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

November 2013

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Habitats Regulations Assessment

Appropriate Assessment

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1 Introduction

1.1 Background and purpose

On 1st February 2012, the Secretary of State for the Department of Energy and Climate Change (DECC) invited applications for licences in the 27th Seaward Licensing Round. The licensing Round forms part of a plan/programme adopted by the Secretary of State following completion of the Offshore Energy Strategic Environmental Assessment (DECC 2011). 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 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.

A screening assessment (including consultation with the statutory agencies/bodies) forming the first stage of the Habitats Regulations Assessment (HRA) process, 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

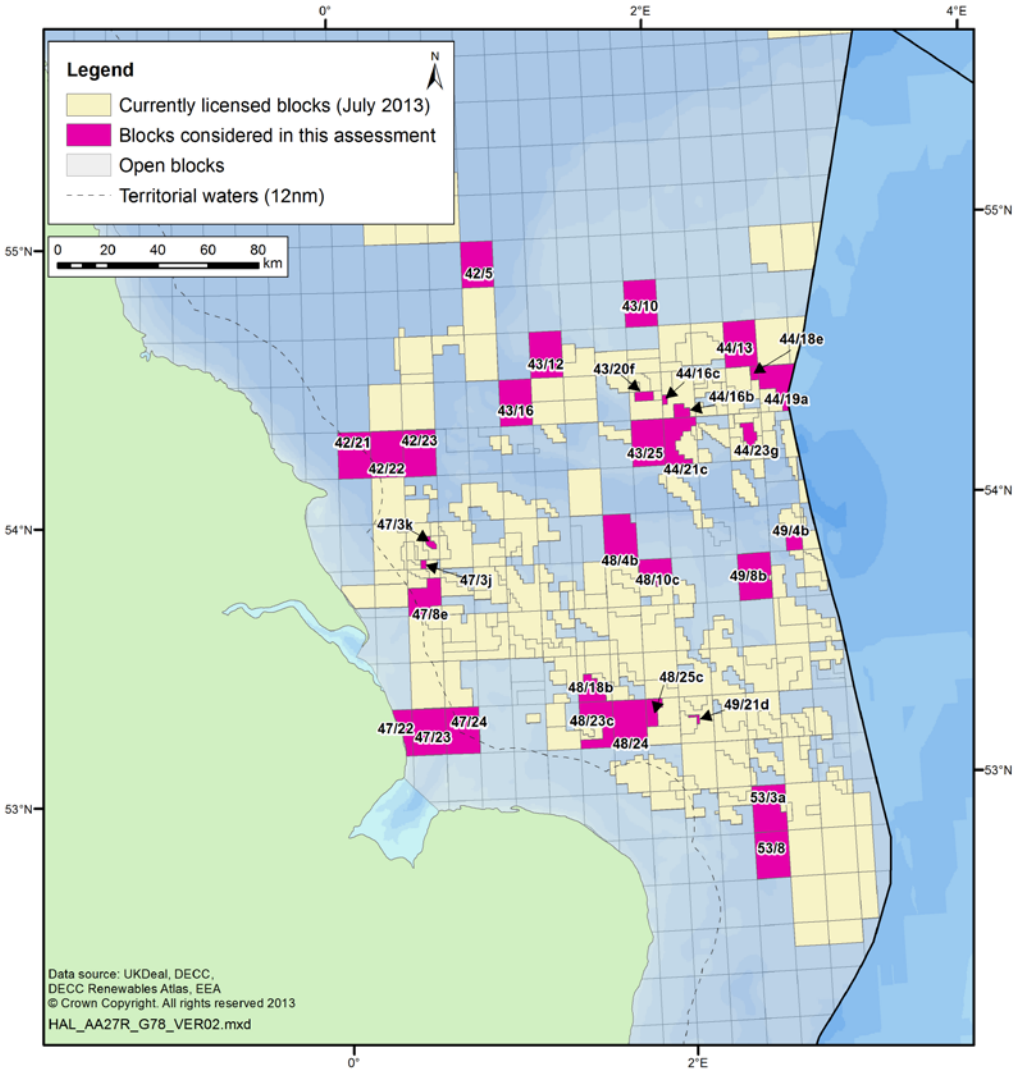
This report documents the further assessment in relation to 33 Blocks in the Southern North Sea (see Section 1.2).

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 are 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 but does not constitute any form of approval for activities to take place in the Blocks, nor does it confer any exemption from other legal or regulatory requirements (see Figure 2.1).

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 (this includes those activities outlined in initial work programmes). Field activities (see Table 2.1), such as seismic survey or drilling, are subject to further individual controls by DECC (see Figures 2.2-2.3), 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.

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

	Block	Initial term work programme	Licence	
			Traditional[1]	Promote[2]
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	-	✓

*Notes: [1]**Traditional:** work programme must be carried out and 50% of block acreage relinquished within 4 years, otherwise licence will not continue to second term. [2]**Promote:** licensee given two years to attract the technical, environmental and financial capacity to complete an agreed 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.*

Table 2.1: Potential activities arising from initial work programmes – note that these descriptions are indicative, and activities would require individual environmental assessment and permitting (see Figures 2.2-2.3)

Potential activity	Description
Geophysical survey	
Deep geological seismic (2D and 3D) survey	2-D seismic involves a survey vessel with a single source and a towed hydrophone streamer. The reflections from the subsurface strata provide an image in two dimensions (horizontal and vertical). Repeated parallel lines are typically run at intervals of several kilometres (minimum ca. 0.5km) and a second set of lines at right angles to the first to form a grid pattern. This allows imaging and interpretation of geological structures and identification of potential hydrocarbon reservoirs. 3D seismic survey is similar but uses more than one source and several hydrophone streamers towed by the survey vessel. Thus closely spaced 2D lines (typically between 25 and 50m apart) can be achieved by a single sail line. 3D survey airgun arrays are normally larger[1] with typical broadband source levels of 248-259db re 1µPa.
Rig site survey	Rig site surveys utilise a range of techniques, including 2-D seismic survey, although for rig site surveys a much smaller energy source and shorter hydrophone streamer is used (with source size of 40-400 cubic inches[1]). The survey typically covers a relatively small area of seabed, in the order of 2km or 3km square. The rig site survey vessel may also be used to gather baseline information on the seabed sediment, fauna, presence of protected habitats and species, and background contamination.
Well evaluation (e.g. Vertical Seismic Profiling)	Sometimes conducted to assist with well evaluation subsequent to drilling. A seismic source (airgun array, typically with a source size of up to ~500 cubic inches[1]) is deployed from onboard the rig, and measurements are made within the wellbore using a series of geophones deployed inside it. VSP produces a relatively high intensity impulse noise, but over a short duration (usually a few hours).
Drilling	
Rig tow out & de-mobilisation	Mobile rigs are towed to and from the well site typically by 2-3 anchor handling vessels.

[1] OGP 2011 – An overview of marine seismic operations.

Potential activity	Description
Rig placement/ anchoring	A jack up rig is assisted into position by anchor handling vessels, and then the rig's legs are lowered to the seafloor to maintain position. Semi-submersible rigs can either use anchors combined with the assistance from anchor handling vessels, or dynamic positioning (DP) to manoeuvre into and stay in position over the drill site. Semi-submersible rigs use either anchors (deployed and recovered by anchor handler vessels) or dynamic positioning (DP) to manoeuvre into and stay in position over the well location. Eight to 12 anchors attached to the rig by cable or chain are deployed radially at 1 to 1.5km from the rig; part of the anchoring hold is provided by a proportion of the cables or chains lying on the seabed (catenary).
Drilling discharges	Typically around 1,000 tonnes of cuttings result from an exploration 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.
Rig/vessel presence and movement (incl. helicopters)	On site, the rig is supported by supply and standby vessels. Supply vessels typically make 2-3 supply trips per week between rig and shore. Helicopter trips to transfer personnel to and from the rig are typically made several times a week.

DECC routinely seeks advice from other Government Departments[2] and statutory nature conservation agencies in considering applications for activity approval. On announcement of each seaward licensing Round, DECC issues a list of "other regulatory requirements", providing guidance on Block specific issues and concerns. Depending on the activity and the nature of the sensitivity, these concerns may affect DECC's decision whether or not to approve particular activities at specified times.

The guidance indicates seasonal concerns for the Blocks considered in this assessment (Table 2.2). Those seasonal concerns identified for seismic survey are related to fish spawning within the months indicated. Drilling related concerns are for periods of very high seabird vulnerability to surface pollution (see Section 7.2.3). There is little evidence of well-defined seasonal patterns associated with the abundance and distribution of most cetacean species. It is therefore difficult to single out areas/times for which seismic surveying would be less advisable. DECC recommends[3] that cetacean sensitivity is considered in relation to each individual project, and also advises applicants to seek advice directly from JNCC and Defra.

Figure 2.1 provides an overview of the plan process which has led to the 27th Licensing Round and the various environmental requirements including HRA. Figures 2.2 and 2.3 outline the stages for subsequent activities and environmental requirements for the work programmes (drilling and seismic survey) indicated by applicants for the blocks subject to assessment. These simplified flow diagrams indicate other stages of assessment typically undertaken prior to activities being permitted/consented. They highlight the regulatory requirements and environmental responsibilities at various stages in the development of the plan or exploration level activity, and further opportunities/requirements for project level environmental assessment and HRA. These Figures show that all activities which could give rise to significant effects on the integrity of relevant sites are subject to regulatory control, including HRA as necessary with consultation with statutory nature conservation bodies. Applications for consent to conduct activities are required to include assessment of potential effects and identification of necessary mitigation measures. There are well proven methods to prevent significant impacts and site specific mitigation would be defined at the project level once the location and nature of activity were defined.

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 it is not regarded that a meaningful assessment of development level activity (e.g. pipelay, placement of jackets, subsea templates or floating installations) can be made at this stage for any given block in relation to relevant sites. Any information provided in relation to these activities is for context. All activities as part of

[2] DECC strongly advise early consultation with all the organisations relevant to location and nature of an operator's proposed activities.
[3] DECC 27th Round other regulatory issues.

exploration, appraisal and development are subject to individual permitting and environmental assessment (incorporating HRA where appropriate) prior to any consent being issued.

Table 2.2: 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)	-	-
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.*
Source: Other regulatory issues (DECC 27th Seaward licensing Round website).

Figure 2.1: Environmental obligations for the competent authority when licensing for offshore oil and gas

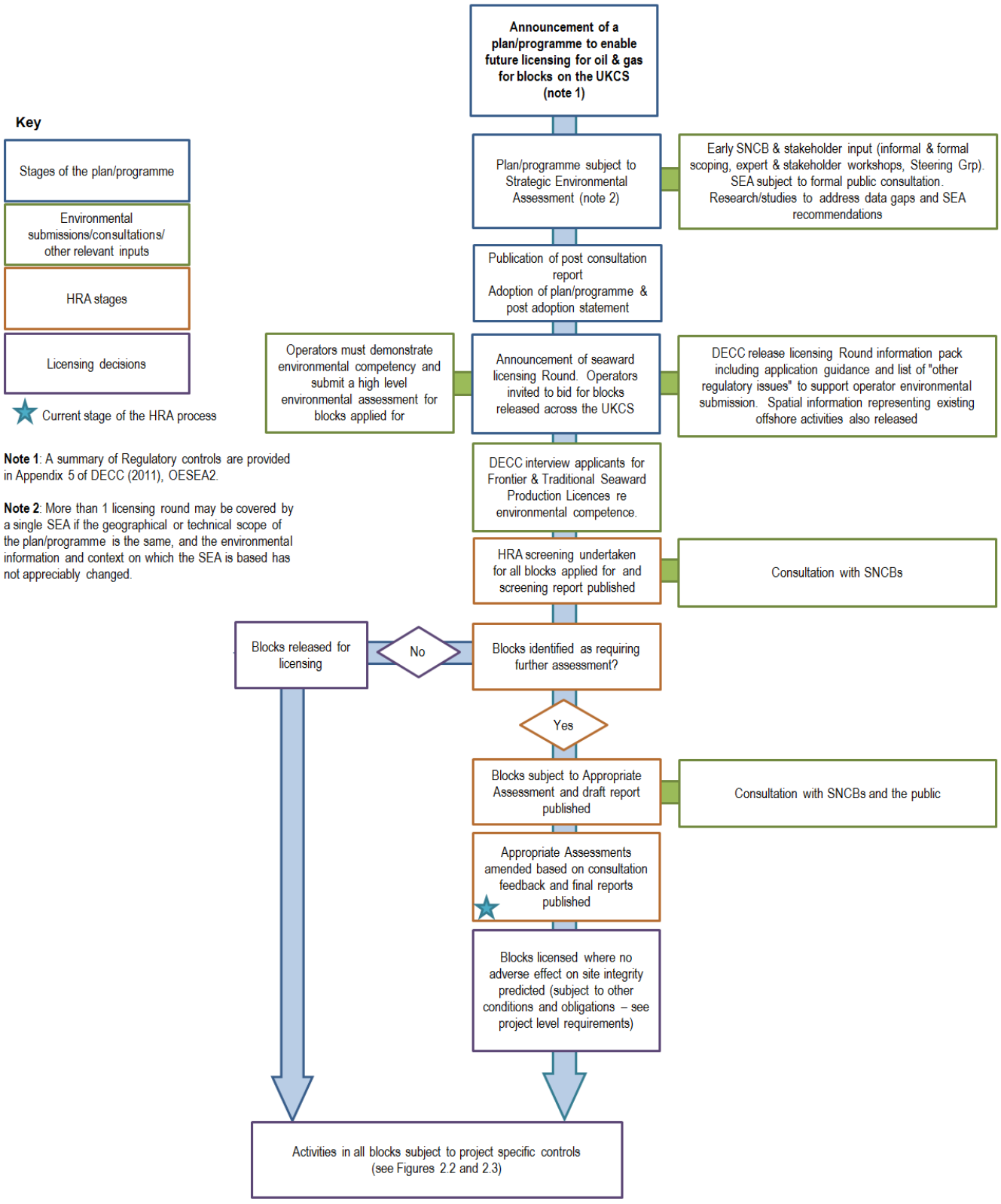


Figure 2.2: High level overview of exploration drilling environmental requirements[4]

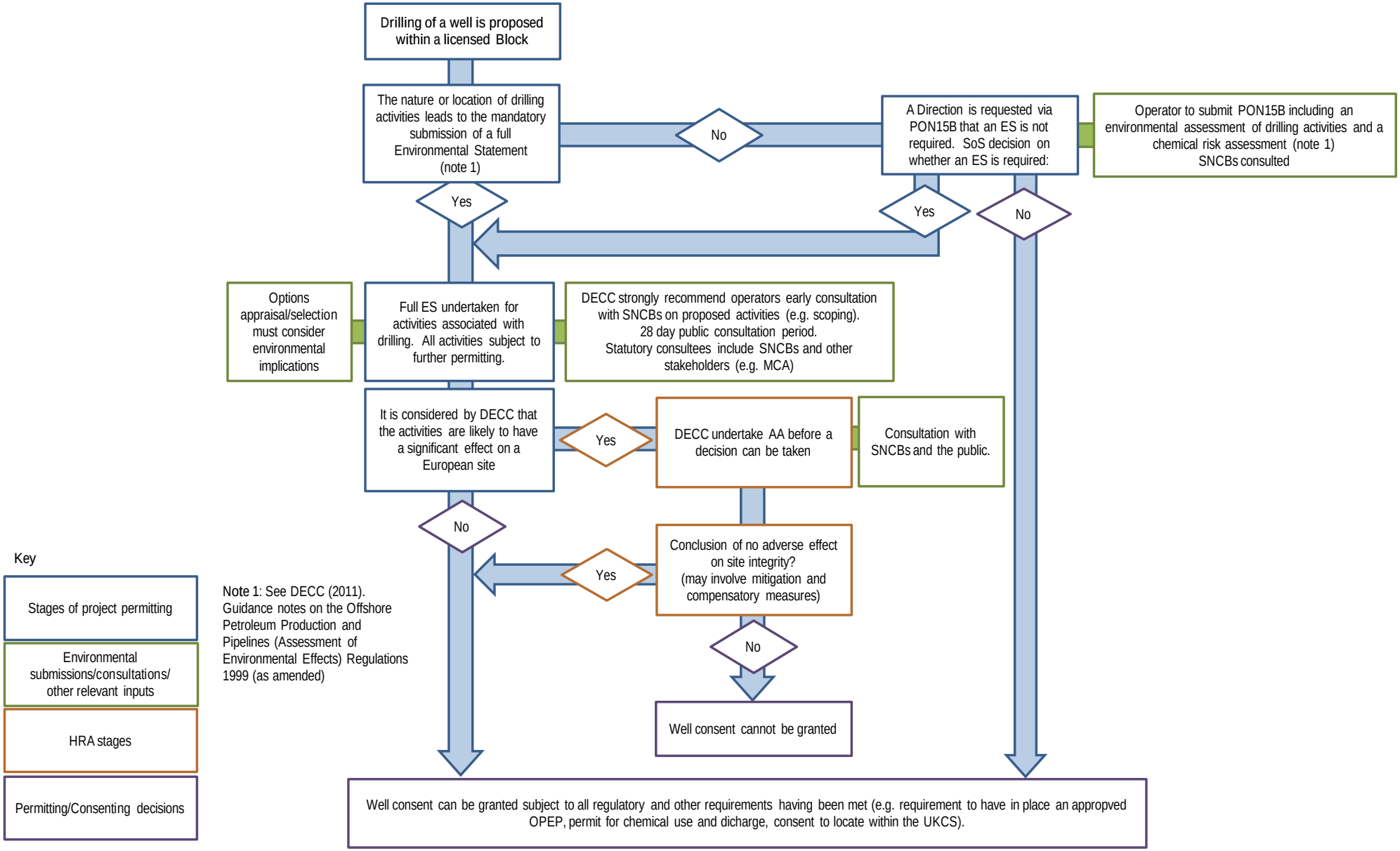
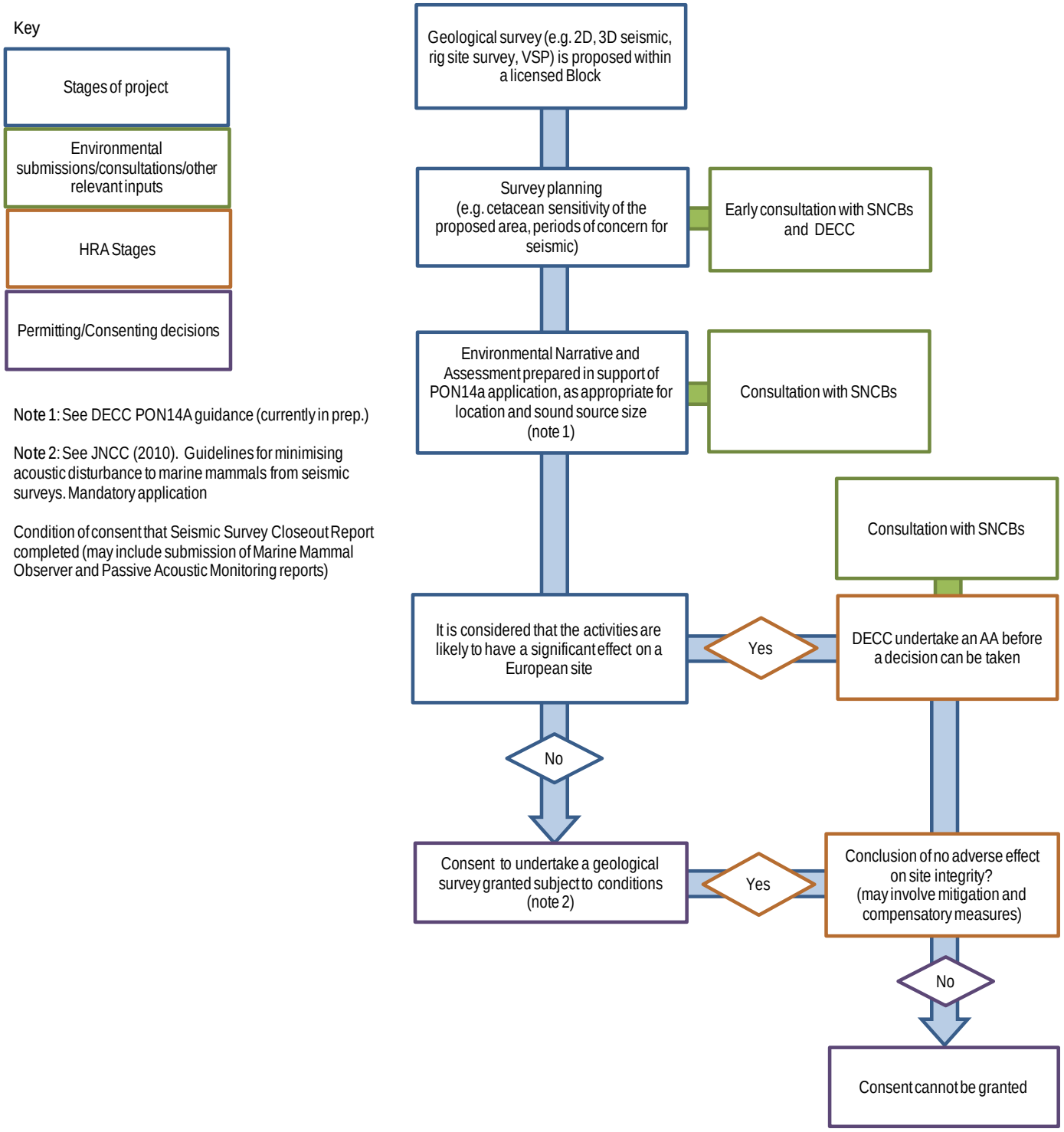


Figure 2.3: High level overview of seismic survey environmental requirements[4]



[4] The PON application processes referred to in Figures 2.2 and 2.3 are presently being replaced with the Portal Environmental Tracking System (PETS). PETS will cover applications including those for Drilling Operations (formerly PON15B) and Marine Survey Notifications and Acoustic Survey Consents (formerly PON14A).

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 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.

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."* Despite reference to the Habitats Regulations not applying as a matter of policy to such sites, in accordance with the National Planning Policy Framework (DCLG 2012[5]) and Marine Policy Statement (HM Government 2011), the relevant sites considered include classified and potential SPAs, designated and candidate SACs and Sites of Community Importance[6] (SCIs). Information gathering is in progress to inform the potential designation of further Natura 2000 sites, for instance the work of Kober *et al.* (2010, 2012) – see Section 7 for a consideration. Should further sites be established in the future, these would be considered as necessary in subsequent

[5] 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.

[6] 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.

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).

In addition to European sites, the characteristics of broadscale physical and ecological features in the area are described in the Offshore Energy SEA (DECC 2011), Charting Progress 2 (Defra 2010) and the OSPAR Quality Status Report (OSPAR 2010).

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 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 in the Southern North Sea area, and those relevant to this Appropriate Assessment

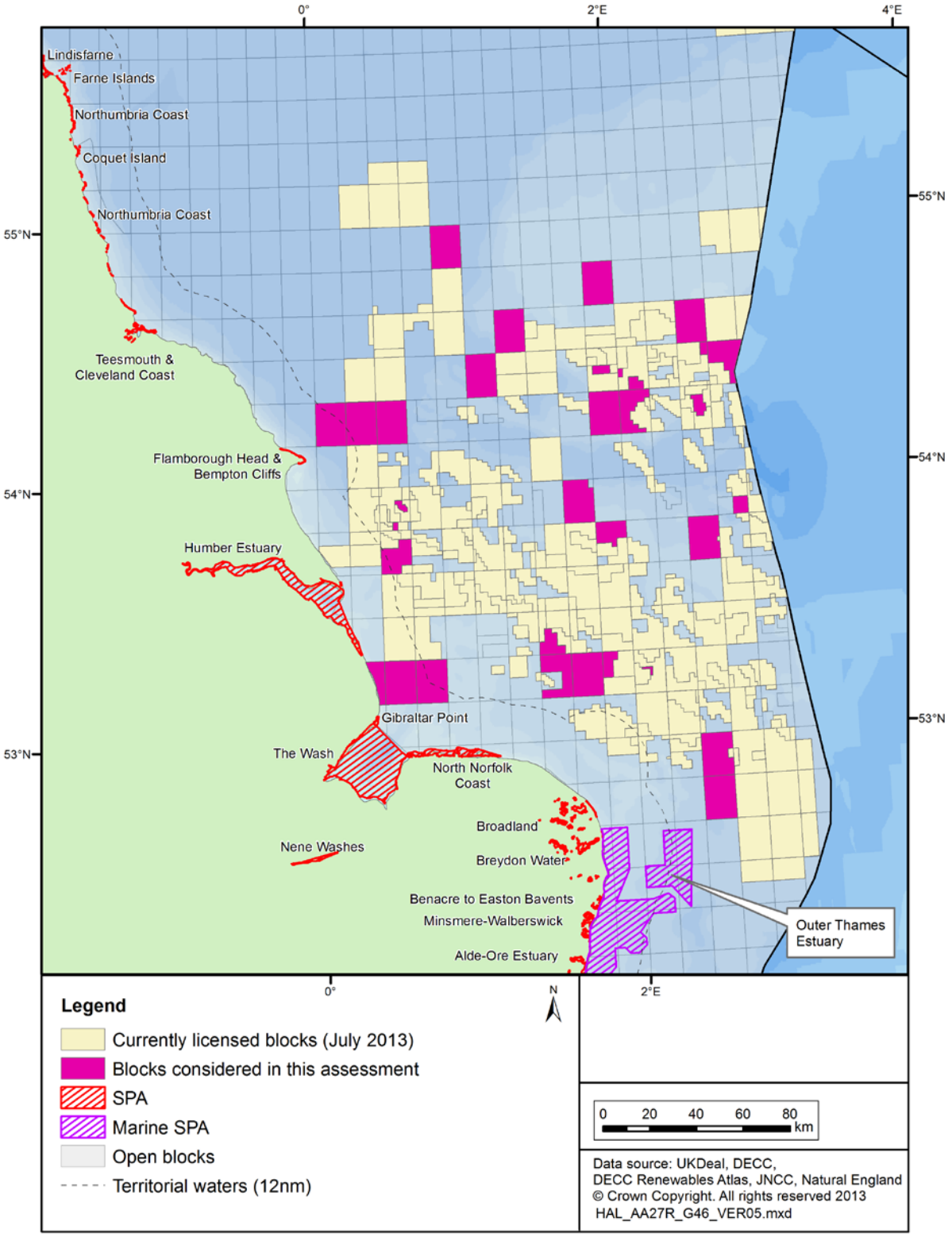


Figure 3.2: SACs in the Southern North Sea area, and those relevant to this Appropriate Assessment

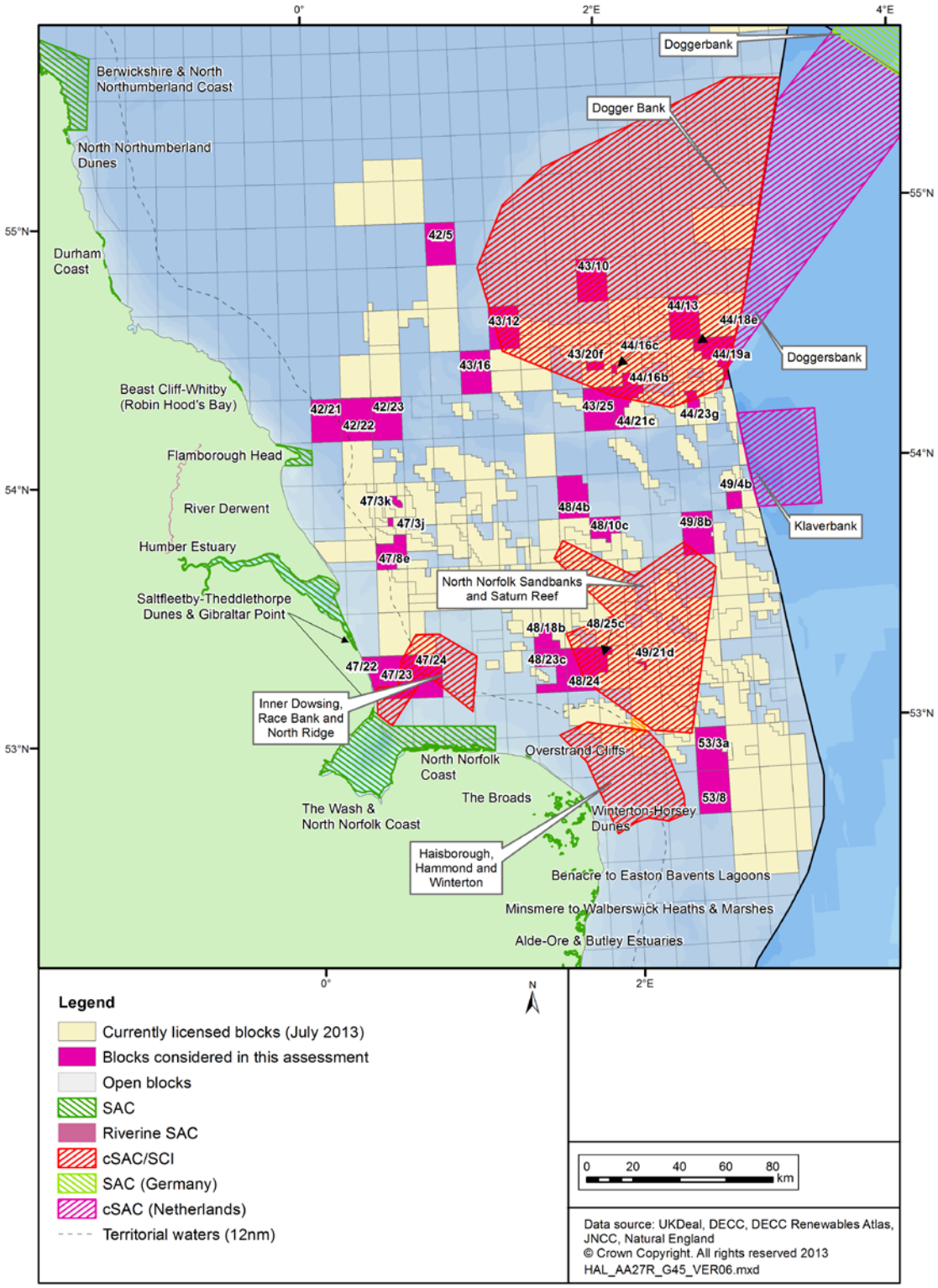


Table 3.1: SPA sites and qualifying features under Article 4.1 and 4.2 in the Southern North Sea area, and those relevant to this Appropriate Assessment (see Appendix A for full site details)

Note: B = Breeding, W = Over Wintering, P = On Passage

	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, 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															

	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
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																	
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 in the Southern North Sea area, and those 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 SCI	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																							
Scrub (mattoral)																							
Sea caves	P						P																
Sea cliffs			P			P	P					P											
Standing freshwater													P										

	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 SCI	North Norfolk Sandbanks and Saturn Reef SCI	Inner Dowsing, Race Bank and North Ridge SCI	Haisborough, Hammond and Winterton SCI
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 in the Southern North Sea area, and those 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 SCI	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:

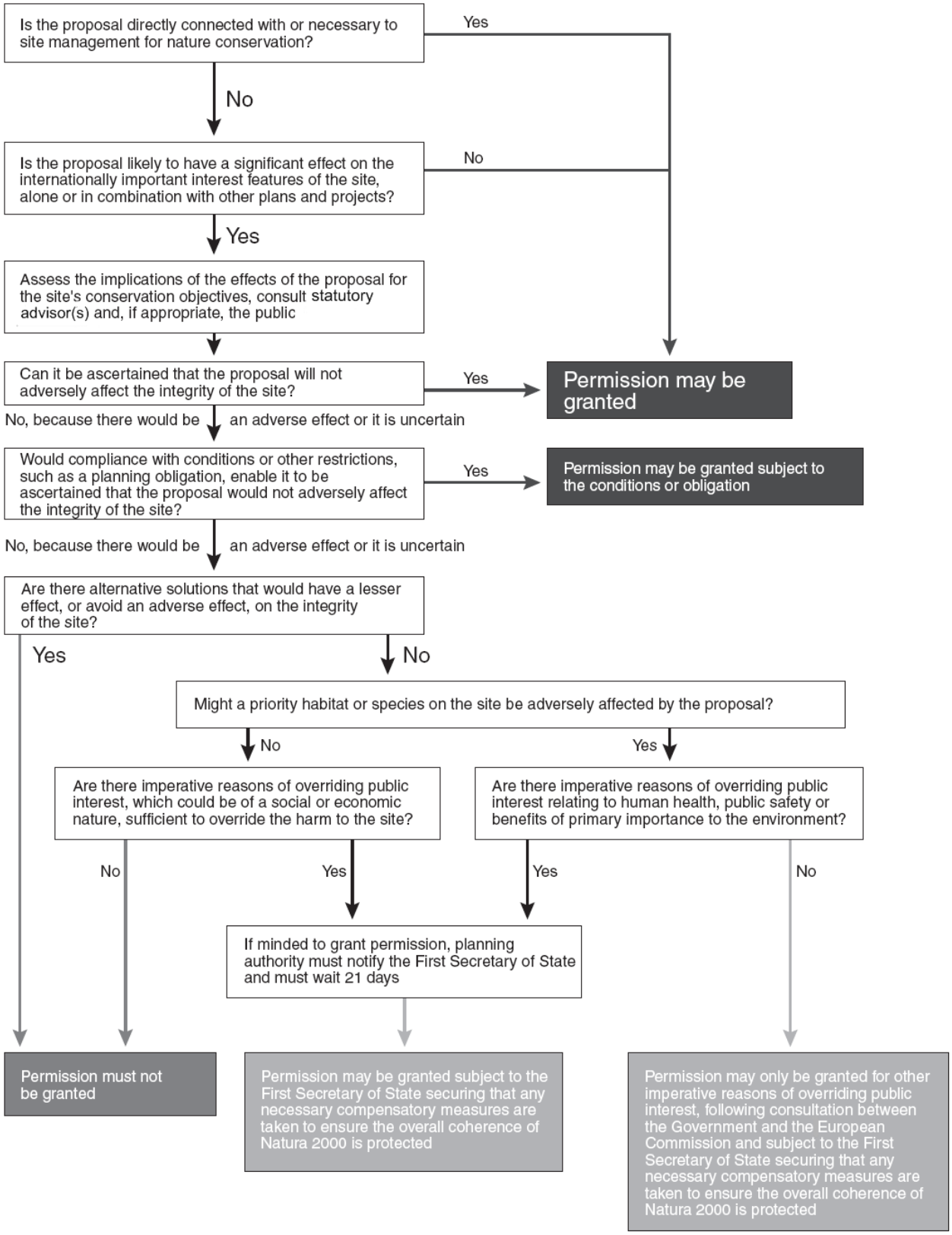
- Considered, on the basis of the precautionary principle, whether it could be concluded that the integrity of relevant sites would not be affected. This impact prediction involved a consideration of the cumulative and in-combination effects.
- Examined, in relation to elements of the plan where it was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

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 4.1). 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 relevant 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 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 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 sites, are discussed under the following broad headings:

- Physical disturbance and other effects (e.g. rig siting, marine discharges)
- Underwater noise (in particular, deep geological seismic and other site surveys, and VSP)
- 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[7] (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 (e.g. of rigs) or technology requirements (or a combination of one or more of these). There is a requirement that these options would also be evaluated in the environmental assessments necessary as part of activity consenting.

The Marine Evidence Group is attempting to address difficulties in assessing the impacts of marine development on European sites and species, in particular gaps in evidence which create uncertainties when undertaking HRA. A report by the group (Defra 2013) provides an overview of the key evidence gaps identified in the Habitats and Wild Birds Directives Implementation Review and progress in addressing them, as well as a set of initial recommendations covering how the evidence base can be improved and how this might be built into the decision making process, which includes improving access to marine data. The areas identified in the review as having information gaps/requiring further research include:

- Modelling of effects on population of seabirds and validating critical input parameters, e.g. population framework, collision and displacement risk
- Modelling of effects on populations of marine mammals and validating critical input parameters, e.g. population framework, displacement risk
- Impacts of marine activity (e.g. offshore wind, cabling) on the seabed and priority species
- Cumulative impacts of marine activities
- Understanding better the specific impacts of different marine sectors and how they can be avoided and the solutions more widely applied
- Understanding better the populations of mobile species at appropriate scales and the population implications of any impacts from significant infrastructure projects in English waters

Many of these gaps (e.g. collision risk) are chiefly of relevance to marine renewable energy developments, although some have applicability to oil and gas activities.

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). 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.

As part of the Habitats and Wild Birds Directives Implementation Review[8], Natural England and JNCC are also in the process of reviewing and updating the existing Conservation Objectives for

[7] The Conservation of Habitats and Species Regulations 2010.
[8] Report of the Habitats and Wild Birds Directives Implementation Review - http://www.Defra.gov.uk/publications/files/pb13724-habitats-review-report.pdf

all European sites, including Marine sites[9]. 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 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, including a site-specific consideration of conservation objectives in relation to activities outlined in the work programmes which may arise from licensing the blocks subject to assessment. The basis and primary concern of the conservation objectives are to maintain or achieve favourable conservation status. Table 4.1 provides a definition of conservation status based on Articles 1(e) and (i) of the Habitats Directive.

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

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

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

High level controls and mitigation measures are in place for each of the broad sources of effect listed above (see Figures 2.2 and 2.3, and Table 4.2). These mitigation measures, which are discussed in more detail in Sections 5-8, should *inter alia* help to avoid the deterioration of any qualifying habitats, and habitats supporting species, and seek to prevent undermining any of the conservation objectives for a given site in relation to the features for which it is designated. These high-level mitigation measures can be partly interpreted as "...conditions or other restrictions such as a planning obligation, [compliance with which would] enable it to be ascertained that the proposal would not adversely affect the integrity of the site" (see Figure 4.1, above), though also represent other non-statutory guidance etc. with regards to the avoidance of significant effects on sites. Where it is considered 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 4.2: High level mitigation measures identified for potential sources of effect

	High level Mitigation
Physical disturbance	Most Blocks under consideration are at least several kilometres offshore and remote from Natura 2000 sites. Potential disturbance of certain species (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 Environmental Statements, HRAs (where necessary) and chemical risk assessments under existing permitting procedures.
Other effects	The IMO International Convention for the Control of Ballast Water and Sediment serves to mitigate against the possible introduction of invasive alien species through shipping ballast, which may degrade sensitive local habitats and communities. Measures include the mid-ocean exchange of ballast water (with ultra-violet irradiation of ballast a proposed alternative). The potential for collision of birds with offshore infrastructure, increased by attraction of birds to lights may be mitigated by limiting well testing to the minimum time required to satisfy test objectives and limit any flaring required to that which meets the technical requirements of processing. Rescheduling of activities, for instance by avoiding or limiting activities during months when large numbers of birds aggregate in the area, could help to reduce the risk of bird collision.
Underwater noise	Application for consent to conduct seismic and other geophysical surveys – PON14 Seismic operators are required, as part of the application process, to justify that their proposed activity is not likely to cause a disturbance etc. under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) and *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended).

High level Mitigation	
	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, NE and other relevant organisations. Additional conditions imposed by DECC, through block-specific licence conditions (i.e. "Essential Elements"), and seasonal periods of concern for drilling, within which there is a presumption for drilling activity to be refused unless appropriate mitigation measures can be agreed (defined at the project level). Project level mitigation defined through permitting/HRA of specific activities (including conditions attached to consents/permits or potentially consent/permit refusal). MCA is responsible for a National Contingency Plan and maintains a contractual arrangement for provision of aerial spraying, with aircraft based at East Midlands and if necessary, Inverness and counter-pollution equipment (booms, adsorbents etc.). The UK Government announced in 2012 that an Emergency Towing Vessel for the waters around the Northern and Western Isles will be stationed in Orkney up to 2015[10]. The government has also been in discussions with the oil industry on the potential of a commercial call-out arrangement to use their vessels[11] and BP have recently agreed to volunteer a vessel to help in an emergency should the MCA deem it appropriate[12].
In-combination effects	The competent authorities will assess the potential for in-combination effects during HRAs of project specific consent applications; this process will ensure that mitigation measures are put in place so that subsequent to licensing, specific projects (if consented) will not result in adverse effects on the integrity of European sites.

[10] Orkney Islands Council website - http://www.orkney.gov.uk/OIC-News/emergency-vessel-to-be-stationed-in-orkney.htm
[11] Scotland Office website - http://www.scotlandoffice.gov.uk/scotlandoffice/17322.html
[12] https://www.gov.uk/government/news/moore-welcomes-bp-and-north-star-support-for-second-support-vessel

5 Consideration of sites & potential physical & 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 relevant 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 exploration and appraisal 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 although post-well

sediments may vary in the immediate vicinity of the well compared to the surrounding seabed. The time taken for full seabed recovery will depend on location, sediment type, and water depth.

Activities following the initial term (platform/subsea template installation and pipelay) would only take place following successful appraisal of potential hydrocarbon reserves, and would be subject to further assessment including HRA (where appropriate) at that stage.

The use of anchors by drill rigs 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 (e.g. Foden *et al.* 2009).

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).

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.

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 dump may be undertaken to protect against scour in areas of strong tidal currents for rig stability. 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 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, 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 where relevant, 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 Notice for drilling activities (PON15B) and where relevant HRAs to underpin those applications. Provisions under the Marine and Coastal Access Act (2009) include certain activities such as decommissioning operations previously covered by the Food and Environment Protection Act which are now permitted through 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. Drilling activities outlined above require individual survey of the proposed rig location, reports from which are used to inform the technical feasibility of drilling. Additional survey work may be required, such as limited benthic survey, but this is considered on a case by case basis. Subject to the results of such surveys, the location of activities could be altered and/or additional survey work undertaken. Such reports are used to underpin operator environmental submissions (e.g. PON15B and Environmental Statements) and are typically made available to nature conservation bodies during the consultation phases of these assessments.

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). Discharges during the exploration phase are restricted to those associated with drilling and related support activities.

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, offshore treatment prior to discharge or reinjection of a proportion of waste material (DECC 2011).

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

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

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 2.2), 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 drilling rig-derived discharges, a range of discharges are associated with 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 Chemicals Regulations 2002 made in 2011 clarify the definition of chemical discharges to include a "discharge" as captured under the relevant operational permit, and a "release" which is any other emission of chemicals outside of that covered by the permit whether as a result of operational requirements or accident. 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. Discharges are considered in detail in project-specific Environmental Statements, HRAs (where necessary) and chemical risk assessments[13] (e.g. PONs) under existing permitting procedures (See Figure 2.2).

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[14] 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

[13] Note that most chemicals used offshore are regarded to Pose Little or No Risk (PLONOR) to the marine environment. Chemicals containing substances marked for substitution (as shown on OSPAR prescribed lists) are due to be phased out by 2016 where their continued use cannot be justified (e.g. due to there being no technical alternative). Offshore operators are currently required to justify the use and/or discharge of candidates for substitution each time that they submit an application for a chemical permit (e.g. PON15B) – see Figure 2.2.
[14] Number of states required to ratify the Convention for it to come into force.

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.

As described in Section 7.3.3.1, the Southern North Sea including the area of the Blocks may support important numbers of seabirds at certain times of the year including overwintering guillemot (October-April) (Kober *et al.* 2010). A number of the Blocks are also within the foraging ranges of qualifying species from coastal SPAs (Table 7.3). Therefore, the presence and/or movement of vessels from and within many of the Blocks during drilling activities could potentially disturb foraging seabirds from coastal sites within the Southern North Sea. However, given the projected limited scale and nature of the activities, and because mitigation is possible (which would be identified during activity specific assessment and permitting processes), adverse effects on the integrity of sites are not expected.

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 (e.g. Outer Thames Estuary SPA). Such disturbance can result in repeated disruption of bird feeding, loafing and roosting. The vulnerability of the red-throated diver within the Outer Thames Estuary SPA to disturbance by noise and visual presence from shipping and other activities is considered to be high. Red-throated divers can be disturbed by wind turbine rotors, boat movements, and general activity. Disturbance can cause birds to reduce or cease feeding in a given area or to fly away from an area (i.e. be displaced). Either response could decrease their energy intake rate at their present (disturbed) feeding site or alternative feeding site, which may be less favoured[15]. With respect to oil and gas activities, available mitigation measures include strict use of existing shipping and aircraft routes, and timing controls on temporary activities to avoid sensitive periods. 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. It is considered this source of potential effect will not result in significant disturbance because of the location of the Blocks outside the SPA site, the projected limited scale and nature of activities, and because mitigation is possible which would be identified during activity specific assessment and permitting processes.

Since 2008, a number of dead seals (>76 animals) displaying corkscrew injuries (Bexton *et al.* 2012) have been found primarily on beaches in eastern Scotland, North Norfolk coast and Strangford Lough (Thompson *et al.* 2010). The injuries are consistent with those that might be expected if the seals had been drawn through a ducted propeller or some types of Azimuth

[15] JNCC & Natural England. Outer Thames Estuary Special Protection Area. Draft advice under Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010 (as amended) and Regulation 18 of The Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007 (as amended). Version 3.7 (March 2013).

thruster (widely used in marine industry vessels), although there is presently no definitive evidence to confirm this (SNCB 2012).

A SMRU research project is underway and in the interim, advice by the statutory nature conservation bodies (SNCB) sets out recommendations for regulators and industry with regards to understanding and minimising the risk of corkscrew injury to seals (SNCB 2012). For high risk areas (defined as within 4nm of a harbour seal SAC and areas where the harbour seal population is in significant decline), current SNCB advice is to consider alternatives to using ducted propellers or avoid the breeding season (1st June-31st August). If these measures are not possible then a Seal Corkscrew Injury Monitoring Scheme should be considered. Guidance for medium risk areas (activity proposed to take place between 4 and 30 nautical miles of a harbour seal SAC or within 4 nautical miles of a grey seal SAC) is similar with the grey seal breeding season identified as 1st October-31st December. Activities proposed to take place beyond 30nm from a harbour seal SAC and 4nm from a grey seal SAC are regarded as having a low risk and no mitigation measures are proposed. The SNCB advice will be reviewed as understanding of the issue improves. A number of Southern North Sea Blocks fall within the definition of medium risk areas (within 30 nm) with respect to The Wash and North Norfolk Coast SAC (harbour seal). Given the temporary nature of the drilling and support activities that could follow licensing and the recommended mitigation, adverse effects on the integrity of sites are not expected.

The seal density maps presented in Figure 6.1 indicate that defined areas of the Southern North Sea may be important for both grey and harbour seals. Radiating out from the Humber Estuary, grey seals appear to use areas along the north Yorkshire coast, out to the Dogger Bank area and from the Humber Estuary to an offshore area to the west (Figure 6.1a). Harbour seals use a more restricted area radiating out from the Wash (Figure 6.1b). A number of Blocks are within or close to areas of low to moderate seal usage. Block 44/19a abuts a Dutch European site, the Doggersbank cSAC (relevant qualifying features include harbour porpoise, grey and harbour seal). Therefore, the presence and/or movement of vessels from and within any of the Blocks during drilling activities could potentially disturb foraging marine mammals within or close to some of the Blocks. However, given the distance of the Blocks from relevant SACs, the low number of individual marine mammals likely to be present over the Blocks at any one time, and the limited temporal and spatial footprint of potential activities, no adverse effect on site integrity associated with the presence and/or movement of vessels from and within any of the Blocks is predicted.

Oil and gas development that could follow on from the exploration activities outlined in the Block work programmes could include platform installation, though oil and gas developments are increasingly based on subsea infrastructure and therefore any disturbance at the sea surface is reduced to periods of construction and decommissioning. The likelihood of significant disturbance to species is further reduced as a result. Development level activities involving oil production and processing may be subject to EIA and require permitting for individual activities including drilling, pipelay, and discharges, and project level HRA will also be undertaken where appropriate. It is therefore concluded that adverse effects on the integrity of sites from physical disturbance are not expected.

5.5 Implications for relevant 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 SCI, 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.

5.5.1 Dogger Bank SCI

The Dogger 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. Sand eels are abundant on the flanks of the bank and provide a food resource for seabirds, cetaceans and other commercial fish species, such as cod.

The qualifying sandbank feature is exposed to physical loss through obstruction by the following pre-existing infrastructure: twenty-one wellheads to the south of the site; four active and one pre-commission gas platforms; two other un-described forms of infrastructure, both active; nine gas pipelines, the longest of which runs approx 78km across site, along the west of the site, one of which is inactive; and 4 telecom cables, the longest of which runs 116km from west to east across the site. The exposure is considered low as each discrete obstruction of the feature is small compared to the size of the site (total coverage is less than 1% of the site area). The feature and its associated biological communities may be exposed to smothering from oil and gas drill cuttings – this would be assessed through individual activity permitting. Any activity would be of limited duration and extent, and as such exposure to this pressure is considered low[16].

Discharges that would be associated with any Block specific activity would be assessed through established regulatory mechanisms prior to activities being permitted, including the use and discharge of chemicals[13].

5.5.2 North Norfolk Sandbanks and Saturn Reef SCI

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. One particular polychaete, the ross worm *Sabellaria spinulosa*, can form biogenic reefs from its fragile sand-tubes which create a solid structure that stands above the surrounding sandy seabed. The Saturn reef is such a structure.

JNCC advice on operations with respect to the site indicates that there is a relatively large amount of hydrocarbon activity within the site boundaries, with over 30 wells, 40 fields, over 70 pipelines some of which transect sand banks. Localised impacts would be expected around such infrastructure although there is no evidence of the existing structures impairing natural sandbank development. JNCC advise that during consenting the competent authority (in this instance DECC) take into account the cumulative impacts of existing infrastructure.

Gas exploration and field development avoid areas where *Sabellaria spinulosa* reef is found (informed by detailed seabed survey and consultation with conservation agencies), obviating interaction. Existing infrastructure could present a continued obstruction to the natural location of *S. spinulosa* reef within the site although it is not possible to quantify this given the uncertainty around its current extent and location within this site.

The sandbanks and reef features may be exposed to both synthetic and non-synthetic compounds due to onsite oil and gas industry activities. Discharges that would be associated

[16] JNCC. Offshore Special Area of Conservation: Dogger Bank Conservation Objectives and Advice on Operations. Version 6.0 (March 2012).

with any Block specific activity would be assessed through established regulatory mechanisms (see Figure 2.2) prior activities being permitted, including the use and discharge of chemicals[13].

5.5.3 Inner Dowsing, Race Bank and North Ridge SCI

Inner Dowsing, Race Bank and North Ridge is located off the south Lincolnshire coast and has been recommended for sandbank and *S. spinulosa* reef communities. A wide range of sandbank types are enclosed by the boundary including banks bordering channels, relict linear banks and sinusoidal banks. The main areas of *S. spinulosa* reef are found in the south-west of the site. These areas support a diverse community of bryozoans, hydroids, sponges and tunicates.

With respect to the site, advice on operations indicates that the placement of oil and gas infrastructure and offshore wind farm cables on the seabed both removes habitat and obstructs some areas of the features. Overall the vulnerability of the dynamic sand communities and gravelly muddy sand communities (sub-features of the sandbank habitat) to obstruction is moderate, and to smothering is low. The reef feature is considered to have higher exposure to obstruction than the sandbank feature as the affected proportion of this habitat is higher although the absolute amounts of habitat loss are small. Overall the vulnerability of *S. spinulosa* reef within the site to obstruction is considered to be high[17].

Rig siting associated with any Block specific activity would be subject to site survey and an associated environmental assessment (e.g. EIA and HRA where necessary) and mitigation, including rig placement. Discharges that would be associated with any Block specific activity (including that of cuttings) would be assessed through established regulatory mechanisms prior activities being permitted, including the use and discharge of chemicals[13].

5.5.4 Overall consideration

All of 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. 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

[17] JNCC & Natural England. Inner Dowsing, Race Bank and North Ridge candidate Special Area of Conservation Formal advice under Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010 (as amended), and Regulation 18 of The Offshore Marine Conservation Regulations (Natural Habitats, &c.) Regulations 2007 (as amended). Version 4.0 (January 2013).

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.

Table 5.1 provides a consideration of potential physical and other impacts associated with the Block work programmes and the conservation objectives of relevant 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. 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. These would be applied at the project level, at which point there will be sufficient definition to make an assessment of likely significant effects, and for applicants to propose project specific mitigation measures.

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 relevant 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 relevant sites.

Table 5.1: Consideration of potential physical and other impacts and relevant site conservation objectives

Relevant sites	Relevant qualifying features	Relevant Blocks	Consideration against conservation objectives (see Appendix C)
Dogger Bank SCI	Sandbanks	43/10, 43/12, 43/20f, 43/25, 44/13, 44/16b, 44/16c, 44/18e, 44/19a, 44/21c, 44/23g	**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. **Rig installation/placement** Moderate vulnerability of feature to obstruction by infrastructure associated with oil and gas activities. Seabed footprint associated with placement of jack up rig is small and temporary (Section 5.2) and unlikely to significantly impact the extent and structure of the feature given the small footprint compared to the size of the site. The scale of potential impact will be determined by the location and nature of activities which are currently unknown. **Drilling discharges** Low vulnerability of feature to smothering by drill cuttings. The impacts from such discharges are localised and transient (Section 5.3). Unlikely to significantly impact the extent and structure of the qualifying feature. The scale of potential impact will be determined by the location and nature of activities which are currently unknown. **Additional mitigation** With respect to the relevant Blocks, DECC will expect the operator to provide sufficient information on the potential impact of the proposed activity on the qualifying site in the application. Based on the advice from SNCBs, DECC may undertake an HRA to determine whether the proposals will have an adverse impact on the site integrity that would undermine the site conservation objectives. Depending on the outcome of the assessment, DECC may agree on mitigation measures or refuse consent.
North Norfolk Sandbanks and Saturn Reef SCI	Sandbanks, reefs	48/24, 48/25c, 49/8b, 49/21d	**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. **Rig installation/placement** High vulnerability of sandbank and reef feature to obstruction by infrastructure associated with oil and gas activities. Seabed footprint associated with placement of jack up rig small and temporary (Section 5.2). The scale of potential impact will be determined by the location and nature of activities which are currently unknown. **Drilling discharges** Vulnerability of features to cuttings not quantified. However, the impacts from such discharges are

Relevant sites	Relevant qualifying features	Relevant Blocks	Consideration against conservation objectives (see Appendix C)
			localised and transient (Section 5.3). The scale of potential impact will be determined by the location and nature of activities which are currently unknown. **Additional mitigation** With respect to the relevant Blocks, DECC will expect the relevant operator to provide sufficient information on the potential impact of the proposed activity on the qualifying site in the application. Based on the advice from SNCBs, DECC may undertake an HRA to determine whether the proposals will have an adverse impact on the site integrity that would undermine the site conservation objectives. Depending on the outcome of the assessment, DECC may agree on mitigation measures or refuse consent.
Inner Dowsing, Race Bank and North Ridge SCI	Sandbanks, reefs	47/22, 47/23, 47/24	**Conservation objectives:** Subject to natural change, maintain* or restore* the sandbanks in favourable condition, in particular the sub-features: • Gravelly muddy sand communities • Dynamic sand communities Subject to natural change, maintain or restore the reefs in favourable condition. **Rig installation/placement** Moderate and high vulnerability of sandbank and reef feature, respectively to obstruction by infrastructure associated with oil and gas activities. Moderate vulnerability of reef feature to anchoring (although none of the Blocks overlap the documented extent of the reef feature). Seabed footprint associated with placement of jack up rig small and temporary and does not involve extensive anchoring (Section 5.2). The scale of potential impact will be determined by the location and nature of activities which are currently unknown. **Drilling discharges** Low vulnerability of sandbank feature to smothering by drill cuttings. The impacts from such discharges are localised and transient (Section 5.3). The scale of potential impact will be determined by the location and nature of activities which are currently unknown. **Additional mitigation** With respect to the relevant Blocks, DECC will expect the relevant operator to provide sufficient information on the potential impact of the proposed activity on the qualifying site in the application. Based on the advice from SNCBs, DECC may undertake an HRA to determine whether the proposals will have an adverse impact on the site integrity that would undermine the site conservation objectives. Depending on the outcome of the assessment, DECC may agree on mitigation measures or refuse consent.

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 survey because of potential adverse effects on fish spawning have been identified for the Blocks (see Table 2.2) 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 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 sites, such as harbour seal *Phoca vitulina*, grey seal *Halichoerus grypus* (e.g. 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 squid may form an important component of the diet of qualifying species of relevant 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 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 Block activity 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 (e.g. Section 5.3 of OESEA2 Environmental Report (DECC 2011), 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

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.

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.

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 geological 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 relevant 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 relevant 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[18] (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 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

[18] Lucke *et al.* (2007) noted that the study harbour porpoise had an elevated hearing threshold compared to published audiograms which may have been due to auditory masking in the relatively noisy test environments or electrical "masking" in their equipment. They suggested therefore that the measured effects should be considered masked temporary threshold shifts (MTTS). MTTS is detected at higher exposure levels than TTS.

the noise source. Where necessary, 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.

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[19].

Derived from aerial surveys of breeding colonies, the minimum number[20] 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

[19] 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

[20] 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.

monitoring to confirm the magnitude and geographical extent of the declines (SCOS 2008, 2010).

Similar advice with respect to the Humber Estuary[21] and The Wash and North Norfolk Coast[22] SACs indicates that both grey and harbour seals are "…highly sensitive and vulnerable to both visual and noise disturbance", which can have the effect of displacing them from their hauled out areas or breeding grounds. The advice further states that, "Seals affected by such disturbance may move to an alternative and perhaps less favourable site, or increase their energy intake through stress". Pup production may also be affected. Grey seals spend a large proportion of their time in the water within the sites.

Recent studies of foraging at sea by harbour seals have been funded by SNH and DECC (Sharples *et al*. 2005, 2008, 2012). 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).

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. 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).

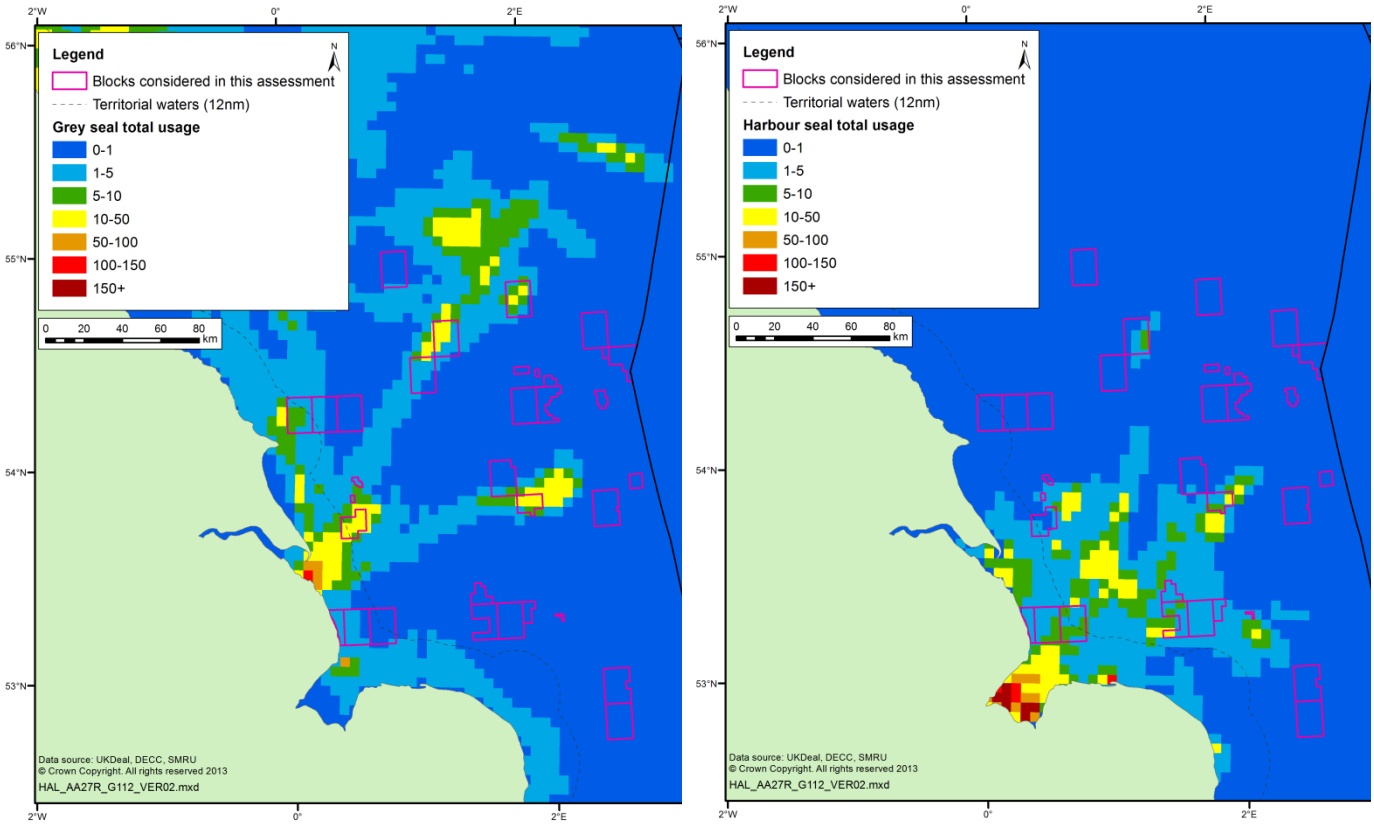
Maps showing the at-sea distribution of grey and harbour seals around the UK have been produced (Marine Scotland website[23]). The density maps (Figure 6.1) indicate that defined areas of the Southern North Sea are important for both grey and harbour seals. Radiating out from the Humber Estuary, important areas for grey seals appear to be along the north Yorkshire coast, out to the Dogger Bank area and from the Humber Estuary to an offshore area to the

[21] 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.
[22] 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. June 2000.
[23] http://www.scotland.gov.uk/Topics/marine/science/MSInteractive/Themes/seal-density

west (Figure 6.1a). Harbour seals use a more restricted area radiating out from the Wash. A number of Blocks are within or close to areas of low to moderate seal usage.

Figure 6.1: Estimated total density of seals in the Southern North Sea area

a) Grey seals **b) Harbour seals**



Source: Marine Scotland website

6.4.1.3 Consideration

Simple calculations of sound propagation[24] can be made to estimate the likely maximum received sound levels at the boundaries of relevant sites should a typical deep geological seismic survey occur in any of the Blocks (Table 6.2) as indicated by the work programmes (see Section 2.2).

[24] Most environmental assessments of noise disturbance use simple spherical propagation models of the form SPL = SL – 20log(R), where SL = source level, R = source-receiver range, to predict sound pressure levels (SPL) at varying distances from source. Cylindrical spreading, SPL = SL – 10log(R), is usually assumed in shallow water, depth < R, where reflection of high frequency signals from the seabed results in approximately cylindrical propagation and therefore higher received spectrum levels than for spherically propagated low frequency signals (which penetrate the seabed). Given the large scale and varied water depths of the AA area, an intermediate spreading model, SPL = SL – 15log(R) has been used to inform the consideration (see Figure 5.2 in OESEA2 Environmental Report). However, several workers have measured or modelled additional signal modification and attenuation due to a combination of reflection from sub-surface geological boundaries, sub-surface transmission loss due to frictional dissipation and heat; and scattering within the water column and sub-surface due to reflection, refraction and diffraction in the propagating medium (see SEA 4 Environmental Report). In shallow water, reflection of high frequency signals from the seabed results in approximately cylindrical propagation and therefore higher received spectrum levels than for spherically propagated low frequency signals (which penetrate the seabed). Attenuation of signal with distance is frequency dependent, with stronger attenuation of higher frequencies with increasing distance from the source. Frequency dependence due to destructive interference also forms an important part of the weakening of a noise signal.

Table 6.2: Estimated received sound levels in relevant 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
Doggerbank SAC (Germany)	Harbour porpoise, harbour seal	180km from Block 43/25	152
Doggersbank cSAC (Netherlands)	Harbour porpoise, grey seal, harbour seal	50km from Block 43/25	160
Klaverbank cSAC (Netherlands)	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.

The received sound 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 characterised by low to very high marine usage by foraging harbour and grey seals (Figure 6.1) associated with the Humber Estuary and The Wash and North Norfolk Coast SACs. Noise levels suggested to cause auditory damage in pinnipeds 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.

Mitigation measures relevant to seismic survey are outlined in Section 6.5. Survey planning and implementation will be subject to consultation and post-activity reporting, and where necessary project level HRA will also be undertaken (see Figure 2.3).

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 SACs, 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, VSP, 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. No Blocks are located close to the entrance of the relevant sites and therefore seismic survey activities are not expected to have an adverse effect on the integrity of the SACs.

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

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.

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 to DECC 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 (see Figure 2.3). Consultations with Government Departments and other interested parties are conducted as standard prior to issuing consent, and JNCC, 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.

All seismic surveys in the UK are required as part of their consent to adhere to JNCC's *Guidelines for minimising the risk of disturbance and injury to marine mammals from seismic surveys* (August 2010 revision reflects amendments (2007 and 2009 amendments) to the *Conservation (Natural Habitats &c.) Regulations 1994 (Habitat Regulations) for England and Wales* and the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (Offshore Marine Regulation*s, as amended in 2009 and 2010). It is a condition of consents issued under Regulation 4 of the *Petroleum Activities (Conservation of Habitats) Regulations 2001* (& 2007 Amendments) for oil and gas related seismic surveys that the JNCC Seismic Guidelines are followed. European Protected Species (EPS) disturbance licences can also be issued under the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007*.

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

In their latest guidelines, JNCC (2010) advise that operators adopt mitigation measures which are appropriate to minimise the risk of an injury or disturbance offence[25] and stipulate, whenever possible, the implementation of several best practice measures, including:

- If marine mammals are likely to be in the area, only commence seismic activities during the hours of daylight when visual mitigation using Marine Mammal Observers (MMOs) is possible.

- Only commence seismic activities during the hours of darkness, or low visibility, or during periods when the sea state is not conducive to visual mitigation, if a Passive Acoustic Monitoring (PAM) system is in use to detect marine mammals likely to be in the area, noting the limitations of available PAM technology (seismic surveys that commence during periods of darkness, or low visibility, or during periods when the observation conditions are not conducive to visual mitigation, could pose a risk of committing an injury offence).

- Plan surveys so that the timing will reduce the likelihood of encounters with marine mammals. For example, this might be an important consideration in certain areas/times, e.g. during seal pupping periods near Special Areas of Conservation for harbour seals or grey seals.

- Provide trained MMOs to implement the JNCC guidelines.

- Use the lowest practicable power levels to achieve the geophysical objectives of the survey.

- Seek methods to reduce and/or baffle unnecessary high frequency noise produced by the airguns (this would also be relevant for other acoustic energy sources).

Passive acoustic monitoring (PAM) may be used as a mitigation tool where JNCC and country conservation agencies deem it appropriate. Periods of seasonal concern for seismic survey are also identified for a number of Blocks considered in this AA (see Table 2.2), for which there would be a presumption against such activity taking place.

Like any offshore activity, seismic surveys are considered on a case-by-case basis, and DECC have the discretion to issue consents with conditions specific to activity taking place and the sensitivities within the area. 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 8.3 for more information).

[25] Defined under Regulation 39 1(a) and 1(b) (respectively) of the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended).

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 (and where marine mammals utilise space outside such sites), 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 relevant 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), or a rig site and/or VSP survey be undertaken as part of proposed drilling operations further HRA may be required to assess the potential for adverse effects on the integrity of sites once the area of survey, source size, timing and proposed mitigation measures are known and can form the basis for a definitive assessment.

- It is considered reasonable to conclude that no adverse effects on the integrity of other SACs in the vicinity of the Blocks will result.

- The utilisation of areas outside the designated SAC boundaries is not well understood, but the known extensive range of grey and harbour seals, and available population monitoring indicates that neither previous activities, nor those associated with proposed licensing will undermine the conservation objectives of qualifying species.

- Individual activities (e.g. drilling, seismic) require individual consents which will not be granted unless the operator can demonstrate that the proposed activities which may include deep geological seismic survey, rig site and VSP surveys will not adversely affect the site integrity of relevant Sites. These activities will be subject to activity level EIA and HRA (where appropriate).

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[26] 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 (EERD), 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

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

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 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[27] with OPEP guidance updated in July 2012[28].

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 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

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

[28] 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

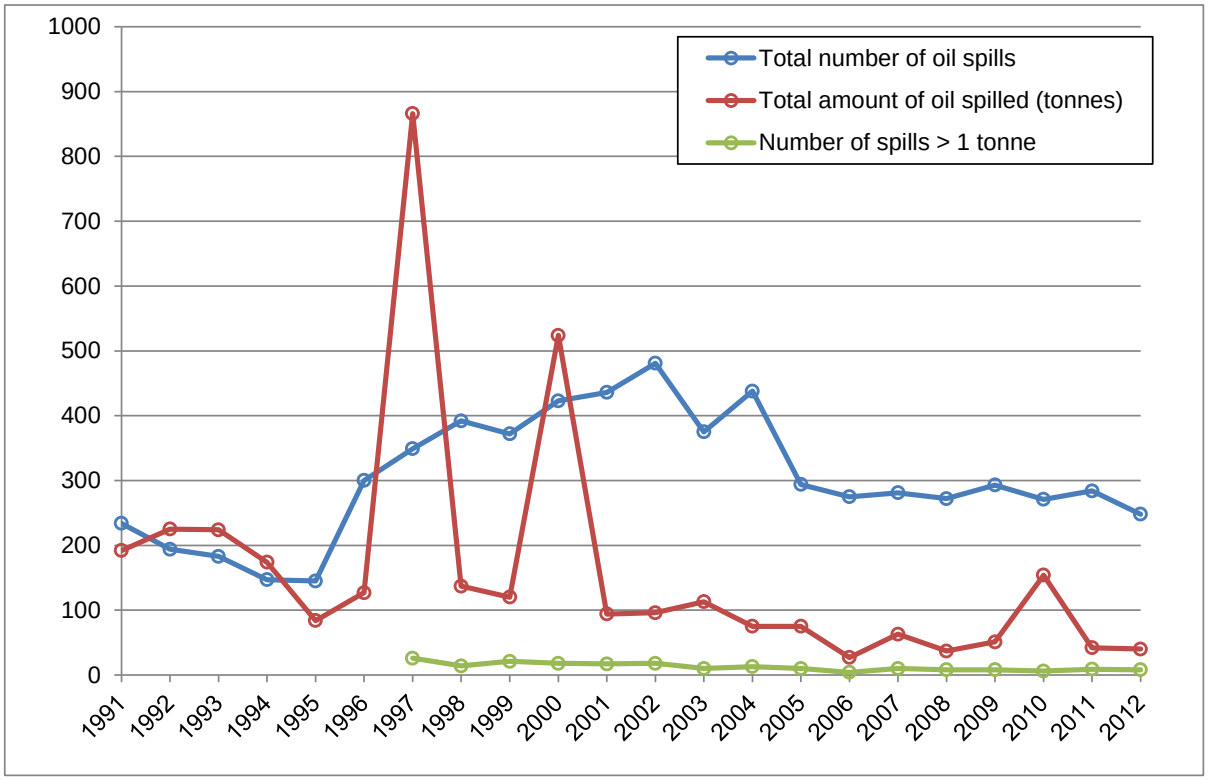
UKCS to date have been from West Vanguard (1985) and Ocean Odyssey (1988), both involving gas and not resulting in significant pollution.

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[29] (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 1991-2012



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 and

[29] Oil and chemical discharge notifications (accessed September 2013) https://www.gov.uk/oil-and-gas-environmental-data#pon-1-data

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.

Collisions between vessels and installations on the UKCS resulting in the spillage of significant quantities have oil have been few. Historical data (HSE 2001, OGP 2010) reveals that despite a significant increase in the number of offshore platforms and the use of mobile rigs on the UKCS, the mean incident frequency (i.e. a collision, irrespective of magnitude) over the period 1975-2001 has reduced, with data since 1995 showing a frequency of ~0.05 incidents per installation (fixed, floating and jack-up), per year. When just considering moderate to severe incidence frequency for all installations, this reduces to almost zero (1989-2001). The vast majority of incidents (~96%, UKOOA 2003) involved in-field vessels (particularly supply and standby vessels), with relatively few being related to passing traffic. See section 7.4 for related mitigation.

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. Based on a wider assessment in UK and Canada, the frequency of blowouts was found to range from 2.8×10^{-5} per well year to 2.1×10^{-4} per well year.

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 2012). This includes all spills reported by POLREP reports by the MCA and PON1 reports to DECC – note that notifications of releases through the PON1 process are now being published on the DECC website on a monthly basis[30]. The review noted a 19.9% increase was evident in the total number of reports by offshore oil and gas installations during 2011, however further analysis indicated that reports of the number of oil spills from offshore oil and gas installations during 2011 was the same number as the mean annual total reported between 2000 and 2010. Of these releases, 62.9% were fuel, lubrication or hydraulic oils; additionally, of the discharges with volume information, 93% were less than 455 litres.

Since the mid-1990s, the reported number of spills has increased (Figure 7.1) consistent with more rigorous reporting of very minor incidents (e.g. the smallest reported spill in 2012 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 2012 totalled 2,248 tonnes (DECC website[31]).

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

[30] https://www.gov.uk/oil-and-gas-environmental-data#pon-1-data
[31] https://www.gov.uk/oil-and-gas-uk-field-data#oil-discharged-with-produced-water

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 release. A GIG update[32] with respect to the environmental aspects of the incident indicated that the vast majority of the release from the 2012 Elgin field blowout was methane gas to atmosphere, but some of the condensate affected the sea surface resulting in a silvery sheen with occasional smaller patches of brown weathered material extending over some 5km^2 (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

[32] 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

the sea by oil, predominantly from merchant shipping, can be a major cause of seabird mortality. Although locally important numbers of birds have been killed on the UKCS directly by oil spills from tankers, for example common scoter off Milford Haven following the Sea Empress spill in 1996, population recovery has generally been rapid.

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.

Oil spill risks to marine mammals have been reviewed by successive SEAs[33] for previous licensing Rounds 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, and any accidental ingestion or breathing of oily fumes could cause physiological stress (Law *et al.* 2011). 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 (Hammond *et al*. 2002).

[33] See: Offshore Energy Strategic Environmental Assessment (SEA): An overview of the SEA process.

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
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).

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. It should be noted that the potential for a large oil spill to arise is negated by the hydrocarbon prospectivity of the Southern North Sea, which is dry gas. Accidental spills are therefore restricted to rig and vessel hydrocarbon inventories.

7.3 Implications for relevant 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 relevant 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.

- **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), and due to the nature of the hydrocarbons in the Southern North Sea (dry gas), dispersant use is unlikely to be proposed or approved for use on any spill.

- **Lagoons, dunes** – sites above Mean High Water Springs are 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, it is 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 the Annex I habitats and Annex II species which may have their conservation objectives undermined if affected by a diesel spill – those sites for which such potential effects from diesel spills has been identified (see Appendix B) are listed. The relevant Blocks from which diesel spills could theoretically affect the sites are also listed. Due to the limited distance spilled diesel oil travels before dispersion (up to *ca*. 24km), potential diesel spill effects relate to a limited number of sites. A full impact assessment of the proposed activities must be provided at the project level and (where relevant) an HRA would be undertaken. In addition, an oil pollution emergency plan (OPEP) must be in place before exploration and appraisal drilling activities are permitted. Based on the limited information available on the foraging of Annex II qualifying species from sites within the area (see Section 6.4), relevant Blocks where qualifying species may forage are identified in Table 7.2. Note: 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 (Blocks from which a diesel spill could directly impact site):** Blocks 47/8e, 47/22, 47/23 & 47/24: Humber Estuary SAC Blocks 47/22, 47/23, 47/24 & 48/23c: The Wash and North Norfolk Coast SAC
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 (Blocks from which a diesel spill could directly impact site):**

Blocks 47/8e, 47/22, 47/23 & 47/24: Humber Estuary SAC

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 (Blocks from which a diesel spill could directly impact site):
Blocks 47/8e, 47/22, 47/23 & 47/24: Humber Estuary SAC
Blocks 47/22, 47/23, 47/24 & 48/23c: The Wash and North Norfolk Coast SAC

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 (Blocks from which a diesel spill could directly impact site):
Blocks 47/22, 47/23, 47/24 & 48/23c: The Wash and North Norfolk Coast SAC

Harbour porpoise

Sites comprise a variety of marine habitats utilised by harbour porpoise (*Phocoena phocoena*) 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 (Blocks from which a diesel spill could directly impact site):
Blocks 44/13, 44/18e & 44/19a: Doggersbank cSAC
Blocks 44/23g, 49/4b & 49/8b: Klaverbank cSAC

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 (Blocks from which a diesel spill could directly impact site):
Blocks 47/8e, 47/22, 47/23 & 47/24: Humber Estuary SAC (grey seal)
Blocks 47/22, 47/23, 47/24 & 48/23c: The Wash and North Norfolk Coast SAC (harbour seal)
Blocks 44/13, 44/18e & 44/19a: Doggersbank cSAC (harbour and grey seal)
Blocks 44/23g, 49/4b & 49/8b: Klaverbank cSAC (harbour and grey seal)
Radiating out from the Humber Estuary, grey seals appear to use areas along the north Yorkshire coast, out to the Dogger Bank and from the Humber Estuary to an offshore area to the west (Figure 6.1). Harbour seals use a more restricted area radiating out from the Wash (Figure 6.1b). A number of Blocks are within or close to areas of low to moderate seal usage.

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 (Blocks from which a diesel spill could directly impact site):** Blocks 47/8e, 47/22, 47/23 & 47/24: Humber Estuary SAC Blocks 47/22, 47/23, 47/24 & 48/23c: The Wash and North Norfolk Coast SAC
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 (Blocks from which a diesel spill could directly impact site):** Blocks 47/8e, 47/22, 47/23 & 47/24: Humber Estuary SAC

7.3.1.1 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, 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). As the anticipated

reservoir hydrocarbon type in the Southern North Sea Blocks is gas, the only large hydrocarbon spill which is possible from exploration activities relates to diesel, which is rapidly dispersed and for which dispersants are not used.

7.3.1.2 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). 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[34] (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.

7.3.1.3 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 work programmes indicate either contingent (43/12, 43/23, 44/13) or firm

[34] 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.

(43/25, 44/19a, 47/3k) wells, where the commitment and therefore likelihood of wells being drilled is strong (see Section 2.2). The potential for spills to cause deterioration of qualifying habitats (and supporting habitats of Annex II species) or significant disturbance of Annex II species (e.g. from spill response activities) will be determined by the location, nature and timing of activities which are currently unknown (Note: oil spills are an accidental event and not a planned activity, and any spill would be restricted to diesel). Therefore, a detailed assessment of the potential for effects of a particular operation cannot be made at this time, but would be required subsequently, as part of project-level EIA. Where relevant, an HRA may also be undertaken for the proposed operations.

Following licensing, specific exploration drilling activities require permitting (see Figure 2.2) and those considered to present a risk to relevant 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 (Section 7.4). Detailed potential effects of such a release on Natura 2000 sites would be considered at the project level.

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 exploration drilling activities require permitting (see Figure 2.2) and those considered to present a risk to relevant 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 all cases, rigorous spill prevention, response and other mitigation measures are required of operators and monitored by the regulator for offshore exploration and production (Section 7.4). Detailed potential effects of such a release on Natura 2000 sites would be considered at the project level.

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 diesel spills. Those sites where the potential for effects from diesel spills has been identified (see Appendix B) are listed. Due to the limited distance which may be travelled by spilled diesel (up to *ca*. 24km), the potential for direct diesel spill effects on sites relates to a limited number of Blocks. A full impact assessment of the proposed activities must be provided at the project level and (where relevant) an HRA would be undertaken. In addition, an oil pollution emergency plan (OPEP) must be in place before exploration and appraisal drilling activities are permitted. Based on information available on the foraging of seabirds (e.g. Thaxter *et al.* 2012, see Section 7.3.3.1 below), where relevant an attempt has been made to identify the qualifying feature from each SPA site that has the greatest mean maximum foraging range and identify those Blocks which fall within that range (e.g. of the qualifying features of the Humber Estuary SPA, it was estimated that little tern had the greatest foraging range (6±2km, from Thaxter *et al.* 2012), and of the SNS Blocks, only 47/22 and 47/23 fell within this range from the SPA). This thereby provides a very basic assessment of which protected species and sites may be potentially at risk from a spill within that Block. 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, although due to their wide range foraging, gannets are described separately below) which nest either on, or generally associated with sea cliffs. Birds 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 surface pollution, particularly during the breeding season when large numbers of birds 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). **Sites potentially at risk (Blocks from which a diesel spill could directly impact site):** Blocks 42/21 & 42/22: Flamborough Head and Bempton Cliffs SPA **Sites potentially at risk (Blocks within which a diesel spill could theoretically impact foraging qualifying species from a relevant site*):** All Blocks except 44/13, 44/19a, 44/18e, 44/23g, 49/8b, 49/21d, 53/3a, 53/8: Flamborough Head and Bempton Cliffs SPA (puffin)
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 (Blocks from which a diesel spill could directly impact site):** Blocks 47/22, 47/23, 47/24 & 47/8e: Humber Estuary SPA Blocks 47/22, 47/23 & 47/24: Gibraltar Point SPA, The Wash SPA, North Norfolk Coast SPA **Sites potentially at risk (Blocks within which a diesel spill could theoretically impact foraging qualifying species from a relevant site*):** Blocks 47/22 & 47/23: Humber Estuary SPA (little tern), Gibraltar Point SPA (little tern), The Wash SPA (common tern) Blocks 47/22, 47/23, 47/24, 48/18c, 48/23c, 48/24, 48/25c: North Norfolk Coast SPA (sandwich tern)
Foraging gannets
Gannets are wide-ranging birds, with mean maximum foraging distances of 229km up to a maximum of 590km recorded in gannet - foraging ranges which potentially brings birds from various colonies into contact with Blocks throughout UK waters. Work carried out studying the tracks of birds originating from each of the main gannet colonies around the UK coast suggest there is spatial segregation

between foraging areas (Wakefield *et al.* 2013) (see Section 7.3.3.1 below).

Sites potentially at risk (Blocks from which a diesel spill could directly impact site):
Block 42/21 & 42/22: Flamborough Head and Bempton Cliffs SPA

Sites potentially at risk (Blocks within which a diesel spill could theoretically impact foraging qualifying species from a relevant site*):
All Blocks: Flamborough Head and Bempton Cliffs SPA (gannet)

Red-throated diver breeding populations utilising coastal waters

Inland sites designated for breeding red-throated diver (*Gavia stellata*) which forage in neighbouring coastal waters.

Sites potentially at risk (Blocks from which a diesel spill could directly impact site):
Block 53/8: Outer Thames Estuary SPA

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 (Blocks from which a diesel spill could directly impact site):
Blocks 47/22, 47/23 & 47/24: Gibraltar Point SPA, North Norfolk Coast SPA

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 (Blocks from which a diesel spill could directly impact site):
Blocks 47/22, 47/23, 47/24 & 47/8e: Humber Estuary SPA
Blocks 47/22, 47/23 & 47/24: The Wash SPA

*Note: *Block is within the mean maximum foraging range of a qualifying feature (listed in brackets, after Thaxter et al. 2012), which relates to a site considered in this AA. Therefore a diesel spill in the block could in theory adversely affect site integrity through impacting qualifying features from the site foraging within the block.*

7.3.3.1 Consideration

The qualifying features of the sites listed in Table 7.3 are potentially vulnerable to a large diesel 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).

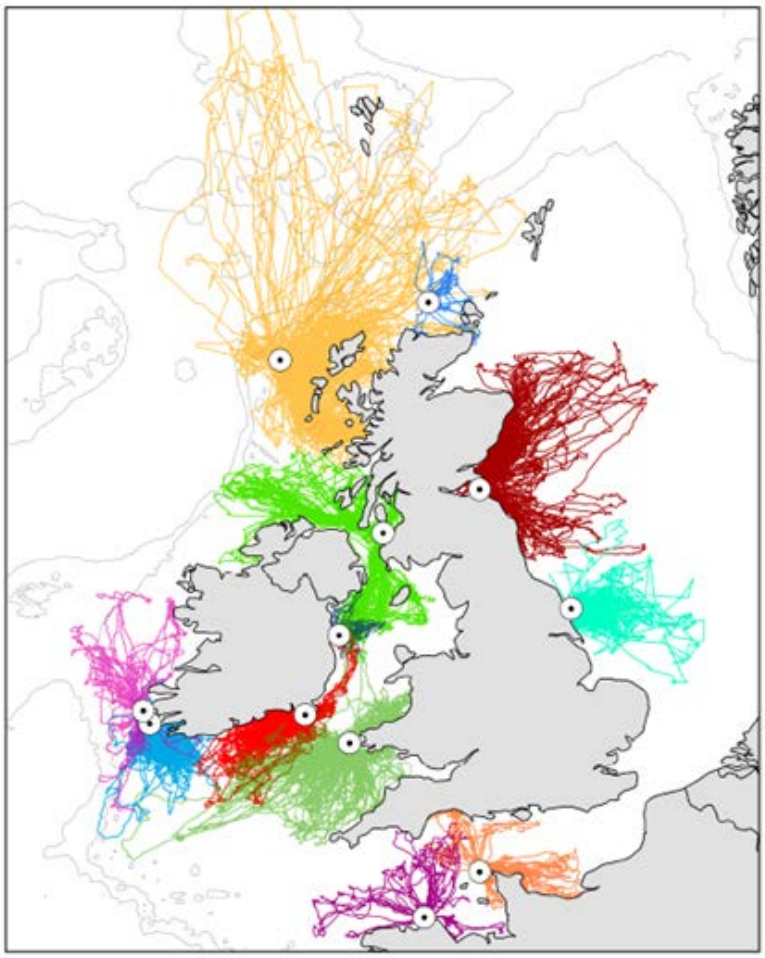
As referred to in Section 7.3.3 above, Thaxter *et al.* (2012) reviewed available information on seabird foraging ranges. As noted by the authors, the use of species-specific foraging ranges is subject to some error, for instance through density-dependent effects (e.g. Lewis *et al*. 2001), annual and inter-annual variation in foraging behaviour (e.g. Hamer *et al.* 2007), or simply differences in marine systems. Caution is therefore needed when using limited foraging range data, for example from a single breeding season or location, to provide ‘‘representative’’ foraging

range information. The foraging distances presented in Thaxter *et al.* (2012) provide an indication of the range within which protected species and sites may be potentially at risk.

With respect to gannet foraging, tracking data from Wakefield *et al*. (2013) indicated that some gannets from Flamborough Head and Bempton Cliffs SPA (14 birds tagged in 2010, 9 in 2011) may forage over many of the Southern North Sea Blocks (Figure 7.2). Gannets from Bass Rock in the Firth of Forth may also be present over some of the more northern Blocks.

Important areas of seabird activity, outside designated, protected sites have been identified around the UK coast as part of an ongoing process to identify possible marine SPAs for seabirds (Kober *et al.* 2010, 2012). Important areas were identified using statistically derived threshold levels of abundance, and in the Southern North Sea, a near qualifying area (based on a 5% threshold, see Kober *et al*. 2010) was identified for over-wintering guillemot (October-April) over the Dogger Bank area (Figure 7.3). Birds congregating in this area will be vulnerable to surface pollution from an accidental spill in any of the Blocks within the area. Offshore Vulnerability Index (OVI) values, for the Blocks in Quadrant 43 are consistently high or very high throughout this period (see Table 7.2).

Figure 7.2: Satellite tracks from gannets from main UK colonies

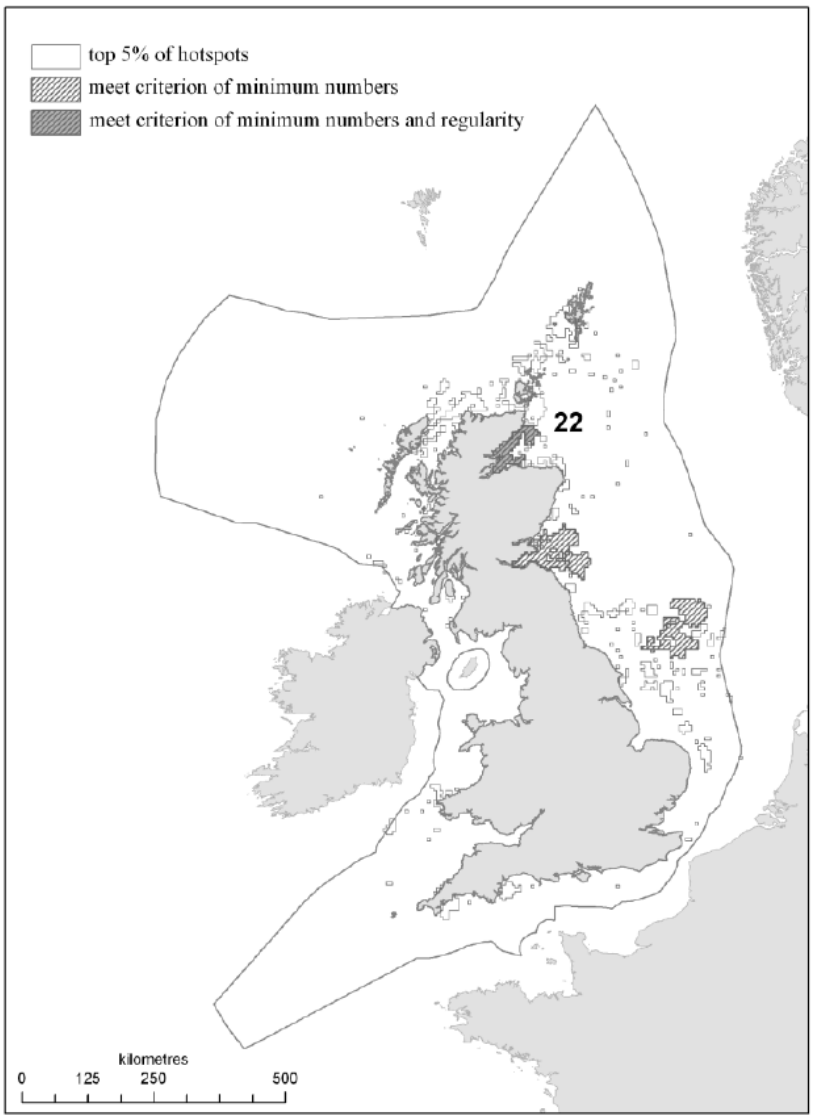


Source: Wakefield et al. (2013).

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 of a particular operation cannot be made at this time, but would be required subsequently, as part of project-level EIA. Where relevant, an HRA may also be undertaken for the proposed operations.

Figure 7.2: Hotspots for overwintering guillemot (near qualifying area)



Source: Kober et al. (2010)

Following licensing, specific exploration drilling activities require permitting (see Figure 2.2) and those considered to present a risk to relevant 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 (Section 7.4). Detailed potential effects of such a release on Natura 2000 sites would be considered at the project level.

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 2.2), 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 exploration drilling activities require permitting (see Figure 2.2) and those considered to present a risk to relevant 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 (Section 7.4). Detailed potential effects of such a release on Natura 2000 sites would be considered at the project level.

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 by DECC 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”). Operators are required to follow international and UK best practice when responding to oil spills (i.e. consistent with DECC’s OPEP requirements) and must have in place the capability to employ response strategies for a spill of any severity. The

minimum requirements for a response to diesel spills of various sizes are shown in Table 7.4, below.

Table 7.4: Guidance on minimum standards required for oil pollution incident response

Estimated Oil Quantity (tonnes)	Oil Type[1]	Aerial Surveillance Capability	Response Times	
			For Block Specific Vulnerability[2] of 1 (very high)	All other Vulnerability Categories (low to high)
0 to 25	1	Within 4 hours	Monitor and natural dispersion – (dispersant requirement assessed on case by case basis)	Monitor and natural dispersion - No dispersant requirement
25 to 100	1		As above	As above
100 to 500	1		As above	As above
>500	1		As above	As above

Notes: [1]Oil type based on ITOPF groups, [2] based on JNCC (1999), see Table 7.1)
Source: DECC OPEP Guidance, July 2012

Activity level management measures (e.g. which should be implemented through an accredited Environmental Management System) can help to reduce the potential for spills of oil and chemicals of all sizes through, for instance, inventories of environmentally critical equipment, related maintenance schedules, training and good practice. Dependent on the activity being undertaken, DECC inspectors at the permitting stage, and on occasions prior to operations taking place, may conduct an onshore and/or offshore inspection of the installation to ensure that crews are aware of procedures in place to prevent spills and their responsibilities in spill prevention and reporting. Offshore, primary responsibility for oil spill response lies with the relevant Operator and their third party accredited pollution responders, although the Secretary of State's Representative may intervene if necessary. The MCA is responsible for a National Contingency Plan and maintains a contractual arrangement for provision of aerial spraying, with aircraft based at East Midlands and if necessary, 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. The UK Government announced in 2012 that an Emergency Towing Vessel for the waters around the Northern and Western Isles will be stationed in Orkney up to 2015[35]. The government has also been in discussions with the oil industry on the potential of a commercial call-out arrangement to use their vessels[36] and BP have recently agreed to volunteer a vessel to help in an emergency should the MCA deem it appropriate[37].

[35] Orkney Islands Council website - http://www.orkney.gov.uk/OIC-News/emergency-vessel-to-be-stationed-in-orkney.htm
[36] Scotland Office website - http://www.scotlandoffice.gov.uk/scotlandoffice/17322.html
[37] https://www.gov.uk/government/news/moore-welcomes-bp-and-north-star-support-for-second-support-vessel\

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[38] within 30 minutes of an oil pollution incident notification
    - has a stock of dispersant sufficient to deal with an oil pollution incident of 25 tonnes, and if required, have the capability (equipment and capacity) of recovering any oil likely to be lost from the installation under a Tier 1[39] 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

It should be noted that as the hydrocarbon prospectivity of the Southern North Sea is for dry gas, spills would be restricted to diesel inventories. Dispersant is unlikely to be proposed or approved for use on such spills. 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.

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[38] Chemical dispersant use is generally inappropriate in shallow sheltered waters, in water depths of less than 20 metres and in waters extending up to 1.15 miles (equivalent to 1 nautical mile) beyond the 20 metre contour, or on refined oil products such as diesel, gasoline or kerosene which should disperse naturally prior to reaching the coast or any sensitive environments. The use of chemical dispersants will, therefore, be dependent upon several factors including the quantity of oil, oil type, sea temperature, time of year, prevailing weather and environmental sensitivities.

[39] 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).

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 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, blowout 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.

A consent to locate a drilling rig is required in advance of drilling (see Figure 2.2), which is subject to consultation with relevant stakeholders (e.g. the MCA, MoD). Such consent requires vessel traffic surveys and a collision risk assessment, and requires the movement and location of the rig to be notified to other users of the sea (e.g. through notices to mariners). A statutory 500m safety zone is established around the rig when in the field, and a standby and/or guard vessel is also located next to the rig during drilling operations to ensure that vessels do not enter the safety zone, and to provide emergency response.

Whilst the indemnity and insurance group of OSPRAG concluded that to date the current Offshore Pollution Liability Association Limited (OPOL) level of US $250 million is appropriate in the majority of scenarios, in certain limited cases spill clean up and compensation costs could result in claims above this limit. Guidance issued by Oil & Gas UK (OGUK) in November 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. DECC released a guidance note to industry[40] effective from January 1st 2013 on the demonstration of financial responsibility before consent may be granted for exploration and appraisal wells. It was noted in this document that, though not constituting DECC guidance, considerable weight would be given to operators who can show that they have met the criteria set out in the OGUK guidance. DECC require that an operator must demonstrate the cost of well control and the cost of financial remediation and compensation from pollution at the time of OPEP submission, and verify this responsibility by, for instance: insurance, parent company guarantee, reliance on credit/financial strength rating of the operator.

[40] DECC Guidance Note To UK Offshore Oil and Gas Operators On The Demonstration Of Financial Responsibility Before Consent May Be Granted for Exploration and Appraisal Wells On The UKCS (December 2012).

7.5 Conclusions

Individual relevant 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 (see Tables 7.2 and 7.3), 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).

- 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 (see Section 8 for in-combination effects).

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 exploration drilling activities require permitting (see section above, Figure 2.2) and those considered to present a risk to relevant 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 relevant sites.

Consent for activities will not be granted unless the operator can demonstrate that the proposed activities will not adversely affect the integrity of Natura 2000 sites.

8 In-combination effects

8.1 Introduction

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). There are a number of potential interactions between activities that may follow licensing and those existing or planned activities in the Southern North Sea, for instance in relation to renewable energy, fishing, shipping and aggregate extraction. Many of these activities are subject to SEA and other strategic level and individual permitting or consenting mechanisms, and in future to marine spatial planning consistent with the Marine Policy Statement. The first Marine Plans (East Inshore and East Offshore) are being consulted on during 2013 and are expected to be adopted in 2014, and planning has now begun for the South Inshore and Offshore Marine Plan areas. These plans seek to introduce spatial planning for marine activities at a regional level.

8.2 Sources of potential effect

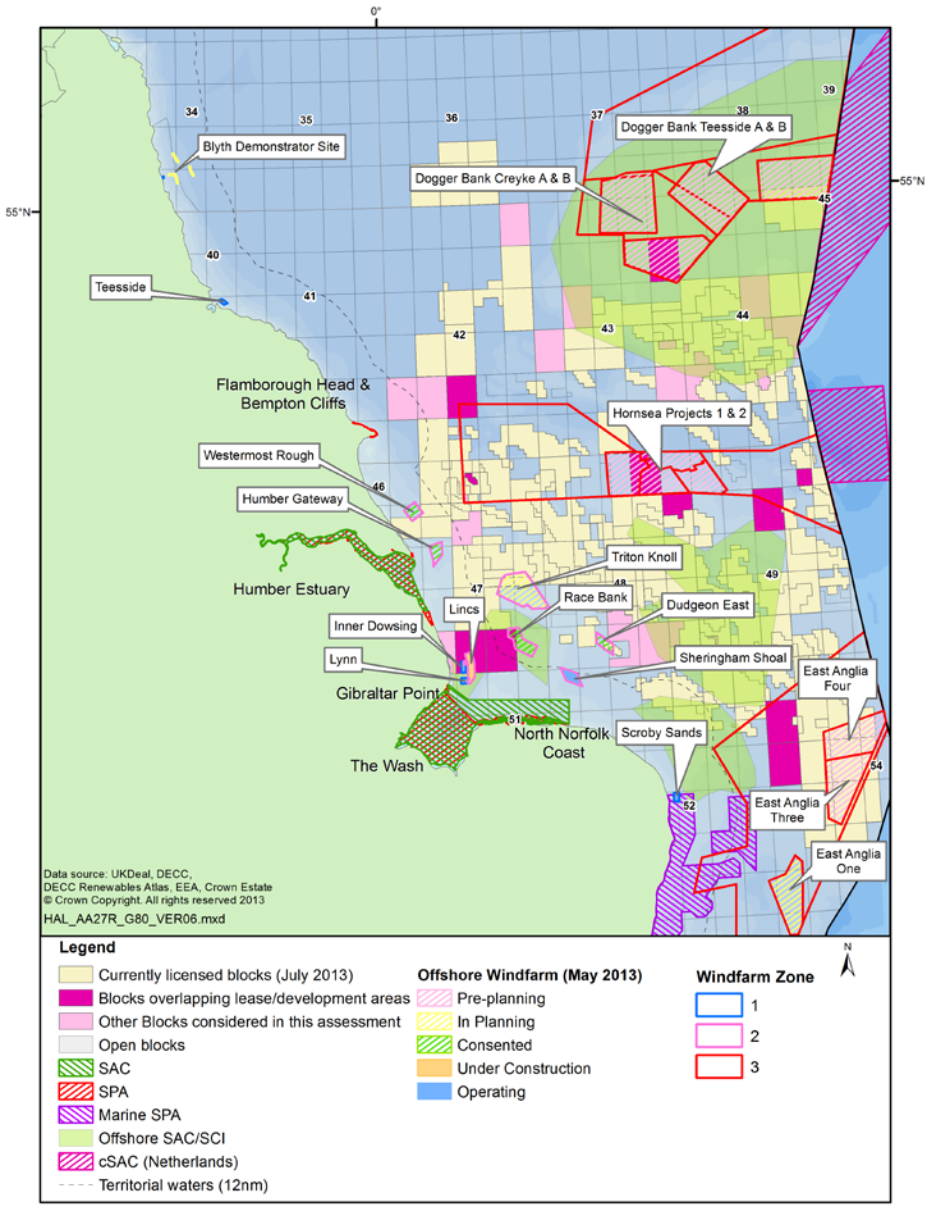
A number of activities take place in the Southern North Sea for which there is a potential for interaction with operations that could arise should all of the Blocks subject to assessment be licensed. The principal sources of cumulative effects are regarded to be related to noise, physical disturbance, and physical presence, primarily arising from offshore wind development. Offshore wind will introduce noise and disturbance sources (particularly during construction) and present an additional physical presence in the marine environment. Offshore wind zones (e.g. Round 3) have already been subject to SEA and HRA, and any related projects will be subject to their own individual assessment and HRA processes. Figure 8.1 indicates the location of wind farms/wind farm zones in relation to the blocks subject to this assessment. Those which interact with zones, areas subject to agreement for lease, or project areas identified by developers are indicated.

The UK Government believe that the oil & gas and wind industry can successfully co-exist, as stated in DECC's *Other Regulatory Issues* for the 27th Round, "…we [(DECC)] advise that successful applicants on such blocks [(areas where oil and gas licenses and proposed or actual wind farm sites exist and indeed overlap)] should make early contact with the holders of any relevant wind farm lease, or the relevant zone developer(s), and establish in good time a mutual understanding of the respective proposals and time frames envisaged (acknowledging that not all aspects of the future plans of either side will necessarily be definitively decided at that time)."[41] Early discussions between the developers will ensure that any potential conflict can be

[41] DECC 27th Round other regulatory issues.

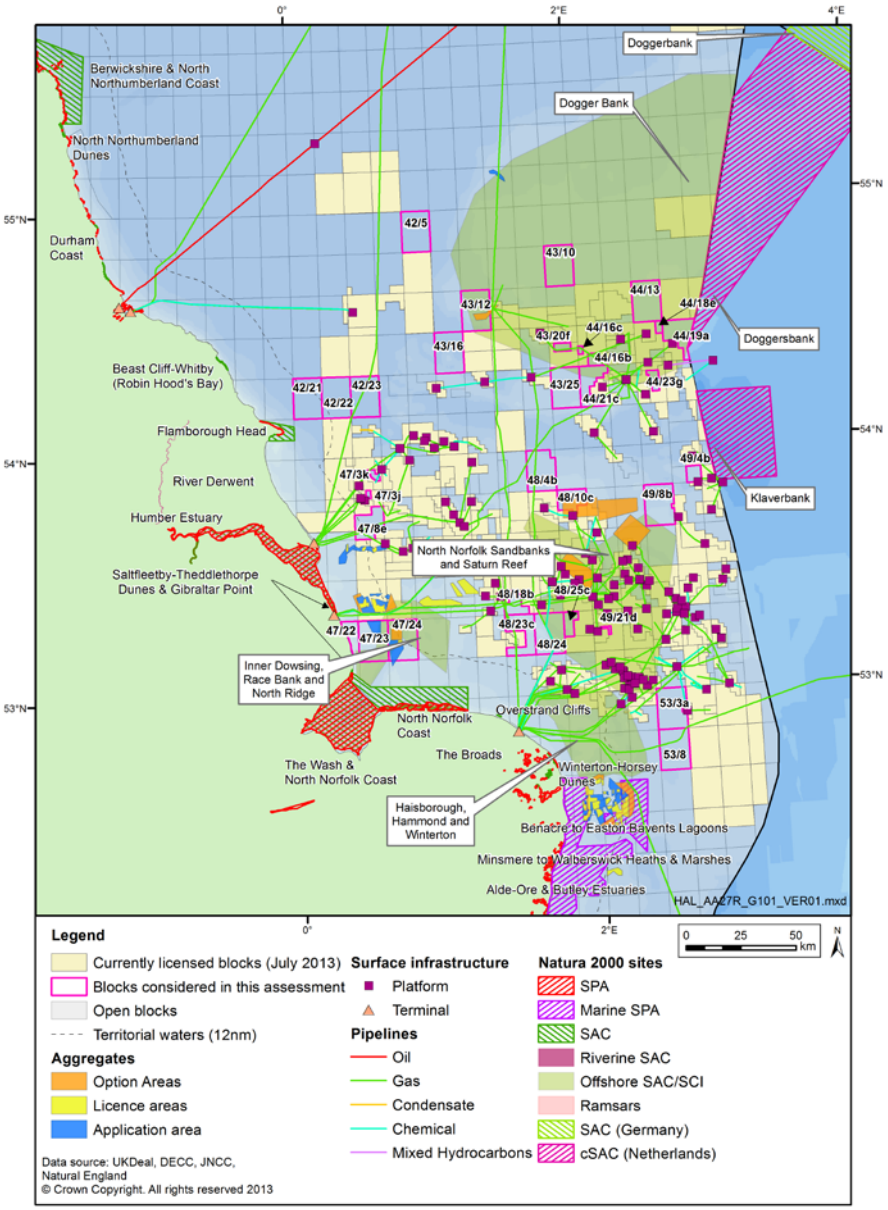
mitigated so that both developments can proceed with minimal delay and without the need to determine any part of an existing Crown Estate Lease or Agreement for Lease. In the context of this advice, it should be noted that should the licences for Blocks 43/10, 48/4b and 48/10c be granted, the initial work programme would need to be undertaken and 50% of block acreage relinquished within four years of its issue (see Section 2.2). As construction activities are not expected to take place until ~2016 in related Round 3 zones (Dogger Bank Creyke Beck, Hornsea projects 1 and 2), there would be considerable scope to avoid any potential cumulative effects. With regards to construction activities, the Lincs offshore wind farm is almost complete, with all turbines now installed and full commissioning expected later in 2013. Certain cumulative interactions (e.g. noise) will be reduced – see Section 8.3 below. With regards to the potentially cumulative impact of those incremental activities arising from licensing blocks in the Southern North Sea, reference should be made to Table 2.1 which defines the likely spatial and temporal scale of activities should they be undertaken.

Figure 8.1: Offshore wind development in the Southern North Sea



Other ongoing activities in the Southern North Sea include existing oil and gas operations, fishing, shipping and aggregate extraction (see Figure 8.2 and discussion in section 8.4). The intensity and location of these activities has been discussed in OESEA2 (DECC 2011).

Figure 8.2: Existing oil & gas infrastructure and aggregates areas in Southern North Sea



8.3 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 with the potential to cause 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 (see discussion on MSFD and noise below).

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, and works are expected to begin at several of these in the near future, including Westermost Rough, Humber Gateway, Race Bank and Dudgeon. For several of these, final investment and construction decisions are pending, though construction is expected to begin at Westermost Rough in 2014. It may be reasonably assumed that, subject to the above decisions, those other consented wind farms will begin construction over the next 1-2 years.

A number of the Blocks (47/23, 47/24 and 48/23c) impinge upon or are adjacent to R1 and R2 wind farm 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 SCI; 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). Current estimates are for construction activities in Round 3 zones to span from 2014 into the 2020s.

Dogger Bank Creyke Beck will be the first stage of development in the Dogger Bank Zone[42]. 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[43]. 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.

[42] Forewind website - http://www.forewind.co.uk/projects/dogger-bank-creyke-beck.html
[43] Forewind website - http://www.forewind.co.uk/projects/dogger-bank-teeside.html

The Forewind development programmes for both the Creyke Beck and Teesside areas indicates that the development consent applications will be submitted in Q3 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[44]. 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. An application to the planning inspectorate was made in 2013, and 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[45]. 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. An application to the planning inspectorate will be made in 2014. Block 48/4b overlaps the proposed Project Two area.

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 wind farm[46]. 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. An application was made to the planning inspectorate in November 2012 for this project, and construction of the wind farm is proposed to start in 2016. East Anglia THREE and FOUR are in the pre-application stage of planning, and scoping reports for both proposed wind farms were published in late 2012. These projects are to be planned and developed in parallel, and it is anticipated that development consent applications will be made for both in summer 2014.

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

[44] SMart Wind website - http://www.smartwind.co.uk/project1.aspx
[45] SMart Wind website - http://www.smartwind.co.uk/project2.aspx
[46] East Anglia Offshore Wind Limited website - http://www.eastangliawind.com/east-anglia-one.aspx

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 reduce the risk of mortality and injury of marine life, including the use of soft start, Marine Mammal Observers and Passive Acoustic Monitoring. 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. Noise sources which are likely to occur following 27th round licensing have been discussed in Section 6. Those blocks within which significant noise sources may be generated (from proposed seismic survey), are 42/21, 42/22, 47/3j, 47/8e and 43/25. Overlap of these blocks with Round 3 wind farm zones (and related development areas) is shown in Figure 8.1. With regards to potential wind farms in proximity to blocks subject to assessment and which are likely to be constructed in the foreseeable future, block 48/4b intersects both the Hornsea Project One and Two areas, though no seismic survey is proposed in this block.

The audibility of operational wind farm noise was discussed in OESEA2 (DECC 2011), with available evidence suggesting that behavioural reactions in seals could not be excluded for up to a few hundred metres from turbine foundations, and that it was unlikely that noise reached dangerous levels or was capable of masking acoustic communication in porpoises. Guidance from JNCC on the potential for disturbance of EPS from operational noise states that there is presently no serious concern over the issue, but that further research would be required to understand any effects from the scaling up of wind farms. Other recent research (e.g. Teilmann & Carstensen 2012) suggested the potential for slow recovery of habitat use by harbour porpoise following construction and into the operational phase based on evidence from Nysted, a Danish offshore wind farm. The authors acknowledged that this was not representative of evidence from other wind farms (e.g. Horns Rev I and Egmond aan Zee) and concluded that until more information was available on the actual cause of the observed difference no generalisation of the results to other wind farms could be recommended (Teilmann & Carstensen 2012). Given the stage of planning and development of Round 3 wind farms in the Southern North Sea, and the relatively discrete level of activity which could arise from the completion of the work programmes, it is not expected that cumulative effects associated with wind farm operation would arise.

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, aggregate extraction (see Figure 8.2), fishing, shipping and military exercise areas) 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 sites. This is due to the presence of effective regulatory mechanisms in place to ensure that operators, DECC and other relevant consenting authorities take such considerations into account during activity permitting. In respect of oil and gas

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

The Marine Strategy Framework Directive (2008/56/EC) (MSFD) requires that the European Commission to establish 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 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), and a Government response was published in December 2012[47]. 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 specific target for either impulsive sounds or ambient sounds which they believe to be equivalent

[47] HM Government (2012b). Marine Strategy Part One: UK Initial Assessment and Good Environmental Status

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.

8.4 Other potential in-combination effects

8.4.1 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), though the work programmes discussed would only entail rig siting, wellhead placement and recovery.

The work programmes for all Blocks which intersect a Round 3 wind farm zone or related project areas include proposals for drill or drop wells. This activity will have a small spatial footprint and be temporally discrete, comprising a single well in each Block, or in the case of 53/3a and 53/8, a single well in one or other of the blocks. The magnitude of physical impacts associated with rig placement and drilling has already been discussed in Section 5.2.

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. 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).

With regards to the overlap between OWF lease areas or project zones and blocks subject to assessment, it is the expectation of DECC that dialogue between OWF developers and those proposing activities in licensed blocks commences early in project planning. This does not only serve to mitigate operational constraints, but to identify any actual interaction (e.g. once specific rig site locations are known), whether European seabed features are present, and whether project level mitigation could avoid cumulative effects.

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

8.4.2 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 behavioural responses 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.

Though representing an incremental source of activity in and around offshore wind farm zones, it is anticipated that cumulative impacts can be avoided through early engagement with lease holders, and that due to the transient nature of exploration drilling that timing of OWF construction activities and any activity associated with the work programmes could be phased in such a way as to avoid cumulative effects from physical presence on any European species.

8.4.3 Marine 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 accumulate on the seabed. However, in view of the scale of the proposed activity, extent of the region, the water depths and currents, this is considered unlikely to be detectable and to have negligible cumulative ecological effect (DECC 2011).

8.5 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 led to adverse impacts on the

integrity of European sites in the area. Any activities relating to the work programmes, and any subsequent development that may occur if site appraisal is successful, will be judged on its own merits and in the context of wider development in the Southern North Sea (i.e. any potential incremental effects. 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 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 relevant 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 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 relevant 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 relevant sites have been designated after the plan level assessment; new information emerges about the nature and sensitivities of interest features within sites, new information emerges about effects including in-combination effects; or if plan level assumptions have not been met at the project level.

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Appendix A – The sites

The migratory and/or Annex I bird species for which SPAs are selected in the UK are listed in Box A.1, and the SPAs from Northumbria to Suffolk and their qualifying features are given in Table A.1 and their locations shown in the Map A.1. JNCC[48] 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."

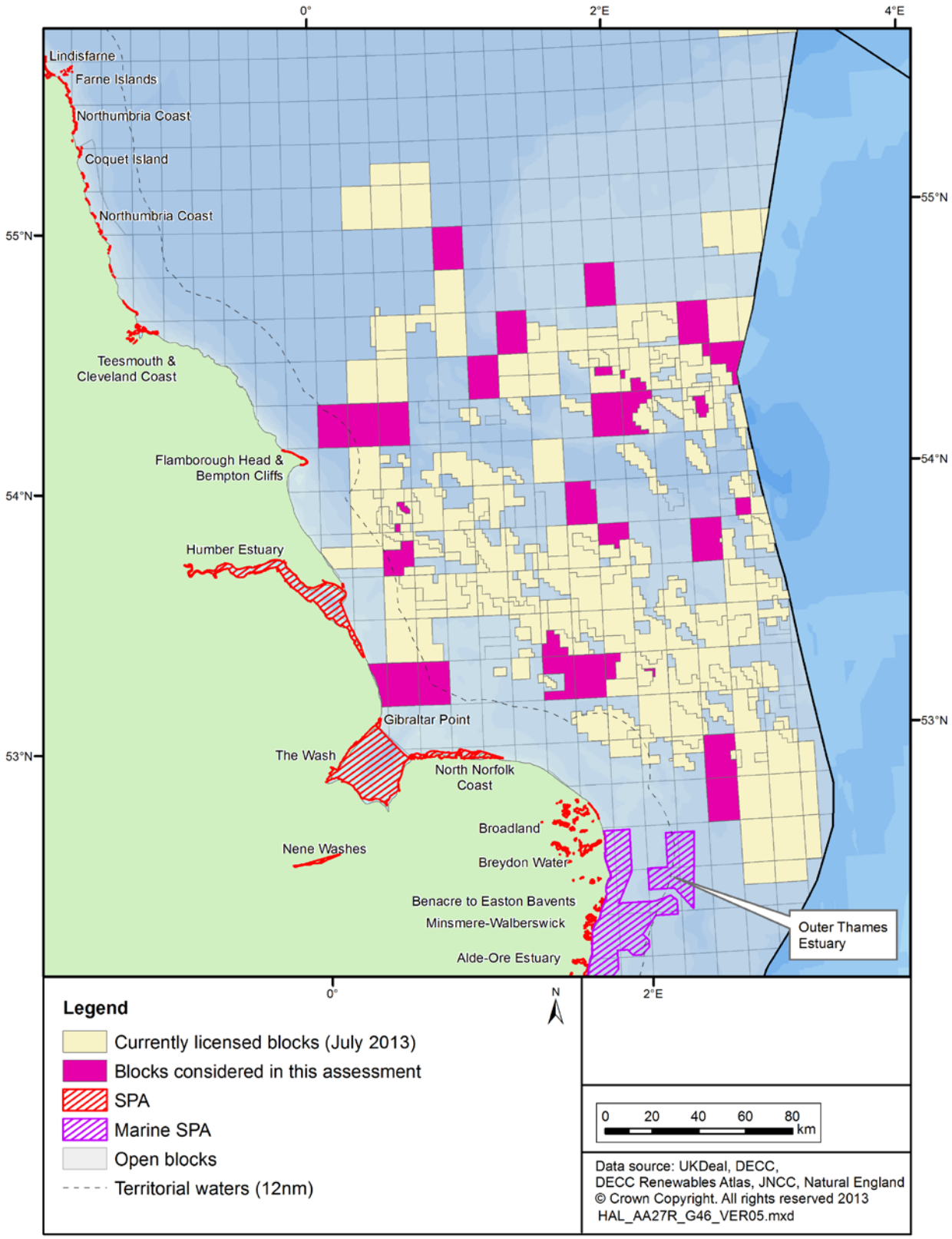
A review of SPA sites was undertaken to identify where a mismatch between the qualifying species lists existed. Each country agency (NE, SNH, CCW, NIEA) was contacted to clarify those features which should be considered. The species listed in Table A.1 reflect the outcome of this review.

Additionally, the Natural England Designations Strategy[49] states that, "A further review (2010 SPA Review) of the terrestrial and coastal SPA network is currently underway. This is targeting parts of the current UK network to ensure UK obligations under Article 4 of the Birds Directive are met. This review will provide information to be used to further support the development of the current UK terrestrial and coastal SPA network. The outcome of this work is likely to result in significant amendments to the SPA series in England... [and is]…likely to impact on the recommendations of the earlier 2001 SPA review".

[48] http://jncc.Defra.gov.uk/page-5485 (accessed: October 2012)
[49] Natural England Designations Strategy – July 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[50]
NORTHEAST ENGLAND				
Lindisfarne	3,679.22	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[51]	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 Golden plover	Over winter: Dunlin Knot Shelduck Black-tailed godwit Redshank On passage: Knot Dunlin Black-tailed godwit Redshank	Non-breeding: Waterfowl

[50] - 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.

[51] 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)

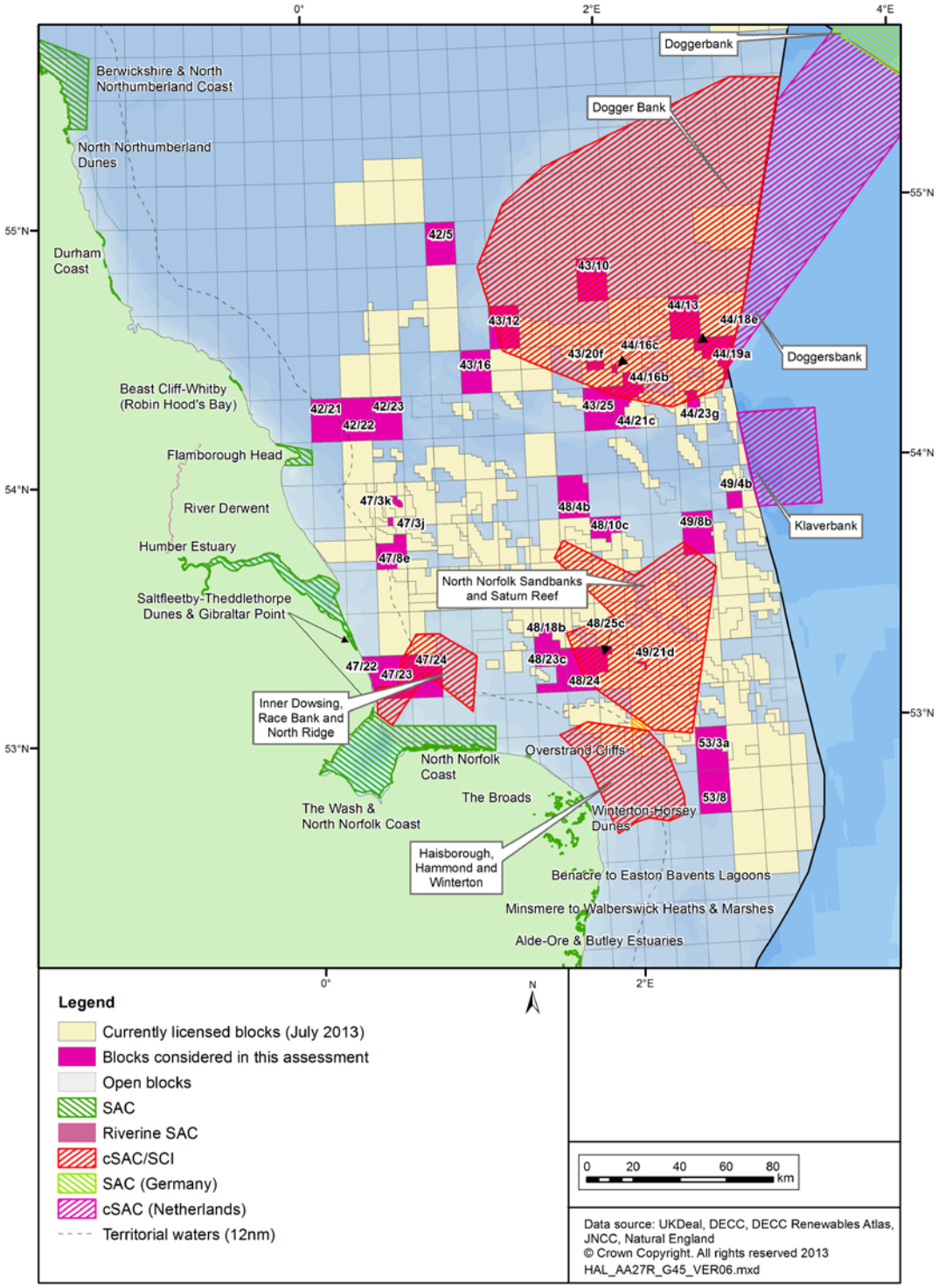
Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[50]
		On passage: Ruff		
LINCOLNSHIRE, NORFOLK and SUFFOLK				
Gibraltar Point SPA	414.09	Breeding: Little tern Over winter: Bar-tailed godwit	Over winter: Grey plover Knot	Over winter: Waterfowl
The Wash SPA	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 North Denes SPA	149.19	Breeding: Little tern	N/A	N/A
Breydon Water SPA	1,202.94	Breeding: Common tern		Over winter: Waterfowl

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory species	Article 4.2 Assemblages[50]
		Over winter: Avocet Bewick's swan Golden plover		
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
Limestone pavements	Limestone pavements * Priority feature
Machairs	Machairs
Mudflats and sandflats	Mudflats and sandflats not covered by seawater at low tide

Annex I Habitat (abbreviated)	Annex I Habitat(s) (full description)
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 Salt marshes and salt meadows	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
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 SCI	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*

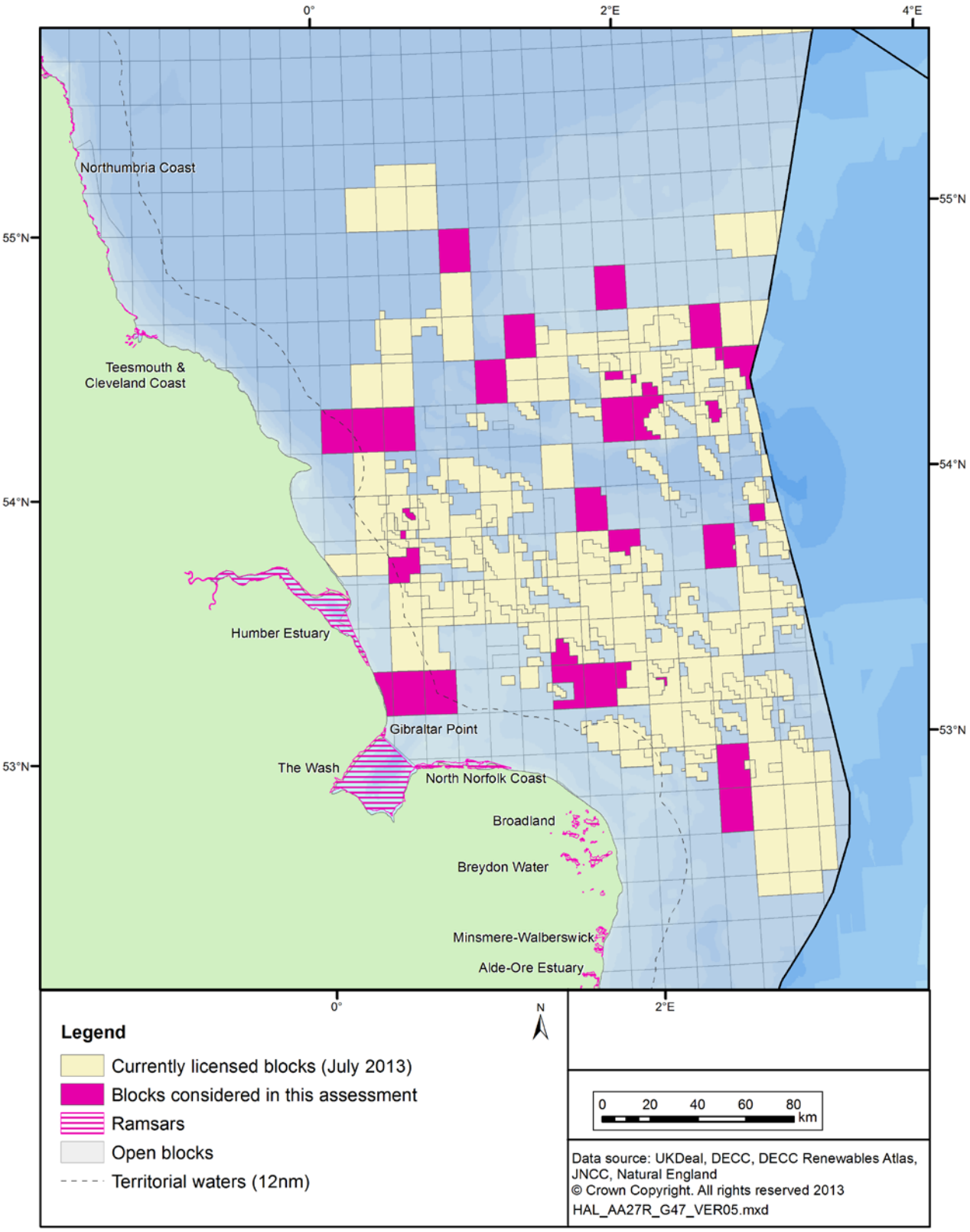
A5 Ramsar Sites

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[52]. 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
- 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
- 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

[52] 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.

- 47/8e – Drill or drop well, shoot 3D seismic (same survey as 47/3j)
- 47/22, 47/23, 47/24 – 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
- 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

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 sites are considered under the following broad headings:

- Physical disturbance and other effects (e.g. rig siting, marine discharges)
- Underwater noise (in particular, deep geological seismic and other site surveys, and VSP)
- 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

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	
								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 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
Lindisfarne	✓	✓	✓	-	-	-	-	**Qualifying features:** breeding tern, overwintering bar-tailed godwit, golden plover, whooper swan, grey plover, greylag goose, knot, light-bellied brent goose, wigeon, on passage ringed plover. Overwintering waterfowl assemblage. **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

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	
Farne Islands	✓	-	-	-	-	-	-	**Qualifying features:** breeding Arctic, common, roseate and sandwich tern, breeding guillemot and puffin. Breeding seabird assemblage. **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 kittiwake. Seabird assemblage. **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. **Appropriate Assessment:** See Section 7.3. 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	
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.
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

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	
								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. **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.

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
Minsmere-Walberswick	✓	✓	-	-	-	-	-	**Qualifying features:** breeding avocet, bittern, little tern, marsh harrier, nightjar, woodlark, over wintering avocet, bittern and hen harrier. **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
Alde-Ore Estuary	✓	✓	-	-	-	-	-	**Qualifying features:** breeding avocet, little tern, marsh harrier, sandwich tern, lesser black-backed gull, overwintering avocet, redshank. Breeding seabird assemblage. Overwintering wildfowl assemblage. **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
Deben Estuary	-	✓	-					**Qualifying features:** Over wintering avocet. **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 Estuary	-	✓	-	✓	-	-	-	**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

Site name	Features present[1]			Vulnerability to effects[2]				Consideration
	Breeding	Wintering	Passage	Oil spills	Physical Disturbance	Acoustic Disturbance	In-combination	
								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. **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 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

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							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. A spill from any of the SNS Blocks could theoretically affect the qualifying species (e.g. grey seal) foraging outside of the site, 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.
LINCOLNSHIRE, NORFOLK AND SUFFOLK							
Saltfleetby - Theddlethorpe Dunes and Gibraltar Point	✓	-	-	-	-	-	**Qualifying features:** Coastal dunes **Consideration of likely significant effects:** Site conservation objectives

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							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. A spill from any of the SNS Blocks but particularly from those in the southern half of the area, could theoretically affect the qualifying species (e.g. harbour seal) foraging outside of the site, 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 site falls within the definition of a medium risk area of corkscrew injury to seals with respect to the presence and/or movement of vessels associated with activities in the Blocks. 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 5.4, 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 major diesel oil spill from Blocks 47/22, 47/23, 47/24 or 48/23c, weathered spilled

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							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
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

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							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
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

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
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 effects (e.g. in relation to physical disturbance). **Appropriate Assessment:** See Sections 7.3 and 8. Further, project

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							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 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

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							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 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

Site name	Features present[1]		Vulnerability to effects[2]				Consideration
	Habitats	Species	Oil spills[3]	Physical Disturbance	Acoustic Disturbance	In-combination	
							Consideration of likely significant effects: 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[53], 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[54] 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.

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

[54] 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 spring 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 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

Site Name: Humber Estuary SPA
• 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 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

Site Name: The Wash SPA

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)

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

Site Name: North Norfolk Coast SPA

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 gravelly 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

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

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

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	
Conservation objectives:	
Subject to natural change, maintain* or restore* the sandbanks in favourable condition, in particular the sub-features: • Gravelly muddy sand communities • Dynamic sand communities Subject to natural change, maintain or restore the reefs in favourable condition. * For definitions of these terms, see the material presented in support of site selection by Natural England/JNCC: http://jncc.Defra.gov.uk/pdf/IDRBNR_Reg%2035_Conservation%20Advice_v4.0.pdf	

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.

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