Department for
Business, Energy
& Industrial Strategy

OFFSHORE OIL & GAS LICENSING 29TH SEAWARD ROUND

Habitats Regulations Assessment

Draft Appropriate Assessment: Mid-North Sea High and Northern North Sea Blocks

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1 Introduction

1.1 Background and purpose

The plan/programme covering this and potential future seaward licensing rounds has been subject to a Strategic Environmental Assessment (OESEA3), completed in July 2016. The SEA Environmental Report includes detailed consideration of the status of the natural environment and potential effects of the range of activities which could follow licensing, including potential effects on conservation sites. The SEA Environmental Report was subject to an 8 week public consultation period, and a post-consultation report summarising the comments and factual responses was produced as an input to the decision to adopt the plan/programme. This decision has allowed the Oil & Gas Authority (OGA) to progress with further seaward oil and gas licensing rounds. As a result on 27th July 2016, the OGA invited applications for licences regarding 1,261 Blocks in a 29th Seaward Licensing Round covering underexplored frontier areas of the UKCS, and applications were received for licences covering 113 Blocks/part Blocks.

The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended) implement the requirements of Articles 6(3) and 6(4) of the Habitats Directive with respect to oil and gas activities in UK territorial waters and on the UK Continental Shelf; and for other relevant activities in offshore waters (excluding territorial waters) this is covered by the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended). Within territorial waters, the Habitats Directive is transposed into UK law via the *Conservation of Habitats and Species Regulations 2010* in England and Wales, the *Conservation (Natural Habitats, &c.) Regulations 1994* in Scotland (for non-reserved matters), and the *Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995* (as amended) in Northern Ireland.

As the petroleum licensing aspects of the plan/programme are not directly connected with or necessary for nature conservation management of European (Natura 2000) sites, to comply with its obligations under the relevant regulations, the Department for Business, Energy and Industrial Strategy[1] (BEIS, formerly the Department of Energy and Climate Change) is undertaking a Habitats Regulations Assessment (HRA). To comply with obligations under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), in summer 2016, the Secretary of State undertook a screening assessment to determine whether

[1] Note that while certain licensing and regulatory functions have been passed to the OGA, environmental regulatory functions are retained by BEIS, and are administered by the Offshore Oil and Gas Environment and Decommissioning Team (OGED).

the award of any of the Blocks offered would be likely to have a significant effect on a relevant site, either individually or in combination[2] with other plans or projects (BEIS 2016).

In doing so, the Department has applied the Habitats Directive test[3] (elucidated by the European Court of Justice in the case of Waddenzee (Case C-127/02)[4]) which test is:

> *A plan or project not directly connected with or necessary to the management of a site must be subject to an AA 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.*

1.2 Relevant Blocks

The screening assessment (including consultation with the statutory conservation agencies/bodies) formed the first stage of the HRA process. The assessment was undertaken in the period within which applications for Blocks were being accepted, and therefore considered all 1,261 Blocks offered in the three frontier areas of the Mid-North Sea High, Northern North Sea and West of Scotland. The screening identified 345 whole or part Blocks as requiring further assessment prior to decisions on whether to grant licences (BEIS 2016). Following the closing date for 29th Seaward Round applications, and the publication of the screening document, those Blocks identified as requiring further assessment were reconsidered against the list of actual applications (Figure 1.1). It was concluded that of the Blocks screened in by BEIS (2016), further assessment (Appropriate Assessment (AA)) was required for 21 of the Blocks applied for (Table 1.1) located in the Northern North Sea and Mid-North Sea High areas.

[2] Note that "in-combination" and "cumulative" effects have similar meanings, but for the purposes of HRA, and in keeping with the wording of Article 6(3) of the Habitats Directive, "in-combination" is used to describe the potential for such effects throughout. More information on the definitions of "cumulative" and "in-combination" effects are available in MMO (2014) and Judd *et al.* (2015).

[3] See Article 6(3) of the Habitats Directive.

[4] Also see the Advocate General's Opinion in the recent 'Sweetman' case (Case C-258/11), which confirms those principles set out in the Waddenzee judgement.

Table 1.1: Blocks requiring further assessment

16/2a	37/11	37/22	38/28
36/15	37/16	37/23	44/2
36/20	37/17	37/24	44/3
36/24	37/18	37/28b	
36/25	37/19	37/29b	
36/29	37/21	38/27	

1.3 Relevant Natura 2000 sites

The screening identified the relevant Natura 2000 sites and related Blocks requiring further assessment (refer to Appendix B of BEIS 2016). Following a reconsideration of those Blocks and sites screened in against those Blocks applied for, three Natura 2000 sites in parts of the Northern North Sea and Mid-North Sea High areas were identified as requiring further assessment in relation to 21 Blocks (Table 1.2 and Figure 1.2).

Table 1.2: Relevant sites requiring further assessment

Relevant site	Feature	Relevant Blocks applied for	Potential effects
Southern North Sea pSAC[5]	Annex II species: Harbour porpoise *Phocoena phocoena*	36/15, 36/20, 36/24, 36/25, 36/29, 37/11, 37/16, 37/17, 37/18, 37/19, 37/21, 37/22, 37/23, 37/24, 37/28b, 37/29b, 38/27, 44/2, 44/3	Underwater noise; Physical disturbance and drilling
Dogger Bank cSAC/SCI	Annex I habitat: Sandbanks which are slightly covered by sea water all the time	37/19, 37/22, 37/23, 37/24, 37/28b, 37/29b, 38/27, 38/28, 44/2, 44/3	Physical disturbance and drilling
Braemar Pockmarks SAC	Annex I habitat: Submarine structures made by leaking gases	16/2a	Physical disturbance and drilling

[5] 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 possible 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."* However, in accordance with the National Planning Policy Framework (DCLG 2012) and Marine Policy Statement (HM Government 2011), the relevant sites considered here include classified and possible SACs.

1.4 Assessment overview

This document sets out the key assumptions and approach to the AA, the evidence base underpinning the assessment and the assessment of relevant Blocks and sites. The document is organised as follows:

- Overview of the licensing process and nature of the activities that could follow (Section 2)
- Description of the approach to ascertaining the absence or otherwise of adverse effects on the integrity of relevant European sites (Section 3)
- Evidence base on the environmental effects of offshore oil and gas activities to inform the AA reports (Section 4)
- Details of the assumptions used to underpin the AA process (Section 5)
- The assessment of effects on the integrity of relevant sites, including in-combination with other plans or projects (Section 6)
- Overall conclusion (Section 7)

As part of this HRA process, this AA document is being subject to statutory consultation and will be amended as appropriate in light of comments received. The final AA document will be available via the 29th Round Appropriate Assessment webpage of the gov.uk website.

Figure 1.1: Blocks offered in the 29th Seaward Licensing Round, those initially screened in and those applied for

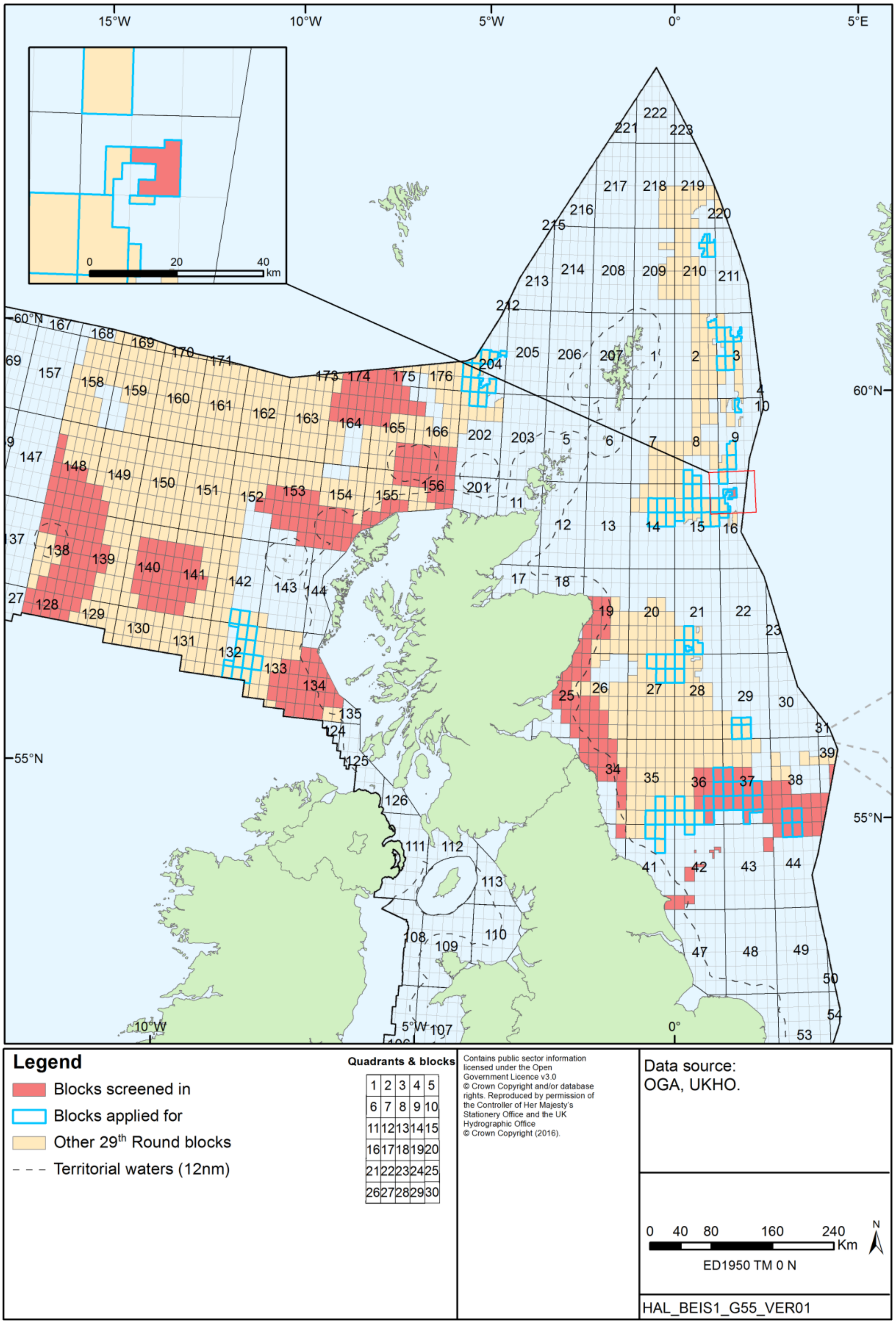
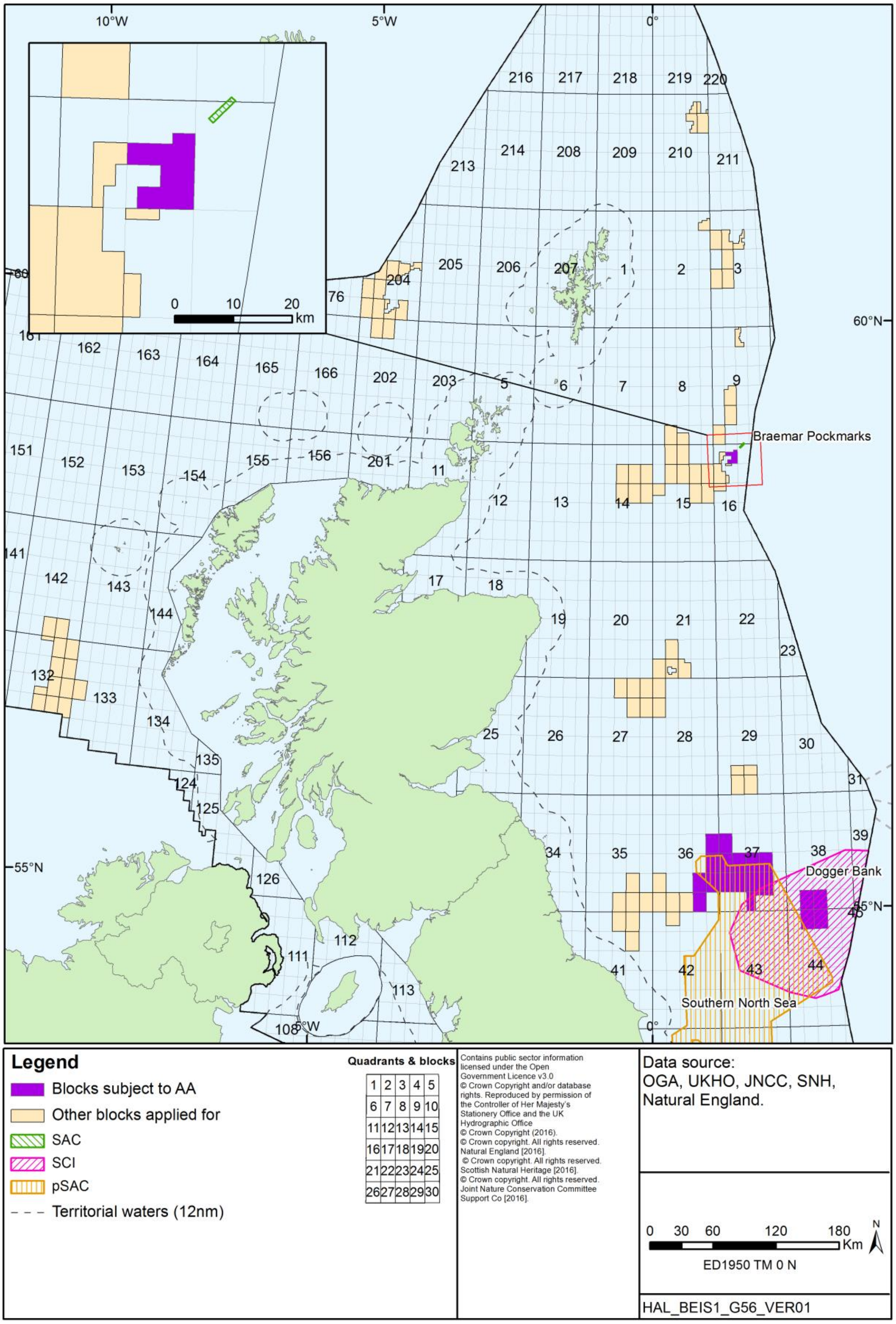


Figure 1.2: Blocks and sites relevant to this Appropriate Assessment



2 Licensing and potential activities

2.1 Licensing

The exclusive rights to search and bore for 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 OGA the power to grant licences to explore for and exploit these resources. Offshore licensing for oil and gas exploration and production commenced in 1964 and progressed through a series of Seaward Licensing Rounds. A Seaward Production 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. Offshore activities are subject to a range of statutory permitting and consenting requirements, including, where relevant, activity specific AA under Article 6(3) of the Habitats Directive (Directive 92/43/EC).

Several sub-types of Seaward Production Licence were available in previous rounds (Traditional, Frontier and Promote). These licence sub-types have now been superseded by a new sub-type of the Seaward Production Licence, the "Innovate" licence, within which, for the 29th Round, the clauses of previous licences[6] may still be applied but within the structure of a single licence type[7].

As per previous licensing structures, the Innovate licence is made up of three terms covering exploration (Initial Term), appraisal and field development planning (Second Term), and development and production (Third Term). The lengths of the first two terms are flexible, but have a maximum duration of 9 and 6 years respectively. The Third Term is granted for 18 years but may be extended if production continues beyond this period. The Innovate licence introduces three Phases to the Initial Term, covering:

- Phase A: geotechnical studies and geophysical data reprocessing (note that the acquisition of new seismic could take place in this phase for the purpose of defining a 3D survey as part of Phase B, but normally this phase will not involve activities in the field)
- Phase B: shooting of new seismic and other geophysical data

[6] The Model Clauses that apply for Seaward Production Licences are set out in the *Petroleum Licensing (Production) (Seaward Areas) Regulations 2008.* These set out the terms and conditions that apply to such licences. (Other regulations, including environmental regulations for offshore oil and gas activities, also apply to licensees.) A number of proposed Innovate licence features require changes to Model Clauses which are yet to be subject to relevant regulatory processes. These are anticipated to be in place, subject to consultation and Parliamentary process, for subsequent seaward Rounds.

[7] Refer to OGA guidance on applications for the 29th Round at: https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/

- Phase C: exploration and appraisal drilling

Applicants have the flexibility to choose the Phase that they wish to initially apply for, the phase combinations they wish to undertake, and the duration of these Phases. For example all phases may be undertaken or a combination of selected phases, or in some instances where it can be demonstrated that no exploration is required (e.g. development of an existing discovery or field re-development), licence award would go straight to the Second Term. Applicants may choose to spend up to 4 years on a single Phase in the Initial Term, but cannot take more than 9 years to progress to the Second Term. A firm commitment to drill a well will normally only be considered for applicants who propose to start at Phase C (i.e. at the point where the drilling decision does not require any more analysis).

The phased approach allows for a decision to be made on whether to proceed to the next phase within the Initial Term. Whilst there is no mandatory requirement to relinquish licensed areas at the end of Phases A and B for the 29th Round, the OGA recommend that any area not being actively worked on should be relinquished. Annual updates on work programme progress will be required, in addition to dialogue with OGA no later than three months before the end of each Phase.

Financial viability and technical capability are considered prior to licence award for applicants proposing to start at Phase A or B, and further technical and financial capacity for Phase C activities would need to be demonstrated before the licence could enter Phase C and drilling could commence. If the applicant proposes to start the licence at Phase C or go straight to the Second Term, it must demonstrate it has the technical competence to carry out the activities that could be permitted under the licence during that term, and the financial capacity to complete the Work Programme, before the licence is granted. It is noted that the safety and environmental capability (e.g. requirements of the Offshore Safety Directive) and track record of applicants is considered by the OGA through written submissions before licences are awarded[8]. Where full details cannot be provided via the written submissions at the application stage, licensees must provide supplementary submissions that address any outstanding environmental and safety requirements before approvals for specific offshore activities such as drilling will be issued.

2.2 Activities that could follow licensing

As part of the licence application process, applicants provide the OGA with details of work programmes they propose in the Initial Term. These work programmes are considered with a range of other factors in OGA's decision on whether to license the Blocks and to whom. Activities detailed in work programmes may include the purchase, reprocessing or shooting of 2D or 3D seismic data (Phases A and B) and the drilling of wells (Phase C).

[8] Refer to OGA technical guidance and safety and environmental guidance on applications for the 29th Round at: https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/

Licence applicants may propose a firm commitment to shoot new seismic or a contingent commitment will be accepted where Phase A involves reprocessing of existing data and it is not clear whether that work will provide sufficient information to identify prospectivity.

There are three levels of drilling commitment:

- A Firm Drilling Commitment is a commitment to the OGA to drill a well. Firm drilling commitments are preferred on the basis that, if there were no such commitment, the OGA 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 relevant activity specific environmental assessments.

- A Contingent Drilling Commitment is also a commitment to the OGA to drill a well, but it includes specific provision for the OGA 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 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.

The OGA technical guidance[8] makes it clear that an award of a Licence does not automatically allow a licensee to carry out all petroleum-related activities (this includes those activities outlined in initial work programmes, particularly Phases B and C). Figure 2.2 provides an overview of the plan process associated with the 29th Seaward Licensing Round and the various environmental requirements including HRA. Activities in the field associated with seismic survey or drilling are subject to further individual controls by BEIS (see Figures 2.3 and 2.4), and there are other regulatory provisions exercised by 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 Initial Term are detailed in the licence applications. For some activities, such as seismic survey noise, the impacts can occur some distance from where the activity is being undertaken and the scale of activity is not necessarily proportional to the size or number of Blocks in an area. In the case of direct physical disturbance, the Blocks being applied for are relevant.

On past experience, less activity actually takes place than is bid at the licence application stage. A proportion of Blocks awarded may be relinquished without any field activities occurring. Activity after the initial term is much harder to predict, as this depends on the results of the initial phase, which is, by definition, exploratory. Typically less than half the wells drilled reveal hydrocarbons, and of these, less than half again will yield an amount significant enough to warrant development. For example, OGA analysis of exploration well failures from the Moray Firth & Central North Sea between 2003 and 2013 indicated an overall technical success rate of 40% with respect to 150 exploration wells and side-tracks (Mathieu 2015). Depending on the expected size of finds, there may be further drilling to appraise the hydrocarbons (appraisal wells). For context, Figure 2.1 highlights the total number of exploration and appraisal wells started on the UKCS each year since 2000 as well as the number of significant discoveries made (associated with exploration activities).

Discoveries that progress to development may require further drilling, installation of infrastructure such as wellheads, pipelines and possibly fixed platform production facilities, although recent developments are mostly tiebacks to existing production facilities rather than stand alone developments. For example, of the 55 current projects identified by the OGA's Project Pathfinder (as of 4th November 2016)[9], 28 are planned as subsea tie-backs to existing production facilities, 6 involve new fixed platform production facilities and 6 will be developed via FPSOs. The final form of development for many of the remaining projects is not decided, with some undergoing re-evaluation of development options but some are likely to be subsea tie-backs. The location, nature, extent and timescale of development, if any, which may ultimately result from the licensing of 29th Round Blocks is therefore uncertain. However, when considered in the context of the number of historical and recent development wells drilled (Figure 2.1), this has generally declined over time. The nature and scale of potential environmental impacts from the drilling of development wells are similar to those of exploration and appraisal wells and thus the evidence base described in Section 4 is applicable to the potential effects of development well drilling.

2.2.1 29th Round activities considered by the HRA

Only activities which could take place as part of the work programmes associated with the Initial Term and its associated Phases A-C are considered in this AA for relevant 29th Round Blocks applied for (see Section 5.1). This is in view of the following:

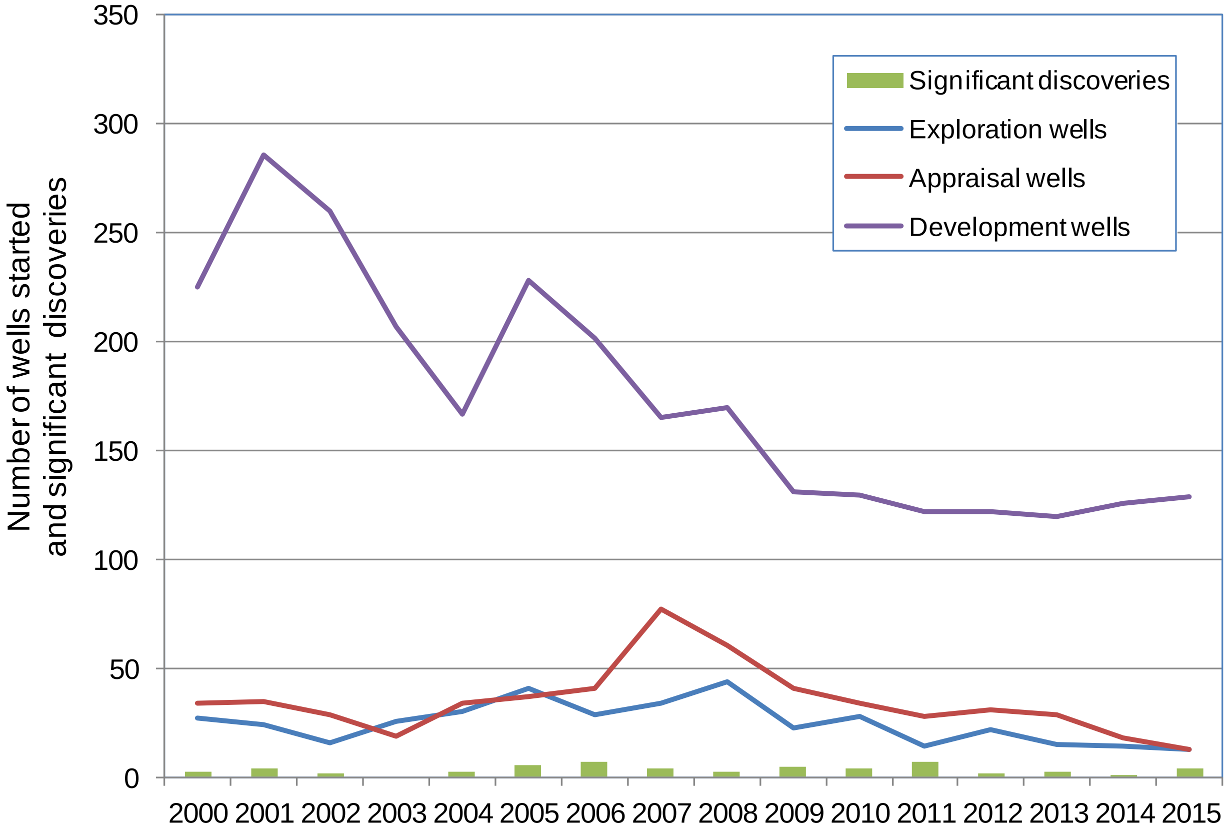
The nature, extent and timescale of development, if any, which may ultimately result from the licensing of 29th Round Blocks is uncertain, and therefore it is regarded that at this stage a meaningful assessment of development level activity (e.g. pipelay, placement of jackets, subsea templates or floating installations) cannot be made. Moreover, once project plans are in place, subsequent permitting processes relating to exploration, development and decommissioning, would require assessment (including HRA) as appropriate, allowing the opportunity for further mitigation measures to be identified as necessary, and for permits to be refused if necessary. In this way the opinion of the Advocate General in ECJ (European Court of Justice) case C-6/04, on the effects on Natura sites, "*must be assessed at every relevant stage of the procedure to the extent possible on the basis of the precision of the plan. This assessment is to be updated with increasing specificity in subsequent stages of the procedure*" is addressed.

Potential accidental events, including spills, are not considered in the AA as they are not part of the work plan. Measures to prevent accidental events, response plans and potential

[9] https://itportal.decc.gov.uk/eng/fox/path/PATH_REPORTS/pdf

impacts in the receiving environment would be considered as part of the environmental impact assessment (EIA) process for specific projects that could follow licensing when the location, nature and timing of the proposed activities are available to inform a meaningful assessment of such risks.

Figure 2.1: UKCS Exploration, appraisal & development wells, and significant discoveries since 2000



Note: The description "significant" generally refers to the flow rates that were achieved (or would have been reached) in well tests (15 mmcfgd or 1000 BOPD). It does not indicate the commercial potential of the discovery.

Source: OGA Drilling Activity (October 2016), Significant Offshore Discoveries (August 2016)

Figure 2.2: Stages of plan level environmental assessment

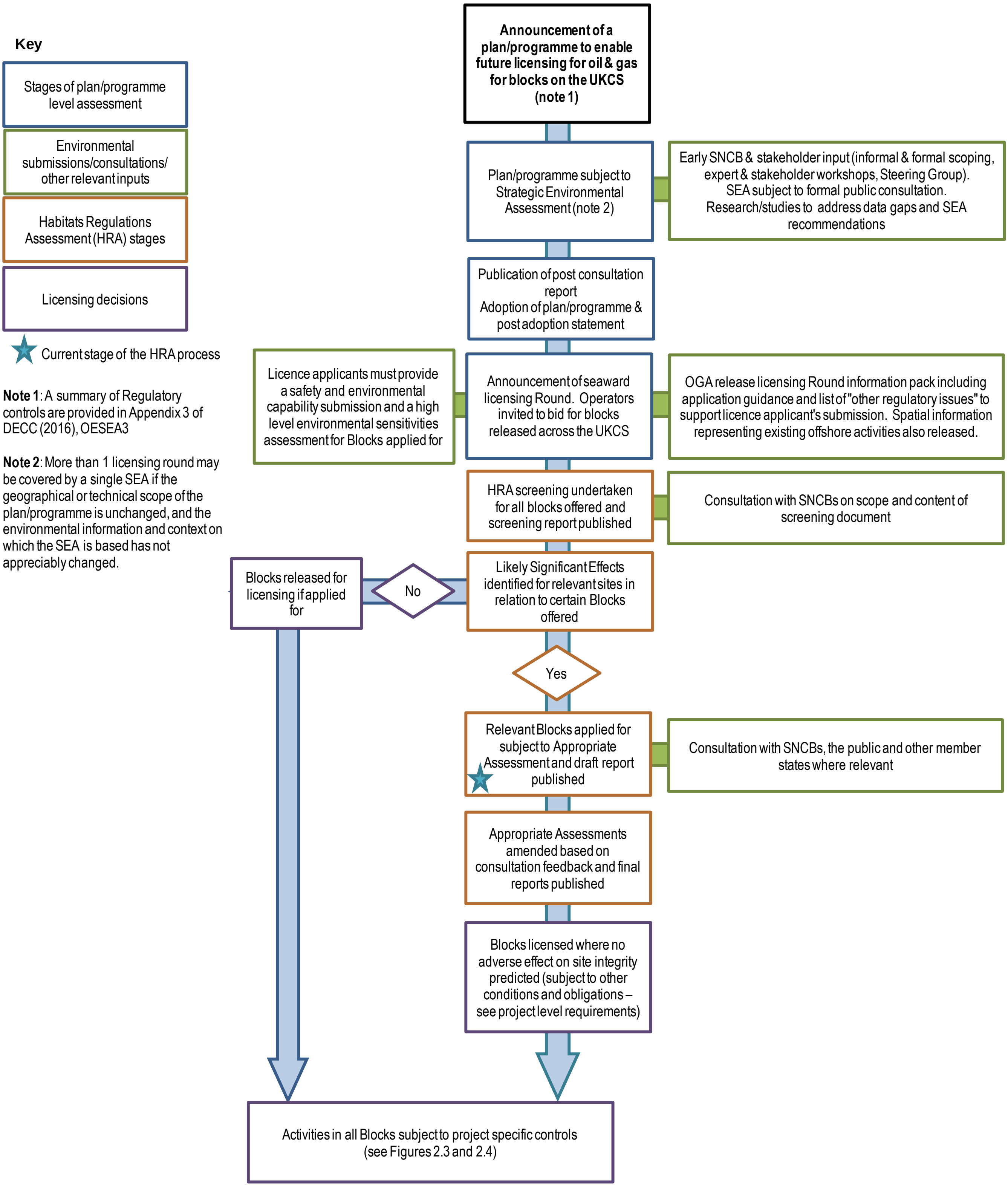
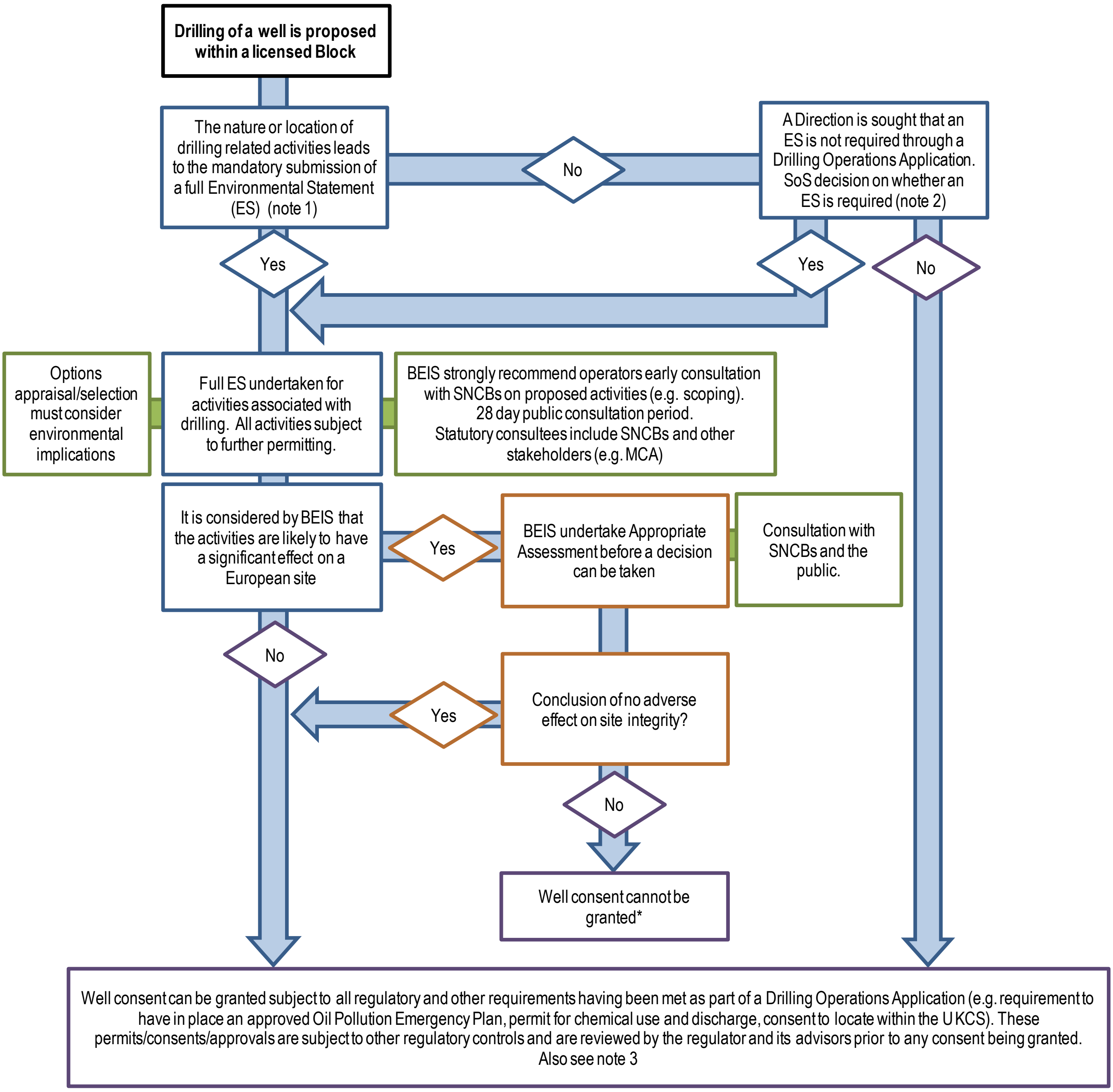


Figure 2.3: High level overview of exploration drilling environmental requirements



Key

- Stages of project permitting
- Environmental submissions/consultations/ other relevant inputs
- Habitats Regulations Assessment (HRA) stages
- Permitting/Consenting decisions

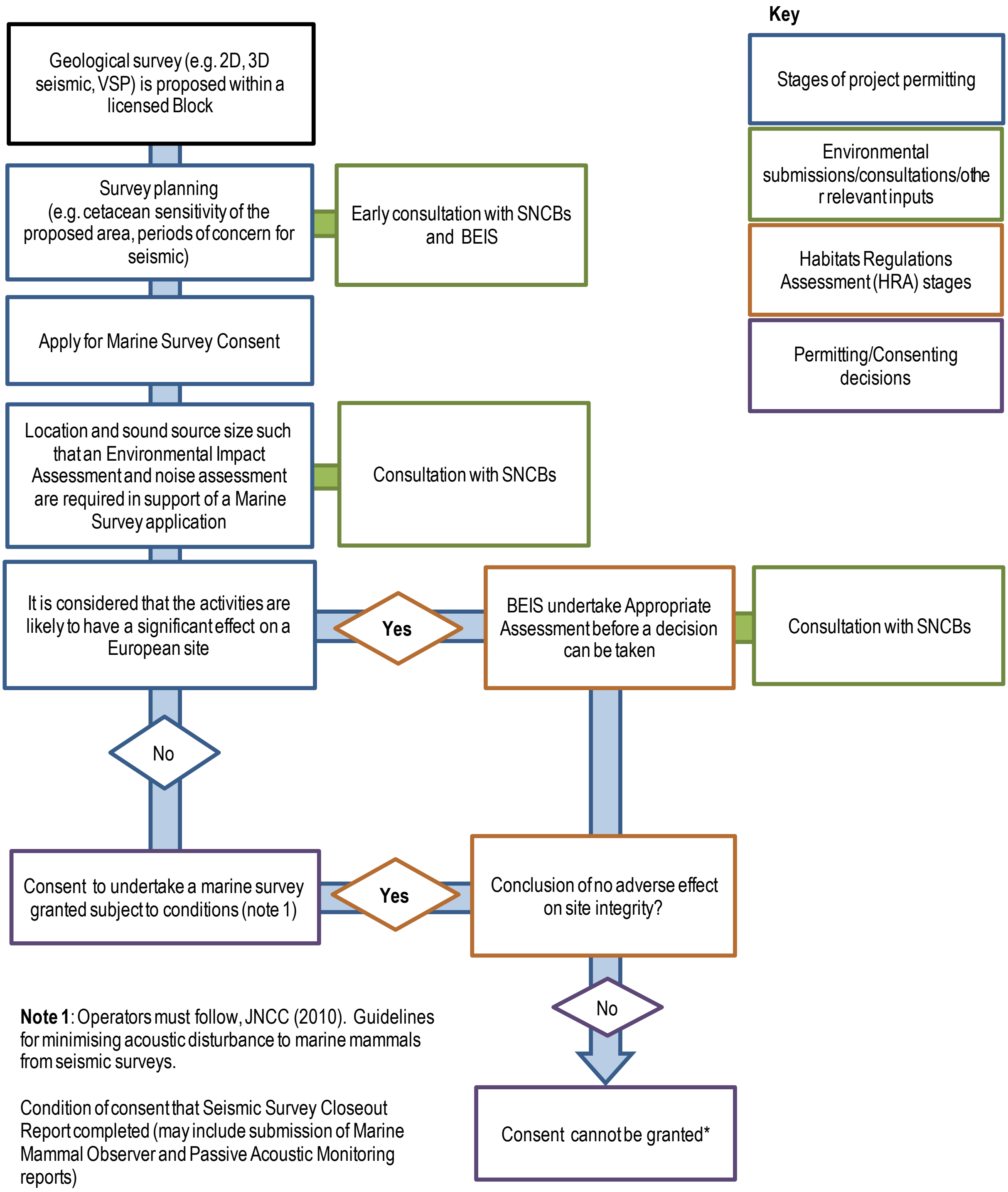
Note 1: See DECC (2011). Guidance notes on the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended)

Note 2: Early consultation between BEIS and licensed operators is typical to mitigate against Environmental Statement (ES) requirements being identified following the request for a direction

Note 3: In cases where an ES was initially identified as not required, or where an ES has been approved, the requirement to undertake AA may still apply (e.g. due to changes in the nature of the project or the designation of additional European sites)

* Article 6(4) of the Habitats Directive provides a derogation which would allow a plan or project to be approved in limited circumstances even though it would or may have an adverse effect on the integrity of a European site (see: Defra 2012).

Figure 2.4: High level overview of seismic survey environmental requirements



Note 1: Operators must follow, JNCC (2010). Guidelines for minimising acoustic disturbance to marine mammals from seismic surveys.

Condition of consent that Seismic Survey Closeout Report completed (may include submission of Marine Mammal Observer and Passive Acoustic Monitoring reports)

* Article 6(4) of the Habitats Directive provides a derogation which would allow a plan or project to be approved in limited circumstances even though it would or may have an adverse effect on the integrity of a European site (see: Defra 2012).

3 Appropriate assessment process

3.1 Process

In carrying out this AA so as to determine whether it is possible to agree to the grant of licences in accordance with Regulation 5(1) of *The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), BEIS has:

- Considered, on the basis of the precautionary principle, whether it could be concluded that the integrity of relevant European Sites would not be affected. This impact prediction involved a consideration of the 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 negated or minimised any potential adverse effects identified.

- Subject to consultation on this document, drawn conclusions on whether or not it can agree to the grant of relevant licences.

In considering the above, BEIS 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 BEIS 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.

3.2 Site integrity

The integrity of a site is defined by government policy, in the Commission's guidance and accepted by the courts (Cairngorms Judicial Review case) as being: *'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/designated.'* This is consistent with the definitions of favourable conservation status in Article 1 of the Directive (JNCC 2002). As clarified by the European Commission (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. An adverse effect would be something that impacts the site features, either directly or indirectly, and results in disruption or harm to the ecological structure and functioning of the site and/or affects the ability of the site to meet its conservation objectives. 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 with respect to 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) of the Habitats Directive, 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.

3.3 Assessment of effects on site integrity

The assessment has been undertaken in accordance with the European Commission Guidance (EC 2000) and with reference to other guidance, reports and policy, including the Habitats Regulations Guidance Notes (EN 1997, Defra 2012, SEERAD 2000), SNH (2015), the National Planning Policy Framework (DCLG 2012), the Marine Policy Statement (HM Government 2011) and English Nature Research report, No. 704 (Hoskin & Tyldesley 2006).

The assessment of effects on site integrity is documented in Section 6. It has been informed by an evidence base on the environmental effects of oil and gas activities on the UKCS and elsewhere (Section 4), and has utilised a number of assumptions on the nature and scale of potential activities that could follow licensing (Section 5), along with the characteristics and specific environmental conditions of the relevant sites (see Section 6). 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 drilling effects (Section 6.2)
- Underwater noise effects (Section 6.3)
- In-combination effects (Section 6.4)

4 Evidence base for assessment

4.1 Introduction

The AAs are informed by an evidence base on the environmental effects of oil and gas activities derived from the scientific literature, relevant Strategic Environmental Assessments (e.g. DECC 2009, 2011 and 2016) and other literature. Recent operator Environmental Statements for offshore exploration and appraisal activities on the UKCS have also been reviewed, providing for example a more specific indication of the range of spatial footprints associated with relevant drilling activities to inform the further consideration of those sites where physical disturbance and drilling effects may be considered likely.

In recent years, significant work has been undertaken in the area of sensitivity assessments and activity/pressure matrices (e.g. Tillin *et al*. 2010) resulting in agreed lists of pressures at a UK and North East Atlantic level (the OSPAR Intersessional Correspondence Group on Cumulative Effects (ICG-C), see Tillin & Tyler-Walters 2014). Defra (2015) includes an evidence base for the latest pressures-activity matrix produced by JNCC (2013). These are intended to be representative of the types of pressures that act on marine species and habitats from a defined set of activities, based on benchmarks of these pressures where the magnitude, extent or duration is qualified or quantified in some way. Whilst these matrices are informative and note many of the pressures associated with hydrocarbon exploration, resultant effects are not inevitable consequences of oil and gas activity since often they can be mitigated through timing, siting or technology (or a combination of these). BEIS expects that these options would be evaluated by the licensees and documented in the environmental assessments required as part of the activity specific consenting regime.

The following sections provide the evidence informing the assessment of effects provided in Section 6. To focus the presentation of relevant information, the sections take account of the environments in which those Blocks to be subject to further assessment are located (Figure 1.2) and those relevant Natura 2000 sites (Table 1.2, Figure 1.2).

4.2 Physical disturbance and drilling effects

The pathways by which exploration activities may have physical disturbance and drilling effects on Natura 2000 sites include:

- Physical damage to benthic habitats caused by semi-submersible drilling rig anchor placement, dragging and contact of anchor chains with the seabed – Northern North Sea area only (see Section 4.2.1)

- Physical damage to benthic habitats caused by the placement of jack-up drilling rig spud cans (see Section 4.2.1)

- Physical loss of benthic habitats through rock dump around jack-up legs for rig stabilisation (see Section 4.2.2)
- Physical loss of benthic habitats through the discharge of surface hole cuttings around the well and placement of wellhead assembly (see Section 4.2.2)
- Smothering by settlement of drill cuttings on seabed following discharge near sea surface (see Section 4.2.2)
- Displacement of sensitive receptors by visual/acoustic disturbance from the presence and movement of vessels and aircraft (see Section 4.2.3)

4.2.1 Physical damage to benthic habitats

The response of benthic macrofauna to disturbance has been well characterised in peer-reviewed literature, with increases in abundance of small opportunistic fauna and decreases in larger more specialised fauna (Pearson & Rosenberg 1978, Connell 1978, Kingston 1987, Olsgard & Gray 1995, Newell *et al.* 1998, Gray *et al.* 1999, van Dalfsen *et al.* 2000, Karakassiss *et al*. 1999, Dernie *et al*. 2003, Currie & Isaacs 2005). Following a disturbance typically the number of species and total biomass both decrease and recovery periods can vary depending on local hydrodynamic regimes, recruitment processes and the relic community at the site (Ellis 2003, Boyd *et al.* 2005, Montagna *et al.* 2013, Valentine & Benfield 2013). High species variability within a benthic habitat can itself be a symptom of disturbance and stress (Warwick & Clark 1993).

Habitat recovery from temporary disturbance (caused by anchor scarring, anchor mounds) will depend primarily on re-mobilisation of sediments by current shear. Subsequent benthic population recovery takes place through a combination of migration, re-distribution (particularly of microfaunal and meiofaunal size classes) and larval settlement. On the basis that seabed disturbance is qualitatively similar to the effects of wave action from severe storms, it is likely that in most of the shallower parts of the UKCS, sand and gravel habitat recovery from the processes of anchor scarring, anchor mounds and cable scrape is likely to be relatively rapid (1-5 years) (van Dalfsen *et al.* 2000, Newell & Woodcock 2013).

Mud habitats, by contrast, are more sensitive to physical disturbance than the coarser sediments typical of high wave- and current-energy areas. The muddy sediments of deeper or quieter waters support benthic communities often characterised by large burrowing crustaceans and pennatulid sea-pens (*Virgularia mirabilis* and *Pennatula phosphorea*). Pennatulid mortality is probably high following physical disturbance, but crustaceans are probably able to restore burrow entrances following limited physical disturbance of the sediment surface (a few cm). Re-establishment of pennatulids is likely to take in excess of 5 years due to their slow growth rate (Gates & Jones 2012).

In the Northern North Sea area, semi-submersible drilling rigs are likely to be used due to water depths (>120m), and therefore there is the potential for seabed disturbance resulting from anchor deployment. This would likely involve 8-10 anchors extending to a radius of up to

1.5km, and an associated footprint in the order of $0.06km^2$. In the Mid-North Sea High area, water depths make the use of jack-up rigs likely. The majority of these rigs are three or four-legged, with each leg terminating in a spud can of up to 20m diameter. Seabed disturbance associated with jack-up rigs likely within a radius of 500m (taking into account of any additional rig stabilisation (rock dump) footprint, and an associated disturbance footprint in the order of $0.001km^2$.

4.2.2 Physical loss of benthic habitats and smothering

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. These cuttings are derived from shallow geological formations and a proportion will therefore be similar to surficial sediments in composition and characteristics. The persistence of cuttings discharged at the seabed is largely determined by the potential for it to be redistributed by tidal and other currents. 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 (seabed 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 (see for example, Jones *et al*. (2012)).

In contrast to historic oil based mud discharges[10], effects on seabed fauna of the discharge of cuttings drilled with water based muds (WBM) and of the excess and spent mud itself are usually subtle or undetectable, although the presence of drilling material at the seabed is often detectable chemically close to the drilling location (<500m) (e.g. Cranmer 1988, Neff *et al.* 1989, Hyland *et al.* 1994, Daan & Mulder 1996, Currie & Isaacs 2005, OSPAR 2009, Bakke *et al*. 2013, DeBlois *et al*. 2014). 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. Modelling of WBM cutting discharges has indicated that deposition of material is generally thin and quickly reduces away from the well.

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. Field experiments on the effects of water-based drill cuttings on benthos by Trannum *et al.* (2011) found after 6 months only minor differences in faunal composition between the controls and those treated with drill cuttings. This corresponds with

[10] OSPAR Decision 2000/3 on the Use of Organic-Phase Drilling Fluids (OPF) and the Discharge of OPF-Contaminated Cuttings came into effect in January 2001 and effectively eliminated the discharge of cuttings contaminated with oil based fluids (OBF) greater than 1% by weight on dry cuttings.

the results of field studies where complete recovery was recorded within 1-2 years after deposition of water-based drill cuttings (Daan & Mulder 1996, Currie & Isaacs 2005).

Although suspensions of finer particles may be dispersed over greater distances than those of coarser particles, they will also be more dilute and therefore can be expected to have less impact on the marine environment. Although chemically inert, suspended barite has been shown under laboratory conditions to potentially have a detrimental effect on suspension feeding bivalves. Standard grade barite, the most commonly used weighting agent in WBMs, was found to alter the filtration rates of four bivalve species (*Modiolus modiolus, Dosinia exoleta, Venerupis senegalensis* and *Chlamys varia*) and to damage the gill structure when exposed to 0.5mm, 1.0mm and 2.0mm daily depth equivalent doses (Strachan 2010, Strachan & Kingston 2012). All three barite treatments altered the filtration rates leading to 100% mortality. The horse mussel (*M. modiolus*) was the most tolerant to standard barite with the scallop (*C. varia*) the least tolerant. Fine barite, at a 2mm daily depth equivalent, also altered the filtration rates of all species, but only affected the mortality of *V. senegalensis*, with 60% survival at 28 days. Field studies undertaken by Strachan (2010) showed that the presence of standard grade barite was not acutely toxic to seabed fauna but did alter benthic community structure. When the suspended barite levels used in laboratory studies are translated to field conditions (i.e. distances from the point of discharge) it is clear that any effects will be very local to a particular installation (in the case of oil and gas facilities, well within 500m).

The chemical formulation of WBM avoids or minimises the inclusion of toxic components, and the materials used in greatest quantities (barite and bentonite) are of negligible toxicity. The bulk of WBM constituents (by weight and volume) are on the OSPAR List of Substances/ Preparations Used and Discharged Offshore which are considered to Pose Little or No Risk to the Environment (PLONOR).

Relevant information on the recovery of benthic habitats to smothering mainly comes from studies of dredge disposal areas. Recovery following disposal occurs through a mixture of vertical migration of buried fauna, together with sideways migration into the area from the edges, and settlement of new larvae from the plankton. The community recolonising a disturbed area is likely to differ from that which existed prior to construction. Opportunistic species will tend to dominate initially and on occasion, introduced and invasive species may then exploit the disturbed site (Bulleri & Chapman 2010). Harvey *et al.* (1998) suggest that it may take more than two years for a community to return to a closer resemblance of its original state (although if long lived species were present this could be much longer). Shallow water (<20m) habitats in wave or current exposed regimes, with unconsolidated fine grained sediments have a high rate of natural disturbance and the characteristic benthic species are adapted to this. Species tend to be short lived and rapid reproducers and it is generally accepted that they recover from disturbance within months. By contrast a stable sand and gravel habitat in deeper water is believed to take years to recover.

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 for example in the form of rock outcrops, glacial dropstones and moraines, relicts of periglacial water flows, accumulations of large mollusc shells, carbonate cemented rock etc., and these are often revealed in UK rig site surveys.

4.2.3 Other disturbance

The presence and/or movement of vessels from and within Blocks during drilling activities could also potentially disturb marine mammals foraging within or close to designated or potential SACs for which they are a qualifying feature. However, shore-based monitoring of the effects of boat activity on the behaviour of bottlenose dolphins off the US South Carolina coast, indicated that slow moving, large vessels, like ships or ferries, appeared to cause little to no obvious response in dolphin groups (Mattson *et al.* 2005). Pirotta *et al.* (2015a) used passive acoustic techniques to quantify how boat disturbance affected bottlenose dolphin foraging activity in the inner Moray Firth. The presence of moving motorised boats appeared to affect bottlenose dolphin buzzing activity (foraging vocalisations), with boat passages corresponding to a reduction by almost half in the probability of recording a buzz. The boat effect was limited to the time where a boat was physically present in the sampled area and visual observations indicated that the effect increased for increasing numbers of boats in the area (Pirotta *et al*. 2013). Dolphins appeared to temporarily interrupt their activity when disturbed, staying in the area and quickly resuming foraging as the boat moved away. Of primary concern for this AA, is whether vessels linked to operations result in a significant increase to overall local traffic. New *et al.* (2013) developed a mathematical model simulating the complex social, spatial, behavioural and motivational interactions of coastal bottlenose dolphins in the Moray Firth to assess the biological significance of increased rate of behavioural disruptions caused by vessel traffic. A scenario was explored in which vessel traffic increased from 70 to 470 vessels a year but despite the more than six fold increase traffic, the dolphins' behavioural time budget, spatial distribution, motivations and social structure remained unchanged.

Worldwide, collisions with vessels are a potential source of mortality to marine mammals, primarily cetaceans. Whales are occasionally reported to be struck and killed, especially by fast-moving ferries but smaller cetacean species and seals can also be impacted by propeller strikes from smaller vessels. In the UK certain areas experience very high densities of commercial and recreational shipping traffic, some of which may also be frequented by large numbers of marine mammals; despite this, relatively few deaths are recorded as results of collisions (Hammond *et al*. 2008). Between 2000 and 2009, only 11 out of 1,100 post-mortems on harbour porpoises and common dolphins identified collision as the cause of death (UKMMAS 2010). Draft advice on operations for the Southern North Sea pSAC[11] indicates that post mortem investigations of harbour porpoise deaths have revealed death caused by trauma (potentially linked with vessel strikes) is not currently considered a significant risk.

[11] http://jncc.defra.gov.uk/pdf/SouthernNorthSeaConservationObjectivesAndAdviceOnActivities.pdf

4.3 Underwater noise

The sources, measurement, propagation, ecological effects and potential mitigation of noise associated with hydrocarbon exploration and production have been extensively reviewed, assessed and updated in each of the successive offshore energy SEAs (see DECC 2009, 2011, 2016).

4.3.1 Noise sources and propagation

Of those activities which can follow licensing (Table 5.1), deep geological seismic survey is of primary concern due to the high amplitude, low frequency and impulsive nature of the sound generated over a relatively wide area. Other sources of impulsive sound are the air-guns and sub-bottom profilers used in site surveys and well evaluation; these tend to generate sound of lower amplitude and, in the case of some sub-bottom profilers, higher frequency, so that the overall area of risk from sound effects is considerably smaller than in the case of deep geological seismic surveys. Drilling operations and support vessel traffic are sources of continuous noise (non-impulsive) of comparable amplitude and dominated by low frequency. For all sources, there is now a reasonable body of evidence to quantify sound levels associated with these activities and to understand the likely propagation of these sounds within the marine environment, even in more complex coastal locations (DECC 2016).

4.3.2 Potential ecological effects

Potential effects of anthropogenic noise on receptor organisms range widely, from masking of biological communication and small behavioural reactions, to chronic disturbance, auditory injury and mortality. In addition to direct effects, indirect effects may also occur for example via effects on prey species, complicating the overall assessment of significant effects. Given in this assessment, the harbour porpoise is the only species of relevance, the focus of this section is on potential effects to marine mammals, with evidence drawn specifically from harbour porpoise studies when possible.

While generally the severity of effects tends to increase with increasing exposure to noise, it is important to draw a distinction between effects associated with physical (including auditory) injury and effects associated with behavioural disturbance. With respect to injury, risk from an activity can be assessed using threshold criteria based on sound levels. For marine mammals, the latest SEA (OESEA3) reflects the injury thresholds criteria developed by Southall *et al.* (2007), including the subsequent update for harbour porpoises in Lepper *et al*. (2014), based on the work by Lucke *et al.* (2009). It is recognised that seismic surveys have the potential to generate sound that exceeds thresholds of injury, but only within a limited range from source (tens to hundreds of metres). Within this zone, current mitigation measures as described in JNCC guidelines are thought sufficient in minimising the risk of injury to negligible levels for marine mammal species considered in this AA (harbour porpoise). Since JNCC guidelines are required to be followed as part of any consent with regard to geophysical surveys across the UKCS, the risk of injury to marine mammals is not considered further.

With respect to disturbance however, it has proved much more difficult to establish broadly applicable threshold criteria based on exposure alone; this is largely due to the inherent complexity of animal behaviour where the same sound level is likely to elicit different responses depending on an individual's behavioural context and exposure history. For compliance with the Habitat Directive, the guidance for the Protection of marine European Protected Species from injury and disturbance (JNCC 2010) recommends that 'disturbance' as described in Regulations 41(1)(b) and 39(1)(b) of *The Conservation of Habitats and Species Regulations 2010* and of *The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended in 2009 and 2010) is interpreted as sustained or chronic disruption of behaviour scoring 5 or more in the Southall *et al*. (2007) behavioural response severity scale. This is to highlight that a disturbance offence is unlikely to occur from sporadic changes in behaviour with negligible consequences on vital rates and population effects (i.e. trivial disturbance). While it is possible to envisage how some behavioural effects may ultimately influence vital rates, evidence is currently limited. The focus of field studies has been on measuring displacement and changes in vocalisation with the assumption that these may influence vital rates mainly via a reduction in foraging opportunities.

Initial focus of research on the effects of seismic surveys focused on baleen whales, because of their greater acoustic sensitivity to low frequency sounds. Evidence for localised avoidance, changes in swimming behaviour and in vocalisation patterns have been obtained but overall, the magnitude of responses has been found to vary between studies, depending on several factors including actual received exposure levels, age, sex, social status, behavioural state and activity (e.g. migrating, foraging, resting).

Evidence of the effects of seismic surveys on odontocetes and pinnipeds is limited but of note are the recent studies carried out in the Moray Firth observing responses to a 10 day 2-D seismic survey (Thompson *et al.* 2013a). The 2D seismic survey took place in September 2011 and exposed a 200km^2 area to noise throughout that period; peak-to-peak source levels were estimated to be 242–253 dB re 1 µPa at 1m while within 5-10km from the source, received peak-to-peak SPLs were estimated to be between 165 and 172 dB re 1 µPa, with SELs for a single pulse between 145 and 151 dB re 1 µPa^{2}s. A relative decrease in the density of harbour porpoises within 10km of the survey vessel and a relative increase in numbers at distances greater than 10km was reported; these effects were however, short-lived with porpoise returning to impacted areas within 19h after cessation of activities. Overall it was concluded that while short-term disturbance was induced, the survey did not lead to long-term or broad-scale displacement (Thompson *et al*. 2013a). Further acoustic analyses revealed that for those animals which stayed in proximity to the survey, there was a 15% reduction in buzzing activity associated with foraging or social activity; however, high levels of natural variability in the detection of buzzes was noted prior to survey (Pirotta *et al*. 2015a).

As concluded in the recent SEA, a conservative assessment of the potential for marine mammal disturbance of seismic surveys will assume that firing of airguns will affect individuals within 10km of the source, resulting in changes in distribution and a reduction of foraging activity but the effect is short-lived. The precautionary criterion applied during initial Block screening (15km) is maintained here to identify the Blocks applied for to be considered in this assessment (see Section 6.2).

Recent evidence on the response of harbour porpoise to impact piling during wind-farm construction is also relevant since the impulsive character of the sound generated during piling is comparable with that from seismic airguns and for assessing in-combination effects with wind farms currently planned or under construction across the North Sea. Empirical studies during the construction of offshore wind farms (OWF) in the North and Baltic Seas (Tougaard *et al.* 2009, Cartensen *et al.* 2006, Brandt *et al.* 2011, Dähne *et al.* 2013) have all observed displacement of harbour porpoises in response to pile-driving. The magnitude of the effect (spatial extent and duration) varied between studies as a function of the many factors at play including exposure level, duration of piling and ecological importance of the area. Nonetheless, from the available evidence it has been concluded that impact piling will displace individual harbour porpoises up to a distance of approximately 20km; however, once piling ceases, harbour porpoises are expected to return readily (hours to days) (DECC 2016).

Information on the potential effects of other geophysical surveys (e.g. sub-bottom profilers) is currently very limited and the most recent OESEA (DECC 2016) concluded that effects are negligible but with a high level of uncertainty. As part of the SEA Research Programme, a field study will measure received sound source levels generated by several types of geophysical survey equipment used routinely on site surveys. Laboratory and field measurements are also taking place on similar equipment as part of a US project[12]. Outputs from these studies will be considered in due course to reduce uncertainty in assessments.

Noise from vessels and drilling activity is audible to marine mammals but are not of the quality and type sufficient to cause injury or disturbance on their own and as such they are not directly relevant in the context of site integrity. There is evidence that vessel traffic may influence marine mammals in several ways, but the cause of that type of disturbance is not the sound *per se* but the overall presence and movement of the vessel and is therefore discussed in Section 4.2.

[12] https://www.boem.gov/Environmental-Studies-Planning/

5 Assessment assumptions

The following section describes the assumptions used to underpin the assessment; these include assumptions relating to the potential activities that could follow Block licensing, the level of this activity, and the regulatory framework within which the assessment takes place.

5.1 Work programme and activities to be assessed

It should be noted that this assessment is being undertaken during the licence application process and therefore agreed work programmes are not yet available for those Blocks subject to further assessment. The approach used in this AA is to consider a generic work programme for the Initial Term that is a maximum of that likely as part of the Block licence application process, consisting of:

- A single well
- 500km of 2D or 3D seismic survey

These relate to Phase B and C activities in the Initial Term (i.e. the periods within which activities could take place in the field). Such activity does not inevitably follow licensing (for example, applicants may propose to reprocess existing seismic data rather than collect new information).

Completion of the work programme is likely to involve one or more of the activities summarised in Table 5.1. A series of assumptions has been developed on the nature and scale of activities to be assessed based on the evidence base for potential effects presented in Section 4 as well as reviews of exemplar Environmental Statements of relevant activities. Subsequent development activity is contingent on successful exploration and appraisal and may or may not result in the eventual installation of infrastructure. Where relevant, such future activities will themselves be subject to activity specific screening procedures and tests under the Habitats Directive.

Table 5.1: Potential activities and assessment assumptions

Potential activity	Description	Assumptions used for assessment
Initial Term Phase B: Geophysical survey		
Deep geological seismic (2D and 3D) survey	2D seismic involves a survey vessel towing a single airgun array and a single streamer (up to 12 km long), containing several hydrophones along its length. 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. Typical airgun arrays for deep geological surveys involve 12-48 airguns and have a total array volume of 3000-8000 in^3	Assuming a survey vessel sailing speed of 4.5 knots and 500 line km of seismic shot per Block, this activity would take at least 2.5 days to complete. Total survey duration could vary between 3 and 11 days depending on its location and time of year (e.g. assuming shooting is undertaken only in daylight hours and suitable sea state is available).
Initial Term Phase C: Drilling and well evaluation		
Rig tow out & de-mobilisation	Mobile rigs are towed to and from the well site typically by 2-3 anchor handling vessels.	The physical presence of a rig and related tugs during tow in/out is both short (a number of days depending on initial location of rig) and transient.
Rig placement/ anchoring	Jack-up rigs are used in shallower waters (normally <120m) and jacking the rig legs to the seabed supports the drilling deck. Each of the rig legs terminates in a spud-can (base plate) to prevent excessive sinking into the seabed. Semi-submersible rigs are used in deeper waters (normally >120m). Mooring is achieved using 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 from the rig; part of the anchoring hold is provided by a proportion of the cables or chains lying on the seabed (catenary).	Given relative water depths, jack-up rigs would be used to drill wells in the Mid-North Sea High area, and semi-submersible rigs would be used to drill wells in the northern North Sea. It is assumed that jack-up rigs will be three or four-legged rigs with 20m diameter spudcans with an approximate seabed footprint of $0.001km^2$ within a radius of *ca*. 50m of the rig centre. For the assessment it is assumed that effects may occur within 500m of a jack-up rig which would take account of any additional rig stabilisation (rock dump) footprint. Semi-submersible rig anchors (if used) may extend out to a radius of 1.5km in North Sea waters of the UK. It is assumed that the seabed footprint of these is in the order of $0.06km^2$.

Potential activity	Description	Assumptions used for assessment
Marine discharges	Typically around 1,000 tonnes of cuttings (primarily rock chippings) result from drilling an exploration well. Water-based mud cuttings are typically discharged at, or relatively close to sea surface during "closed drilling" (i.e. when steel casing in the well bore and a riser to the rig are in place), whereas surface hole cuttings are normally discharged at seabed during "open-hole" drilling. Use of oil based mud systems, for example in highly deviated sections or in drilling water reactive shales, would require onshore disposal or treatment offshore to the required standards prior to discharge.	The footprint of cuttings and other marine discharges, or the distance from source within which smothering or other effects may be considered is generally a few hundred metres. For the assessment it is assumed that effects may occur within 500m of the well location covering an area in the order of $0.8km^2$.
Rig/vessel presence and movement	On site, the rig is supported by supply and standby vessels, and helicopters are used for personnel transfer.	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.
Rig site survey	Rig site surveys are undertaken to identify seabed and subsurface hazards to drilling, such as wrecks and the presence of shallow gas. The surveys use a range of techniques, including multibeam and side scan sonar, sub-bottom profiler, magnetometer and high resolution seismic involving a much smaller source (mini-gun or four airgun cluster of 160 in^3) and a much shorter hydrophone streamer. The rig site survey vessel may also be used to characterise seabed habitats, biota and background contamination.	Rig site survey typically covers $2\text{-}3km^2$. Survey durations are usually of the order of four or five days.
Well evaluation (e.g. Vertical Seismic Profiling)	Sometimes conducted to assist with well evaluation by linking rock strata encountered in drilling to seismic survey data. A seismic source (airgun array, typically with a source size of ~500 in^3 and a maximum of 1,200 in^3) is deployed from the rig, and measurements are made using a series of geophones deployed inside the wellbore.	Vertical Seismic Profiling (VSP) surveys are static and of short duration (one or two days at most).

5.2 Existing regulatory requirements and controls

Mandatory controls and required mitigation measures for each of the broad sources of potential effect from activities associated with 29th Round licensing have been identified in the HRA screening (BEIS 2016). The AA assumes that the high level controls described below are applied as standard to activities since they are legislative requirements which if not adhered to would constitute an offence. These are distinct from further mitigation measures which may be identified and employed to avoid likely significant effects on relevant sites (see Sections 6.1.3 and 6.2.3).

5.2.1 Physical disturbance and drilling

The routine sources of potential physical disturbance and drilling effects associated with exploration are assessed and controlled through a range of regulatory processes, such as

Environmental Impact Assessment (EIA) under the *Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999* (as amended) as part of the Drilling Operations Application through the Portal Environmental Tracking System and, where relevant, HRA to inform decisions on those applications[13].

There is a mandatory requirement to have sufficient recent data to characterise the seabed in areas where activities are due to take place (e.g. rig placement). If required, survey reports must be made available to the relevant statutory bodies on submission of a relevant permit application or Environmental Statement for the operation to be undertaken, and the identification of sensitive habitats by such survey (including those under Annex I of the Habitats Directive) may affect BEIS's decision on a project level consent.

Discharges from offshore oil and gas facilities have been subject to increasingly stringent regulatory controls over recent decades (see review in DECC 2016, and related Appendices 2 and 3). As a result, oil and other contaminant concentrations in the major streams (drilling wastes and produced water) have been substantially reduced or eliminated (e.g. the discharge of oil based muds and contaminated cuttings is effectively banned), with discharges of chemicals and oil exceeding permit conditions or any unplanned release, potentially constituting a breach of the permit conditions and an offence. Drilling chemical use and discharge is subject to strict regulatory control through permitting, monitoring and reporting (e.g. the mandatory Environmental and Emissions Monitoring System (EEMS) and annual environmental performance reports). The use and discharge of chemicals must be risk assessed as part of the permitting process (e.g. Drilling Operations Application) under the *Offshore Chemicals Regulations 2002* (as amended), and the discharge of chemicals which would be expected to have a significant negative impact would not be permitted.

At the project level, discharges would be considered in detail in project-specific EIAs, (where necessary through HRAs) and chemical risk assessments under existing permitting procedures.

5.2.2 Acoustic disturbance

Controls are currently in place to cover all significant noise generating activities on the UKCS, including geophysical surveying. All seismic surveys (including VSP and high-resolution site surveys), sub-bottom profile surveys and shallow drilling activities require an application for consent under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) and cannot proceed without consent. These applications are supported by an EIA, which includes a noise assessment. Applications are made through BEIS's Portal Environmental Tracking System using a standalone Master Application Template (MAT) and Geological Survey Subsidiary Application Template (SAT). BEIS consults the relevant statutory consultees on each application for advice and a decision on whether to grant consent is only made after careful consideration of their comments. Statutory consultees may request additional information or risk assessment, specific additional conditions to be attached to

[13] https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation

consent (such as specify timing or other specific mitigation measures), or advise against consent.

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 and sub-bottom profile surveys that the JNCC Seismic Guidelines are followed. Where appropriate, European Protected Species (EPS) disturbance licences may also be required under the *Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended)[14].

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 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 used to detect marine mammals 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) – the use of PAM as a mitigation tool will be required where JNCC and other SNCBs deem it appropriate.
- 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).

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 of OGA's Other Regulatory Issues[15] which accompanied the 29th Round offer) which licensees should take account of. Licensees should also be aware that it may influence BEIS's decision whether or not to approve particular activities.

[14] Disturbance of European Protected Species (EPS) (i.e. those listed in Annex IV) is a separate consideration under Article 12 of the Habitats Directive, and is not considered in this assessment.

[15] https://www.ogauthority.co.uk/media/2213/other_regulatory_issues-230816.pdf

6 Assessment

The screening process (BEIS 2016) identified a number of sites where there was the potential for likely significant underwater noise, physical disturbance and/or drilling effects associated with proposed activities that could follow licensing of Blocks offered in the 29th Round. A number of these Blocks have been applied for (see Section 1.2) and the further assessment of licensing of these Blocks on relevant Natura 2000 sites (those shown in Figure 1.2) is given below. This assessment has been informed by the evidence base on the environmental effects of oil and gas activities (Section 4.2) and the assumed nature and scale of potential activities (Section 5).

6.1 Assessment of physical disturbance and drilling effects

6.1.1 Blocks and sites to be assessed

The nature and extent of potential physical disturbance and drilling effects are summarised in Section 5.2. On the basis of this information, in conjunction with the location of Blocks applied for in the 29th Round (Figure 1.1) and the location of sites with relevant qualifying features, potential likely significant effects are considered to remain for 21 Blocks (or part Blocks), in respect of three sites, Braemar Pockmarks SAC, Dogger Bank cSAC/SCI and the Southern North Sea pSAC (Figure 6.1).

The Braemar Pockmarks in the northern North Sea are a series of crater-like depressions on the sea floor at a depth of approximately 120m and were probably formed by the venting of biogenic/petrogenic fluids or gases into the water column. A study of the pockmarks was undertaken by Gafeira & Long (2015), who reported 49 pockmarks, 27 of which were within the existing site boundaries, with the remainder, apart from 1, within 1km of the boundaries. Large Blocks, pavement slabs and smaller fragments of methane derived authigenic carbonate (MDAC) (a type of the Annex I habitat, 'submarine structures made by leaking gases') have formed through precipitation during the oxidation of methane gas. These MDAC and carbonate structures are ecologically significant because they provide a habitat for marine fauna usually associated with rocky reef, and chemosynthetic organisms which feed off both methane (seeping from beneath the sea floor) and its microbial degradation by-product, hydrogen sulphide. Larger blocks of carbonate also provide shelter for fish species such as wolf-fish and cod[16].

The Dogger Bank in the southern North Sea was formed by glacial processes before being submerged through sea level rise during the last marine transgression (by *c*. 8,000 years BP). The southern part of the bank is covered by water seldom deeper than 20m and extends within the SAC in UK waters down to 35-40m deep. The bank structure slopes down to greater than

[16] http://jncc.defra.gov.uk/page-6529

50m deep in UK, Dutch and German waters and its location in open sea exposes the bank to substantial wave energy preventing the colonisation of the sand by vegetation on the shallower parts of the bank. Sediments range from fine sands containing many shell fragments on top of the bank to muddy sands at greater depths supporting invertebrate communities. Sand eels are an important prey resource found at the bank supporting a variety of species including fish, seabirds and cetacean. Occasional, discrete areas of coarser sediments (including pebbles) are dominated by the soft coral *Alcyonium digitatum*, the bryozoan *Alcyonidium diaphanum* and serpulid worms[17].

The Southern North Sea pSAC has been recognised as an area with predicted persistent high densities of harbour porpoise, see Section 6.2.1. As part of the site identification process, analysis of the observed density of harbour porpoise against different environmental variables (Heinänen & Skov 2015) indicated that the coarseness of the seabed sediment was an important determinant of porpoise density, with porpoises showing a preference for coarser sediments (such as sand/gravel) rather than fine sediments (e.g. mud). Sandeels which are known prey for harbour porpoises, exhibit a strong association with sandy substrates. The majority of the substrate types within the site are categorised as sublittoral sand and sublittoral coarse sediment. Water depths within the site range between 10m and 75m, with the majority of the site shallower than 40m – depths across Blocks relevant to this AA are between 30m and 60m. Moderate energy levels at the seabed (including wave and tidal energy) are estimated across the majority of the site[18].

6.1.2 Implications for site integrity of relevant sites

The conservation objectives of relevant sites and other relevant information relating to site selection and advice on operations has been considered against indicative Block work programmes for the Blocks applied for to determine whether they could adversely affect site integrity. The results are given in Table 6.1 below. In terms of mitigation, all mandatory requirements (as given in Section 5.2.1) are assumed to be in place as a standard for all activities assessed here.

[17] http://jncc.defra.gov.uk/page-6508
[18] http://jncc.defra.gov.uk/pdf/SouthernNorthSeaSelectionAssessmentDocument.pdf

Figure 6.1: Sites and Blocks to be subject to further assessment for physical disturbance and drilling effects

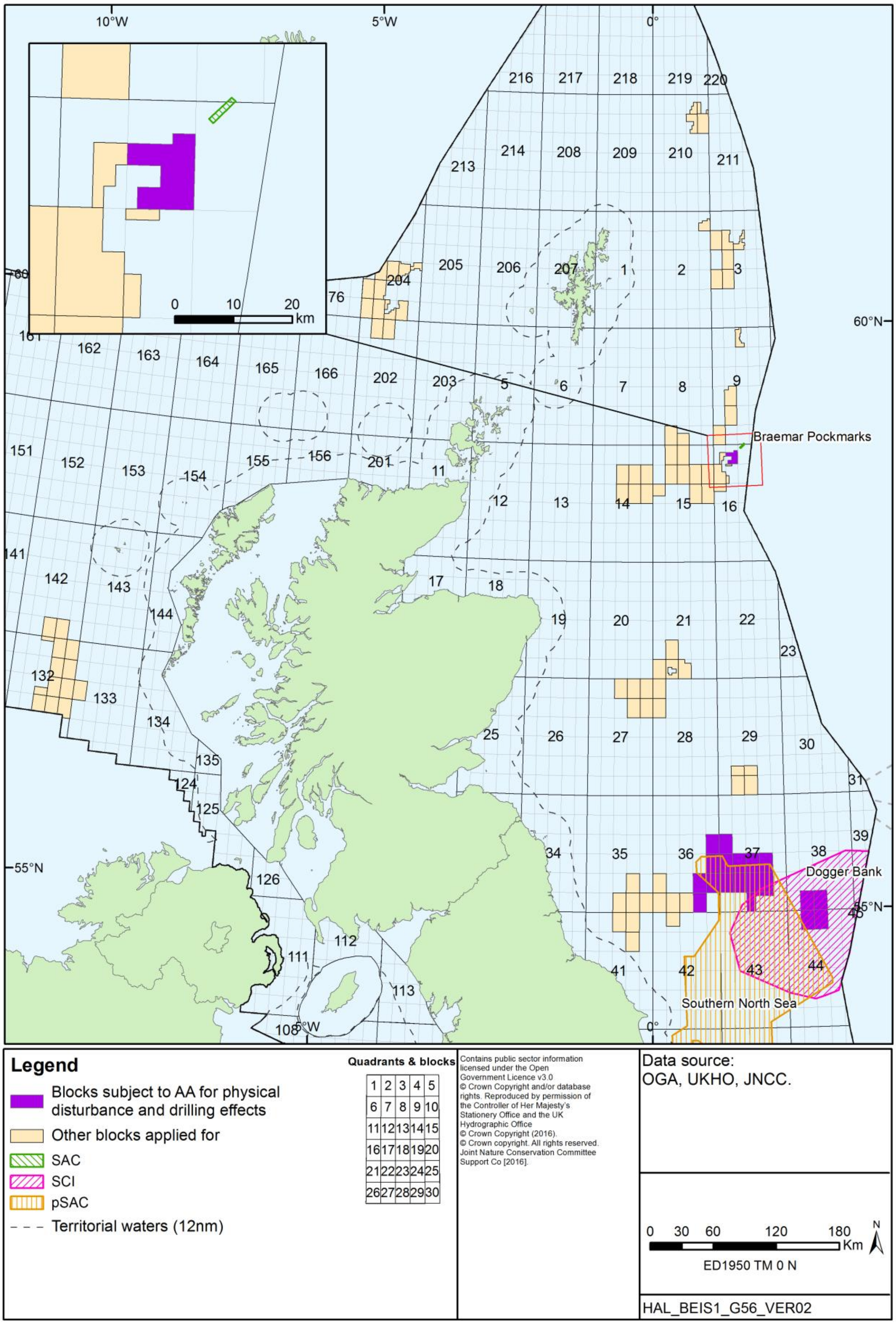


Table 6.1: Consideration of potential physical disturbance and drilling effects and relevant site conservation objectives

Dogger Bank cSAC/SCI
Site information
Area (ha): 1,233,115 **Relevant qualifying features:** Sandbanks which are slightly covered by sea water all the time **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
Relevant Blocks for physical disturbance and drilling effects
37/19, 37/22, 37/23, 37/24, 37/28b, 37/29b, 38/27, 38/28, 44/2, 44/3
Assessment of effects on site integrity
Rig siting The qualifying feature is moderately sensitive to physical damage through disturbance or abrasion by the placement of spud cans as part of rig siting. The moderate sensitivity is associated with the soft coral *Alcyonium digitatum* and the bryozoan, *Alcyonidium diaphanum*, occasionally found in discrete areas of coarser sediments (Diesing *et al*. 2009)[19]. Blocks 37/19 and 37/22 are 9.6km and 6.4km respectively from the site boundary and given the assumed distance from a jack-up rig within which effects may occur (500m, see Table 5.1), no physical damage to the qualifying feature could occur from rig installation in either of the Blocks. Blocks 37/23 and 37/24 have significant areas outside the site boundaries in which rig siting will be possible, and therefore interaction with sensitive site features could be avoided, thereby negating any adverse effects on site integrity. With respect to the remaining Blocks, the maximum seabed footprint associated with jack-up rig siting (0.001km^2) is very small compared to the large site (covering <0.0001%), and its offshore location and relatively shallow depth (15-40m) exposes it to substantial wave energy, particularly during storm events which may cause significant sediment mobilisation[20]. Recovery from physical damage of the scale associated with rig placement is expected to be rapid. The small scale and temporary nature of the potential physical damage and the further mitigation measures available (e.g. rig siting to ensure sensitive seabed surface features are avoided, see Section 6.1.3), will ensure that site conservation objectives are not undermined. **Drilling discharges** The qualifying feature has a low sensitivity to smothering from drilling discharges, and though it is exposed to drill cuttings from existing oil and gas operations, given the limited duration and extent, exposure to this pressure is considered to also be low[15]. It is assumed that effects relating to drilling discharges occur within 500m of the well location (Table 5.1) and therefore no adverse effects on site integrity are expected for Blocks beyond this distance from the site (37/19 and 37/22) or which have significant areas outside the site boundaries in which drilling will be possible (37/23 and 37/24). With respect to the other Blocks, the maximum spatial footprint within which smothering by drilling discharges may occur (0.8km^2) is small (representing 0.006% of the total site area) and given the site's exposure to wave energy, redistribution of drilling discharges and recovery from smothering would be rapid. The small scale and temporary nature of potential smothering and low sensitivity of the qualifying feature, and mandatory mitigation requirements with respect to drilling chemical use and discharge (Section 5.2.1) will ensure that site conservation objectives are not undermined. **In-combination effects** Intra-plan in-combination effects are possible although spatial footprints associated with rig installation and drilling discharges in Blocks 37/28b, 37/29b, 38/27, 38/28, 44/2 and 44/3 (i.e. those Blocks entirely or largely within the site) are localised and temporary, and unlikely to overlap between Blocks either spatially or temporally. The combined spatial footprint within which physical disturbance and drilling effects could occur (within 500m of the rig/well location) across the 6 Blocks is estimated at 4.8km^2 (0.04% of the site). However, the temporary nature of the disturbance, low to moderate sensitivity of the qualifying feature and available mitigation (Sections 5.2.1 and

[19] http://jncc.defra.gov.uk/PDF/DoggerBank_ConservationObjectivesAdviceonOperations_6.0.pdf
[20] http://jncc.defra.gov.uk/PDF/DoggerBank_SelectionAssessment_v_9.pdf

6.1.3), will ensure that site conservation objectives are not undermined. Section 6.3.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.
Southern North Sea pSAC
Site information
Area (ha): 3,695,766 **Relevant qualifying features:** Harbour porpoise **Conservation objectives:** To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining Favourable Conservation Status (FCS) for the UK harbour porpoise. To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term: • The species is a viable component of the site. • There is no significant disturbance of the species. • The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.
Relevant Blocks for physical disturbance and drilling effects
36/15, 36/20, 36/24, 36/25, 36/29, 37/11, 37/16, 37/17, 37/18, 37/19, 37/21, 37/22, 37/23, 37/24, 37/28b, 37/29b, 38/27, 44/2, 44/3
Assessment of effects on site integrity
Rig siting The delineation of the Southern North Sea site was based on the prediction of 'harbour porpoise habitat' within the North Sea (Heinänen & Skov 2015). The analysis indicated a preference for water depths between 30 and 50m throughout the year, and in general, the coarseness of the seabed sediment was important, with porpoises showing a preference for coarser sediments (such as sand/gravel)[21]. Physical damage to benthic habitats through disturbance or abrasion by the placement of spud cans as part of rig installation has the potential to impact on the extent of supporting habitat within the site. It is assumed that physical damage effects occur within 500m of the rig location (Table 5.1) and therefore no adverse effects on site integrity are expected for Blocks beyond this distance from the site (36/15, 36/29, 37/11, 38/27 and 44/3). With respect to the other Blocks, the maximum seabed footprint associated with jack-up rig siting (0.001km^2) is very small compared to the large site (covering <0.0001%), and recovery from physical damage in relevant sand/gravel habitats across the relatively shallow site (majority of site less than 40m) is expected to be relatively rapid. The small scale and temporary nature of the potential physical damage, and the mobile nature of the qualifying features will ensure that site conservation objectives are not undermined. **Drilling discharges** It is assumed that effects relating to drilling discharges occur within 500m of the well location (Table 5.1) and therefore no adverse effects on site integrity are expected for Blocks outwith this distance from the site (36/15, 36/29, 37/11, 38/27 and 44/3). With respect to the other Blocks, the maximum spatial footprint within which smothering by drilling discharges may occur (0.8km^2) is small (representing 0.002% of the total site area) and recovery from smothering in relevant sand/gravel habitats across the relatively shallow site (majority of site less than 40m) is expected to be relatively rapid. The small scale and temporary nature of potential smothering and mandatory mitigation requirements with respect to drilling chemical use and discharge (Section 5.2.1) will ensure that site conservation objectives are not undermined. **In-combination effects** Intra-plan in-combination effects are possible although spatial footprints associated with rig installation and drilling discharges in Blocks 36/20, 36/24, 36/25, 37/16, 37/17, 37/18, 37/19, 37/21, 37/22, 37/23, 37/24, 37/28b, 37/29b, 44/2 are localised and temporary, and unlikely to overlap between Blocks either spatially or temporally. The combined spatial footprint within which physical disturbance and drilling effects could occur across the 14 Blocks is estimated at 11.2km^2 (0.03% of the site). However, the temporary nature of the disturbance, the mobile nature of the qualifying feature and mandatory mitigation measures (Section 5.2.1), will ensure that site conservation objectives are not undermined. Section 6.3.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

[21] http://jncc.defra.gov.uk/pdf/SouthernNorthSeaSelectionAssessmentDocument.pdf

Braemar Pockmarks SAC
Site information
Area (ha): 518 **Relevant qualifying features:** Submerged structures made by leaking gases **Conservation objectives:** Subject to natural change, restore the submarine structures made by leaking gases to favourable condition, such that: • The natural environmental quality is restored; • The natural environmental processes are maintained; • The extent, physical structure, diversity, community structure and typical species representative of the submarine structures made by leaking gases in the Northern North Sea are restored.
Relevant Blocks for physical disturbance and drilling effects
16/2a
Assessment of effects on site integrity
Rig siting The qualifying feature is highly sensitive to physical damage through disturbance or abrasion (e.g. anchoring)[22]. However, Block 16/2a is 3.4km from the site boundary and given the assumed anchor radius of a semi-submersible drilling rig in the northern North Sea (1.5km, see Table 5.1), no physical damage to the qualifying feature could occur from rig installation thereby ensuring site conservation objectives are not undermined. **Drilling discharges** The qualifying feature is moderately sensitive to smothering from drilling discharges. As the feature lies in a low energy environment, drill cuttings may not be removed by currents and the feature's associated biological community is unlikely to be accustomed to changing sediment levels[23]. For the assessment it is assumed that effects associated with drilling discharges may occur within 500m of the well location (Table 5.1). Given the distance of Block 16/2a from the site, no physical loss of the qualifying feature from smothering by drilling discharges could occur from drilling a well in Block 16/2a thereby ensuring site conservation objectives are not undermined. **Other effects** The qualifying feature is highly sensitive to physical loss through interruption of the gas or fluid flow on which it depends. The qualifying feature is considered to be sustained by shallow biogenic gas seepage. However, if the structures are supported by deeper petrogenic gas, there is the potential for a reduction in seepage and subsequent accretion of MDAC if the supply of methane is interrupted, e.g. by drilling. Shallow seismic data acquisition by British Geological Survey across the area appears to show evidence (acoustic turbidity etc.) consistent with the presence of gas within the shallow sediments with an acoustic feature beneath one of the pockmarks suggestive of a vertical gas migration pathway (Gafeira & Long 2015). Given that Block 16/2a is 3.4km from the site boundary and does not appear to be linked to the Braemar reservoir present under much of the site, it is very unlikely that the drilling of a well in the Block would interfere or interrupt the supply of any deeper gas that may be supplying the qualifying feature. With respect to potential interference of shallow gas sources, the distance from the site and further mitigation measures such as site survey to identify and characterise relevant shallow gas accumulations (see Section 6.1.3), will ensure site conservation objectives are not undermined. **In-combination effects** Section 6.3.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

6.1.3 Further mitigation measures

Further mitigation measures are available which are identified through the EIA process and operator's environmental management and the BEIS permitting processes. These

[22] http://jncc.defra.gov.uk/PDF/BraemarPockmarks_ConservationObjectives_AdviceonOperations_4.0.pdf
[23] http://nsrac.org/wp-content/uploads/2013/07/Paper-8.3-Braemar-Pockmarks-Site.pdf

considerations are informed by specific project plans and the nature of the sensitivities identified from detailed seabed information collected in advance of field activities taking place. Site surveys are required to be undertaken before drilling rig placement (for safety and environmental reasons) and the results of such surveys (survey reports) allow for the identification of further mitigation including the re-siting of activities (e.g. wellhead, rig leg or anchor positions) to ensure sensitive seabed surface or subsurface features (such as shallow gas accumulations) are avoided. Such survey reports are used to underpin operator environmental submissions (e.g. EIAs) and where requested, survey reports are made available to nature conservation bodies during the consultation phases of these assessments[24].

In all instances, consent for project-level activities will not be granted unless the operator can demonstrate that the proposed exploration activities will not have an adverse effect on the integrity of relevant sites. The information provided by operators in their applications must be detailed enough for BEIS (and its advisors) to make a decision on whether the activities could lead to a likely significant effect.

6.1.4 Conclusions

Likely significant effects identified with regards to physical damage to the seabed, drilling discharges and other effects (see Section 6.1.2) when considered along with project level mitigation (Section 6.1.3) and relevant activity permitting (see Sections 5.2.1 and 6.1.3), will not have an adverse effect on the integrity of the Natura 2000 sites considered in this assessment. There is a legal framework through the implementation of the EIA Regulations and 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, it is concluded that activities arising from the licensing of Blocks 16/2a, 36/15, 36/20, 36/24, 36/25, 36/29, 37/11, 37/16, 37/17, 37/18, 37/19, 37/21, 37/22, 37/23, 37/24, 37/28b, 37/29b, 38/27, 38/28, 44/2, 44/3, in so far as they may generate physical disturbance and drilling effects, will not cause an adverse effect on the integrity of the Dogger Bank cSAC/SCI, Southern North Sea pSAC or Braemar Pockmarks SAC. 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 drilling rig, will not have an adverse effect on the integrity of relevant sites.

[24] Whether within or outside an SAC, rig site survey typically includes a consideration of the presence of, amongst other sensitivities, Annex I habitats.

6.2 Assessment of underwater noise effects

6.2.1 Blocks and sites to be assessed

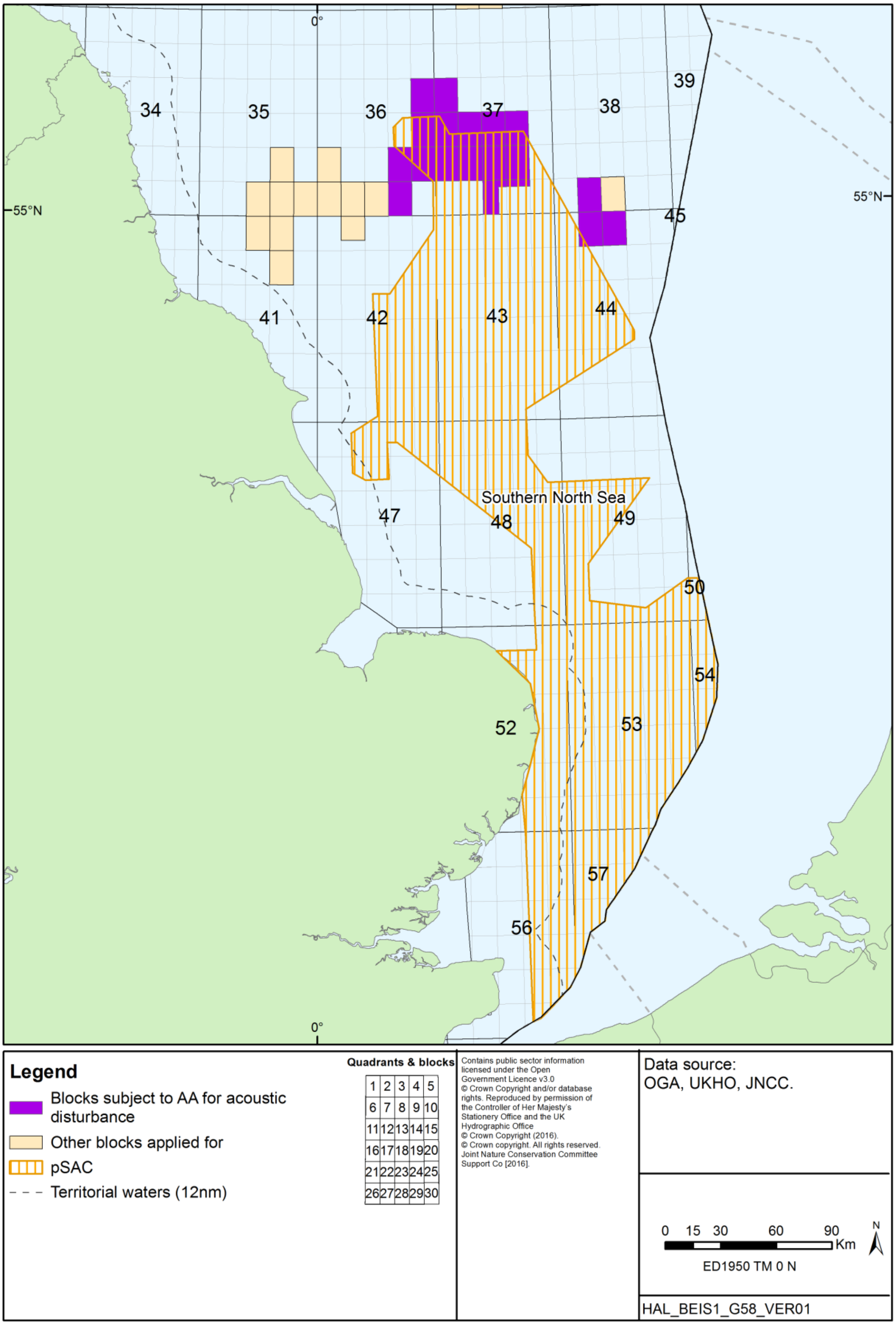
The nature and extent of potential underwater noise effects are summarised in Section 4.3. On the basis of this information, in conjunction with the location of Blocks applied for in the 29th Round (Figure 1.1) and the location of sites with relevant qualifying features, likely significant effects are considered to remain for 19 Blocks (or part Blocks), all in relation to a single site, the Southern North Sea pSAC (Figure 6.2).

The harbour porpoise is the most common cetacean in UK waters; it is wide-ranging and abundant throughout the UK shelf seas, both coastally and offshore. It is protected in European waters under the provisions of Annex IV and Article 12 of the Habitats Directive and within the UK its conservation status is favourable[25]. Individuals in the UK are part of the north east Atlantic population which is mainly considered to be a single 'continuous' population, even though some degree of genetic differentiation has been observed (Andersen *et al.* 1997, 2001, Tolley *et al.* 2001, Fontaine *et al.* 2007); from a management and conservation perspective however, three distinct UK Management Units (MU) have been identified; the North Sea, West Scotland and the Celtic & Irish Seas (IAMMWG 2015). The Southern North Sea pSAC is the largest of the possible SACs proposed for the conservation of harbour porpoise; it was selected primarily on the basis of preferential and prolonged use by harbour porpoises in contrast to other areas of the North Sea, but variability in numbers within the site and across the North Sea (seasonally and between years) is known to be high. For example, a large southerly shift in distribution was reported across the North Sea between 1994 and 2005 when SCANS and SCANSII surveys took place (Hammond *et al*. 2013).

The current draft conservation objectives indicates that the concept of 'site population' may not be appropriate for this species. It highlights the need to assess impacts on the site based on how the proposed activities translate into effects on the relevant MU population. In the case of this AA, it refers to the North Sea Management Unit ranging from the east coast of the UK to part of Denmark (Skagerrak and northern Kattegat).

[25] JNCC (2013). Species conservation status reports. Third Report by the United Kingdom under Article 17 of the EU Habitats Directive. Joint Nature Conservation Committee, Peterborough. http://jncc.defra.gov.uk/page-6564 (accessed August 2015).

Figure 6.2: Sites and Blocks to be subject to further assessment for acoustic disturbance effects



6.2.2 Implications for site integrity of relevant sites

The site conservation objectives and other relevant information relating to site selection and advice on operations has been considered against indicative Block work programmes to determine whether they could adversely affect site integrity. The results are given in Table 6.2 below. In terms of mitigation, all mandatory requirements (as given in Section 5.2.2) are assumed to be in place as a standard for all activities assessed at this stage.

Table 6.2: Consideration of potential underwater noise effects and relevant site conservation objectives

Southern North Sea pSAC
Site information
Area (ha): 3,695,766 **Relevant qualifying features:** Harbour porpoise **Conservation objectives:** To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining Favourable Conservation Status (FCS) for the UK harbour porpoise. To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term: • The species is a viable component of the site. • There is no significant disturbance of the species. • The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.
Relevant Blocks for underwater noise effects
36/15, 36/20, 36/24, 36/25, 36/29, 37/11, 37/16, 37/17, 37/18, 37/19, 37/21, 37/22, 37/23, 37/24, 37/28b, 37/29b, 38/27, 44/2, 44/3
Assessment of effects on site integrity
2D or 3D deep-geological seismic survey Individuals within 10km of the airgun arrays are expected to be affected, through displacement and reduced foraging opportunities. However, the survey would be limited in time (days) and as the vessel travels along transects, ensonification is variable across the area surveyed. Harbour porpoises are known to be able to travel over large distances (>20km) within a day and given current understanding of harbour porpoise distribution and abundance across the North Sea, there is no evidence to suggest that areas where individuals may be displaced into would be of significantly lower quality. Based on the maximum likely duration of the activity (Table 5.1), the likelihood that should surveys take place (e.g. for some Blocks, applicants may only wish to reprocess existing data) these are likely to be spatially and/or temporally disparate, the location of the activity (no access of the site to harbour porpoises can be assumed to be blocked) and the size of the potential displacement (e.g. each Block constitutes approximately 0.6% of the site area), a deep-geological seismic survey will not result in an adverse effect on site integrity. **VSP** Given the duration and spatial footprint of this activity is less than for the deep-geological survey, a VSP associated with the drilling of a well will not result in an adverse effect on site integrity. **Rig site survey** The intensity, duration and spatial footprint of activities associated with rig site survey are less than for the deep-geological survey, and it is not regarded that such activity will result in an adverse effect on site integrity. **In-combination effects** The work programmes for the Blocks being assessed have not yet been finalised, and the timing and duration of any survey that may take place are unknown. At this stage, such uncertainty does not allow for an exact estimation of the potential size of the area that harbour porpoises may be displaced from and the duration of the displacement. As a hypothetical worst case, a maximum estimate of area and duration can be provided based on two scenarios; either all 19 surveys take place at the same time or they all take place consecutively. It is assumed that at any point in time, seismic noise from a survey will affect harbour porpoises within 10km from the airgun array. In the first scenario, displacement may occur over a very short period of 1-2 weeks across an area of approximately 6,000km^2 (corresponding to 16% of the pSAC area). This is clearly an unrealistic over estimate

Southern North Sea pSAC
as several adjacent Blocks will have overlapping footprints and not all Blocks are within the site. In the second scenario, seismic noise will take place over a more prolonged period (5-10 months) but the affected area will be 314km^2 (less than 1% of the site area and will be transient across the Blocks). Given our current understanding of the site and its feature being in favourable condition and having taken into consideration current and past activity, neither scenario is expected to result in adverse effect on site integrity. For comparison, the number of 3D surveys undertaken within or adjacent to this pSAC between 2001 and 2015 has ranged between 0 and 6 surveys per year (cumulative coverage of approximately 18,531km^2 over 34 surveys). The greatest survey coverage during this period was in 2013, within which an area of up to 7,682km^2 was shot across 6 surveys. Additionally, 2D surveys have also been conducted but comparable information on area or duration is not readily available. The potential for in-combination effects with other plans and projects is discussed in Section 6.3.

6.2.3 Further mitigation measures

BEIS require operators to provide sufficient information in the EIA on the potential impact of proposed activities on relevant sites and their qualifying features as well as proposed further mitigation measures in their applications for a Geological Survey consent. In all instances, BEIS will expect strict implementation of the JNCC seismic guidelines. The information provided by operators must be detailed enough for BEIS to make a decision on whether the activities could lead to a likely significant effect, and whether they should therefore be subject to the requirement for HRA. Depending on the nature and scale of the proposed activities (e.g. area of survey, source size, timing and proposed mitigation measures) and whether likely effects are identified for these, BEIS may undertake further HRA to assess the potential for adverse effects on the integrity of sites at the activity specific level.

Consent for project-level activities will not be granted unless the operator can demonstrate that the proposed activities, which may include seismic survey and other activities such as rig site survey, VSP and drilling will not have an adverse effect on the integrity of relevant sites.

The planning of seismic surveys should endeavour to minimise exposure of harbour porpoises to underwater noise by careful consideration of the timing with respect to 1) seasonal differences in the distribution of the harbour porpoise across the site and across the wider southern North Sea and 2) the presence of other underwater noise generating activities (i.e. other seismic surveys and impact piling). It is advised that the licensees of Blocks 36/15, 36/20, 36/24, 36/25, 36/29, 37/11, 37/16, 37/17, 37/18, 37/19, 37/21, 37/22, 37/23, 37/24, 37/28b, 37/29b, 38/27, 44/2, 44/3, establish early discussions with BEIS and also the leaseholders of OWF areas, to understand the nature and timing of proposed activities such that significant in-combination effects can be avoided (see Section 6.3). Early consultation of the relevant SNCBs in this regard will also be an advantage.

6.2.4 Conclusion

Although underwater sound generated during any project level activities, specifically deep-geological surveys has the potential to injure and disturb individual harbour porpoises, the actual risk is minimised by the controls currently in place. An adverse effect on site integrity would require disturbance to the qualifying feature and/or to the distribution and viability of the relevant population which may arise from direct mortality or from behavioural changes with implications for long-term ecological viability (e.g. sustained displacement from foraging grounds, reproductive failure).

With respect to the Southern North Sea pSAC, it is concluded that the likely level of activity expected to take place within Blocks 36/15, 36/20, 36/24, 36/25, 36/29, 37/11, 37/16, 37/17, 37/18, 37/19, 37/21, 37/22, 37/23, 37/24, 37/28b, 37/29b, 38/27, 44/2, 44/3 will not be expected to cause an adverse effect on site integrity, taking account of the following:

- Should a deep-geological survey be proposed in any of the Blocks applied for, further HRA may be required to assess the potential for adverse effects on the integrity of the site once the area of survey, source size, timing and proposed mitigation measures are known and can form the basis for a definitive assessment
- 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 3D seismic surveys will not adversely affect the site integrity of relevant sites. These activities will be subject to activity level EIA and where appropriate, HRA.

6.3 In-combination effects

6.3.1 Introduction

Potential incremental, cumulative, synergistic and secondary effects from a range of operations, discharges and emissions (including noise) were considered in the latest Offshore Energy SEA (DECC 2016; 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 Mid-North Sea High and Northern North Sea areas, for instance in relation to renewable energy, fishing, shipping and aggregate extraction. These activities are subject to SEA or other strategic level and individual permitting or consenting mechanisms, or are otherwise managed at a national or international level.

In English waters the North East Marine Plans are in preparation and will complement the first Marine Plans (East Inshore and East Offshore) published in June 2014 to set out objectives and policies to guide development in the southern North Sea over a 20-year period. The Scottish National Marine Plan was adopted in March 2015 and subsequent regional planning has been proposed for a further 11 inshore areas.

The potential for effects in-combination with other plans or projects was considered and a number of sites were highlighted in Sections 6.1 and 6.2 for which there is the potential for intra-plan in-combination effects (i.e. that multiple Blocks have the potential to be licensed within the same site).

6.3.2 Sources of potential effect

Table 6.3 and Figures 6.3-6.4 highlight projects which have recently been granted consent or may be granted consent in the near future, for which potential interactions with operations that could arise from 29th Round Block licensing have been identified. Interactions were identified on the basis of the nature and location of the proposed activities, using a combination of documents submitted as part of project applications and related spatial datasets in a Geographic Information System (GIS). Additionally, potential interactions with existing activities are considered including those associated with oil and gas, shipping, military practice and exercise and fisheries.

A number of factors limit the range of foreseeable interactions with potential 29th Round activities, including:

- Limited existing infrastructure or exploration activity associated with oil and gas development in the area.
- Relatively low to very low shipping activity away from the coast. Shipping densities over the licence Blocks are predominantly low to moderate. Any additional vessels associated with drilling or seismic survey will represent a small incremental increase to existing traffic (see Table 5.1). The siting of any rig will require individual consenting at the activity level, including vessel traffic survey and a collision risk assessment where there is considered to be a significant navigational risk as part of the consent to locate process. This includes all Blocks within the moderate to very high shipping density categories and any in the low to

very low categories where a traffic survey identifies a route within 2nm of where a rig may be sited. Additionally, charting, advertising through notices to mariners, and fisheries liaison raise awareness of the nature and timing of any proposed activity. Activities are typically restricted to within a statutory 500m safety zone around the rig, and the presence of the rig and standby vessel would be temporary (days to a few months).

- The East Marine Plans have identified areas of potential aggregates resource which could be exploited in the future. However, at present there is limited interest in aggregate extraction in the Mid-North Sea High area, and the absence of any option, application or licence areas within any Block applied for prevents an in-combination assessment.

The principal sources of in-combination 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 have been or will be subject to their own individual assessment and HRA processes[26]. Figure 6.3 indicates the location of wind farms/wind farm zones in relation to the Blocks subject to this assessment and relevant Natura 2000 sites.

The UK Government believes that the oil & gas and wind industry can successfully co-exist, as stated in OGA's Other Regulatory Issues for the 29th Round, "…*we [(OGA)] advise that potential 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 Agreement for lease (AfL), 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)*"[27]. Early discussions between the developers will ensure that any potential conflict can be 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 addition to renewables activities, early engagement with other users (e.g. through fisheries liaison, vessel traffic surveys, consultation with the MoD or holders of other Crown Estate offshore interests)[28] where scheduling overlaps may occur should allow both for developer cooperation, and the mitigation of potential cumulative or in-combination effects.

[26] For those sites having already been subject to HRA, note that the competent authority is under an obligation to reconsider and review consents for projects that are likely to have a significant effect on new SAC and SPA sites once they become a candidate site. Nothing in such a review can affect anything done in pursuance of the consent prior to the candidate stage of designation. See: https://www.gov.uk/government/publications/guidance-on-when-new-marine-natura-2000-sites-should-be-taken-into-account-in-offshore-renewable-energy-consents-and-licences

[27] OGA 29th Round Other Regulatory Issues

[28] https://www.ogauthority.co.uk/licensing-consents/overview/the-crown-estate-interests/

This is also reflected in the East Inshore and East Offshore Marine Plans (paragraph 295) which state "*Future oil and gas activity has the potential to require access to the same area of seabed as other activities. In most cases, the consequence of this will be insignificant due to the small footprint of oil and gas production infrastructure. In some cases this may not be the case, such as where another user of the sea bed has a lease in place. Where a lease has been agreed for a co-located activity, there may be a requirement for negotiation between parties involved*." and is supported in plan policies such as GOV2 and GOV3, which respectively promote the maximisation of activity co-existence, and the demonstration that activity displacement will be avoided, minimised or mitigated. Policies for the other marine plan areas of relevance to the Mid-North Sea High area (North East Inshore and Offshore) are yet to be drafted, but may be expected to be consistent with those of the East Marine Plans. In Scottish waters, policy OIL&GAS3 relates to the minimisation of the footprint of developments and for environmental and socio-economic constraints to be taken into account, and policy GEN4 supports development co-existence.

Table 6.3: Projects relevant to the in-combination effects assessment

Relevant projects	Project summary	Project status	Relevant sites[1]
Offshore Renewables			
Dogger Bank Creyke Beck A Dogger Bank Creyke Beck B	Located approximately 131km offshore, these two wind farms will collectively contain up to 400 turbines with a total capacity of up to 2,400MW. The turbines may be fixed to the seabed using monopile, jacket or gravity base foundations. Additionally, collector and converter stations will be required offshore. Export cables will have their landfall on the coast of the East Riding of Yorkshire.	Consented. Installation expected from 2020.	Dogger Bank SCI, Southern North Sea pSAC
Dogger Bank Teesside A	Located approximately 165-196km offshore, these two wind farms will collectively contain up to 400 turbines with a total capacity of up to 2,400MW. The turbines may be fixed to the seabed using monopile, jacket or gravity base foundations. Additionally, collector and converter stations will be required offshore. Export cables will have their landfall on the Teesside coastline.	Consented. Installation expected from 2023.	Dogger Bank SCI
Dogger Bank Teesside B			Dogger Bank SCI, Southern North Sea pSAC
Hornsea Project One	Located approximately 100km to the east of the Yorkshire coast, Hornsea Project One is made up of the Heron and Njord wind farm areas, with a total capacity of up to 1,218MW delivered from between 152 and 203 turbines depending on the capacity of the generators installed. Foundations may be monopile, jacket, gravity base or mono-suction caisson types. The export cable route travels to the south west and has its landfall at Horse Shoe Point to the south of Grimsby. Cable installation methods potentially include jetting, ploughing, trenching, rock-cutting, surface laying with protection depending on ground conditions.	Onshore construction has commenced. Operation expected from 2019.	Southern North Sea pSAC
Hornsea Project Two	The wind farm has a proposed capacity of 1,800MW generated by up to 300 wind turbines located approximately 90km to the east of the Yorkshire coast. The turbines may be fixed to the seabed using monopile, jacket or gravity base foundations. The export cable route shares that of Project One.	Consented. Installation expected from 2020.	Southern North Sea pSAC

Relevant projects	Project summary	Project status	Relevant sites[1]
Hornsea Project Three	The wind farm is proposed to have a capacity of up to 2,400MW generated from up to 400 turbines located more that 150km from the Yorkshire coast. Wind turbine capacity and foundation type remain flexible but could be monopile, piled jacket, suction caisson, mono suction bucket, gravity base or floating structures. The export cable landfall has presently not been selected, but is expected to be somewhere on the North Norfolk coast.	Pre-application. Expected to apply in 2018.	Southern North Sea pSAC
Oil & gas and CCS developments			
Sillimanite gas condensate field	Located in Block 44/19a, an exploration well relating to the field was drilled in July 2015, but no further details are available on the timing or nature of any development.	Exploration	Dogger Bank SCI, Southern North Sea pSAC
Cygnus gas field	The development includes three manned bridge-linked platforms called Cygnus A, and a separate NUI called Cygnus B in Blocks 44/12a and 44/11a respectively, connected by a 5.9km pipeline. A 51km export pipeline connects the development to the Esmond Transportation System (ETS) pipeline, providing a connection to Bacton in North Norfolk. The development was installed in 2015 and is presently being commissioned.	Commissioning	Dogger Bank SCI, Southern North Sea pSAC
Yorkshire and Humber CCS Offshore Pipeline and Storage Project	Development consists of a small normally unmanned installation located approximately 80km offshore of the East Riding of Yorkshire, using jacket-type foundations secured to the seabed with driven/drilled piles. The installation will be connected to a 90km carbon dioxide export pipeline, with a landfall at Barmston, Yorkshire. Time-lapse (4D) seismic survey is planned to take place to monitor the stored carbon dioxide.	In planning. Project timing uncertain.	Southern North Sea pSAC

Source: RenewableUK (2016), National Grid (2015), relevant Development Consent Orders and related post-consent modifications (https://infrastructure.planninginspectorate.gov.uk/ – accessed 9/11/2016), OGA Project Pathfinder current list of projects (https://itportal.decc.gov.uk/pathfinder/currentprojectsindex.html – accessed 20/10/2016), DECC (2016).

Notes: [1] – those sites considered to be relevant to 29th seaward round exploration activities

Figure 6.3: Location 29th Round Blocks in relation to other projects

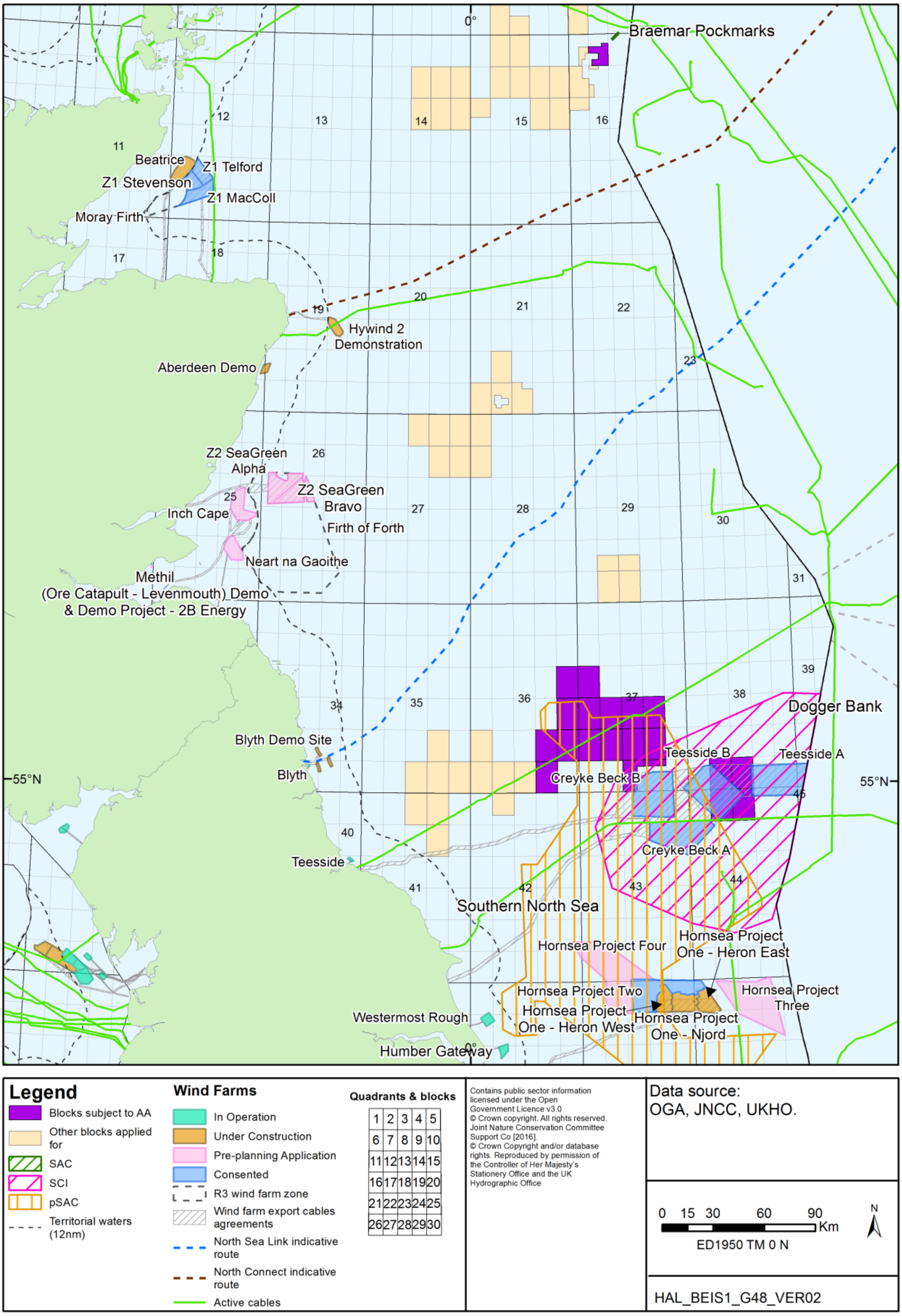
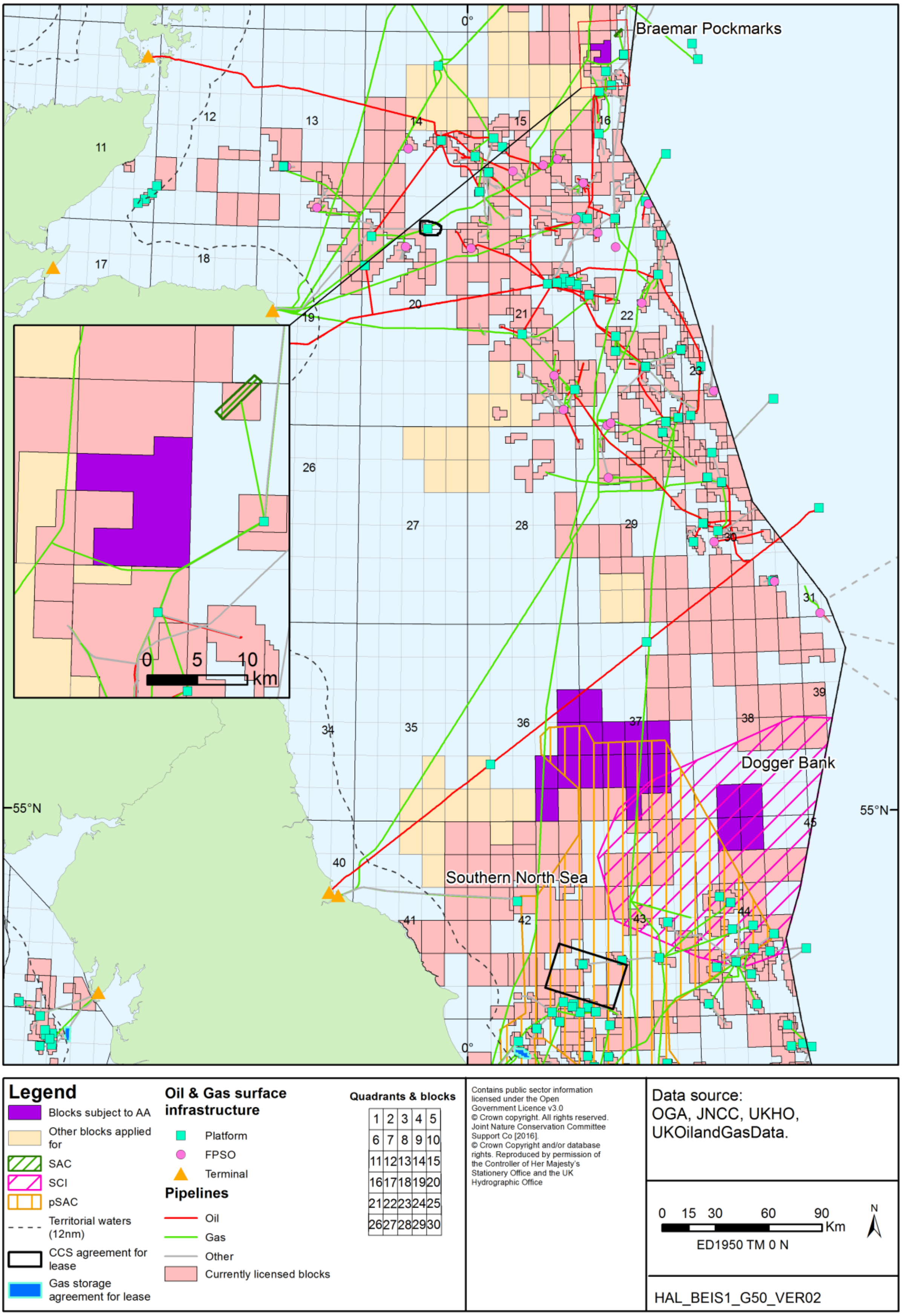


Figure 6.4: Location 29th Round Blocks in relation to other projects (continued)



6.3.3 Physical disturbance and drilling

Potential sources of physical disturbance to the seabed, and damage to biotopes, associated with oil and gas activities that could result from licensing were described in Section 4.2 and Section 6.1 and include the siting of jack-up/semi-submersible drilling rigs and wellhead placement and recovery.

Existing or proposed oil & gas developments

Though existing oil and gas infrastructure is widespread in the southern North Sea and central North Sea (Figure 6.4), the relative density and footprint of these is small. Due to the relative paucity of exploration and development activity in the Mid-North Sea High and Northern North Sea areas there is no overlap with any fixed surface infrastructure and those 29th Round Blocks subject to AA. The main interaction relates to existing export pipelines (e.g. the Langeled and Shearwater to Bacton (SEAL) with Blocks 36/24, 36/25 and 37/18, 37/23, 37/28b respectively). These pipelines are well-established and charted, having been installed in 2005 and 1999 respectively, and no physical effects in-combination with these is considered likely.

A review of field development and decommissioning projects (as of October 2016) published by OGA's Project Pathfinder[29] indicates nine current projects for Blocks within the wider Mid-North Sea High and a further twelve in the Northern North Sea area. Two developments (see Table 6.3), though relatively distant from the 29th Round Blocks at between approximately 29 and 36km, are located within the Dogger Bank SCI and Southern North Sea pSAC. There are presently no decommissioning projects scheduled to take place in the Mid North Sea High area, though in the northern North Sea area initial decommissioning planning is taking place for the Brae and East Brae facilities in Blocks adjacent to Block 16/2a, and the Braemar Pockmarks SAC. A number of proposed developments are present in Quadrants 9 (Mariner and Mariner East: 9/11a and b, Morrone: 9/23b) and 16 (Utgard: 16/18a, Caledonia: 16/26, Maria: 16/29a), though these are distant from Block 16/2a and the Braemar Pockmarks SAC (at least 20km). Additionally, Block 9/28b was licensed in the 28th round following HRA[30], though no wells have been drilled there to date. Given the small and temporary seabed footprint associated with drilling activities which may follow the licensing of 29th Round Blocks and those standard and additional mitigation measures set out already in Section 5.2 and 6.1.3, significant in-combination effects associated with those limited other oil and gas projects discussed is not expected.

With respect to drilling discharges, previous discharges of WBM cuttings across relevant parts of the UKCS have been shown to disperse rapidly and to have minimal ecological effects (See Section 4.2). 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 2016), particularly when considered in the context of the

[29] https://itportal.decc.gov.uk/pathfinder/currentprojectsindex.html
[30] https://www.gov.uk/government/consultations/28th-seaward-licensing-round-appropriate-assessments

historically limited levels of exploration and development in the Mid-North Sea High area. Similarly, the potential for in-combination effects relating to chemical usage and discharge from exploratory drilling is limited by the existing legislative and permitting controls that are in place, which the UK Marine Strategy[31] has identified as making an ongoing contribution to managing discharges.

Offshore renewables

OWFs are the only type of operational or proposed renewable energy projects in the Mid-North Sea High area or of relevance to the Blocks considered in this assessment. Sources of effect from physical disturbance associated with these projects include both installation of turbines and associated infrastructure such as interconnecting and export cables. The current project timelines for project proposals, most of which have been consented, indicate the potential for interaction with exploration activity as part of the Initial Term of 29th Round licences (up to 9 years), as construction is proposed to take place within this period. As indicated above, early engagement between any Block licence holder and wind farm developer can help to avoid spatial conflict, which may involve commercial agreement, and applicants taking part in the 29th Round were made aware of such relevant Crown Estates interests[32], with these and relevant marine plan policies being considerations in any application.

Ten Blocks were identified on the basis of a potential for likely significant effect in relation to the Dogger Bank SCI, and were considered in Section 6.1.2, and of these 5 also coincide with Dogger Bank zone offshore wind project areas. None of the Blocks entirely cover any project area (the main interaction being with Dogger Bank Teesside B), and therefore mitigation may be provided by the ability to locate any drilling rig, if used, outside of the wind farm boundaries or through dialogue to avoid any conflict of interest. Further mitigation is available through activity timing/phasing, such that those sources of effect from wind farm installation and operation (e.g. localised and temporary increases in suspended sediment concentrations including re-suspension of contaminants, loss of sandbank habitat[33]) are not compounded by rig installation – note that the footprint of any drilling rig would be small (approximately 0.001km^2 – also see Table 5.1) and temporary, and tidal currents in the shallow southern North Sea are generally such that discharged cuttings are rapidly dispersed. It is therefore not regarded that activity which could take place in the initial term of licenses offered as part of the 29th Round would lead to a physical change significant enough to lead to an adverse effect on site integrity on its own or in-combination with the Dogger Bank OWFs.

Once firm project proposals are known, existing statutory and planning processes allow for further consideration of interactions between other activities and, where applicable, subject to project level HRA. Should one or more Blocks be granted a licence within any wind farm zone for which an interaction with a Natura 2000 site has also been established, the in-combination

[31] https://www.gov.uk/government/publications/marine-strategy-part-three-uk-programme-of-measures
[32] https://www.ogauthority.co.uk/licensing-consents/overview/the-crown-estate-interests/
[33] See the record of the HRA undertaken in relation to the Dogger Bank Creyke Beck Offshore Wind Farm: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010021/EN010021-000003-Habitats%20Regulations%20Assessment.PDF

effects of the proposed work programme must be considered as part of any project level HRA. Given the small and temporary seabed footprint associated with drilling activities, significant in-combination effects associated with offshore renewables projects are not expected.

Fisheries

Fishing and particularly bottom trawling has historically contributed to seabed disturbance over extensive areas, and was identified as an ongoing problem in the UK initial assessment for MSFD[34]. It was also noted that depending on the nature of future measures (e.g. in relation to MPA management in the wider environment and within MPAs), such effects are likely to be reduced and therefore some improvement in benthic habitats could be expected. The management of fisheries in relation to Article 6 of the Habitats Directive is fundamentally different to other activities such as offshore energy development, and a revised approach to the management of commercial fisheries in European sites[35] has sought to implement steps to ensure that they are managed in accordance with Article 6.

In England management is coordinated between the Inshore Fisheries and Conservation Authorities and the Marine Management Organisation for sites within 12nm (note that any measure which may influence vessels of other member states can only be adopted after consultation with the Commission, other Member States and the Regional Advisory Councils) and for offshore sites beyond 12nm from the coast, measures are required to be proposed by the European Commission in accordance with the CFP[36,37]. In relation to specific sites of relevance to this AA, management proposals for the Dogger Bank have been drawn up by the Dogger Bank Steering Group which includes a number of zones which would be closed for beam trawl, bottom/otter trawl, dredges and semi-pelagic trawl fisheries. These are to be agreed with a regional group of EU Member States with a direct management interest in the area (the Scheveningen Group) for development as a joint proposal to the European Commission, with measures covering those Dogger Bank Natura 2000 sites in UK and adjacent state waters[38]. Similarly, proposals have been made to prohibit all demersal fishing gears within the Braemar Pockmarks SAC[39]. Whilst fishing may be linked to historical damage to site features, and presents an ongoing risk to these, future management measures should limit the potential for in-combination effects with other activities, particularly when considered in addition to mitigation which is available to avoid effects on sites from exploration activity (see Section 5.2), and other activities including offshore renewables which are subject to statutory environmental impact assessment and where appropriate, an HRA.

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[34] https://www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status

[35] https://www.gov.uk/government/publications/revised-approach-to-the-management-of-commercial-fisheries-in-european-marine-sites-overarching-policy-and-delivery and see http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/SACmanagement

[36] See: http://ec.europa.eu/environment/nature/natura2000/marine/docs/fish_measures.pdf and also refer to Regulation (EU) No. 1380/2013 on the Common Fisheries Policy.

[37] Note those closures already in place to the north and west of Scotland (e.g. Hatton Bank, North West Rockall and Darwin Mounds)

[38] See http://jncc.defra.gov.uk/page-6508 and http://www.nsrac.org/reports/meetings-c/ecowg/spatial-planning-working-group-meeting-4th-july-2016-the-hague/

[39] http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/SACmanagement

It should also be noted that when oil and gas surface structures (fixed and floating installations) become operational, safety zones with a radius of 500m are automatically created under the *Petroleum Act 1987* such that other activities are excluded from taking place there, including fisheries. This includes mobile drilling rigs and is notified to other users of the sea (e.g. through notices to mariners and Kingfisher charts). Additionally, appropriate fisheries liaison between operators proposing to undertake exploration activities and fishermen can avoid negative interactions. In view of the differences in relative scale of physical impacts resulting from trawling and from oil and gas exploration (both spatially and temporally), the incremental effects may be considered unlikely. In addition, since fishing activities are effectively excluded during drilling, and the proposed site management measures to be implemented under the CFP, it is not considered likely that significant in-combination effects could be generated.

6.3.4 Physical presence

Physical presence of offshore infrastructure and support activities may potentially cause behavioural responses in fish, birds and marine mammals (see Section 5.6 of DECC 2016). No SPA sites or SACs with qualifying fish species were screened into this assessment (see Section 1.3) and therefore the potential for in-combination effects is regarded to be restricted to the harbour porpoise feature of the Southern North Sea pSAC. 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 have been an important consideration at the project level for the large offshore wind developments that are planned for the area of the southern North Sea relevant to the Mid-North Sea High (Figures 6.3 and 6.4) and formed an important part of associated HRAs[40].

Shipping densities over the relevant Blocks are predominantly low to moderate. Additional vessels associated with drilling or seismic survey will represent a small increment to existing traffic, for example typical supply visits to rigs while drilling may be in the order of 2 to 3 per week. Moreover, given the location of the Blocks applied for are relatively close to existing mature hydrocarbon basins, helicopters and vessels are likely to use established routes.

Though representing an incremental source of activity in and around OWF zones (particularly those in the Dogger Bank), it is anticipated that in-combination effects can be avoided through early engagement with lease holders. The transient nature of exploration drilling and the timing of OWF construction activities are such that any activity associated with the work

[40] Refer to those HRAs in relation to Dogger Bank Creyke Beck, Dogger Bank Teesside and Hornsea Projects One and Two.

programmes could be phased in such a way as to avoid in-combination effects from physical presence on any qualifying features of relevant European sites. Such interactions would need to be considered as part of assessments, including in HRA where appropriate, for project-level activity.

6.3.5 Underwater noise

A number of projects are relevant to the consideration of in-combination effects with activities which may follow the licensing of 29th Round Blocks (see Table 6.3) as they have associated activities which can generate noise levels which are known to have the potential to result in disturbance or injury to animals, and the following considers the potential for such effects in relation to the Southern North Sea pSAC.

Of most relevance to the Blocks being considered are a series of Round 3 and Round 2 extension wind farms. While the operation, maintenance and decommissioning of offshore wind energy developments will introduce noise into the marine environment, these are typically of low intensity. The greatest noise levels arise during the construction phase, and it is these which have the greatest potential for acoustic disturbance effects (see DECC 2016). Pile-driving of mono-pile foundations or pin piles used in jacket-type 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 OWF developments at present (including in the studies looking at the effect of wind farm construction on harbour porpoise behaviour, as discussed in Section 4.3.2), however for some of the proposed developments, sufficient flexibility in foundation type remains in their Development Consent Orders to allow for the potential use of gravity base and even tethered foundations that may generate less noise on installation. The final selection of foundation type is uncertain for some developments as this will be subject to detailed design.

Of those wind farms listed in Table 6.3, several are either under construction or are planned to be constructed before 2020 and are within or adjacent to the Southern North Sea pSAC (Hornsea Project One: Heron Wind and Njord, East Anglia One and Galloper Extension), with the Dogger Bank Creyke Beck and Teesside developments being scheduled for construction from 2020 and 2023 respectively and Hornsea Project Two (Breesea and Optimus) due for construction from 2020 (see Section 2.7.4 and Appendix 1h of DECC 2016[41]). These projects are expected to result in changes in harbour porpoise distribution and a reduction of foraging activity for those individuals within the impacted area. However, assessment of the integrity of the site must be undertaken with respect to the site contributing to maintaining the Favourable Conservation Status of the wider harbour porpoise population. It follows that projects across the whole North Sea Management Unit are therefore also relevant. Given the spatially limited and temporary nature of the proposed seismic surveys, and that there is significant scope to avoid concurrent OWF construction and seismic activity either through dialogue with relevant

[41] Also see: RenewableUK Offshore Wind Project Timelines (June 2016): http://www.renewableuk.com/news/294516/Offshore-Wind-Project-Timelines.htm

leaseholders or by virtue of wind farm construction timelines, significant in-combination effects are considered to be unlikely. Additionally, mitigation measures (including HRA, where appropriate, at the activity specific level) are available to avoid such effects.

Several modelling frameworks are being developed and refined to assess population level impacts of acoustic disturbance (Thompson *et al.* 2013b, King *et al.* 2015, Tougaard *et al*. 2016, Heinis *et al*. 2015, van Beest *et al*. 2015, Nabe-Nielsen & Harwood 2016); while progress is being made, the degree of uncertainty in extrapolating from individual empirical observations to modelled population estimates is still uncomfortably high. It has not yet been possible to establish criteria for determining limits of acceptable cumulative impact at the UK or EU level, but the collation of data through the Marine Noise Registry (https://mnr.jncc.gov.uk/) has been an important first-step. BEIS is cognisant of the ongoing efforts to implement the MSFD and will review the results of the ongoing process closely with respect to the consenting of relevant activities which may result from future licensing, as well as other activities which generate noise in the marine environment. The draft conservation objectives and advice on operations for the Southern North Sea pSAC state that, *"Case Work Advice Guidance in relation to various activities is being developed and expands this supplementary advice to define 'significant portion and period' in the context of impacting site integrity"*.

There is the potential for other seismic surveys to take place in adjacent Blocks which have either been applied for as part of the 29th Round (though not screened in), in existing licensed areas which are yet to be fully explored or which have been developed, and in any other area through the separate Seaward Exploration Licence (not covered by the plan being assessed). The timing, location and scale of any such surveys are unknown and a meaningful assessment of these cannot be made at this time, but they will be subject to activity specific permitting, including HRA where appropriate.

It is proposed that up to five 3D seismic surveys be undertaken during the project life (40 years) of the Yorkshire and Humber CCS Offshore Pipeline and Storage Project in order to generate time lapse (4D) survey data as part of the site monitoring programme, as required by the CCS Directive[42]. There is a high level of uncertainty with regards to whether this project will progress following the withdrawal of funding associated with the former DECC CCS Commercialisation Competition, and Secretary of State is yet to decide the outcome of the Yorkshire and Humber CCS Cross Country Pipeline which is integral to the offshore scheme[43].

In addition to those activities which may follow licensing of the Mid North Sea High Blocks and the other potentially relevant developments listed in Table 6.3, there are a variety of other existing (e.g. oil and gas production, fishing, shipping, military exercise areas, wildlife watching cruises) and planned (e.g. oil and gas exploration and production) noise-producing activities in overlapping or adjacent areas. Despite this, BEIS is not aware of any projects or activities which are likely to cause cumulative and in-combination effects that, when taken in-

[42] Annex II of Directive 2009/31/EC on the geological storage of carbon dioxide.
[43] See: https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/yorkshire-and-humber-ccs-cross-country-pipeline/

combination with the likely number and scale of activities likely to result from Block licensing (Section 5.1), would adversely affect the integrity of the relevant sites. This is due to the presence of effective regulatory mechanisms (Section 5.2 and also Appendix 3 of DECC 2016) which ensure that operators, BEIS and other relevant consenting authorities take such considerations into account during activity permitting. These mechanisms generally allow for public participation in the process, and this has been strengthened by Regulations amending the offshore EIA regime which are due to come into force by 2017. These will reflect Directive 2014/52/EU (amending the EIA Directive) which provides for closer co-ordination between the EIA and Habitats Directives, with a revised Article 3 indicating that biodiversity within EIA should be described and assessed "with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC".

6.3.6 Conclusions

Available evidence (see e.g. UKBenthos database and OSPAR 2010) for the Mid-North Sea High indicates that past oil and gas activity and discharges has not lead 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 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 European sites.

BEIS will assess the potential for in-combination effects whilst considering project specific EIAs and, where appropriate, through HRAs; this process will ensure that mitigation measures are put in place to ensure that activities, if consented, will not result in adverse effects on integrity of European sites. Therefore, bearing this in mind, it is concluded that the in-combination effects from activities arising from the licensing of Mid North Sea High Blocks with those from existing and planned activities in the Mid North Sea High area will not adversely affect the integrity of relevant European Sites.

7 Overall conclusion

Taking account of the evidence and assessment presented above, the report determines that the licensing through the 29th Licensing Round of the 21 Blocks considered in this AA will not have a significant adverse effect on the integrity of the relevant sites (identified in Section 1.3), and BEIS have no objection to the OGA awarding seaward licences (subject to meeting application requirements) covering Blocks 16/2a, 36/15, 36/20, 36/24, 36/25, 36/29, 37/11, 37/16, 37/17, 37/18, 37/19, 37/21, 37/22, 37/23, 37/24, 37/28b, 37/29b, 38/27, 38/28, 44/2, 44/3. 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 (as described in Section 6), taking account of the mitigation measures that can be imposed through existing permitting mechanisms on the planning and conduct of activities (as described in Section 6.1 and 6.2).

These mitigation measures are incorporated in respect of habitat and species interest features through the range of legislation and guidance (see https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation) which apply to activities which could follow licensing. Where necessary, project-specific HRA based on detailed project proposals would be undertaken by BEIS to ensure that permits/ consents are only granted where the proposed activity will not result in adverse effects on integrity of relevant sites.

Even where a site/interest feature has been screened out, or where a conclusion of no adverse effect on integrity has been reached at plan level, it is likely that a project level HRA 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 changed at the project level.

This AA document is being subject to statutory consultation and conclusions may be amended as appropriate in light of comments received. The final AA document will be available via the 29th Round Appropriate Assessment webpage of the gov.uk website.

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