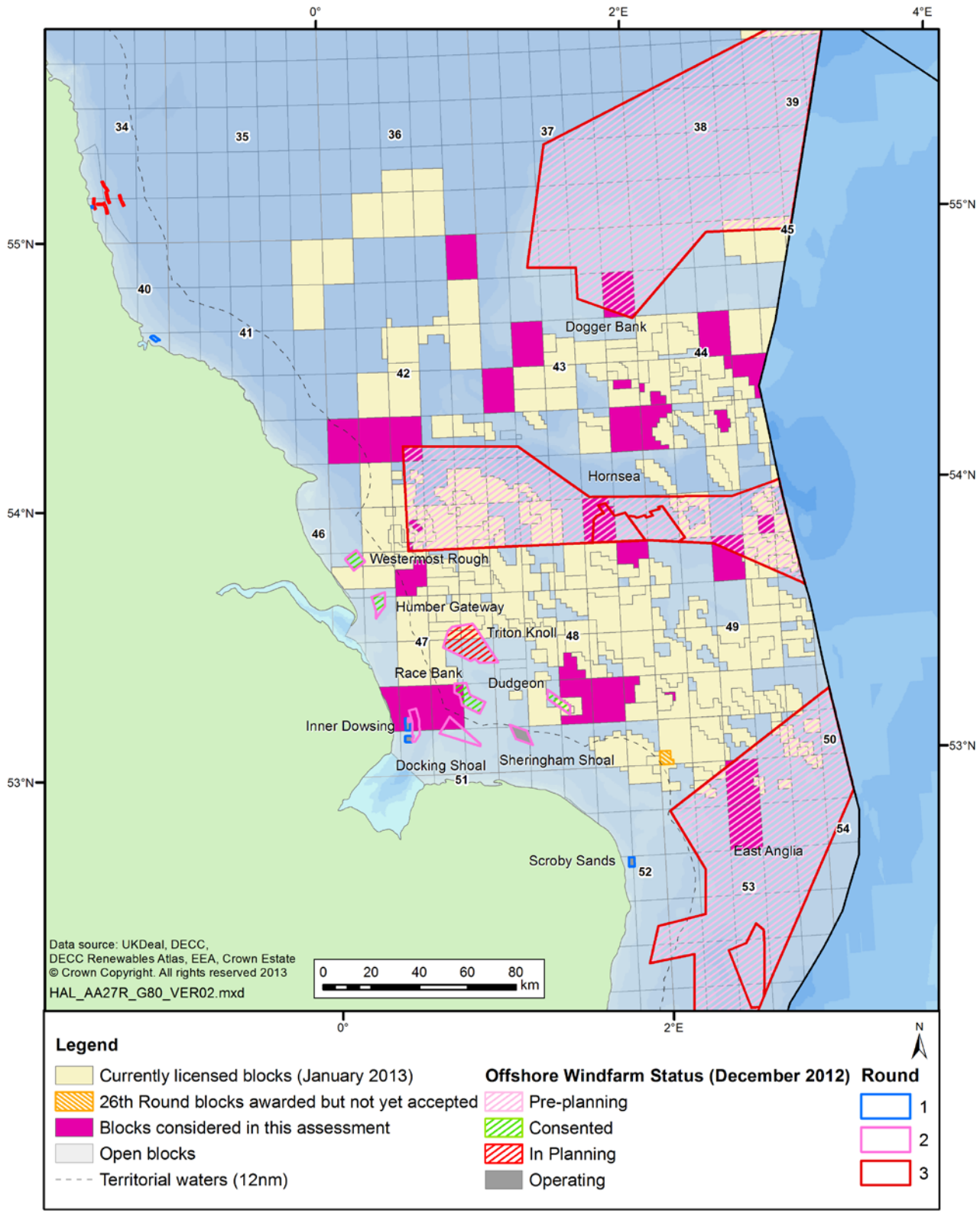
8.1 Underwater Noise

Seismic survey 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". There is the potential for cumulative noise impacts where concurrent and sequential activities result in long-term exposure to elevated noise levels within the wider area. However, the likelihood of this is low (because of technical interference) and subject to mitigation in the near future by measures introduced to achieve Good Environmental Status under the Marine Strategy Framework Directive.

Other noise producing activities which are likely to occur within the southern North Sea include those associated with the development of marine renewable energy. Offshore wind energy is expected to undergo large-scale development off the east coast of England and wider southern North Sea over the next decade. In addition to the constructed offshore wind farms in UK waters of the southern North Sea, applications have been made and consents granted for several substantial offshore wind energy developments in the region. A limited number of these are currently under construction, with works expected to begin at several more in the near future. A number of the Blocks (47/23, 47/24 and 48/23c) impinge upon or are adjacent to R1 and R2 windfarm areas (see Figure 8.1).

In addition to the wind farm developments noted above, following the Offshore Energy SEA, The Crown Estate have entered three Round 3 zonal development agreements for the generation of up to 9, 4 and 7.2GW of offshore wind energy respectively. The Dogger Bank zone, overlaps the northern half of the Dogger Bank cSAC; the Hornsea zone extends east from approximately 36km east of Flamborough Head to the median line; while the East Anglia zone lies east of Norfolk and Suffolk immediately south of the North Norfolk Sandbanks SCI (Figure 8.1).

Figure 8.1: Offshore wind development in the southern North Sea



Dogger Bank Creyke Beck will be the first stage of development in the Dogger Bank Zone[22]. It will have an installed capacity of up to 2.4GW and will connect into the existing Creyke Beck substation near Cottingham, in the East Riding of Yorkshire. It will comprise of two offshore wind farms with an installed capacity of up to 1.2GW each:

- Dogger Bank Creyke Beck A located in the south of the Dogger Bank zone, with a size of 515km^2 and 131km from shore at its closest point.

- Dogger Bank Creyke Beck B located in the south west of the Dogger Bank zone, with a size of 599km^2 and also 131km from shore at its closest point.

Dogger Bank Teesside is Forewind's second stage of development of the Dogger Bank Zone[23]. This stage will comprise four wind farms, each with a maximum installed capacity of 1.2GW. They are expected to connect to the national grid in Teesside, just south of the Tees Estuary. The first two wind farms are:

- Dogger Bank Teesside A located in the south eastern part of the Dogger Bank zone, with a size of 560km^2 and with closest point from shore at 196km.

- Dogger Bank Teesside B which is located to the west of Teesside A close to the Creyke Beck areas. It is 593km^2 and is 165km from shore at its closest point.

The Forewind development programmes for both the Creyke Beck and Teesside areas indicates that the development consent applications will be submitted in Q1 2013 and Q1 2014 respectively, with construction proposed between 2016 and 2021, and operation from 2017 onwards.

Figure 8.1 highlights that a number of Blocks are within the Hornsea zone. The first development in the zone, Project One will comprise of up to three wind farm arrays with a combined capacity of up to 1.2GW[24]. Project One will be located in the centre of the Hornsea Zone, covering an area of approximately 407km² (as shown on Figure 8.1). Depending on the rated capacity of the turbines selected (between 3.6 and 8MW each), the estimated number of wind turbines will be between 150 and 332. Construction of Project One is proposed between 2015 and 2017. Block 48/4b overlaps the proposed Project One area with Block 48/10c adjacent to the south of the area.

Project Two, the second development in the Zone, will have a combined capacity of up to 1.8GW[25]. The offshore wind turbines for Project Two will be located in the centre of the Hornsea zone, adjacent to Project One. Depending on the rated capacity of the turbines selected (between 5 and 15 MW each), the estimated number of wind turbines will be between 80 and 360.

The East Anglia zone is being developed by the East Anglia Offshore Wind Limited (EAOW). EAOW is currently developing the first project, known as the East Anglia ONE offshore

[22] Forewind website - http://www.forewind.co.uk/projects/dogger-bank-creyke-beck.html
[23] Forewind website - http://www.forewind.co.uk/projects/dogger-bank-teeside.html
[24] SMart Wind website - http://www.smartwind.co.uk/project1.aspx
[25] SMart Wind website - http://www.smartwind.co.uk/project2.aspx

windfarm[26]. It will be located in the south of the zone (as shown on Figure 8.1) and covers an area of approximately 300km^2. Up to 325 wind turbines will provide an installed capacity of 1.2GW and the closest distance to land will be 43.4km off the coast of Suffolk. Proposed construction of the windfarm will start in 2016.

The consenting of offshore wind developments in the region will be subject to detailed project-specific EIA and Habitats Regulations Assessments. The development of offshore wind energy is also taking place in other North Sea nations, with plans for several large developments close to the UK median line, although these will similarly be subject to EIA and Habitats Regulations Assessments.

There is currently no infrastructure deployed in the region associated with the extraction of wave and tidal energy, and none is envisaged in the immediate future. Prospective areas for wave and tidal development in the southern North Sea were identified in OESEA2 (DECC 2011).

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, 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 wind farm 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 southern North Sea Blocks under consideration and future marine renewable energy development, there are a variety of other existing (e.g. gas production, wind turbine deployments, fishing, shipping, military exercise areas, aggregate extraction) and planned (e.g. gas exploration and production, carbon transport and storage) noise-producing activities in overlapping or adjacent areas (see OESEA2 Appendix 3h, DECC, 2011). 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 undermine the conservation objectives 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

[26] East Anglia Offshore Wind Limited website - http://www.eastangliawind.com/east-anglia-one.aspx

with the potential to affect Natura 2000 sites, these mechanisms also include project specific Habitats Regulations Assessments.

The Marine Strategy Framework Directive (2008/56/EC) (MSFD) requires that the European Commission (by 15 July 2010) should lay down criteria and methodological standards to allow consistency in approach in evaluating the extent to which Good Environmental Status (GES) is being achieved. Task Group 11 reported on underwater noise and other forms of energy (though note that at present only noise is considered), 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 GES 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)[27]. The report recognised that there was insufficient data to provide a quantitative assessment of 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 indicated 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

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

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 125 Hz (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/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 (e.g. Round 3 wind farm zones), 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 will likely be an important consideration at the project level for the large offshore wind developments that are planned for the southern North 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. Given the general separation distances of existing oil and gas installations within southern North Sea, a presumption against the discharge to sea of produced water from new developments, and that production is largely isolated to gas hydrocarbons, there is unlikely to be a cumulative effect from multiple produced water discharges.

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

8.3 Conclusions

Available evidence (see e.g. UKBenthos database and OSPAR 2000) for the southern North 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 effects from activities arising from the licensing of the 33 Blocks considered in this assessment with those from existing and planned activities in the southern North Sea will not adversely affect the integrity of 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 42/5, 43/16, 42/21, 42/22, 42/23, 43/10, 43/12, 43/20f, 43/25, 44/21c, 44/13, 44/16b, 44/16c, 44/18e, 44/19a, 44/23g, 47/3j, 47/3k, 47/8e, 47/22, 47/23, 47/24, 48/4b, 48/10c, 48/18c, 48/23c, 48/24, 48/25c, 49/4b, 49/8b, 49/21d, 53/3a, 53/8 (considered further in Sections 6-9). 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 integrity of European sites.

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

10 References

André M, Solé M, Lenoir M, Durfort M, Quero C, Mas A, Lombarte A, van der Schaar M, López-Bejar M, Morell M, Zaugg S & Houégnigan L (2011). Low-frequency sounds induce acoustic trauma in cephalopods. *Frontiers in Ecology and the Environment* **9**: 489–493

Berrow S, Holmes B & Goold J (2002). The distribution and intensity of ambient and point source noises in the Shannon estuary. Final report to the Heritage Council. http://www.shannondolphins.ie/downloads/Berrow_SourceNoisesShannonEstuary.pdf

Berry JA & Wells PG (2004). Integrated fate modelling for exposure assessment of produced water on the Sable Island Bank (Scotian Shelf, Canada). *Environmental Toxicology and Chemistry* **23**: 2483–2493

Bradshaw C, Veale LO & Brand AR (2002). The role of scallop-dredge disturbance in long-term changes in Irish Sea benthic communities: a re-analysis of an historical dataset. *Journal of Sea Research* **47**: 161-184.

Brandt MJ, Diederichs A, Betke K & Nehls G (2011). Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. *Marine Ecology Progress Series* **421**: 205–216.

Burns K, Codi S, Furnas M, Heggie D, Holway D, King B & McAllister F (1999). Dispersion and fate of produced formation water constituents in an Australian Norwest shelf shallow water ecosystem. *Marine Pollution Bulletin* **38**: 597-603

Camphuysen CJ (2007). Chronic oil pollution in Europe: a status report. A report by the Royal Netherlands Institute for Sea Research for IFAW, 88pp.

Christian JR, Mathieu A, Thompson DH, White D & Buchanan RA (2003). Effect of seismic energy on snow crab (*Chionoecetes opilio*) 7th November 2003. Environmental Research Funds Report No. 144, Calgary, 106pp

Coyle MD & Wiggins SM (2010). European marine site risk review. Natural England Research Reports No. 38.

Cranmer G (1988). Environmental survey of the benthic sediments around three exploration well sites. Report No 88/02. Report to the United Kingdom Offshore Operators Association. Aberdeen University Marine Studies Ltd, Aberdeen, UK, 33pp.

Currie DR & Isaacs LR (2005). Impact of exploratory offshore drilling on benthic communities in the Minerva gas field, Port Campbell, Australia. *Marine Environmental Research* **59**: 217–233

Daan R & Mulder M (1996). On the short-term and long-term impact of drilling activities in the Dutch sector of the North Sea. *ICES Journal of Marine Science* **53**: 1036-1044.

Davis RA, Richardson WW, Thiele L, Dietz R & Johansen P (1991). State of the Arctic Environment report on underwater noise. Arctic Center Publications 2, Finland special issue. *The State of The Arctic Environment Reports*: 154-269.

DCLG (2012). National Planning Policy Framework. Department for Communities and Local Government. March 2012, 59pp.

De Groot SJ & Lindeboom HJ (1994). Environmental impact of bottom gear on benthic fauna in relation to natural resources management and protection of the North Sea. NIOZ Rapport 1994-11, Texel, The Netherlands.

DECC (2008). 25th Seaward Round Block Screening Assessment, November 2008. Department of Energy and Climate Change, 65pp.

DECC (2009). Offshore Energy Strategic Environmental Assessment, Environmental Report. Department of Energy and Climate Change, UK, 307pp plus appendices. http://www.offshore-sea.org.uk/site/scripts/book_info.php?consultationID=16&bookID=11

DECC (2011). Offshore Energy Strategic Environmental Assessment 2, Environmental Report. Department of Energy and Climate Change, UK, 443pp plus appendices. http://www.offshore-sea.org.uk/site/scripts/book_info.php?consultationID=17&bookID=18

DECC (2012a). Offshore Oil & Gas Licensing: 27th Seaward Round. Habitats Regulation Assessment Phase 1 – Block Screening. URN 12D/288: October 2012, 19pp + appendices.

DECC (2012b). Guidance notes to operators of UK offshore oil and gas installations (including pipelines) on Oil Pollution Emergency Plan requirements, 58pp.

DECC (2012c). Elgin gas release, environmental aspects update. Government Interest Group, 16 May 2012.

Defra (2010). Charting Progress 2: An assessment of the state of UK seas. Published by the Department for Environment Food and Rural Affairs on behalf of the UK Marine Monitoring and Assessment Strategy community, London, 194pp.

Dernie KM, Kaiser MJ & Warwick RM (2003). Recovery rates of benthic communities following physical disturbance. *Journal of Animal Ecology*. **72**: 1043-1056.

DFO (2004). Potential impacts of seismic energy on snow crab. DFO (Fisheries and Ocean Canada) Canadian Science Advisory Secretariat. Habitat Status Report 2004/003

Dixon T (2011). Annual survey of reported discharges attributed to vessels and offshore oil and gas installations operating in the United Kingdom pollution control zone 2010. Advisory Committee on Protection of the Sea (ACOPS). 82pp.

Duck CD (2009). Grey seal pup production in Britain in 2008. SCOS briefing paper

Duck CD & Mackey BL (2008). Grey seal pup production in Britain in 2007. SCOS briefing paper

E&P Forum (1994). North Sea Produced Water: Fate and effects in the marine environment. Exploration and Production Forum Report No. 2.62/204. May 1994. 48pp.

EC (2000) Managing NATURA 2000 Sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, 69pp.

Energy and Climate Change Committee (2011). Second report: UK deepwater drilling – Implications of the Gulf of Mexico spill. UK Government Select Committee report. http://www.publications.parliament.uk/pa/cm201011/cmselect/cmenergy/450/45002.htm

Engås A, Løkkeborg S, Ona E & Soldal AV (1996). Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*). *Canadian Journal of Fisheries and Aquatic Sciences* **53**: 2238-2249.

English Nature (2000). Wash and North Norfolk Coast European marine site. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994, 141pp.

English Nature (2003). The Humber Estuary European Marine Site. English Nature□s advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994: Interim Advice, April 2003, 147pp.

Faber Maunsell & Metoc (2007). Marine renewables Strategic Environmental Assessment (SEA). Report to The Scottish Government. Faber Maunsell & Metoc, UK.

Frid CLJ, Harwood KG, Hall SJ & Hall JA (2000). Long-term changes in the benthic communities on North Sea fishing grounds. *ICES Journal of Marine Science* **57**: 1303-1309

Gage JD, Roberts JM, Hartley JP & Humphery JD (2005). Potential impacts of deep-sea trawling on the benthic ecosystem along the northern European continental margin: a review. In: PW Barnes & JP Thomas Eds. *Benthic habitats and the effects of fishing*. American Fisheries Society, Symposium 41, Bethesda, Maryland. pp. 503-517.

Goold JC & Fish PJ (1998). Broadband spectra of seismic survey air-gun emissions, with reference to dolphin auditory thresholds. *Journal of Acoustical Society of America* **103**: April 1998

Goold JC (1996). Acoustic assessment of populations of common dolphin, *Delphinus delphis*, in conjunction with seismic surveying. *Journal of the Marine Biological Association of the UK* **76**: 811-820.

Gordon JCD, Gillespie D, Potter J, Frantzis A, Simmonds M & Swift R (1998). The effects of seismic surveys on marine mammals. In: ML Tasker & C Weir Eds. *Proceedings of the Seismic and Marine Mammals Workshop*, 23-25 June 1998, London.

Gundlach ER & Hayes MO (1978). Vulnerability of coastal environments to oil spill impacts. *Marine Technology Society Journal* **12**: 18-27.

Hall-Spencer J, Allain V & Fossa JH (2002). Trawling damage to Northeast Atlantic ancient coral reefs. *Proceedings of the Royal Society B: Biological Sciences* **269**: 507-511.

Hammond PS, Northridge SP, Thompson D, Gordon JCD, Hall AJ, Duck CD, Aarts G, Cunningham L, Embling CB & Matthiopoulos J (2006). Background information on marine mammals for Strategic Environmental Assessment 7. Report to the DTI from Sea Mammal Research Unit, University of St. Andrews, UK, 63pp. plus appendices.

Hammond PS, Northridge SP, Thompson D, Gordon JCD, Hall AJ, Murphy SN & Embling CB (2008). Background information on marine mammals for Strategic Environmental Assessment 8. Report to the Department for Business, Enterprise and Regulatory Reform. Sea Mammal Research Unit, St. Andrews, Scotland, UK, 52pp.

Hamoutene D, Samuelson S, Lush L, Burt K, Drover D, King T & Lee K (2010). In vitro effect of produced water on cod, *Gadus morhua*, sperm cells and fertilization. *Bulletin of Environmental Contamination and Toxicology* **84**: 559–563.

Hampton S, Kelly PR & Carter HR (2003). Tank vessel operations, seabirds and chronic oil pollution in California. *Marine Ornithology* **31**: 29

Harris RE, Miller GW & Richardson WJ (2001). Seal responses to airgun sounds during summer seismic surveys in the Alaskan Beaufort Sea. *Marine Mammal Science* **17**: 795-812.

Hassel A, Knutsen T, Dalen J, Skaar, K, Løkkeborg S, Misund OA, Øivind Ø, Fonn M & Haugland EK (2004). Influence of seismic shooting on the lesser sandeel (*Ammodytes marinus*). *ICES Journal of Marine Science* **61**: 1165-1173.

Hastings MC, Popper AN, Finneran JJ & Lanford PJ (1996). Effect of low frequency underwater sound on hair cells of the inner ear and lateral line of the teleost fish *Astronotus ocellatus*. *Journal of the Acoustical Society of America* **99**: 1759-1766.

HM Government (2011). UK Marine Policy Statement. HM Government, Northern Ireland Executive, Scottish Government, Welsh Assembly Government. 51pp.

HM Government (2012a). Marine Strategy Framework Directive consultation - UK initial assessment and proposals for Good Environmental Status, 148pp.

HM Government (2012b). Marine Strategy Part One: UK Initial Assessment and Good Environmental Status. December 2012, 163pp.

Hoskin R and Tyldesley D (2006). How the scale of effects on internationally designated nature conservation sites in Britain has been considered in decision making: A review of authoritative decisions. English Nature Research Reports, No 704.

Hyland J, Hardin D, Steinhauer M, Coats D, Green R & Neff J (1994). Environmental impact of offshore oil development on the outer continental shelf and slope off Point Arguello, California. *Marine Environmental Research* **37**: 195-229.

IMO (International Maritime Organisation) GloBallast website (accessed October 2012) http://globallast.imo.org/

Iona Energy Company (UK) Ltd (2012). Kells Field Development, Block 3/8d. Environmental Statement, February 2012, 198pp.

Ithaca Energy (UK) Ltd (2008). Jacky Development, Block 12/21c. Environmental Statement, April 2008, 322pp.

JNCC (2010). JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys. August 2010. Joint Nature Conservation Committee, Aberdeen, UK, 16pp.

JNCC (Joint Nature Conservation Committee) website (accessed October 2012) http://www.jncc.gov.uk/

Kaiser MJ, Clarke KR, Hinz H, Austen MCV, Somerfield PJ & Karakassis I (2006). Global analysis of response and recovery of benthic biota to fishing. *Marine Ecology Progress Series* **311**: 1-14.

Kaiser MJ, Collie JS, Hall SJ, Jennings S & Poiner IR (2002a). Impacts of fishing gear on marine benthic habitats. In: M Sinclair & G Valdimarsson Eds. *Responsible fisheries in the marine ecosystem*. CABI Publishing, Wallingford, pp.197-217.

Kaiser MJ, Collie JS, Hall SJ, Jennings S & Poiner IR (2002b). Modification of marine habitats by trawling activities: prognosis and solutions. *Fish and Fisheries* **3**: 114-133.

Kober K, Webb A, Win I, Lewis L, O'Brien S, Wilson LJ & Reid J (2010). An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs. JNCC Report 431. JNCC Peterborough

Lacroix DL, Lanctot RB, Reed JA & McDonald TL (2003). Effect of underwater seismic surveys on molting male long-tailed ducks in the Beaufort Sea, Alaska. *Canadian Journal of Zoology* **81**: 1862-1875

Law RJ, Kirby MF, Moore J, Barry J, Sapp M & Balaam J (2011). PREMIAM – Pollution Response in Emergencies Marine Impact Assessment and Monitoring: Post-incident monitoring guidelines. Science Series Technical Report, Cefas, Lowestoft,146: 164pp.

Lawson JW, Malme CI & Richardson WJ (2001). Assessment of noise issues relevant to marine mammals near the BP Clair Development. Report to BP from LGL Ltd., Environmental Research Associates and Engineering and Science Services.

Lonergan M, Duck CD, Thompson D, Mackey BL, Cunningham L & Boyd IL (2007). Using sparse survey data to investigate the declining abundance of British harbour seals. *Journal of Zoology* **271**: 261-269.

Lonergan M, Duck CD, Thompson D, Moss S & McConnell B (2011). British grey seal (*Halichoerus grypus*) abundance in 2008: an assessment based on aerial counts and satellite telemetry. *ICES Journal of Marine Science* **68**: 2201-2209.

Lucke K, Siebert U, Lepper PA & Blanchet M-A (2009). Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. *Journal of the Acoustical Society of America* **125**: 4060-4070.

Lucke K, Siebert U, Lepper PA & Blanchet M-A (2009). Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. *Journal of the Acoustical Society of America* **125**: 4060-4070.

Maitland G (2011). Offshore oil and gas in the UK - an independent review of the regulatory regime, December 2011, 205pp.

Mason J (1983). Scallop and queen fisheries in the British Isles. Fishing News Books Ltd. Surrey, England.

Matthiopoulos J, McConnell B, Duck C & Fedack M (2004). Using satellite telemetry and aerial counts to estimate space use by grey seals around the British Isles. *Journal of Applied Ecology* **41**: 476-491.

McBreen F, Askew N, Cameron A, Connor D, Ellwood H & Carter A (2011). UKSeaMap 2010: Predictive mapping of seabed habitats in UK waters. JNCC Report, No. 446.

McCauley RD (1994). Seismic surveys. In, Swan, JM, Neff, JM and Young, PC (Eds) Environmental implications of offshore oil and gas developments in Australia. The findings of an independent scientific review. Australian Petroleum Exploration Association, Sydney, NSW. 696pp.

McCauley RD, Fewtrell J & Popper AN (2003). High intensity anthropogenic sound damages fish ears. *Journal of the Acoustical Society of America* **113**: 638-642.

MMS (2004). Geological and geophysical exploration for mineral resources on the Gulf of Mexico Outer Continental Shelf. Final programmatic environmental assessment. Report no. MMS 2004-054. Report to the U.S. Department of the Interior Minerals Management Service, New Orleans, 487pp.
http://www.ocsbbs.com/2004-054.pdf

Moriyasu M, Allain R, Benhalima K & Claytor R (2004). Effects of seismic and marine noise on invertebrates: A literature review. Canadian Science Advisory Secretariat. Research Document 2004/126.

Murphy S, Gordon JCD, McConnell B, Matthiopoulos J, Isojunno S & Hammond PS (2008). Background information on marine mammals for Offshore Strategic Environmental Assessment. Report to the Department of Energy and Climate Change. SMRU Limited, St. Andrews, Scotland, UK, 130pp.

National Commission (2011). National Commission on the BP Deepwater Horizon Spill and Offshore Drilling. Deep water: The Gulf oil disaster and the future of offshore drilling: Report to the president. US Government report. 398pp.

Natural Resource Damage Assessment (2012). Status update for the Deepwater Horizon oil spill. 91pp.

Nedwell JR & Needham K (2001). Measurement of drill rig noise. Subacoustech Ltd. Report No. 452R0102.

Nedwell JR, Edwards B & Needham K (2002). Noise measurements during pipeline laying operations around the Shetland Islands for the Magnus EOR project. Subacoustech Ltd. Report No. 473R0212.

Nedwell JR, Needham K & Edwards B (2001). Report on measurements of underwater noise from the Jack Bates Drill Rig. Subacoustech Ltd. Report No. 462R0202.

Neff JM (2005). Composition, environmental fates, and biological effects of water based drilling muds and cuttings discharged to the marine environment: A synthesis and annotated bibliography. Prepared for Petroleum Environmental Research Forum (PERF) and American Petroleum Institute. Battelle, January 2005.

Neff JM, Bothner MH, Maciolek NJ & Grassle JF (1989). Impacts of exploratory drilling for oil and gas on the benthic environment of Georges Bank. *Marine Environmental Research* **27**: 77-114.

Nehls G, Betke K, Eckelmann S & Ros M (2007). Assessment and costs of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore windfarms. Report to COWRIE Ltd. BioConsult SH report, Husum, Germany, 47pp.

Nowacek DP, Thorne LH, Johnston DW & Tyack PL (2007). Responses of cetaceans to anthropogenic noise. *Mammal Review* **37**: 81-115.

ODPM (2005). Government circular: Biodiversity and geological conservation - statutory obligations and their impact within the planning system. ODPM Circular 06/2005. Office of the Deputy Prime Minister, UK, 88pp.

OLF (1998). Produced water discharges to the North Sea: Fate and effects in the water column. Summary Report. 39pp.

OSPAR (2000). Quality Status Report 2000. OSPAR Commission, London. http://www.ospar.org/eng/html/qsr2000/QSR2000welcome3.htm

OSPAR (2009). Assessment of impacts of offshore oil and gas activities in the North-East Atlantic. OSPAR Commission, 40pp.

OSPAR (2010). Quality Status Report 2010. OSPAR Commission, London, 176pp.

OSPAR (2012). Report of the OSPAR Workshop on research into possible effects of regular platform lighting on specific bird populations. Offshore Industry Series, 17pp.

Parry GD & Gason A (2006). The effect of seismic surveys on catch rates of rock lobsters in western Victoria, Australia. *Fisheries Research* **79**: 272-284.

Peacock EE, Nelson RK, Solow AR, Warren JD, Baker JL, & Reddy CM (2005). The West Falmouth oil spill: 100 kg of oil persists in marsh sediments. *Environmental Forensics* **6**:273-281.

Popper AN, Carlson TJ, Hawkins AD, Southall BJ & Gentry RL (2006). Interim Criteria for Injury of Fish Exposed to Pile Driving Operations: A White Paper. Report to the Fisheries Hydroacoustic Working Group, California Department of Transportation, USA, 15pp.

Popper AN, Fewtrell J, Smith ME & McCauley RD (2003). Anthropogenic sound: Effects on the behavior and physiology of fishes. *Marine Technology Society Journal* **37**: 35-40.

Popper AN, Smith ME, Cott PA, Hanna BW, MacGillivray AO, Austin ME & Mann DA (2005). Effects of exposure to seismic airgun use on hearing of three fish species. *Journal of the Acoustical Society of America* **117**: 3958-3971.

Reddy CM, Eglinton TI, Hounshell A, White HK, Xu L, Gaines RB & Frysinger GS (2002). The West Falmouth oil spill after thirty years: the persistence of petroleum hydrocarbons in marsh sediments. *Environmental Science and Technology* **36**: 4754 -4760.

Richardson WJ, Greene CR Jr, Malme CI & Thomson DH (1995). *Marine Mammals and Noise.* Academic Press, San Diego, US, 576pp.

Riddle AM, Beline EM & Murray-Smith RJ (2001). Modelling the uncertainties in predicting produced water concentrations in the North Sea. *Environmental Modelling & Software* **16**: 659-668.

Robinson JE, Newell RC, Seiderer LJ & Simpson NM (2005). Impacts of aggregate dredging on sediment composition and associated benthic fauna at an offshore dredge site in the southern North Sea. *Marine Environmental Research* **60**: 51-68.

Russell DJF, McConnell B, Thompson D, Duck C, Morris C, Harwood J & Matthiopoulos J (2013). Uncovering the links between foraging and breeding regions in a highly mobile mammal. *Journal of Applied Ecology* doi: 10.1111/1365-2664.12048

SCOS (2008). Scientific advice on matters related to the management of seal populations: 2008. Special Committee on Seals, 99pp.
http://www.smru.st-andrews.ac.uk/documents/SCOS_2008_v1.pdf

SCOS (2010). Scientific advice on matters related to the management of seal populations: 2010.

SCOS (2011). Scientific advice on matters related to the management of seal populations: 2011. Special Committee on Seals, 127pp.

SEERAD (2000). Nature conservation: implementation in Scotland of EC directives on the conservation of natural habitats and of wild flora and fauna and the conservation of wild birds ("the Habitats and Birds Directives"). June 2000. Revised guidance updating Scottish Office circular no. 6/199.

Sharples RJ, Cunningham L & Hammond PS (2005). Distribution and movement of harbour seals around the UK. Briefing paper by the Sea Mammal Research Unit (SMRU), Gatty Marine Laboratory, University of St Andrews, for the Special Committee on Seals (SCOS) report: Scientific advice on matters related to the management of seal populations, pp.66-69.
http://www.scotland.gov.uk/Resource/Doc/921/0020956.pdf

Sharples RJ, Matthiopoulos J & Hammond PS (2008). Distribution and movements of harbour seals around the coast of Britain. Report to the Department of Energy and Climate Change (DECC). Sea Mammal Research Unit, St. Andrews, UK, 65pp.

Sharples RJ, Moss SE, Patterson TA & Hammond PS (2012). Spatial variation in foraging behaviour of a marine top predator (*Phoca vitulina*) determined by a large-scale satellite tagging program. *PLoS ONE* **7**: 1-14. doi:10.1371/journal.pone.0037216

Simmonds M, Dolman S & Weilgart L (2003). Oceans of Noise. A Whale and Dolphin Conservation Society Science Report.

Skalski JR, Pearson WH & Malme CI (1992). Effects of sounds from a geophysical survey device on catch-per-unit-effort in a hook-and-line fishery for rockfish (*Sebastes* spp.). *Canadian Journal of Fisheries and Aquatic Science* **49**: 1343-1356.

Slotte A, Hansen K, Dalen J & Ona E (2004). Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. *Fisheries Research* **67**: 143-150.

SMRU (2007). Potential impact of oil and gas exploration and development on SACs for bottlenose dolphins and other marine mammals in the Moray Firth and Cardigan Bay/Pembrokeshire. Report to the DTI. Sea Mammal Research Unit, University of St Andrews, Scotland, 13pp.

Snelgrove PVR (1999). Getting to the bottom of marine biodiversity: Sedimentary habitats. *BioScience* **49**: 129-138.

Southall BL, Bowles AE, Ellison WT, Finneran JJ, Gentry RL, Greene Jr. CR, Kastak D, Ketten DR, Miller JH, Nachtigall PE, Richardson WJ, Thomas JA & Tyack PL (2007). Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33: 411-522.

Stemp R (1985). Observations on the effects of seismic exploration on seabirds. In: Greene
GD, Engelhardt FR & Paterson RJ (Eds) *Proceedings of the Workshop on Effects of Explosives Use in the Marine Environment*. Jan 29-31, 1985, Halifax, Canada.

Stone CJ & Tasker ML (2006). The effects of seismic airguns on cetaceans in UK waters. *Journal of Cetacean Research and Management* **8**: 255-263.

Stone CJ (2003). The effects of seismic activity on marine mammals in UK waters, 1998-2000. JNCC Report no. 323. Joint Nature Conservation Committee, Peterborough.

Swift RJ & Thompson PM (2000). Identifying potential sources of industrial noise in the Foinaven and Schiehallion region. Report prepared for BP Amoco Exploration, UK Operations, Farburn Industrial Estate, Dyce, Aberdeen, Scotland.

Tasker ML, Amundin M, Andre M, Hawkins A, Lang W, Merck T, Scholik-Schlomer A, Teilmann J, Thomsen F, Werner S & Zakharia M (2010). Underwater noise and other forms of energy: Marine Strategy Framework Directive Task Group 11 report, 64pp.

Teal JM & Howarth RW (1984). Oil spill studies: a review of ecological effects. *Environmental Management* **8**: 27-43

Teal JM, Farrington JW, Burns KA, Stegeman JJ, Tripp BW, Woodin B & Phinney C (1992). The West Falmouth oil spill after 20 years: fate of fuel oil compounds and effects on animals. *Marine Pollution Bulletin* **24**: 607-614.

Thompson D, Sjoberg M, Bryant ME, Lovell P & Bjorge A (1998). Behavioural and physiological responses of harbour (*Phoca vitulina*) and grey (*Halichoerus grypus*) seals to seismic surveys. Report the European Commission of BROMMAD Project.

Trannum HC, Nilsson HC, Schaanning MT & Øxnevad S (2010). Effects of sedimentation from water-based drill cuttings and natural sediment on benthic macrofaunal community structure and ecosystem processes. *Journal of Experimental Marine Biology and Ecology* **383**: 111–121

Trannum HC, Setvik Å, Norling K & Nilsson HC (2011). Rapid macrofaunal colonization of water-based drill cuttings on different sediments. *Marine Pollution Bulletin* **62**: 2145–2156

Tyldesley & Associates (2012). Habitats Regulations Appraisal of Plans: Guidance for Plan-making Bodies in Scotland. Scottish Natural Heritage report no. 1739, 67pp.

Van der Graaf AJ, Ainslie MA, André M, Brensing K, Dalen J, Dekeling RPA, Robinson S, Tasker ML, Thomsen F, Werner S (2012). European Marine Strategy Framework Directive - Good Environmental Status (MSFD GES): Report of the Technical Subgroup on Underwater noise and other forms of energy, 75pp.

Washburn L, Stone S & MacIntyre S (1999). Dispersion of produced water in a coastal environment and its biological implications. *Continental Shelf Research* **19**: 57–78.

Weilgart LS (2007). The impacts of anthropogenic ocean noise on cetaceans and implications for management. *Canadian Journal of Zoology* **85**: 1091-1116.

Wiese FK, Montevecchi WA, Davoren GK, Huettmann F, Diamond AW & Linke J (2001). Seabirds at risk around offshore oil platforms in the North-west Atlantic. *Marine Pollution Bulletin* **42**: 1285-1290.

Williams JM, Tasker ML, Carter IC & Webb A (1994). Method for assessing seabird vulnerability to surface pollutants. *Ibis* **137**: 147-152.

Witbaard R & Klein R (1993). A method to estimate the bottom trawl intensity independently from fisheries itself by using internal molluscan growth lines. *ICES CM 1993* **K:16**, 8pp.

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 from Northumbria to Suffolk and their qualifying features are given in Table A.1 and their locations shown in the Map A.1. JNCC[28] 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 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 a 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 purposes of management, assessment and development control.

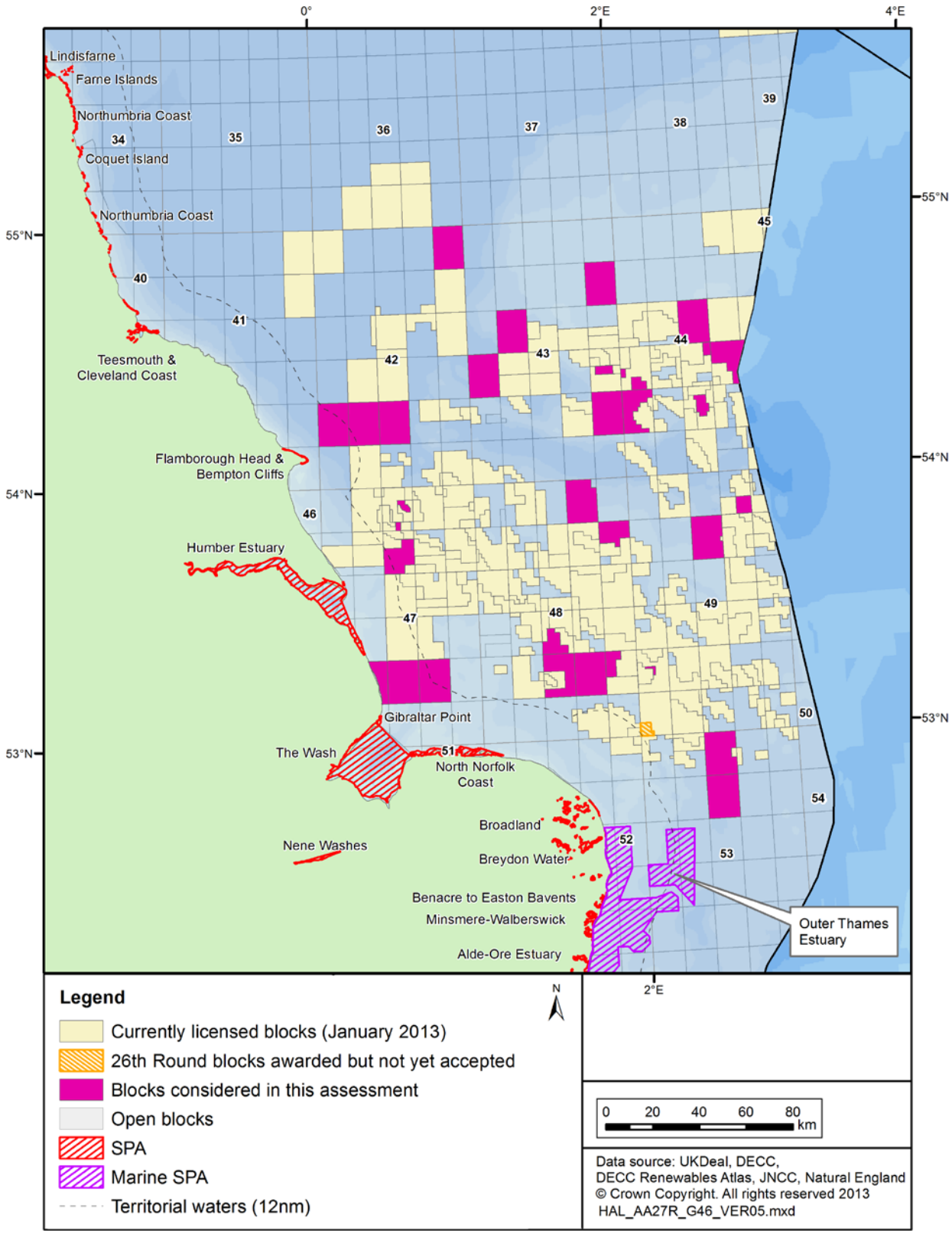
The individual site accounts in 2001 Review should be taken as the definitive list of qualifying species at the SPAs concerned. However, at sites where there remain differences between that list of qualifying species and the extant site citation, then the relevant country agency should be contacted for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

[28] 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 the 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*
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*

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*
Canadian light-bellied brent goose *Branta bernicla hrota*
Svalbard 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 from Northumbria to Suffolk and their Qualifying Features

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[29]
NORTHEAST ENGLAND				
Lindisfarne	3679.22	Breeding: Little tern Over winter: Bar-tailed godwit Golden plover Whooper swan	On passage: Ringed plover Over winter: Grey plover Greylag goose Knot Light-bellied brent goose Wigeon	Over winter; Waterfowl
Farne Islands	101.86	Breeding: Arctic tern Common tern Roseate tern Sandwich tern	Breeding: Guillemot Puffin	Breeding: Seabirds
Northumbria Coast SPA	1,107.98	Breeding: Little tern	Over winter: Purple sandpiper Turnstone	N/A
Coquet Island SPA	22.28	Breeding: Arctic tern Common tern Roseate tern Sandwich tern	Breeding: Puffin	Breeding: Seabirds
Teesmouth and Cleveland Coast SPA	1,247.31	Breeding: Little tern On passage: Sandwich tern	On passage: Ringed plover Over winter: Knot Redshank	Over winter: Waterfowl
YORKSHIRE AND HUMBER				
Flamborough Head and Bempton Cliffs SPA[30]	212.17	N/A	Breeding: Kittiwake	Breeding: Seabirds
Humber Estuary SPA	37,630.24	Breeding: Bittern Marsh harrier Avocet Little tern Over winter: Bittern Avocet Hen harrier Bar-tailed godwit	Over winter: Dunlin Knot Shelduck Black-tailed godwit Redshank On passage: Knot Dunlin Black-tailed godwir	Non-breeding: Waterfowl

[29] - 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.

[30] There is a proposal for a terrestrial and marine extension to this site, with a terrestrial component to cover an area from Filey Brigg to Cunstone Nab, and a marine extension out to 2km (see: http://www.naturalengland.org.uk/ourwork/marine/mpa/ems/flamboroughspa.aspx)

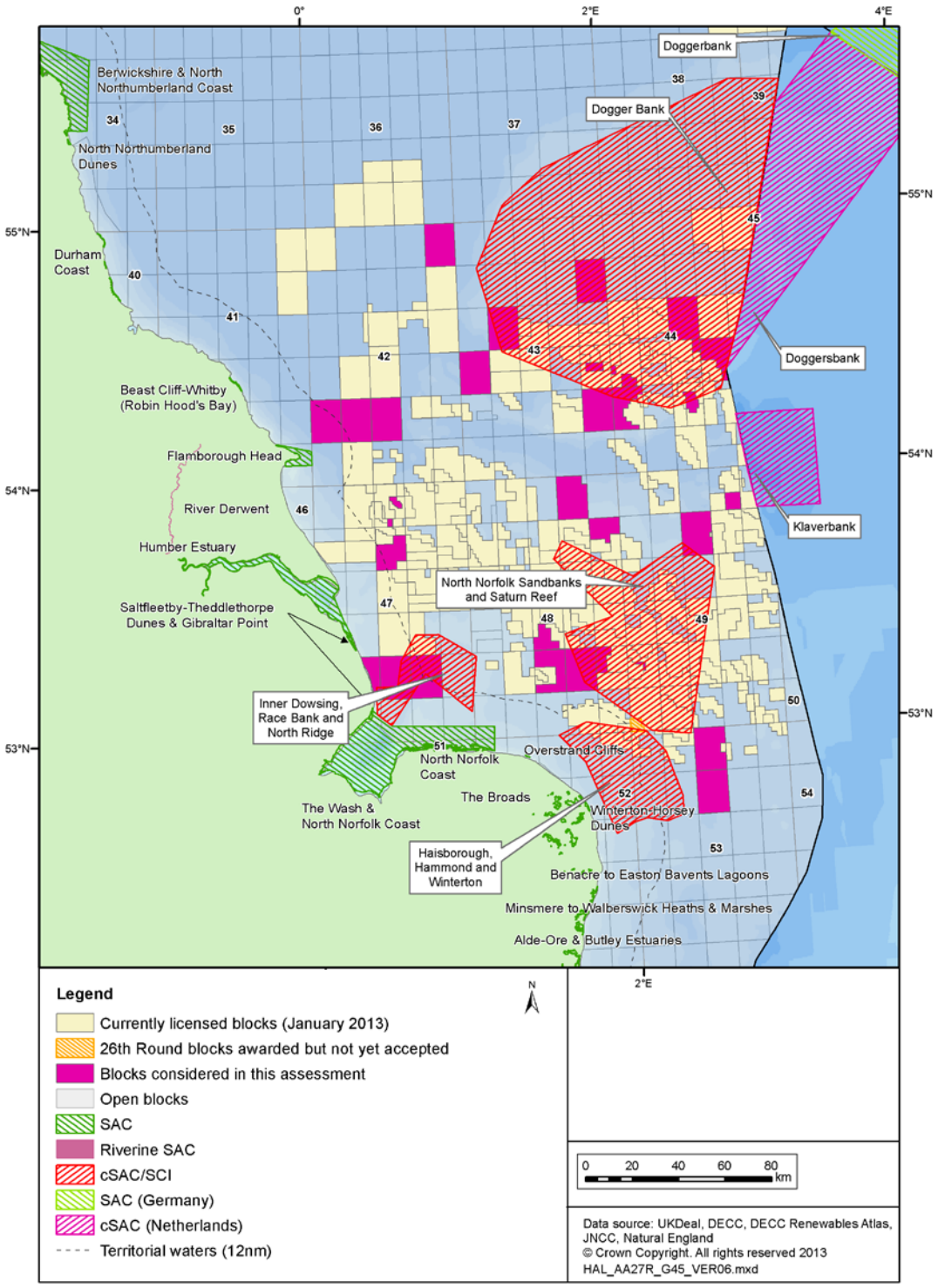
Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[29]
		Golden plover On passage: Ruff	Redshank	
LINCOLNSHIRE, NORFOLK and SUFFOLK				
Gibraltar Point SPA	414.09	Breeding: Little tern Over winter: Bar-tailed godwit	Over winter: Grey plover Knot	Over winter: Waterfowl
The Wash SPA	62,211.66	Breeding: Common tern Little tern Marsh harrier Over winter: Avocet Bar-tailed godwit Golden plover Whooper swan	On passage: Ringed plover Sanderling Over winter: Black-tailed godwit Curlew Dark-bellied brent goose Dunlin Grey plover Knot Oystercatcher Pink-footed goose Pintail Redshank Shelduck Turnstone	Over winter: Waterfowl
North Norfolk Coast SPA	7,886.79	Breeding: Avocet Bittern Common tern Little tern Marsh harrier Mediterranean gull Roseate tern Sandwich tern Over winter: Avocet Bar-tailed godwit Bittern Golden plover Hen harrier Ruff	Breeding: Redshank Ringed plover On passage: Ringed plover Over winter: Dark-bellied brent goose Knot Pink-footed goose Pintail Redshank Wigeon	Over winter: Waterfowl
Broadland SPA	5,462.4	Breeding: Bittern Marsh harrier Over winter: Bewick's swan Bittern Ruff Whooper swan	Over winter: Gadwall Pink-footed goose Shoveler	Over winter: Waterfowl
Great Yarmouth	149.19	Breeding:	N/A	N/A

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[29]
North Denes SPA		Little tern		
Breydon Water SPA	1,202.94	Breeding: Common tern Over winter: Avocet Bewick's swan Golden plover		Over winter: Waterfowl
Benacre to Easton Bavents SPA	516.83	Breeding: Bittern Little tern Marsh harrier Over winter: Bittern	N/A	N/A
Minsmere-Walberswick SPA	2,018.92	Breeding: Avocet Bittern Little tern Marsh harrier Nightjar Woodlark Over winter: Avocet Bittern Hen harrier	N/A	N/A
Alde-Ore Estuary SPA	2,416.87	Breeding: Avocet Little tern Marsh harrier Sandwich tern Over winter: Avocet	Breeding: Lesser black-backed gull Over winter: Redshank	Breeding: Seabirds Over winter: Waterfowl
Deben Estuary SPA	978.93	Over winter: Avocet	N/A	N/A
Outer Thames Estuary SPA	379,268.14	Over winter: Red-throated diver	N/A	N/A

A2 Coastal and Marine Special Areas of Conservation

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.

Map A.2: Location of 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 Degraded raised bogs still capable of natural regeneration Depressions on peat substrates of the *Rhynchosporion* Transition mires and quaking bogs
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
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 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 European dry heaths Northern Atlantic wet heaths with *Erica tetralix*
Inlets and bays	Large shallow inlets and bays

Annex I Habitat (abbreviated)	Annex I Habitat(s) (full description)
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. 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 from Northumbria to Suffolk and their Qualifying Features

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
NORTHEAST ENGLAND					
Berwickshire and North Northumberland Coast SAC	65,045.5	Mudflats and sandflats Inlets and bays Reefs Sea caves	N/A	Grey seal *Halichoerus grypus*	N/A
North Northumberland Dunes SAC	1,147.56	Coastal dunes	N/A	Petalwort *Petalophyllum ralfsii*	N/A
Durham Coast SAC	393.63	Sea cliffs	N/A	N/A	N/A
YORKSHIRE AND THE HUMBER					
North York Moors SAC	44,082.25	Heaths	Bogs	N/A	N/A
Fen Bog SAC	27.49	Bogs	N/A	N/A	N/A
Beast Cliff-Whitby (Robin Hood's Bay) SAC	260.2	Sea cliffs	N/A	N/A	N/A
Flamborough Head SAC	6,311.96	Reefs Sea cliffs Sea caves	N/A	N/A	N/A
Humber Estuary SAC	36,657.15	Estuaries Mudflats and sandflats	Sandbanks Salt marshes and salt meadows Coastal lagoons Coastal dunes	N/A	River lamprey *Lampetra fluviatilis* Sea lamprey *Petromyzon marinus* Grey seal *Halichoerus grypus*
LINCOLNSHIRE, NORFOLK AND SUFFOLK					
Saltfleetby - Theddlethorpe Dunes and Gibraltar Point SAC	960.2	Coastal dunes	Coastal dunes	N/A	N/A
The Wash and North Norfolk Coast SAC	107,761.28	Sandbanks Mudflats and sandflats Inlets and bays Reefs	Coastal lagoons	Harbour seal *Phoca vitulina*	Otter *Lutra lutra*

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
		Salt marshes and salt meadows			
North Norfolk Coast SAC	3,207.37	Coastal lagoons Vegetation of stony banks Salt marshes and salt meadows Coastal dunes	N/A	N/A	Otter *Lutra lutra* Petalwort *Petalophyllum ralfsii*
Overstrand Cliffs SAC	30.02	Sea cliffs	N/A	N/A	N/A
The Broads SAC	5,865.6	Standing freshwater Bog Fens Forests	Grasslands	Desmoulin's whorl snail *Vertigo moulinsiana* Fen orchid *Liparis loeselii* Ramshorn snail *Anisus vorticulus*	Otter *Lutra lutra*
Winterton-Horsey Dunes SAC	425.94	Coastal dunes	Coastal dunes	N/A	N/A
Benacre to Easton Bavents Lagoons SAC	366.93	Coastal lagoons	N/A	N/A	N/A
Minsmere to Walberswick Heaths and Marshes SAC	1,265.52	Vegetation of drift lines Heath	Vegetation of stony banks	N/A	N/A
Alde, Ore and Butley Estuaries SAC	1,561.53	Estuaries	Mudflats and sandflats Salt marshes and salt meadows	N/A	N/A
Orfordness-Shingle Street SAC	901.19	Coastal lagoons Vegetation of drift lines Vegetation of stony banks	N/A	N/A	N/A

A3 Offshore Special Areas of Conservation

Table A.3: Offshore SACs in the Southern North Sea and their Qualifying Features

Site Name	Area (ha)	Annex I Habitat	Annex II Species
Dogger Bank cSAC	1,233,884	Sandbanks	N/A
North Norfolk Sandbanks and Saturn Reef SCI	360,341	Sandbanks Reefs (biogenic *Sabellaria spinulosa*)	N/A
Inner Dowsing, Race Bank and North Ridge SCI	84,514	Sandbanks Reefs (biogenic *Sabellaria spinulosa*)	N/A
Haisborough, Hammond and Winterton SCI	146,759	Sandbanks Reefs (biogenic *Sabellaria spinulosa*)	N/A
Doggerbank SAC (Germany)	169,895	Sandbanks	Harbour porpoise *Phocoena phocoena* Harbour seal *Phoca vitulina*
Doggersbank cSAC (Netherlands)	417,750	Sandbanks	Harbour porpoise *Phocoena phocoena* Harbour seal *Phoca vitulina* Grey seal *Halichoerus grypus*
Klaverbank cSAC (Netherlands)	123,733	Reefs	Harbour porpoise *Phocoena phocoena* Harbour seal *Phoca vitulina* Grey seal *Halichoerus grypus*

A4 Riverine Special Areas of Conservation

In addition to the mapped SACs, the following riverine SACs designated for migratory fish and/or the freshwater pearl mussel are also considered.

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

Site Name	Freshwater pearl mussel *Margaritifera margaritifera*	Migratory fish[1]
River Derwent	-	SL, RL

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

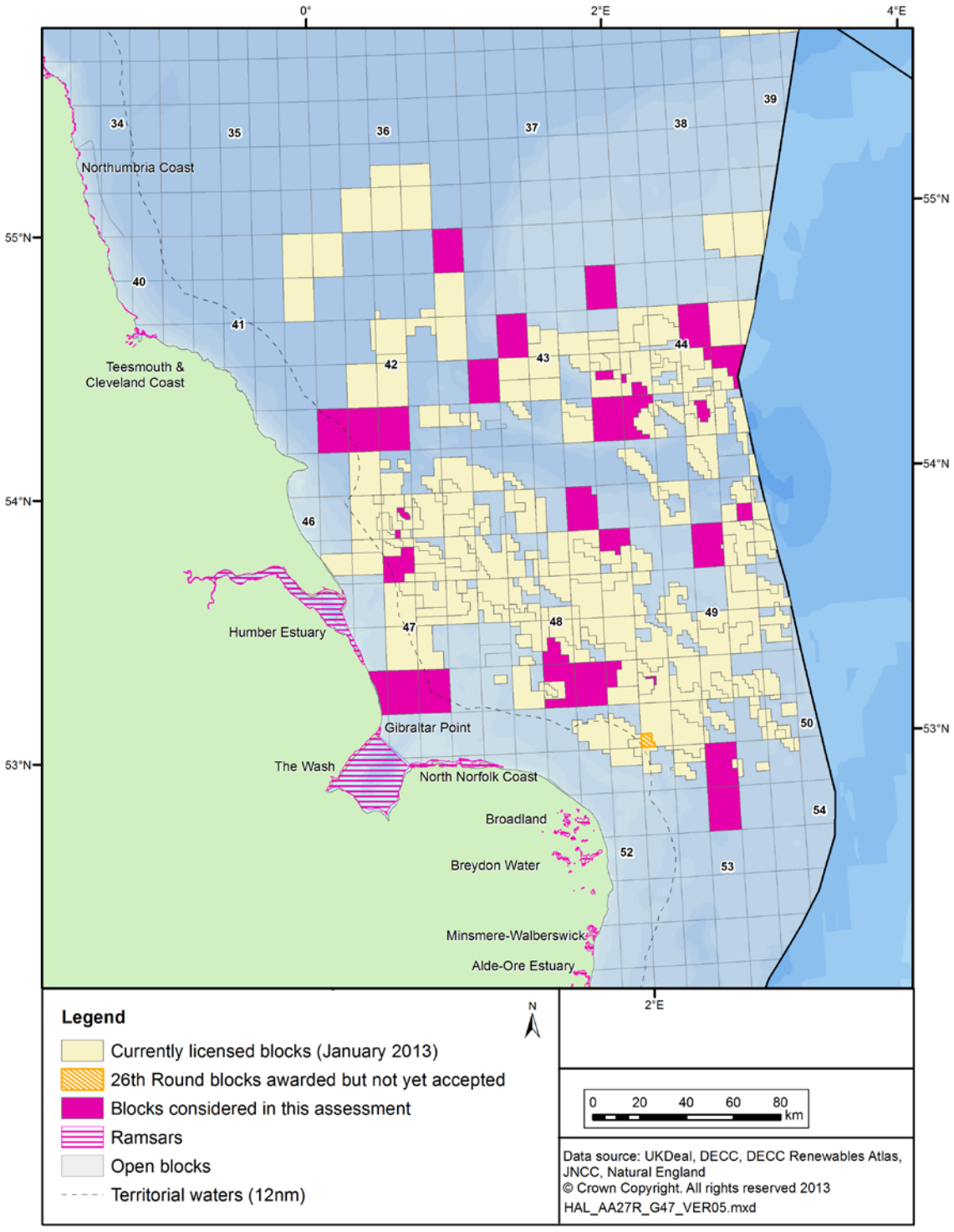
A5 Ramsar Sites

Coastal Ramsar sites are also SPAs 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: Wetlands of international importance

Ramsar name	SPA name	SAC name
Teesmouth & Cleveland Coast	Northumbria Coast Teesmouth & Cleveland Coast	Durham Coast
Northumbria Coast	Northumbria Coast Teesmouth & Cleveland Coast	Berwickshire and North Northumberland Coast Durham Coast North Northumberland Dunes
Gibraltar Point	Gibraltar Point The Wash	Saltfleetby-Theddlethorpe Dunes & Gibraltar Point The Wash and North Norfolk Coast
Humber Estuary	Humber Estuary	Humber Estuary Saltfleetby-Theddlethorpe Dunes & Gibraltar Point
North Norfolk Coast	North Norfolk Coast The Wash	North Norfolk Coast The Wash and North Norfolk Coast
The Wash	Gibraltar Point North Norfolk Coast The Wash	The Wash and North Norfolk Coast
Breydon Water	Breydon Water	-
Broadland	Broadland	The Broads

Map A.3: Location of coastal Ramsar sites



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

In the original block 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[31]. 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):

- 42/21, 42/22 – Drill or drop well, shoot 2D seismic
- 42/23 – Contingent well
- 47/3j – Drill or drop well, shoot 3D seismic
- 47/3k – Firm well
- 47/8e – Drill or drop well, shoot 3D seismic (same survey as 47/3j)
- 47/22, 47/23, 47/24 – Drill or drop well
- 42/5 – Firm well
- 43/10 – Drill or drop well
- 43/12 – Contingent well
- 43/16 – Drill or drop well
- 43/20f – Drill or drop well
- 43/25 – Contingent well, shoot 3D seismic
- 44/13 – Contingent well
- 44/16b – Drill or drop well
- 44/16c – Drill or drop well
- 44/18e – Drill or drop well
- 44/19a – Firm well
- 44/21c – Firm well
- 44/23g – Drill or drop well
- 48/4b – Drill or drop well
- 48/10c – Drill or drop well
- 48/18c – Drill or drop well
- 48/23c – Drill or drop well
- 48/24, 48/25c – Drill or drop well
- 49/8b – Drill or drop well
- 49/4b – Drill or drop well
- 49/21d – Drill or drop well
- 53/3a, 53/8 – Drill or drop well

[31] 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.

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:

- 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	Physical Disturbance	Acoustic Disturbance	In-combination	
NORTHEAST ENGLAND								
Northumbria Coast	✓	✓	-	-	-	-	-	**Qualifying features:** Breeding tern, overwintering waders **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. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Coquet Island	✓	-	-	-	-	-	-	**Qualifying features:** Breeding terns and seabirds. **Consideration of likely significant effects:** Site is remote from Blocks and its conservation objectives would not be undermined by

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	
								emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Teesmouth and Cleveland Coast	✓	✓	✓	-	-	-	-	**Qualifying features:** Breeding and on passage terns, on passage and overwintering waders. **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. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
YORKSHIRE AND THE HUMBER								
Flamborough Head and Bempton Cliffs	✓	-	-	✓	-	-	-	**Qualifying features:** Breeding seabirds. **Consideration of likely significant effects:** Site objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major diesel oil spill from Blocks 42/21 or 42/22, weathered spilled diesel oil could theoretically affect the qualifying features (breeding kittiwake) when foraging in adjacent areas beyond the site boundaries 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.
Humber Estuary	✓	✓	✓	✓	-	-	-	**Qualifying features:** Breeding and overwintering bittern, birds of prey, waders, breeding tern, on passage waterfowl 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 47/22, 47/23 or 47/8e, weathered spilled diesel oil could theoretically affect the features (over-wintering and breeding waterfowl and terns), although mitigation would be possible.

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	
								Appropriate Assessment: See Section 7.3. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
LINCOLNSHIRE, NORFOLK AND SUFFOLK								
Gibraltar Point	✓	✓	-	✓	-	-	-	**Qualifying features:** Breeding little tern, overwintering waders and waterfowl. **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 47/22, 47/23 or 47/24, weathered spilled diesel oil could theoretically affect the features (breeding terns) when foraging in adjacent areas beyond the site boundaries 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.
The Wash	✓	✓	✓	✓	-	-	✓	**Qualifying features:** Breeding tern, birds of prey, on passage and overwintering waders and waterfowl. **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 47/22, 47/23 or 47/24, weathered spilled diesel oil could theoretically affect the features (breeding terns) when foraging in adjacent areas beyond the site boundaries. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to physical presence). **Appropriate Assessment:** See Sections 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	
North Norfolk Coast	✓	✓	✓	✓	-	-	✓	**Qualifying features:** Breeding waders, terns, birds of prey and gulls, on passage and overwintering waders, waterfowl and birds of prey. **Consideration of likely significant effects:** Site conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. In the unlikely event of a major diesel oil spill from Blocks 47/22, 47/23 or 47/24, weathered spilled diesel oil could theoretically affect the features (see Table A.1) when foraging in adjacent areas beyond the site boundaries. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to physical presence). **Appropriate Assessment:** See Sections 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Broadland	✓	✓	-	-	-	-	-	**Qualifying features**: Breeding and overwintering bittern and birds of prey, overwintering waterfowl and waders. **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. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Great Yarmouth and North Denes	✓	-	-	-	-	-	-	**Qualifying features**: Breeding tern **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. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Breydon Water	✓	✓	-	-	-	-	-	**Qualifying features**: Breeding tern, on passage and overwintering waders and waterfowl.

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	
								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. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Benacre to Easton Bavents	✓	✓	-	-	-	-	-	**Qualifying features**: Breeding tern, birds of prey and bittern, overwintering bittern. **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. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Outer Thames	-	✓	-	✓	-	-	-	**Qualifying features**: Overwintering red-throated diver **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 Block 53/3a or 53/8, weathered spilled diesel oil could theoretically affect the features (over-wintering red throated divers). **Appropriate Assessment:** See Sections 7.3 and 8. 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

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	
NORTHEAST ENGLAND							
Berwickshire and North Northumberland Coast	✓	✓	-	-	-	-	**Qualifying features:** Mudflats and sandflats, inlets and bays, reefs, sea caves, grey seal **Consideration of likely significant effects:** Site is remote from Blocks (*ca.* 150km) and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
North Northumberland Dunes	✓	✓	-	-	-	-	**Qualifying features:** Coastal dunes, petalwort **Consideration of likely significant effects:** Site is remote from Blocks (*ca.* 150km) and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Durham Coast	✓	-	-	-	-	-	**Qualifying features:** Sea cliffs **Consideration of likely significant effects:** Site is remote from Blocks (*ca.* 150km) and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
YORKSHIRE AND THE HUMBER							
Beast Cliff-Whitby (Robin Hood's Bay)	✓	-	-	-	-	-	**Qualifying features:** Sea cliffs **Consideration of likely significant effects:** Conservation objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major diesel oil spill from the closest

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							Block (42/21), weathered spilled crude oil could theoretically affect the qualifying feature although not considered particularly sensitive to spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Flamborough Head	✓	-	-	-	-	-	**Qualifying features:** Reefs, sea cliffs, sea caves **Consideration of likely significant effects:** Conservation objectives would not be undermined by emissions or discharges from routine operations. In the unlikely event of a major diesel oil spill from the closest Block (42/21), weathered spilled crude oil could theoretically affect the qualifying feature although not considered particularly sensitive to spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Humber Estuary	✓	✓	✓	-	✓	✓	**Qualifying features:** Mudflats and sandflats, salt marshes and salt meadows, coastal lagoons, coastal dunes, river lamprey, sea lamprey, grey seal **Consideration of likely significant effects:** In the unlikely event of a major diesel oil spill from Blocks 47/8e, 47/22, 47/23, or 47/24, weathered spilled diesel oil could theoretically affect some qualifying habitats (e.g. estuaries, mudflats and sandflats), although mitigation would be possible. Certain activities (i.e. seismic survey in Blocks 47/3j and 47/8e) may cause temporary acoustic disturbance to the species features (grey seal and migratory fish), although mitigation would be possible. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to physical presence and noise). **Appropriate Assessment:** See Sections 6.4, 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
LINCOLNSHIRE, NORFOLK AND SUFFOLK							
Saltfleetby - Theddlethorpe Dunes and Gibraltar Point	✓	-	-	-	-	-	**Qualifying features:** 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 from Blocks 47/22, 47/23 or 47/24, weathered spilled diesel oil could theoretically affect the dune habitat present; however dune features are not regarded to be generally vulnerable to surface oil pollution. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
The Wash and North Norfolk Coast	✓	✓	✓	-	✓	✓	**Qualifying features:** Sandbanks, mudlfats and sandflats, inlets and bays, reefs, salt marshes and meadows, coastal lagoons, harbour seal, otter **Consideration of likely significant effects:** In the unlikely event of a major diesel oil spill from Blocks 47/22, 47/23, 47/24 or 48/23c, weathered spilled diesel oil could theoretically affect some qualifying habitats (e.g. mudflats and sandflats), although mitigation would be possible. Certain activities (i.e. seismic survey in Blocks 47/3j and 47/8e) may cause temporary acoustic disturbance to the species features (grey seal and migratory fish), although mitigation would be possible. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to physical presence and noise). **Appropriate Assessment:** See Sections 6.4, 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
North Norfolk Coast	✓	✓	✓	-	-	✓	**Qualifying features:** Coastal lagoons, vegetation of stony banks, salt marshes and salt meadows, coastal dunes, otter, petalwort **Consideration of likely significant effects:** In the unlikely event of a

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							major diesel oil spill from Blocks 47/22, 47/23, 47/24 or 48/23c, weathered spilled diesel oil could theoretically affect some qualifying habitats (e.g. salt marshes and salt meadows), although mitigation would be possible. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to physical presence and noise). **Appropriate Assessment:** See Sections 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Overstrand Cliffs	✓	-	-	-	-	-	**Qualifying features:** Sea cliffs **Consideration of likely significant effects:** Site is some distance from Blocks (*ca.* 30km) and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
The Broads	✓	✓	-	-	-	-	**Qualifying features:** Standing freshwater, bog, fens, forests, grasslands, Desmoulin's whorl snail, fen orchid, ramshorn snail, otter **Consideration of likely significant effects:** Site is some distance from Blocks (*ca.* 50km) and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Winterton-Horsey Dunes	✓	-	-	-	-	-	**Qualifying features:** Coastal dunes **Consideration of likely significant effects:** Site is some distance from Blocks (*ca.* 50km) and its conservation objectives would not be undermined 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	
Benacre to Easton Bavents Lagoons	✓	-	-	-	-	-	**Qualifying features:** Coastal lagoons **Consideration of likely significant effects:** Site is some distance (*ca.* 50km) from Blocks and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Minsmere to Walberswick Heaths and Marshes	✓	-	-	-	-	-	**Qualifying features:** Vegetation of drift lines, heath, vegetation of stony banks **Consideration of likely significant effects:** Site is remote from Blocks (*ca.* 65km) and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Alde, Ore and Butley Estuaries	✓	-	-	-	-	-	**Qualifying features:** Mudflats and sandflats, salt marshes and salt meadows **Consideration of likely significant effects:** Site is remote from Blocks (*ca.* 80km) and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Orfordness-Shingle Street	✓	-	-	-	-	-	**Qualifying features:** Coastal lagoons, vegetation of drift lines, vegetation of stony banks **Consideration of likely significant effects:** Site is remote from Blocks (*ca* 80km) and its conservation objectives would not be undermined 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	
Hamford water pSAC	-	✓	-	-	-	-	**Qualifying features:** Fisher's estuarine moth **Consideration of likely significant effects:** Site is remote from Blocks (*ca* 110km) and its conservation objectives would not be undermined by emissions or discharges from routine operations or accidental spills. **Appropriate Assessment:** No foreseeable interaction between plan activities and site negates likely significant effect
Tankerton Slopes and Swalecliffe pSAC	-	✓	-	-	-	-	**Qualifying features:** Fisher's estuarine moth **Consideration of likely significant effects:** Site is remote from Blocks (*ca* 160km) and its conservation objectives would not be undermined 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	
Dogger Bank SCI	✓	-	-	✓	-	✓	**Qualifying features:** Sandbanks **Consideration of likely significant effects:** Several Blocks are within or adjacent to the SCI (43/10, 43/12, 43/20f, 43/25, 44/13, 44/16b, 44/16c, 44/18e, 44/19a, 44/21c, 44/23g). Certain activities in, or related to, these Blocks could potentially undermine site conservation objectives through physical damage or loss from smothering by drilling discharges, the installation of gas (and renewable energy industry) infrastructure and cables. Oil spills within the site would be unlikely to undermine site conservation objectives/status as the features of interest are benthic (see Section 7.2), and the relatively small inventory of diesel, lube and similar oils involved. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to physical disturbance). **Appropriate Assessment:** See Sections 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
North Norfolk Sandbanks and Saturn Reef SCI	✓	-	-	✓	-	✓	**Qualifying features:** Sandbanks, reefs **Consideration of likely significant effects:** Several Blocks are within or adjacent to the SCI (48/24, 48/25c, 49/8b, 49/21d). Certain activities in, or related to, these Blocks could potentially undermine site conservation objectives through physical damage or loss from smothering by drilling discharges, the installation of gas (and renewable energy industry) infrastructure and cables. Oil spills within the site would be unlikely to undermine site conservation objectives as the features of interest are benthic (see Section 7.2), and the relatively small inventory of diesel, lube and similar oils involved. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							effects (e.g. in relation to physical disturbance). **Appropriate Assessment:** See Sections 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Inner Dowsing, Race Bank and North Ridge SCI	✓	-	-	✓	-	✓	**Qualifying features:** Sandbanks, reefs **Consideration of likely significant effects:** Blocks 47/22, 47/23 and 47/24 overlap with the SCI. Certain activities in, or related to, these Blocks could potentially undermine site conservation objectives through physical damage or loss from smothering by drilling discharges, the installation of gas (and renewable energy industry) infrastructure and cables. Oil spills within the site would be unlikely to undermine site conservation objectives/status as the features of interest are benthic (see Section 7.2), and the relatively small inventory of diesel, lube and similar oils involved. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to physical disturbance). **Appropriate Assessment:** See Sections 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Haisborough, Hammond and Winterton SCI	✓	-	-	✓	-	✓	**Qualifying features:** Sandbanks, reefs **Consideration of likely significant effects:** Several Blocks are in close proximity to the SCI (e.g. 48/23c, 48/24, 53/3a, 53/8 – minimum linear distance 6km). It is unlikely that activities in, or related to, these Blocks could potentially undermine site conservation objectives through physical damage or loss from smothering by drilling discharges, the installation of gas (and renewable energy industry) infrastructure and cables (unless cable routes traverse the site). Oil spills within the adjacent Blocks would be unlikely to undermine site conservation objectives/status as the features of

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							interest are benthic (see Section 7.2), and the relatively small inventory of diesel, lube and similar oils involved. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to physical disturbance). **Appropriate Assessment:** See Sections 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Sites in Adjacent States							
Doggerbank SAC	✓	✓	-	-	✓	✓	**Qualifying features:** Sandbanks, harbour porpoise, harbour seal **Consideration of likely significant effects:** The German site is remote from the Blocks (and some 25km from UK median line) and its conservation objectives/conservation status would not be affected by emissions or discharges from routine operations or accidental spills. Certain activities (i.e. seismic survey) may be detectable within site boundaries although mitigation would be possible. The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to acoustic disturbance). **Appropriate Assessment:** See Sections 6.4 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Doggersbank cSAC	✓	✓	✓	-	✓	✓	**Qualifying features:** Sandbanks, harbour porpoise, harbour seal, grey seal **Consideration of likely significant effects:** The Dutch site abuts the UK median line. In the unlikely event of a major diesel oil spill from Blocks 44/13, 44/18e and 44/19a, weathered spilled diesel oil could theoretically affect the qualifying species, although mitigation would be possible. Seismic survey noise would be detectable within site boundaries should this activity take place, however the acquisition of new seismic data is not proposed as part of the indicative work programmes for Blocks in proximity

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							to the site (closest Block for which seismic survey is proposed, 43/25, is *ca.* 50km distance). The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to acoustic disturbance). **Appropriate Assessment:** See Sections 6.4, 7.3 and 8. Further, project specific mitigation measures would be defined by subsequent HRA once project plans are known.
Klaverbank cSAC	✓	✓	✓	-	✓	✓	**Qualifying features:** Reefs, harbour porpoise, harbour seal, grey seal **Consideration of likely significant effects:** The Dutch site abuts the UK median line. In the unlikely event of a major diesel oil spill from Blocks 44/23g, 49/4b and 49/8b, weathered spilled diesel oil could theoretically affect the qualifying species, although mitigation would be possible. Seismic survey noise would be detectable within site boundaries should this activity take place, however the acquisition of new seismic data is not proposed as part of the indicative work programmes for Blocks in proximity to the site (closest Block for which seismic survey is proposed, 43/25, is *ca.* 50km distance). The location of the site and Blocks in relation to a number of offshore wind zones has the potential to result in-combination effects (e.g. in relation to acoustic disturbance). **Appropriate Assessment:** See Sections 6.4, 7.3 and 8. 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

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	
River Derwent	✓	✓	-	-	✓	-	**Qualifying features:** Running freshwater, river lamprey, sea lamprey, bullhead, otter **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 (river and sea lamprey) outside of the site boundaries, although mitigation would be possible. **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[32], 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[33] 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.

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

[33] 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

Site Name: Flamborough Head and Bempton Cliffs SPA	
Location	Grid Ref: TA233723 (central point) Latitude 54º 07'55"N Longitude 00º 06'48"W
Area (ha)	212.17
Summary	Flamborough Head is located on the east coast of Yorkshire. The cliffs project into the North Sea, rising to 135 m at Bempton, exposing a wide section of chalk strata. The cliff-top vegetation comprises maritime grassland species alongside species more typical of chalk grassland. The site supports large numbers of breeding seabirds including kittiwake *Rissa tridactyla* and auks, as well as the only mainland-breeding colony of gannet *Morus bassanus* in the UK. The seabirds feed and raft in the waters around the cliffs, outside the SPA, as well as feeding more distantly in the North Sea. The intertidal chalk platforms are also used as roosting sites, particularly at low water and notably by juvenile kittiwakes.
Qualifying features for which the site is designated:	
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:** Kittiwake *Rissa tridactyla*, 83,370 pairs representing at least 2.6% of the Eastern Atlantic breeding population (as of 1987).	
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 305,784 individual seabirds including: Puffin *Fratercula arctica*, razorbill *Alca torda*, guillemot *Uria aalge*, herring gull *Larus argentatus*, gannet *Morus bassanus*, kittiwake *Rissa tridactyla*.	
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: Humber Estuary SPA

Location	Latitude 53º 32'59"N Longitude 00º 03'25"E
Area (ha)	37,630.24
Summary	The Humber Estuary is the largest coastal plain estuary on the east coast of Britain. The site supports internationally important populations of waterfowl species overwinter and provides a migratory feeding ground during sping and autumn migrations. In the summer the site supports several important breeding populations of declining species such as bittern, marsh harrier and avocet.

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:
Bittern *Botaurus stellaris,* 10.5% of the breeding population in Great Britain (3 year mean 2000 – 2002)
Marsh harrier *Circus aeruginosus,* 6.3% of the breeding population in Great Britain (3 year mean 2000 – 2002)
Avocet *Recurvirostra avosetta,* 8.6% of the breeding population in Great Britain (3 year mean 2000 – 2002)
Sandwich tern *Sterna sandvicensis*, 2.1% of the breeding population in Great Britain (3 year mean 2000 – 2002)

Over winter:
Bittern *Botaurus stellaris,* 4% of the wintering population in Great Britain (5 year peak mean 1998/9 - 2002/3)
Hen harrier *Circus cyaneus,* 1.1% of the wintering population in Great Britain (5 year peak mean 1997/8 - 2001/2)
Bar-tailed Godwit *Limosa lapponica,* 4.4% of the wintering population in Great Britain (5 year peak mean 1996/7 - 2000/1)
Golden plover *Pluvialis apricaria,* 12.3% of the wintering population in Great Britain (5 year peak mean 1996/7 - 2000/1)
Avocet *Recurvirostra avosetta,* 1.7% of the wintering population in Great Britain (5 year peak mean 1996/7 - 2000/1)

On passage:
Ruff *Philomachus pugnax,* 1.4% of the wintering population in Great Britain (5 year peak mean 1996 - 2000)

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

Over winter:
Dunlin *Calidris alpina alpina,* 1.7% of the Northern Siberia/Europe/Western Africa population (5 year peak mean 1996/7 - 2000/1)
Knot *Calidris canutus,* 6.3% of the breeding North-eastern Canada/Greenland/Iceland/North-western Europe population (5 year peak mean 1996/7 - 2000/1)
Black-tailed Godwit *Limosa limosa islandica,* 3.2% of the breeding Iceland population (5 year peak mean 1996/7 - 2000/1)
Shelduck *Tadorna tadorna,* 1.5% of the North-western Europe population (5 year peak mean 1996/7 - 2000/1)
Redshank *Tringa totanus,* 3.6% of the wintering Eastern Atlantic population (5 year peak mean 1996/7 - 2000/1)

On passage:
Dunlin *Calidris alpina alpina,* 1.5% of the Northern Siberia/Europe/Western Africa population (5 year peak mean 1996 - 2000)
Knot *Calidris canutus,* 4.1% of the breeding North-eastern Canada/Greenland/Iceland/North-western Europe population (5 year peak mean 1996 - 2000)
Black-tailed Godwit *Limosa limosa islandica,* 2.6% of the breeding Iceland population (5 year peak mean 1996 - 2000)
Redshank *Tringa totanus,* 5.7% of the wintering Eastern Atlantic population (5 year peak mean 1996 - 2000)

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.

In the non-breeding season, the area regularly supports 153934 individual waterfowl (5 year peak mean 1996/7 - 2000/1) including: Teal *Anas crecca*, Wigeon *Anas penelope, Mallard Anas platyrhynchos,* Ruddy turnstone *Arenaria interpres,* Pochard *Aythya farina,* Scaup *Aythya marila,* Bittern *Botaurus stellaris , Dark-bellied brent goose Branta bernicla bernicla,* Goldeneye *Bucephala clangula,* Sanderling *Calidris alba,* Dunlin *Calidris alpina alpina,* knot *Calidris canutus, Ringed plover Charadrius hiaticula,* Oyster catcher *Haematopus ostralegus, Bar-tailed Godwit Limosa lapponica,* Black-tailed Godwit *Limosa limosa islandica,* Curlew *Numenius arquata,* Whimbrel *Numenius phaeopus,* Ruff *Philomachus pugnax,* Golden plover *Pluvialis apricaria,* Grey plover *Pluvialis squatarola,* Avocet *Recurvirostra avosetta,* Shelduck *Tadorna tadorna,* Greenshank *Tringa nebularia,* Redshank *Tringa totanus,* Lapwing *Vanellus vanellus*

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

Site Name: Humber Estuary SPA

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: Gibraltar Point SPA

Location	Latitude 53º 06'00"N Longitude 00º 20'16"E
Area (ha)	414.09
Summary	Gibraltar Point is located on the Lincolnshire coast in eastern England. It lies north of The Wash and consists of an actively accreting sand-dune system, saltmarsh and extensive intertidal flats. All stages of dune development are represented with the older dunes extensively colonised by scrub. There are also small areas of freshwater marsh and open water. The site accommodates large numbers of overwintering birds and significant colonies of breeding terns. The terns feed outside the SPA in nearby waters. The site is also important for waders during the spring and autumn passage period.

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:
Little Tern *Sterna albifrons*, 220 pairs representing at least 9.2% of the breeding population in Great Britain (5 year mean, 1992-1996)

Over winter:
Bar-tailed godwit *Limosa lapponica*, 719 individuals representing at least 1.4% 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:

Over winter:
Grey plover *Pluvialis squatarola*, 2,017 individuals representing at least 1.3% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)
Knot *Calidris canutus*, 10,155 individuals representing at least 2.9% of the wintering Northeastern Canada/Greenland/Iceland/Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)

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 22,137 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: oystercatcher *Haematopus ostralegus*, knot *Calidris canutus*, grey plover *Pluvialis squatarola*, bar-tailed godwit *Limosa lapponica*.

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: The Wash SPA	
Location	Grid Ref: TF537403 (central point) Latitude 52º 56'16"N Longitude 00º 17'12"E
Area (ha)	62,211.66
Summary	The Wash is the largest estuarine system in the UK. It is fed by the rivers Witham, Welland, Nene and Great Ouse that drain much of the east Midlands of England. The Wash comprises very extensive saltmarshes, major intertidal banks of sand and mud, shallow waters and deep channels. The eastern end of the site includes low chalk cliffs at Hunstanton. In addition, on the eastern side, the gravel pits at Snettisham are an important high-tide roost for waders. The intertidal flats have a rich invertebrate fauna and colonising beds of glasswort which are important food sources for the large numbers of waterbirds dependent on the site. The sheltered nature of the Wash creates suitable breeding conditions for shellfish, principally mussel, cockle and shrimps. These are important food sources for some waterbirds such as oystercatchers. The Wash is of outstanding importance for a large number of geese, ducks and waders, both in spring and autumn migration periods, as well as through the winter. The SPA is especially notable for supporting a very large proportion (over half) of the total population of Canada/Greenland breeding knot. In summer, the Wash is an important breeding area for terns and as a feeding area for marsh harrier that breed just outside the SPA. To the north, the coastal habitats of the Wash are continuous with Gibraltar Point SPA, whilst to the east the Wash adjoins the North Norfolk Coast SPA.

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*, 152 pairs representing at least 1.2% of the breeding population in Great Britain (Count as at 1993)
Little tern *Sterna albifrons*, 33 pairs representing at least 1.4% of the breeding population in Great Britain (5 year mean 1992-1996)
Marsh harrier *Circus aeruginosus*, 15 pairs representing at least 9.4% of the breeding population in Great Britain (Count as at 1995)

Over winter:
Avocet *Recurvirostra avosetta*, 110 individuals representing at least 8.7% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
Bar-tailed godwit *Limosa lapponica*, 11,250 individuals representing at least 21.2% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
Golden plover *Pluvialis apricaria*, 11,037 individuals representing at least 4.4% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
Whooper swan *Cygnus cygnus,* 68 individuals representing at least 1.2% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)

This site also qualifies 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*, 1,185 individuals representing at least 2.4% of the Europe/Northern Africa - wintering population (5 year peak mean 1991/2 - 1995/6)
Sanderling *Calidris alba*, 1,854 individuals representing at least 1.9% of the Eastern Atlantic/Western & Southern Africa - wintering population (2 year mean Aug 1994 - 1995)

Over winter:
Black-tailed godwit *Limosa limosa islandica*, 859 individuals representing at least 1.2% of the wintering Iceland - breeding population (5 year peak mean 1991/2 - 1995/6)
Curlew *Numenius arquata*, 3,835 individuals representing at least 1.1% of the wintering Europe - breeding population (5 year peak mean 1991/2 - 1995/6)
Dark-bellied brent goose *Branta bernicla bernicla*, 22,248 individuals representing at least 7.4% of the wintering Western Siberia/Western Europe population (5 year peak mean 1991/2 - 1995/6)
Dunlin *Calidris alpina alpina*, 35,620 individuals representing at least 2.5% of the wintering Northern Siberia/Europe/Western Africa population (5 year peak mean 1991/2 - 1995/6)
Grey plover *Pluvialis squatarola*, 9,708 individuals representing at least 6.5% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)
Knot *Calidris canutus*, 186,892 individuals representing at least 53.4% of the wintering Northeastern

Site Name: The Wash SPA

Canada/Greenland/Iceland/Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)
Oystercatcher *Haematopus ostralegus*, 25,651 individuals representing at least 2.9% of the wintering Europe & Northern/Western Africa population (5 year peak mean 1991/2 - 1995/6)
Pink-footed goose *Anser brachyrhynchus*, 33,265 individuals representing at least 14.8% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean 1991/2 - 1995/6)
Pintail *Anas acuta*, 923 individuals representing at least 1.5% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)
Redshank *Tringa totanus*, 2,953 individuals representing at least 2.0% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)
Shelduck *Tadorna tadorna*, 15,981 individuals representing at least 5.3% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)
Turnstone *Arenaria interpres*, 717 individuals representing at least 1.0% of the wintering Western Palearctic - wintering population (5 year peak mean 1991/2 - 1995/6)

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 400,273 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: black-tailed godwit *Limosa limosa islandica*, avocet *Recurvirostra avosetta*, golden plover *Pluvialis apricaria*, bar-tailed godwit *Limosa lapponica*, pink-footed goose *Anser brachyrhynchus*, dark-bellied brent goose *Branta bernicla bernicla*, shelduck *Tadorna tadorna*, pintail *Anas acuta*, oystercatcher *Haematopus ostralegus*, grey plover *Pluvialis squatarola*, whooper swan *Cygnus cygnus,* dunlin *Calidris alpina alpina*, sanderling *Calidris alba*, curlew *Numenius arquata*, redshank *Tringa totanus*, turnstone *Arenaria interpres*, little grebe *Tachybaptus ruficollis*, cormorant *Phalacrocorax carbo*, white-fronted goose *Anser albifrons albifrons,* wigeon *Anas penelope*, mallard *Anas platyrhynchos*, ringed plover *Charadrius hiaticula*, lapwing *Vanellus vanellus*, knot *Calidris canutus*, 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.

Site Name: North Norfolk Coast SPA	
Location	Grid Ref: TF745446 (central point) Latitude 52º 58'13"N Longitude 00º 35'55"E
Area (ha)	7,886.79
Summary	The North Norfolk Coast SPA encompasses much of the northern coastline of Norfolk in eastern England. It is a low-lying barrier coast that includes a great variety of coastal habitats. The main habitats, found along the whole coastline, include extensive intertidal sand and mudflats, saltmarshes, shingle and sand dunes, together with areas of freshwater grazing marsh and reedbed, which has developed in front of rising land. The site contains some of the best examples of saltmarsh in Europe. The great diversity of high-quality freshwater, intertidal and marine habitats results in very large numbers of waterbirds occurring throughout the year. In summer, the site holds large breeding populations of waders, four species of terns, bittern and wetland raptors such as marsh harrier. In winter, the coast is used by very large numbers of geese, seaducks, other ducks and waders. The coast is also of major importance for staging waterbirds in the spring and autumn migration periods. Breeding terns, particularly sandwich tern, and wintering seaducks regularly feed outside the SPA in adjacent coastal waters. To the west, the coastal habitats of North Norfolk Coast SPA are continuous with the Wash SPA, with which area the ecology of this site is intimately linked.

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:
Avocet *Recurvirostra avosetta*, 177 pairs representing at least 30.0% of the breeding population in Great Britain (Count as at 1998)
Bittern *Botaurus stellaris*, 3 individuals representing at least 15.0% of the breeding population in Great Britain (Count as at 1998)
Common tern *Sterna hirundo*, 460 pairs representing at least 3.7% of the breeding population in Great Britain (Count as at 1996)
Little tern *Sterna albifrons*, 377 pairs representing at least 15.7% of the breeding population in Great Britain (5 year mean 1994-1998)
Marsh harrier *Circus aeruginosus*, 14 pairs representing at least 8.8% of the breeding population in Great Britain (Count as at 1995)
Mediterranean gull *Larus melanocephalus*, 2 pairs representing at least 20.0% of the breeding population in Great Britain (Count as at 1996)
Roseate tern *Sterna dougallii*, 2 pairs representing at least 3.3% of the breeding population in Great Britain (5 year mean 1994-1998)
Sandwich tern *Sterna sandvicensis*, 3,457 pairs representing at least 24.7% of the breeding population in Great Britain (5 year mean 1994-1998)

Over winter:
Avocet *Recurvirostra avosetta*, 153 individuals representing at least 12.0% of the wintering population in Great Britain (Count as at 1997/8)
Bar-tailed godwit *Limosa lapponica*, 1,236 individuals representing at least 2.3% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
Bittern *Botaurus stellaris*, 5 individuals representing at least 5.0% of the wintering population in Great Britain (5 year peak mean 1993/4 - 1998/9)
Golden plover *Pluvialis apricaria*, 2,667 individuals representing at least 1.1% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
Hen harrier *Circus cyaneus*, 16 individuals representing at least 2.1% of the wintering population in Great Britain (5 year mean 1993/4-1997/8)
Ruff *Philomachus pugnax*, 54 individuals representing at least 7.7% of the wintering population in Great Britain (5 year peak mean 1993/4 - 1998/9)

This site also qualifies 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:
Redshank *Tringa totanus*, 700 pairs representing at least 1.2% of the breeding Eastern Atlantic - wintering population (Count as at 1998)
Ringed plover *Charadrius hiaticula*, 220 pairs representing at least 1.4% of the breeding Europe/Northern Africa - wintering population (Count as at 1998)

Site Name: North Norfolk Coast SPA

On passage:
Ringed plover *Charadrius hiaticula*, 1,256 individuals representing at least 2.5% of the Europe/Northern Africa - wintering population (5 year peak mean 1994/5 - 1998/9)

Over winter:
Dark-bellied brent goose *Branta bernicla bernicla*, 11,512 individuals representing at least 3.8% of the wintering Western Siberia/Western Europe population (5 year peak mean 1991/2 - 1995/6)
Knot *Calidris canutus*, 10,801 individuals representing at least 3.1% of the wintering Northeastern Canada/Greenland/Iceland/Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)
Pink-footed goose *Anser brachyrhynchus*, 23,802 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*, 1,139 individuals representing at least 1.9% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)
Redshank *Tringa totanus*, 2,998 individuals representing at least 2.0% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1993/4 - 1997/8)
Wigeon *Anas penelope*, 14,039 individuals representing at least 1.1% of the wintering Western Siberia/Northwestern/Northeastern Europe population (5 year peak mean 1991/2 - 1995/6)

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 91,249 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: shelduck *Tadorna tadorna*, avocet *Recurvirostra avosetta*, golden plover *Pluvialis apricaria*, ruff *Philomachus pugnax*, bar-tailed godwit *Limosa lapponica*, pink-footed goose *Anser brachyrhynchus*, dark-bellied brent goose *Branta bernicla bernicla*, wigeon *Anas penelope*, pintail *Anas acuta*, knot *Calidris canutus*, redshank *Tringa totanus*, bittern *Botaurus stellaris*, white-fronted goose *Anser albifrons albifrons*, dunlin *Calidris alpina alpina*, gadwall *Anas strepera*, teal *Anas crecca*, shoveler *Anas clypeata*, common scoter *Melanitta nigra*, velvet scoter *Melanitta fusca*, oystercatcher *Haematopus ostralegus*, ringed plover *Charadrius hiaticula*, grey plover *Pluvialis squatarola*, lapwing *Vanellus vanellus*, sanderling *Calidris alba*, cormorant *Phalacrocorax carbo*.

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: Outer Thames Estuary SPA	
Location	Latitude 51º 54'58"N Longitude 01º 32'04"E
Area (ha)	379,268.14
Summary	The Thames Estuary is located in the southern part of the North Sea on the east coast of England. The SPA boundary is divided into three areas: the main part of the site is the outer part of the estuary; a separate area extending south along the coast of E Norfolk to Woodbridge (Suffolk) and lying mainly within the 12nm zone; and a third area lying slightly further north and partly within 12nm, but also with a larger area extending well beyond the 12 nm zone. The seaward boundary of the SPA lies partly within the 20m depth contour and marginally into the 20-50m depth contour. The Outer Thames Estuary SPA consists of areas of shallow and deeper water, high tidal current streams and a range of mobile sediments. Large areas of mud, silt and gravelly sediments form the deeper water channels, the main ones of which form the approach route to the ports of London and as such are continually disturbed by shipping and maintenance dredging. Sand in the form of sandbanks separated by troughs predominates in the remaining areas and the crests of some of the banks are exposed at mean low water. The seabed in along the coast of Norfolk and Suffolk coast is of a similar composition to that in the main estuary with large shallow areas of mud, sand, silt and gravely sediments but, in the absence of main port areas within this area, there is consequently less disturbance through shipping or dredging. The seabed and waters of the site provide an important habitat over winter for red-throated divers, which visit the area to feed on fish.
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*, 6,486 individuals representing 38% of the wintering population in Great Britain (annual mean peak count 1989-2006/07)	
Draft conservation objectives:	
For the Annex I species: 'Red-throated diver (Gavia stellata)': subject to natural change, maintain in favourable condition* the internationally important populations of: • red-throated diver (*Gavia stellata*) and its supporting habitats and prey species (relevant habitats include shallow coastal waters and areas in the vicinity of sub-tidal sandbanks) * For definitions of these terms, see the material presented in support of site selection by Natural England/JNCC: http://www.naturalengland.org.uk/Images/Thames-consobj_tcm6-21678.pdf Note: These are high-level draft conservation objectives, which may be refined by Natural England/JNCC in light of increased understanding of the features. The draft objectives must be viewed in light of the material presented in support of site selection and relevant definitions of favourable conservation status (see link above).	

C2 Coastal and marine Special Areas of Conservation

Site Name: Humber Estuary SAC	
Location	Latitude 53º 35'21"N Longitude 00º 44'05"W
Area (ha)	36,657.15
Summary	The Humber is the second-largest coastal plain estuary in the UK, and the largest coastal plain estuary on the east coast of Britain. It is a muddy, macro-tidal estuary, fed by the Rivers Ouse, Trent and Hull, Ancholme and Graveney. Suspended sediment concentrations are high, and are derived from a variety of sources, including marine sediments and eroding boulder clay along the Holderness coast. This is the northernmost of the English east coast estuaries whose structure and function is intimately linked with soft eroding shorelines. As salinity declines upstream, reedbeds and brackish saltmarsh communities fringe the estuary. This section of the estuary is also noteworthy for extensive mud and sand bars, which in places form semi-permanent islands. Significant fish species present include the migratory river lamprey and sea lamprey, which breed in the River Derwent, a tributary of the River Ouse. Donna Nook, on the south shore at the mouth of the estuary, is used by grey seals as a breeding colony and haul-out site.
Qualifying features for which the site is designated:	
Annex I Habitat Primary features: Estuaries, mudflats and sandflats not covered by seawater at low tide Secondary features: Sandbanks which are slightly covered by seawater all the time, coastal lagoons, *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'), dunes with *Hippophae rhamnoides* ***Annex II Species*** Primary features: None Secondary features: Sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluvitilis*, grey seal *Halichoerus grypus*	
Conservation objectives:	
With regard to the natural habitats and/or species for which the site has been designated (the Qualifying Features listed above), 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 populations of qualifying species; • The distribution of qualifying species within the site.	

Site Name: The Wash and North Norfolk Coast SAC	
Location	Grid Ref: TF558403 (central point) Latitude 52º 56'13"N Longitude 00º 19'05"E
Area (ha)	107,761.28
Summary	The Wash is the largest embayment in the UK with extensive areas of subtidal mixed sediment. In the tide-swept approaches to the Wash, the relatively common tube-dwelling polychaete worm *Sabellaria spinulosa* forms areas of biogenic reef. The site includes one of the largest expanses of sublittoral sandbanks and the second-largest area of intertidal flats in the UK. These habitats support important invertebrate communities; benthic communities on sandflats in the deeper, central part of the Wash are particularly diverse. The embayment supports a variety of mobile species, including a range of fish and harbour seal, with the subtidal sandbanks also providing important nursery grounds for young commercial fish species. Extensive saltmarsh habitats are also present, fringed by important areas of Mediterranean and thermo-Atlantic vegetation.

Qualifying features for which the site is designated:

Annex I Habitat

Primary features: Sandbanks which are slightly covered by sea water all the time, mudflats and sandflats not covered by seawater at low tide, large shallow inlets and bays, reefs, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)

Secondary features: Coastal lagoons

Annex II Species

Primary features: Harbour seal *Phoca vitulina*

Secondary features: 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 above), 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 populations of qualifying species;
- The distribution of qualifying species within the site.

Site Name: North Norfolk Coast SAC	
Location	Grid Ref: TF752445 (central point) Latitude 52º 28'08"N Longitude 00º 36'38"E
Area (ha)	3,207.37
Summary	The site comprises of a range of habitat features including a number of small percolation lagoons, the most notable of which are Blakeney Spit Pools, a lagoon system of six pools between a shingle ridge and saltmarsh. Perennial vegetation of stony banks occurs at Blakeney Point, a shingle spit on the east coast of England with a series of recurves partly covered by sand dunes, supporting a typical sequence of shingle vegetation. The embryonic shifting dunes at the site represent one of only two locations where this feature is found on the east coast. Both shifting (white dunes) and fixed (grey dunes) are also found at the site.

Qualifying features for which the site is designated:

Annex I Habitat

Primary features: Coastal lagoons, perennial vegetation of stony banks, Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*), embryonic shifting dunes, shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes`), fixed dunes with herbaceous vegetation (`grey dunes`), humid dune slacks

Annex II Species

Primary features: None

Secondary features: Otter *Lutra lutra, Petalwort Petalophyllum ralfsii*

Conservation objectives:

With regard to the natural habitats and/or species for which the site has been designated ("the Qualifying Features" listed above);

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 populations of qualifying species;
- The distribution of qualifying species within the site.

Site Name: Dogger Bank SCI	
Location	Latitude 54º 51'27"N Longitude 02º 13'08"E
Area (ha)	1,233,884
Summary	The Dogger Bank in the Southern North Sea is the largest sandbank in UK waters and the SCI adjoins Dutch and German Dogger Bank sites. The bank supports communities typical of sandy sediments, characterised by polychaete worms, amphipods and small clams within the sediments and hermit crabs, flatfish and starfish on the seabed. Sandeels are abundant on the flanks of the bank and provide a food resource for seabirds, cetaceans and other commercial fish species, such as cod. Harbour porpoise, harbour seals and grey seals are also present at the site and have been included as non-qualifying features.

Qualifying features for which the site is designated:

Annex I Habitat

Primary features: Sandbanks which are slightly covered by sea water all the time

Annex II Species

None

Draft conservation objectives:

Subject to natural change, restore* the sandbanks to favourable condition, such that:

- The natural environmental quality* is restored;
- The natural environmental processes* and the extent* are maintained;
- The physical structure*, diversity*, community structure* and typical species*, representative of sandbanks which are slightly covered by seawater all the time, in the Southern North Sea, are restored.

* For definitions of these terms, see the material presented in support of site selection by Natural England/JNCC: http://jncc.defra.gov.uk/pdf/DoggerBank_ConservationObjectivesAdviceonOperations_6.0.pdf

Notes:

- In the case of the Dogger Bank site, there is some evidence to date that, due to damage caused by bottom trawling and possibly infrastructure development, the Annex I feature may not be in favourable condition and might require restoration where possible.
- These are high-level conservation objectives, which may be refined by Natural England/JNCC in light of increased understanding of the features. The objectives must be viewed in light of the material presented in support of site selection and relevant definitions of favourable conservation status.

Site Name: North Norfolk Sandbanks and Saturn Reef SCI	
Location	Latitude 53º 22'29"N Longitude 02º 07'15"E
Area (ha)	360,341
Summary	The North Norfolk Sandbanks consist of 10 main sandbanks and a number of smaller banks, which collectively form the most extensive example of offshore linear ridge sandbanks in UK waters. The banks are home to invertebrate communities typical of sandy sediments, such as polychaete worms, crabs and brittlestars. The Saturn reef is a *Sabellaria spinulosa* biogenic reef structure located within the area occupied by the sandbank site.

Qualifying features for which the site is designated:

Annex I Habitat
Sandbanks which are slightly covered by sea water all the time; reefs (biogenic *Sabellaria spinulosa*)

Annex II Species
None

Draft conservation objectives:

Subject to natural change, restore* the *sandbanks which are slightly covered by seawater all the time* and *reefs* to favourable condition, such that the:

- The natural environmental quality*, natural environmental processes* and extent* are maintained
- The physical structure*, diversity*, community structure* and typical species*, representative of *sandbanks which are slightly covered by seawater all the time* and *reefs* in the Southern North Sea are restored.

* For definitions of these terms, see Offshore Special Area of Conservation: North Norfolk Sandbanks and Saturn Reef Conservation Objectives and Advice on Operations (September 2012): http://jncc.defra.gov.uk/pdf/NNSandbanksandSaturnReef_ConservationObjectives_AdviceonOperations_6.0.pdf
Note: These are high-level draft conservation objectives, which may be refined by Natural England/JNCC in light of increased understanding of the features. The objectives must be viewed in light of the material presented in support of site selection and relevant definitions of favourable conservation status (see link above).

Site Name: Inner Dowsing, Race Bank and North Ridge SCI	
Location	Latitude 53º 15'26"N Longitude 00º 43'14"E
Area (ha)	84,514
Summary	The site is located off the south Lincolnshire coast and has been recommended for the sandbank habitat and *Sabellaria spinulosa* reef communities present. A wide range of sandbank types are enclosed by the boundary including banks bordering channels, relict linear banks and sinusoidal banks. The area contains species such as polychaete and nemertean worms and the ascidian *Molgula* sp. The main areas of *S. spinulosa* reef are found in the southwest of the site, particularly at Lynn Knock and in the Docking Shoal area. These areas support a diverse community of bryozoans, hydroids, sponges and tunicates. Harbour porpoise and grey seal are also present at the site and have been included as non-qualifying features.

Qualifying features for which the site is designated:

Annex I Habitat
Sandbanks which are slightly covered by sea water all the time; reefs (biogenic *Sabellaria spinulosa*)

Annex II Species
None

Draft conservation objectives:

For the Annex I Habitat: 'Sandbanks which are slightly covered by seawater all the time': subject to natural change, maintain* or restore* the feature in favourable condition, such that:

- The natural environmental quality* is maintained
- The natural environmental processes* are maintained
- The extent*, physical structure*, diversity*, community structure* and typical species* representative of low diversity dynamic sand communities are maintained
- The extent*, physical structure*, diversity*, community structure* and typical species* representative of moderate diversity stable sand communities are maintained, or restored where deterioration has occurred.

For the Annex I Habitat: 'Sabellaria spinulosa reefs': subject to natural change, maintain* or restore* Sabellaria spinulosa reefs in/to favourable condition, such that:

- The natural environmental quality* is maintained
- The natural environmental processes* are maintained
- The extent*, physical structure*, diversity*, community structure* and typical species* representative of *Sabellaria spinulosa* biogenic reef in the southern North Sea are maintained, or restored where deterioration has occurred.

(Note: the reef feature is dependent on the maintenance of the same underpinning environmental quality and environmental processes that will enable the sandbank feature to be in favourable condition.)

* For definitions of these terms, see the material presented in support of site selection by Natural England/JNCC: http://www.jncc.gov.uk/pdf/InnerDowsingandRaceBank_ConsObsAOOFinal_2_0_030909.pdf
Note: These are high-level draft conservation objectives, which may be refined by Natural England/JNCC in light of increased understanding of the features. The draft objectives must be viewed in light of the material presented in support of site selection and relevant definitions of favourable conservation status (see link above).

Site Name: Haisborough, Hammond and Winterton SCI	
Location	Latitude 52º 50'27"N Longitude 01º 57'58"E
Area (ha)	146,749
Summary	The Haisborough, Hammond and Winterton site contains a collection of sandbanks off the north-east coast of Norfolk. On the tops of the banks polychaete worms and amphipods are present in small numbers due to the high level of sediment movement. In the troughs between the banks where the sediments are more stable, bryozoans, hydroids and sea anemones have settled. Bivalves and crustaceans are found throughout the site. The site has also been recommended for the presence of biogenic *Sabellaria spinulosa* reef. The tiny sand-tubes that make up the reef support a diverse array of hydroids, sponges and tunicates. Harbour porpoise and grey seals are also present at the site and have been included as non-qualifying features

Qualifying features for which the site is designated:

Annex I Habitat
Sandbanks which are slightly covered by sea water all the time; reefs (biogenic *Sabellaria spinulosa*)

Annex II Species
None

Draft conservation objectives:

For the Annex I Habitat: 'Sandbanks which are slightly covered by seawater all the time': subject to natural change, maintain* the feature in favourable condition, such that:

- The natural environmental quality* is maintained
- The natural environmental processes* are maintained
- The extent*, physical structure*, diversity*, community structure* and typical species* representative of low diversity dynamic sand communities are maintained
- The extent*, physical structure*, diversity*, community structure* and typical species* representative of moderate diversity stable sand communities are maintained.

For the Annex I Habitat: 'Sabellaria spinulosa reefs': subject to natural change, maintain* or restore* Sabellaria spinulosa reefs in/to favourable condition, such that:

- The natural environmental quality* is maintained
- The natural environmental processes* are maintained
- The extent*, physical structure*, diversity*, community structure* and typical species* representative of *Sabellaria spinulosa* biogenic reef in the southern North Sea are maintained, or restored where deterioration has occurred.

(Note: the reef feature is dependent on the maintenance of the same underpinning environmental quality and environmental processes that will enable the sandbank feature to be in favourable condition.)

* For definitions of these terms, see the material presented in support of site selection by Natural England/JNCC: http://www.jncc.gov.uk/pdf/HHW_DraftCOsandAdviceOnOperations_4_0.pdf
Note: These are high-level draft conservation objectives, which may be refined by Natural England/JNCC in light of increased understanding of the features. The draft objectives must be viewed in light of the material presented in support of site selection and relevant definitions of favourable conservation status (see link above).

Site Name: River Derwent SAC	
Location	Grid Ref: SE704474 (central point) Latitude 53º 55'03"N Longitude 00º 55'40"W
Area (ha)	411.23
Summary	The Derwent is one example of river lamprey populations which inhabit the many rivers flowing into the Humber estuary in eastern England. Only the lower reaches of the Derwent are designated, reflecting the spawning distribution of the species in the Derwent system. Larvae spend several years in silt beds before metamorphosing and migrating downstream into estuaries to feed on fish for 1-2 years before returning to freshwater to spawn.

Qualifying features for which the site is designated:

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

Annex II Species
Primary features: River lamprey *Lampetra fluvitilis*
Secondary features: Sea lamprey *Petromyzon marinus*, bullhead *Cuttus 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 above), 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 populations of qualifying species;
- The distribution of qualifying species within the site.

Department of Energy & Climate Change
3 Whitehall Place
London SW1A 2AW
www. gov.uk

URN 12D/408