Department for
Business, Energy
& Industrial Strategy

OFFSHORE OIL & GAS LICENSING 32ND SEAWARD ROUND

Habitats Regulations Assessment

Draft Appropriate Assessment: West of Shetland

February 2020

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1 Introduction

1.1 Background and purpose

The plan/programme covering this seaward licensing round 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 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 further seaward oil and gas licensing rounds. On 11th July 2019, the OGA invited applications for licences relating to 796 Blocks in a 32nd Seaward Licensing Round covering mature areas of the UK Continental Shelf (UKCS), and applications were received for licences covering 234 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. The *Conservation of Offshore Marine Habitats and Species Regulations 2017* cover other relevant activities in offshore waters (i.e. excluding territorial waters). Within territorial waters, the Habitats Directive is transposed into UK law via the *Conservation of Habitats and Species Regulations 2017* 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[1]) sites, to comply with its obligations under the relevant regulations, the Department for Business, Energy and Industrial Strategy[2] (BEIS) is undertaking a Habitats Regulations Assessment (HRA). To comply with obligations under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), in autumn 2019, the Secretary of State undertook a screening assessment to determine whether the award of any of the Blocks offered would be

[1] This includes Special Areas of Conservation (SAC) and Special Protection Areas (SPA), and potential sites for which there is adequate information on which to base an assessment.
[2] Note that while certain licensing and regulatory functions were passed to the OGA (a government company wholly owned by the Secretary of State for BEIS) on 1 October 2016, environmental regulatory functions are retained by BEIS, and are administered by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED).

likely to have a significant effect on a relevant site, either individually or in combination[3] with other plans or projects (BEIS 2019a). In doing so, the Department has applied the Habitats Directive test[4] (elucidated by the European Court of Justice (ECJ) in the case of Waddenzee (Case C-127/02)[5]) which is:

> *…any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects.*
>
> *…where a plan or project not directly connected with or necessary to the management of a 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 796 Blocks offered. The screening identified 239 whole or part Blocks as requiring further assessment prior to the OGA making decisions on whether to grant licences (BEIS 2019a). Following the closing date for 32nd Seaward Round applications, and the publication of the screening document, those Blocks identified as requiring further assessment were reconsidered against the list of actual Blocks applied for. It was concluded that further assessment (Appropriate Assessment) was required for 82 Blocks that were applied for. Because of the wide distribution of these Blocks around the UKCS, the Appropriate Assessments (AA) in respect of each potential licence award are contained in three regional reports as follows:

- Southern North Sea
- Central North Sea

[3] 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).

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

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

- West of Shetland

1.2.1 West of Shetland Blocks

The relevant west of Shetland Blocks applied for in the 32nd Round and considered in this assessment are listed below in Table 1.1, and are shown in Figure 1.1.

Table 1.1: Blocks requiring further assessment

205/15	205/18	205/20

1.3 Relevant Natura 2000 sites

The screening assessment identified the relevant Natura 2000 sites and related Blocks requiring further assessment west of Shetland (refer to Appendix B of BEIS 2019a). Following a reconsideration of the Blocks and sites screened in against those Blocks applied for, two Natura 2000 sites in the wider west of Shetland area were identified as requiring further assessment in relation to three Blocks (Table 1.2 and Figure 1.1).

Table 1.2: Relevant sites requiring further assessment

Relevant site Features	**Relevant Blocks applied for**	**Sources of potential effect**
SPAs		
Seas off Foula pSPA Breeding great skua. Breeding and over-wintering seabird assemblages	205/15, 205/18, 205/20	Physical disturbance and drilling: rig siting, drilling discharges, vessel presence and movement
	205/15, 205/18, 205/20	Underwater noise: deep geological seismic survey, conductor piling, site survey and well evaluation
Foula SPA[1] Breeding Arctic tern, Leach's petrel, red-throated diver, great skua, guillemot, puffin & shag. Breeding seabird assemblage	205/15, 205/18, 205/20	Physical disturbance and drilling: rig siting, drilling discharges, vessel presence and movement
	205/15, 205/18, 205/20	Underwater noise: deep geological seismic survey, conductor piling, site survey and well evaluation

Note: [1]Foula SPA is considered here as a feeder colony for the features of Seas off Foula pSPA

1.4 Assessment overview

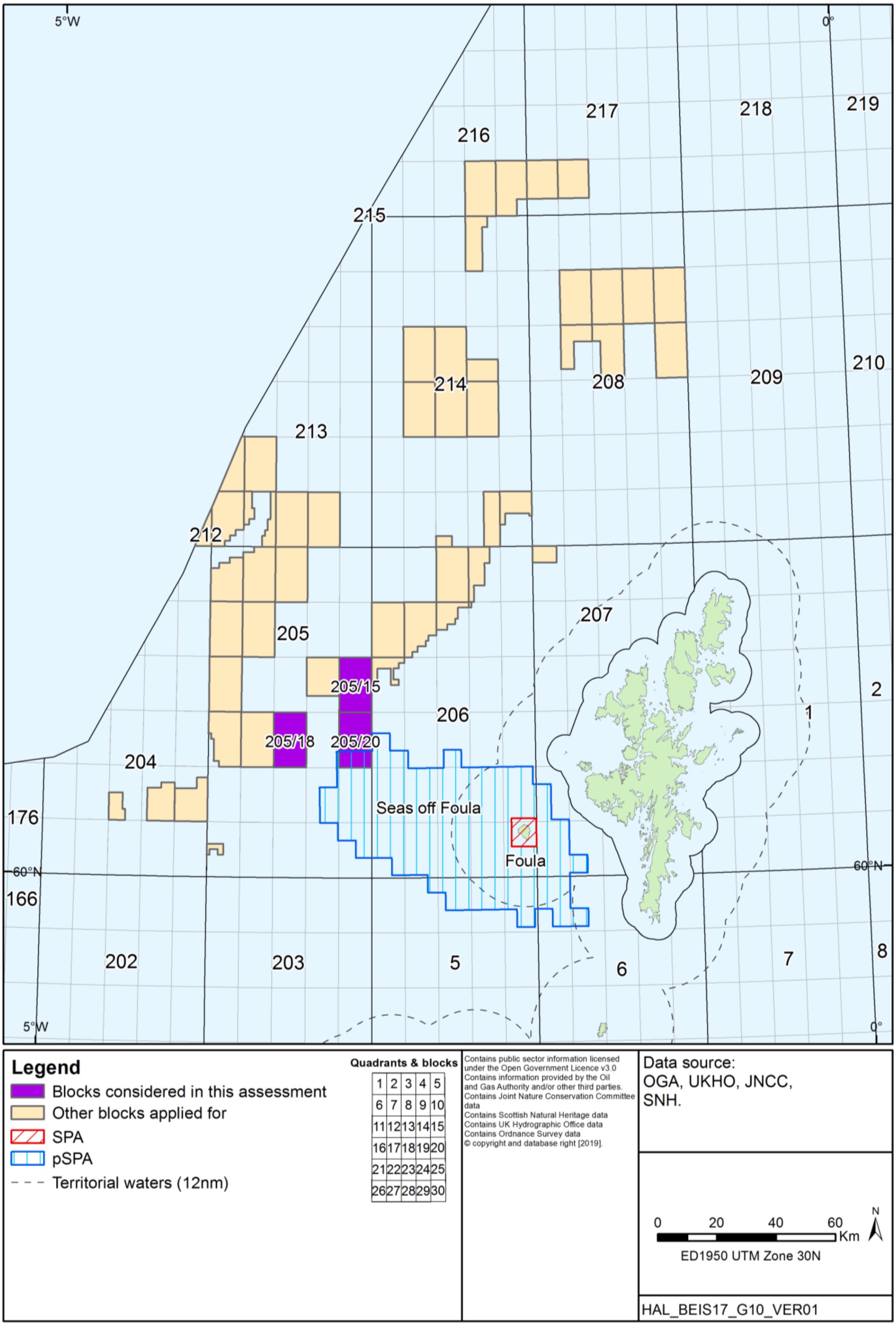
This document sets out the key assumptions and approach to the AA, the evidence base underpinning the assessment and the assessment of relevant Blocks and sites. The document is organised as follows:

- Overview of the licensing process and nature of the activities that could follow including assumptions used to underpin the AA process (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 assessment (Section 4)
- The assessment of effects on the integrity of relevant sites, including in-combination with other plans or projects (Section 5)
- Overall conclusion (Section 6)

As part of this HRA process, the draft AA document is being subject to consultation with appropriate nature conservation bodies and the public (via Consultation pages of the gov.uk website) and will be amended as appropriate in light of comments received. The final AA document will be available via the 32nd Round Appropriate Assessment webpage of the gov.uk website.

Figure 1.1: 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. The main type of offshore Licence is the Seaward Production Licence. 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 (Traditional, Frontier and Promote) were replaced after the 28th Round by the single "Innovate" licence[6]. 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 nine and six 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 this phase will not involve activities in the field)
- Phase B: acquisition of new seismic data and other geophysical data
- Phase C: exploration and appraisal drilling

Applicants may propose the Phase combination in their submission to the OGA. Phase A and Phase B are optional and may not be appropriate in certain circumstances, but every application must propose a Phase C, except where the applicant does not think any exploration is needed (e.g. in the development of an existing discovery or field re-development) and proposes to go straight to development (i.e. 'straight to Second Term'). The duration of the Initial Term and the Phases within it are agreed between the OGA and the applicant.

[6] *The Petroleum and Offshore Gas Storage and Unloading Licensing (Amendment) Regulations 2017* amend the Model Clauses to be incorporated in Seaward Production Licences.

Applicants may choose to spend up to four years on a single Phase in the Initial Term but cannot take more than nine years to progress to the Second Term. Failure to complete the work agreed in a Phase, or to commit to the next Phase means the licence ceases, unless the term has been extended by the OGA.

Financial viability is considered prior to licence award for applicants proposing to start at Phase A or B, but 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, the applicant must demonstrate that it has the technical competence to carry out the activities that would 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 and track record of all applicants are considered by the OGA (in consultation with the Offshore Safety Directive Regulator)[7] through written submissions before licences are awarded[8].

As part of these written submissions operators must demonstrate that they have the relevant safety and environmental capabilities to undertake the proposed work programme (e.g. company environmental policies, awareness of statutory safety and environment provisions, and has environmental management systems). 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 can be issued. In all instances applicants must submit an environmental sensitivity assessment, demonstrating at the licence application stage that they are aware of environmental sensitivities relevant to the Blocks being applied for and the adjacent areas, and understand the constraints and potential impacts they might have on the proposed work programme.

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 along with a range of other factors by the OGA before arriving at a 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). 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

[7] The Offshore Safety Directive Regulator is the Competent Authority for the purposes of the Offshore Safety Directive comprising OPRED and the Health and Safety Executive (HSE) working in partnership.
[8] Refer to OGA technical guidance and safety and environmental guidance on applications for the 32nd Round at: https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/

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 (unless otherwise decided by the OGA) 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 general guidance[9] makes it clear that an award of a Production Licence does not automatically allow a licensee to carry out any offshore petroleum-related activities from then on (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 32nd Seaward Licensing Round and the various environmental assessments including HRA. Offshore activities such as drilling are subject to relevant activity specific environmental assessments by the Department (see Figure 2.3), and there are other regulatory provisions exercised by the Offshore Safety Directive Regulator and 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, the potential impacts associated with noise could occur some distance from the licensed Blocks and the degree of activity is not necessarily proportional to the size or number of Blocks in an area. In the case of direct physical disturbance, the licence Blocks being applied for are relevant.

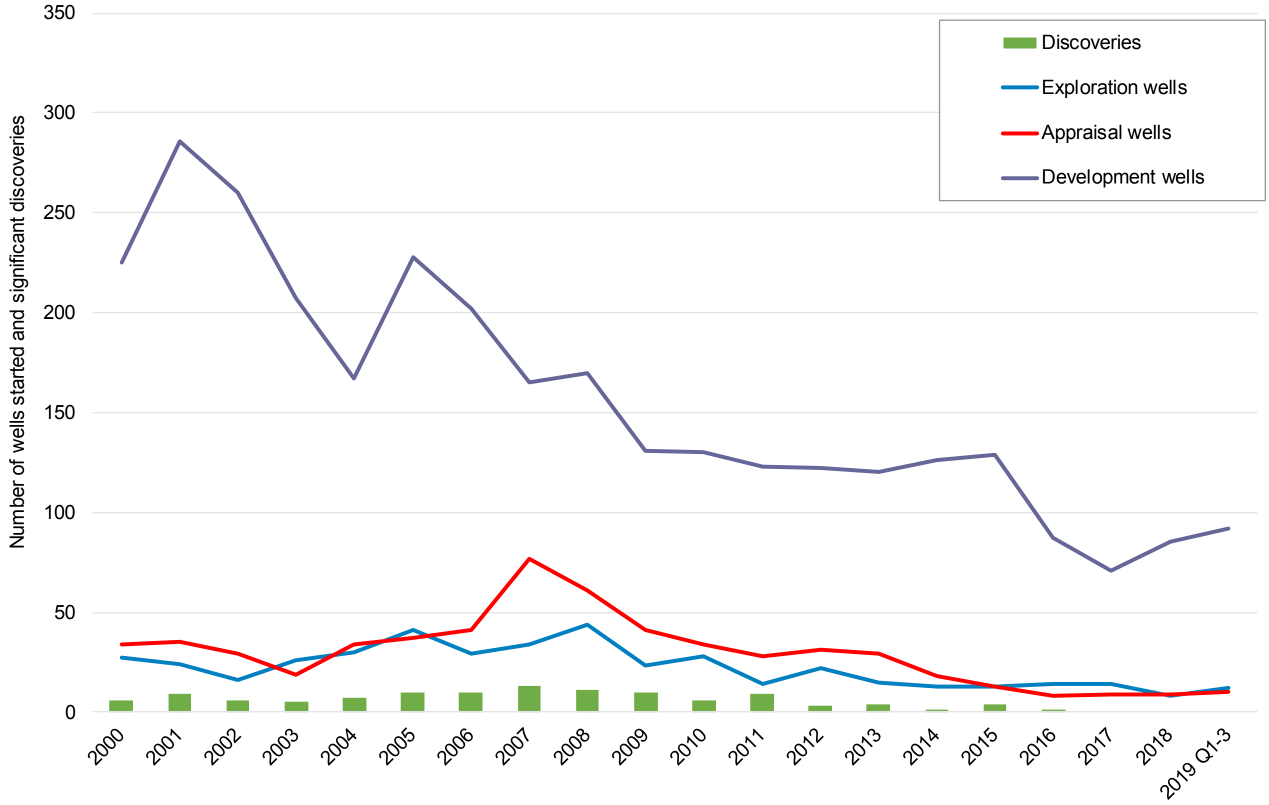
2.2.1 Likely scale of activity

On past experience the activity that actually takes place is less than what is included in the work programme at the licence application stage. A proportion of Blocks awarded may be relinquished without any offshore activities occurring. Activity after the Initial Term is much harder to predict, as this depends on the results of the initial phase, which is, by definition, exploratory. Typically, less than half the wells drilled reveal hydrocarbons, and of that, less than half will have a potential to progress to development. For example, the OGA analysis of exploration well outcomes 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

[9] https://www.ogauthority.co.uk/media/5888/general-guidance-32nd-seaward-licensing-round-june-2019.pdf

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).

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



Note: "significant" generally refers to the flow rates that were achieved (or would have been reached) in well tests (15 mmcfgd or 1000 BOPD) and does not indicate commercial potential of the discovery. Source: OGA Drilling Activity (October 2019), Significant Offshore Discoveries (October 2018)

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 40 current projects identified by the OGA's Project Pathfinder (as of 13th December 2019)[10], 20 are planned as subsea tie-backs to existing infrastructure, 4 involve new stand-alone production platforms and 4 are likely to be developed via Floating Production, Storage and Offloading (FPSO) facilities. 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. Figure 2.1 indicates that the number of development wells has declined over time and this pattern is likely

[10] https://itportal.ogauthority.co.uk/eng/fox/path/PATH_REPORTS/pdf

to continue. 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 screening criteria described in Section 4 are applicable to the potential effects of development well drilling within any of the 32nd Round Blocks.

2.2.2 32nd Round activities considered by the HRA

The nature, extent and timescale of development, if any, which may ultimately result from the licensing of 32nd 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 where appropriate an HRA, allowing the opportunity for further mitigation measures to be identified as necessary, and for permits to potentially be refused. In this way the opinion of the Advocate General in ECJ 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. Therefore, only activities as part of the work programmes associated with the Initial Term and its associated Phases A-C are considered in this AA (see Table 2.2).

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 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.

The approach used in this assessment has been to take the proposed activity for the Block as being the maximum of any application for that Block, and to assume that all activity takes place. The estimates of work commitments for the relevant Blocks derived from the applications received by the OGA are shown in Table 2.1. Two or more of the Blocks may be part of a single licence application, such that the level of activity suggested in Table 2.1 may be greater than that which occurs, e.g. drilling will only take place in one licence area rather than in every Block applied for, although seismic survey may cover parts of several or all Blocks comprising a single licence.

Table 2.1: Indicative work programmes relevant to Blocks considered in this assessment

Relevant Blocks	Obtain[11] and/or reprocess 2D or 3D seismic data	Shoot 3D seismic	Drill or drop well
205/15	-	✓	✓
205/18	-	✓	✓
205/20	-	✓	✓

Completion of the work programmes is likely to involve one or more of the activities summarised in Table 2.2. 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 relevant legislation.

[11] To obtain seismic data means purchasing or otherwise getting the use of existing data and does not involve shooting new seismic.

Table 2.2: Potential activities and assessment assumptions

Potential activity	Description	Assumptions used for assessment
Initial Term Phase B: Geophysical survey		
Seismic (2D and 3D) survey	2D seismic involves a survey vessel with an airgun array and a towed hydrophone 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 several hydrophone streamers towed by the survey vessel. Thus, closely spaced 2D lines (typically between 25 and 75m apart) can be achieved by a single sail line.	These deep-geological surveys tend to cover large areas (300-3,000km^2) and may take from several days up to several weeks to complete. Typically, large airgun arrays are employed with 12-48 airguns and a total array volume of 3,000-8,000 in^3. From available information across the UKCS, arrays used on 2D and 3D seismic surveys produce most energy at frequencies below 200Hz, typically peaking at 100Hz, and with a peak broadband source level of around 256dB re 1μPa @ 1m (Stone 2015). While higher frequency noise will also be produced which is considerably higher than background levels, these elements will rapidly attenuate with distance from source; it is the components < 1,000Hz which propagate most widely.
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	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 twelve 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).	Semi-submersible rig anchors (if used) may extend to a radius of over 2.5km in west of Shetland waters. It is assumed that the seabed footprint of these is in the order of 0.1km^2.
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 through water reactive shales, would require onshore disposal or treatment offshore to the required standards prior to discharge.	The distance from source within which smothering or other effects may be considered possible 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 (refer to Section 4.2 for supporting information).

Potential activity	Description	Assumptions used for assessment
Conductor piling	Well surface holes are usually drilled "open-hole" with the conductor subsequently inserted and cemented in place to provide a stable hole through which the lower well sections are drilled. Where the nature of the seabed sediment and shallow geological formations are such that they would not support a stable open-hole (i.e. risking collapse), the conductor may be driven into the sediments. In the North Sea, the diameter of the conductor pipe for exploration wells is typically 26" or 30" (<1m), which is driven with hammer energies of <300kJ (see: Matthews 2014, MacGillivray 2018, Intermoor website). This compares with pile diameters of >3.5m and hammer energies up to 3,000kJ in the installation of monopile foundations at some southern North Sea offshore wind farm sites, which generate noise of considerably higher amplitude. Direct measurements of underwater sound generated during conductor piling are limited, but suggest that sound pressure levels of approximately 150-160dB re 1 µPa at 500-750m from the source, with peak energy at <500Hz and a rapid decline in energy above 1kHz (Jiang *et al*. 2015, MacGilllivray 2018, and see Section 4.3.1).	The need to pile conductors is well-specific and is not routine. It is anticipated that a conductor piling event would last between 4-6 hours.
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. A review of Environmental Statements for exploratory drilling suggests that the rig could be on location for, on average, up to 10 weeks. Support and supply vessels (50-100m in length) are expected to have broadband source levels in the range 165-180dB re 1µPa@1m, with the majority of energy below 1kHz (OSPAR 2009). Additionally, the use of thrusters for dynamic positioning has been reported to result in increased sound generation (>10dB) when compared to the same vessel in transit (Rutenko & Ushchipovskii 2015).

Potential activity	Description	Assumptions used for assessment
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 profilers, 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. Arrays used on site surveys and some Vertical Seismic Profiling (VSP) operations (see below) typically produce frequencies predominantly up to around 250Hz, with a peak source level of around 235dB re 1µPa @ 1m (Stone 2015). Calibrated measurements of a range of other sources commonly used in site surveys have recently become available and are described in detail in Section 4.3.1. These non-airgun sources operate at a range of frequencies, source levels and signal types, although most have dominant energy at much higher frequencies than airguns, are more directional, and typically exhibit lower source levels not exceeding 230dB re 1µPa @ 1m SPL_{p-p}.	A rig site survey typically covers 2-3km^2. The rig site survey vessel may also be used to characterise seabed habitats, biota and background contamination. 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 around 500 in^3 and with a maximum of 1,200 in^3, Stone 2015) is deployed from the rig, and measurements are made using a series of geophones deployed inside the wellbore.	VSP surveys are of short duration (one or two days at most).

2.3 Existing regulatory requirements and controls

The AA assumes that the high-level controls described below are applied as standard to activities since they are legislative requirements. These are distinct from further mitigation measures which may be identified and employed to avoid likely significant effects on relevant sites (see Section 5.2.3 and 5.3.3).

2.3.1 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[12].

There is a mandatory requirement to have sufficient recent and relevant data to characterise the seabed in areas where activities are due to take place (e.g. rig placement)[13]. 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 proposed activity, and the identification of any sensitive habitats by such survey (including those under Annex I of the Habitats Directive) may influence the Department'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 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 environmental impact assessments, (where necessary through HRAs) and chemical risk assessments under existing permitting procedures.

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[12] https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation
[13] See BEIS (2019b). The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended) – a guide.

2.3.2 Underwater noise

Controls are in place to cover all significant noise generating activities on the UKCS, including geophysical surveying. 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 the Department's Portal Environmental Tracking System using a standalone Master Application Template (MAT) and appropriate Subsidiary Application Template (SAT). Regarding noise thresholds to be used as part of any assessment, applicants are encouraged to seek the advice of relevant SNCB(s) (JNCC 2017) in addition to referring to European Protected Species (EPS) guidance (JNCC 2010). Applicants should be aware of recent research development in the field of marine mammal acoustics, including the development of a new set of criteria for injury (NMFS 2018, referred to as NOAA thresholds), which were recently adopted as updated criteria thresholds in the peer-reviewed literature (Southall *et al*. 2019).

The Department consults the relevant statutory consultees on the consent applications 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 consent (such as specify timing or other specific control 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* (as amended) for oil and gas related seismic and sub-bottom profile surveys that the JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys are followed. Where appropriate, EPS disturbance licences may also be required under the *Conservation of Offshore Marine Habitats and Species Regulations 2017*[14]. The updated JNCC guidelines (2017) reaffirm that adherence to these guidelines constitutes best practice and will, in most cases, reduce the risk of deliberate injury to marine mammals to negligible levels. Applicants are expected to make every effort to design a survey that minimises sound generated and consequent likely impacts, and to implement best practice measures described in the guidelines.

In addition, potential disturbance of certain qualifying species (or their prey) may be avoided by the seasonal timing of offshore activities. For example, periods of seasonal concern for individual Blocks on offer have been highlighted with respect to seismic survey and fish spawning (see Section 2 of OGA's Other Regulatory Issues[15] which accompanied the 32nd Round offer) which licensees should take account of. Licensees should also be aware that it may influence the Department'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/5883/other-regulatory-issues-july-2019.pdf

Figure 2.2: Stages of plan level environmental assessment

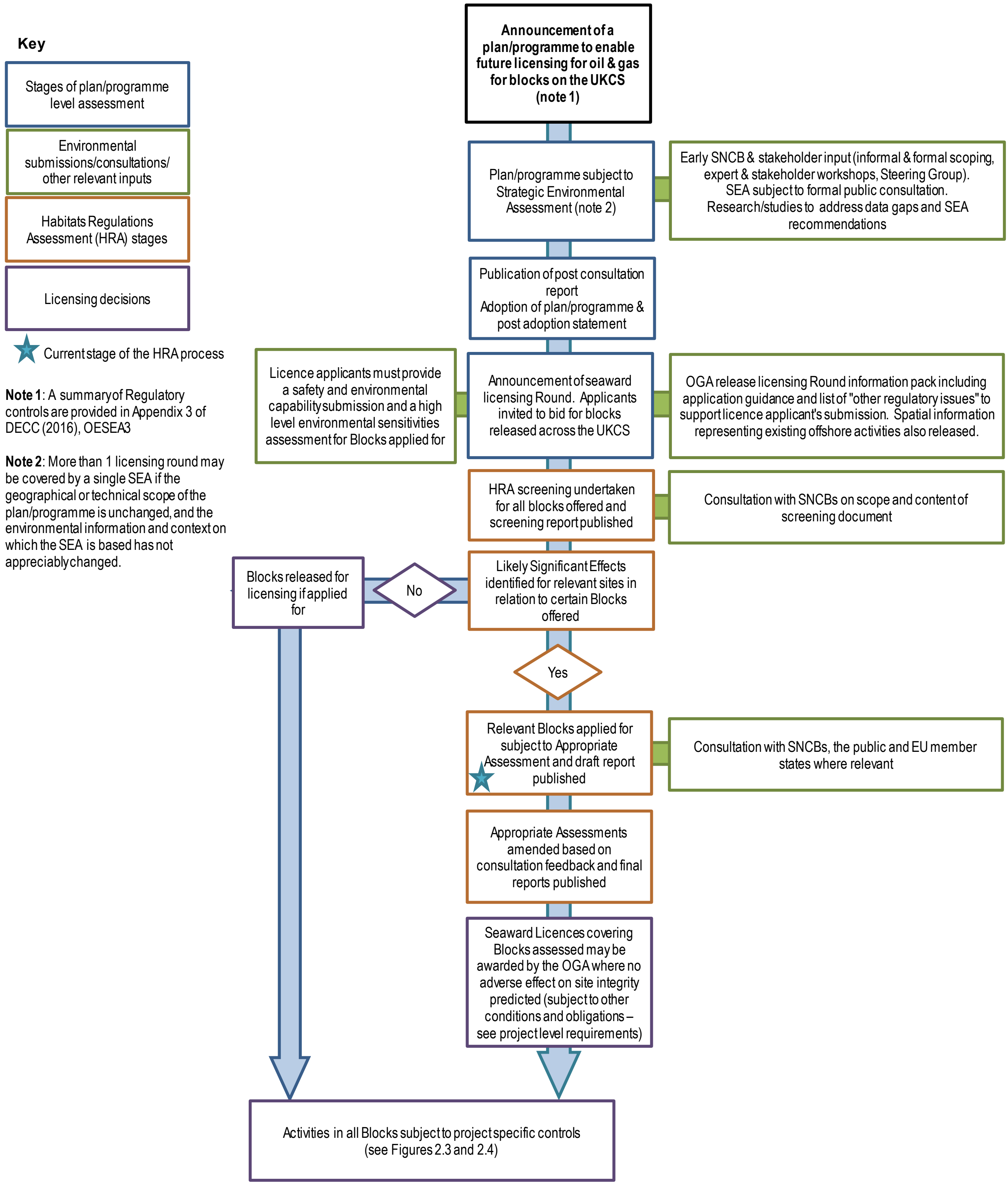
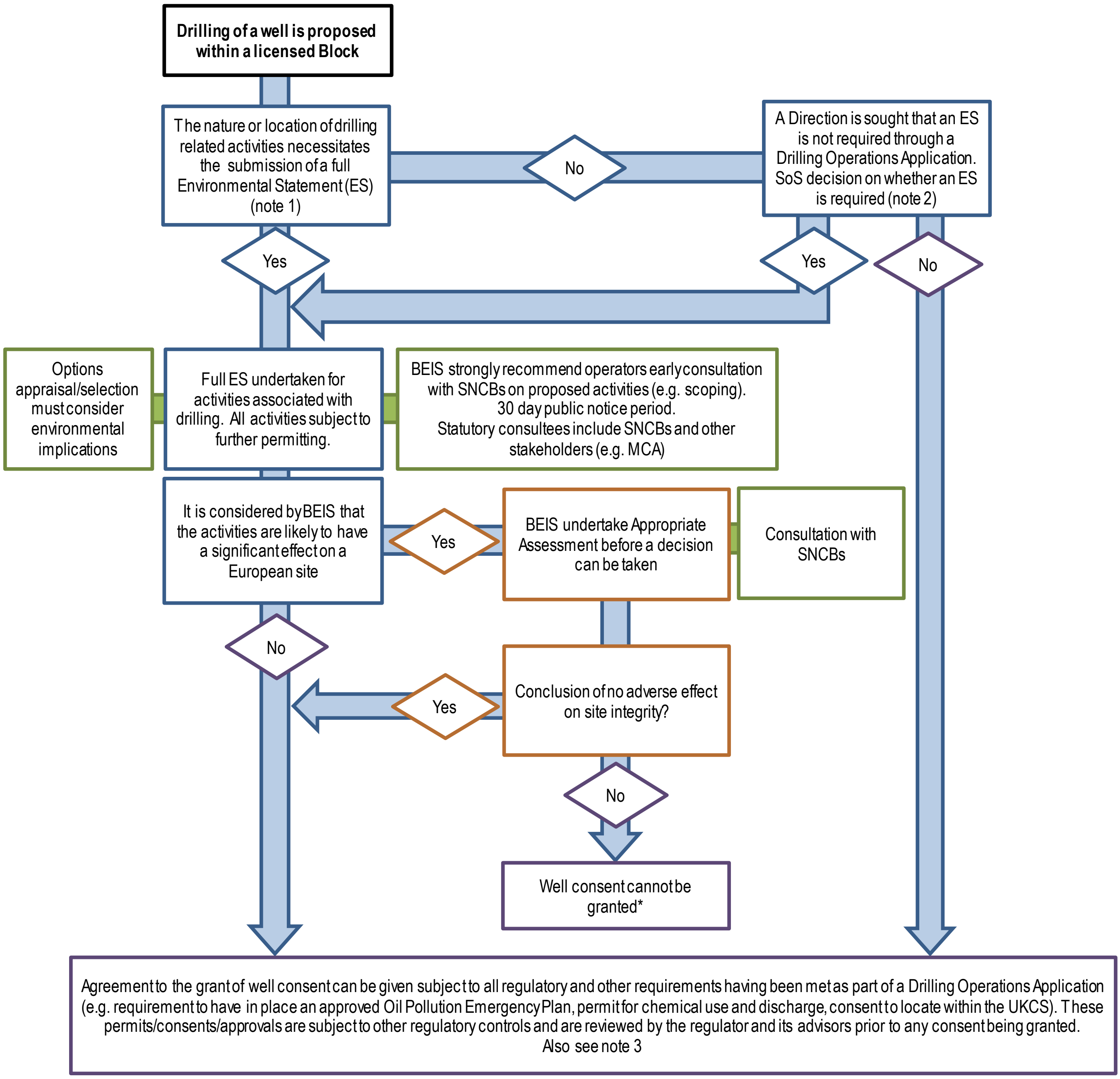


Figure 2.3: High level overview of exploration drilling environmental requirements



Key

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

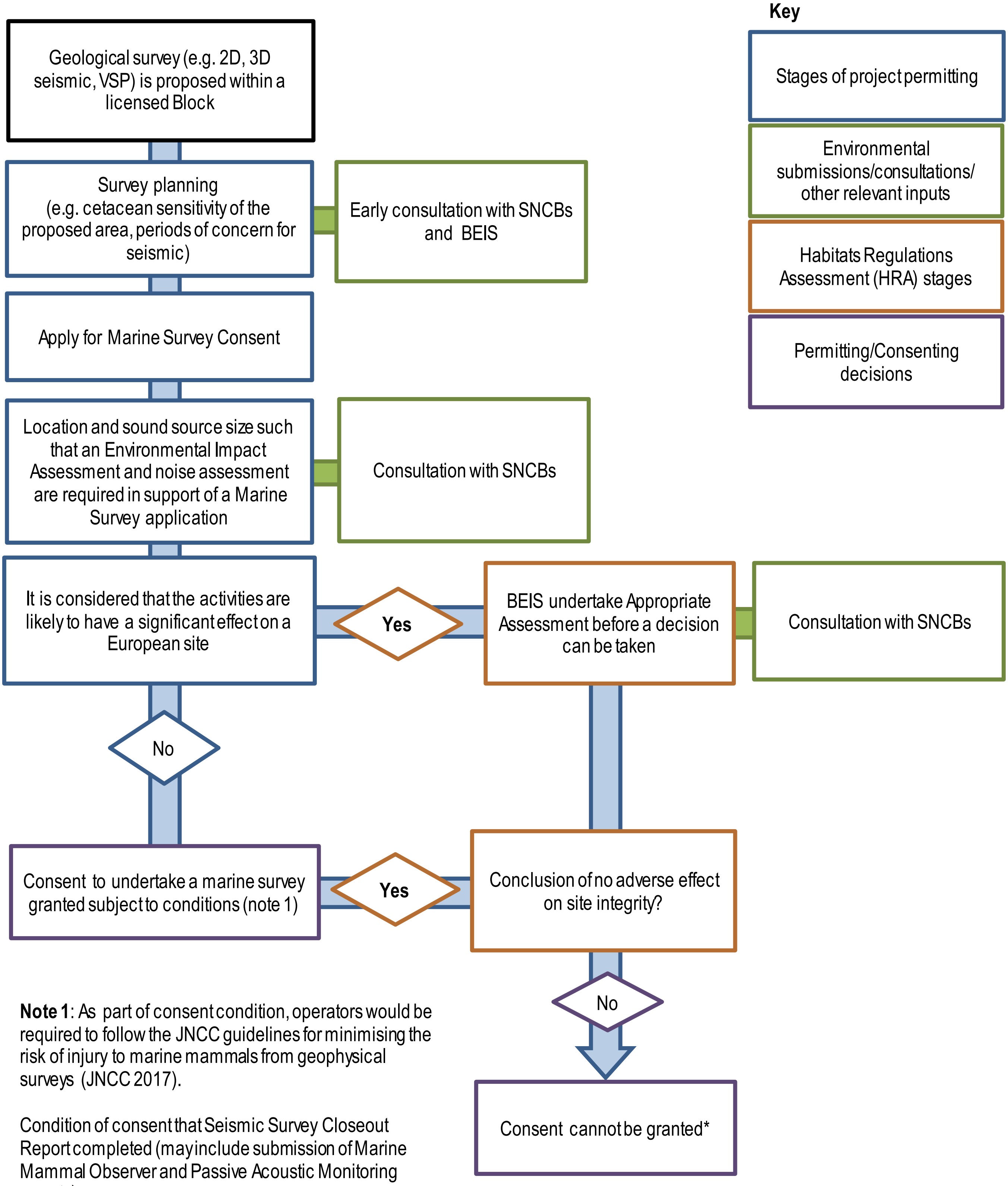
Note 1: See BEIS (2019b). The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended) – a guide.

Note 2: Early consultation between BEIS and 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: As part of consent condition, operators would be required to follow the JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys (JNCC 2017).

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), the Department 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.

In considering the above, the Department 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 the Department 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 clarified by the courts (Cairngorms judicial review case[16]) 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

[16] World Wild Life Fund & Others, Re application for judicial review of decisions relating to the protection of European Sites at Cairngorm Mountain, by Aviemore and proposals for construction of a funicular railway thereon.

in Article 1 of the Directive (JNCC 2002). As clarified by the European Commission (2019), 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 2019) and with reference to other guidance, reports and policy, including the Habitats Regulations Guidance Notes (English Nature 1997, Defra 2012, SEERAD 2000), SNH (2015), the National Planning Policy Framework (MHCLG 2019), the Marine Policy Statement (HM Government 2011), English Nature report No. 704 (Hoskin & Tyldesley 2006) and Natural England report NECR205 (Chapman & Tyldesley 2016).

The assessment of effects on site integrity is documented in Section 5. 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 (Table 2.2), along with the characteristics and specific environmental conditions of the relevant sites (see Section 5). 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 5.1)
- Underwater noise effects (Section 5.2)
- In-combination effects (Section 5.3)

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 the review of OESEA3 in BEIS 2018) 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, much work has been undertaken in the area of sensitivity assessments and activity/pressure (i.e. mechanisms of effect) matrices (e.g. Tillin *et al*. 2010, JNCC 2013, Tillin & Tyler-Walters 2014, Defra 2015, Robson *et al.* 2018, the Scottish Government Feature Activity Sensitivity Tool, FeAST, the MarESA tool, Tyler-Walters *et al*. 2018). These matrices are intended to describe the types of pressures that act on marine species and habitats from a defined set of activities and are related to benchmarks where the magnitude, extent or duration is qualified or quantified in some way and against which sensitivity may be measured – note that benchmarks have not been set for all pressures. The sensitivity of features to any pressure is based on tolerance and resilience, and can be challenging to determine (e.g. see Tillin & Tyler-Walters 2014, Pérez-Domínguez *et al.* 2016, Maher *et al.* 2016), for example due to data limitations for effect responses of species making up functional groups and/or lack of consensus on expert judgements. Outputs from such sensitivity exercises can therefore be taken as indicative.

This approach underpins the Scottish Government's FeAST[17] database that facilitates the identification of potential management requirements for Nature Conservation Marine Protected Areas (MPAs). This database was used to inform the draft advice[18] for the Seas off Foula pSPA given the importance of sandeels as a qualifying feature of the pSPA. Whilst these matrices are informative and note relevant pressures associated with hydrocarbon exploration, resultant effects are not inevitable consequences of activity since often they can be mitigated through timing, siting or technology (or a combination of these). The Department 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.

On review of the identified pressures for the relevant sites (e.g. relating to abrasion/disturbance of surface/subsurface substrate, siltation rate changes, introduction of contaminants etc) and their justifications, it is regarded that the evidence base for potential effects of oil and gas

[17] http://www.marine.scotland.gov.uk/FEAST/Index.aspx
[18] http://jncc.defra.gov.uk/pdf/SAS_Conservation_Objectives_and_Reg_18_Foula.pdf

exploration from successive Offshore Energy SEAs and the review of the OESEA3 Environmental Report (BEIS 2018) covers the range of pressures identified in the advice, and has therefore been used to underpin the assessment against site-specific information.

The following sections provide a summary of the evidence informing the site-specific assessment of effects provided in Section 5. To focus the presentation of relevant information, the sections take account of the environments in which those Blocks and relevant Natura 2000 sites to be subject to further assessment are located (Figure 1.1).

4.2 Physical disturbance and drilling effects

The pressures[19] which may result from exploration activities and cause physical disturbance and drilling effects on relevant Natura 2000 sites assessed in Section 5.2 are described below with respect to rig siting, drilling discharges and other effects.

4.2.1 Rig siting

Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion and abrasion/disturbance of the substrate on the surface of the seabed

Semi-submersible rigs normally use anchors to hold position, typically between eight and twelve in number at a radius related to water depth, seabed conditions and anticipated metocean conditions. The seabed footprint associated with semi-submersible rig anchoring results from a combination of anchor scars caused by anchors dragging before gaining a firm hold, and scraping by the cable and/or chain linking the anchor to the rig, where these contact the seabed (the catenary contact). An Environmental Statement for an exploration well in Block 205/15 (Nexen 2015) indicated that given the water depth (*ca.* 250m), the anchor spread radius could extend to 2,500m of which approximately 1,000m would be in contact with the seabed (catenary contact). It was estimated that deployment of the eight drilling rig anchors would result in a temporary direct impact on the seabed over an area of 0.08km^2. Similarly, ESs for developments in Blocks 206/8 (BP 2010) and 214/30 (Total 2014) in 140m and 435m water depth respectively, estimated the area of seabed affected by anchoring to be 0.032km^2 and 0.11km^2. Water depths across the Blocks being considered in this AA are broadly comparable to these (*ca*. 200-400m), and the extent of seabed disturbance is likely to be in the range described above (see Table 2.2).

The response of benthic macrofauna to physical disturbance has been well characterised in peer-reviewed literature, with increases in abundance of small opportunistic fauna and decreases in larger more specialised fauna (Eagle & Rees 1973, Newell *et al.* 1998, van Dalfsen *et al.* 2000, Dernie *et al*. 2003).

[19] Relevant pressures identified from draft advice on operations for Seas off Foula pSPA, FEAST database information on sandeels feature and JNCC PAD (2018).

Habitat recovery from temporary disturbance (caused by anchor scarring, anchor mounds) will depend primarily on re-mobilisation of sediments by current shear (as reviewed by Newell *et al*. 1998, Foden *et al.* 2009). Subsequent benthic population recovery takes place through a combination of migration, re-distribution (and larval settlement). The Blocks are likely to be characterised by gravelly sands and cobbles and boulders (e.g. Nexen 2015). Relict iceberg plough marks were identified in Block 205/15 (Nexen 2015) although these did not constitute areas of stony reef habitat. Given the Blocks are exposed to relatively strong bottom currents (0.4-0.5m/s, Holmes *et al*. 2003), recovery from anchor scarring, anchor mounds and cable scrape is likely to be relatively rapid (1-5 years) (van Dalfsen *et al.* 2000, Newell & Woodcock 2013).

Physical change to another seabed type

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. 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, iceberg ploughmarks, relicts of periglacial water flows, accumulations of large mollusc shells, carbonate cemented rock etc., and these are often revealed in rig site surveys. The use of semi-submersible rigs in the water depths within the Blocks considered in this AA removes the possible need to add stabilisation material for rig siting and therefore this pressure is not relevant.

4.2.2 Drilling discharges

Abrasion/disturbance of the substrate on the surface of the seabed, smothering and siltation rate changes and habitat structure changes – removal of substratum

The pressures described in this section relate to physical ones associated with the discharge and settlement of cuttings during exploration well drilling rather than potential chemical pressures (described below). Water-based mud cuttings are typically discharged at, or relatively close to the 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. Surface hole cuttings are derived from shallow geological formations and a proportion will be similar to surficial sediments in composition and characteristics. Dispersion of mud and cuttings is influenced by various factors, including particle size distribution and density, vertical and horizontal turbulence, current flows and water depth. In deep water, the range of cuttings particle size results in a significant variation in settling velocity, and a consequent gradient in the size distribution of settled cuttings, with coarser material close to the discharge location and finer material very widely dispersed away from the location, generally at undetectable loading (DECC 2016, JNCC PAD 2018). In contrast to historic oil based mud discharges, potential smothering effects due to the discharge of cuttings drilled with water based muds (WBM) are usually subtle or undetectable, although the presence of drilling material at the seabed is often detectable close to the drilling location (<500m).

Dispersion modelling of a WBM cuttings discharge of 3,160 tonnes of mud and cuttings from a well in Block 214/30a (water depth *ca*. 435m) predicted deposition in a 560m by 120m (0.85km^2) area. The thickest deposit of cuttings (203mm) was present at the discharge point, falling quickly to 5mm within *ca*. 50m of the well and then to 1mm or less over the remainder of the 0.85km^2 area. The model showed that the majority of the WBM (the finer particles) remained suspended in the water column and did not settle in the vicinity (Total 2014). Similarly, modelling of a WBM cuttings discharge of 3,400 tonnes from a well in Block 205/15 predicted deposition within a 175m by 50m area. Outside this area, any cuttings deposition would be less than 10mm thick and likely indistinguishable from the background seabed (Nexen 2015). Jones *et al.* (2006, 2012) compared pre- and post-drilling ROV surveys of a West of Shetland exploration well in Block 206/1a in *ca*. 600m water depth and documented physical smothering effects within 100m of the well. Outside the area of smothering, fine sediment was visible on the seafloor up to at least 250m from the well. After three years, there was significant reduction of cuttings material visible particularly in the areas with relatively low initial deposition (Jones *et al*. 2012). The area with complete cuttings cover had reduced from 90m to 40m from the drilling location, and faunal density within 100m of the well had increased considerably and was no longer significantly different from conditions further away.

The extent and potential impact of drilling discharges have been reviewed in successive SEAs, OESEA, OESEA2 and OESEA3 (DECC 2009, 2011 and 2016, respectively, also see BEIS 2018).

Relevant information on the recovery of benthic habitats to smothering mainly comes from studies of dredge disposal areas (see Newell *at al.* 1998). 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).

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)).

Contamination[20]

The past discharge to sea of drill cuttings contaminated with oil-based drill mud (OBM) resulted in well documented acute and chronic effects at the seabed (e.g. Davies *et al.* 1989, Olsgard & Gray 1995, Daan & Mulder 1996). These effects resulted from the interplay of a variety of factors of which direct toxicity (when diesel based muds were used) or secondary toxicity as a consequence of organic enrichment (from hydrogen sulphide produced by bacteria under anaerobic conditions) were probably the most important. Through OSPAR and other actions, the discharge of oil-based and other organic phase fluid contaminated material is now effectively banned. The “legacy” effects of contaminated sediments on the UKCS resulting from OBM discharges have been the subject of joint industry work (UKOOA 2002) and reporting to OSPAR.

The UK Government/Industry Environmental Monitoring Committee has reviewed UK offshore oil and gas monitoring requirements with an aim to ensure that adequate data is available on the environmental quality status in areas of operations for permitting assurance and to meet the UK’s international commitments to report on UK oil industry effects. This strategy has been implemented since 2004 and has included regional studies in various parts of the North Sea, and surveys around specific single and multi-well sites. The most recent survey was undertaken as part of the Department’s SEA monitoring with a survey in the Fladen Ground in late 2015 (see Appendix 1b of OESEA3).

Overall, there are positive indications of recovery of sediments and communities in both the Fladen Ground and East Shetland Basin from the historic effects of oil-based mud discharges. The total PAH and total n-alkane concentrations in Fladen Ground sediments were all lower in 2001 than in 1989 and are now at levels which are considered below ‘background’. The results of the most recent Fladen Ground survey confirm this general pattern of recovery.

In contrast to historic oil based mud discharges[21], 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, Aagaard-Sørensen *et al.* 2018). 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 (see above).

OSPAR (2009) concluded that the discharge of water-based muds and drill cuttings may cause some smothering in the near vicinity of the well location. The impacts from such discharges

[20] Including contamination from transition elements and organo-metals, hydrocarbons and PAHs, synthetic compounds and the introduction of other substances (solid, liquid or gas).
[21] 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.

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 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).

Finer particles may be dispersed over greater distances than coarser particles although exposure to WBM cuttings in suspension will in most cases be short-term (Bakke *et al.* 2013). 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. The bulk of WBM constituents (by weight and volume) are on the OSPAR list of substances used and discharged offshore which are considered to Pose Little or No Risk to the Environment (PLONOR). Barite and bentonite are the materials typically used in the greatest quantities in WBMs and are of negligible toxicity. 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).

4.2.3 Other effects

Visual disturbance

Blocks may support important numbers of birds at certain times of the year including overwintering birds and those foraging from coastal SPAs. Therefore, the presence and/or movement of vessels and aircraft from and within Blocks during exploration and appraisal activities could create visual stimuli which could evoke a disturbance response (JNCC PAD 2018) in birds from relevant SPA sites. In areas where helicopter transits are regular, a degree of habituation to disturbance amongst some birds has been reported (see Smit & Visser 1993). The anticipated level of helicopter traffic associated with Block activity (2-3 trips per week, see Table 2.2) is likely to be insignificant in the context of existing helicopter, military and civilian aircraft activity levels. However, the Blocks applied for are in less-explored areas where helicopter traffic is less well established, leading to the potential for temporary disturbance of birds with limited exposure to this pressure. Existing activity in the region includes helicopter and vessel traffic in relation to operations at the Clair, Schiehallion, Lancaster and Foinaven fields.

Physical disturbance of seaduck and other waterbird flocks by vessel and aircraft traffic associated with hydrocarbon exploration and appraisal is possible, particularly in SPAs established for shy species (e.g. common scoter). Such disturbance can result in repeated disruption of bird feeding, loafing and roosting. For example, large flocks of common scoter were observed being put to flight at a distance of 2km from a 35m vessel, though smaller flocks were less sensitive and put to flight at a distance of 1km (Kaiser 2002, also see Schwemmer *et al.* 2011). Larger vessels would be expected to have an even greater disturbance distance (Kaiser *et al.* 2006). Mendel *et al.* (2019) further note behavioural response in red-throated diver within 5km of ships. With respect to the disturbance and subsequent displacement of seabirds in relation to offshore wind farm (OWF) developments, the Joint SNCB interim displacement advice (2017)[22] recommends for most species a standard displacement buffer of 2km with the exception of the species groups of divers and sea ducks. Divers and sea ducks have been assessed as being the most sensitive species groups to offshore development and associated boat and helicopter traffic. Therefore, for divers and sea ducks a 4km displacement buffer is recommended. Whilst displacement effects for divers have been detected at greater distances (e.g. 5-7km, Webb 2016; significant changes noted at 10-16.5km, Mendel *et al.* 2019), this relates to the construction and operation of offshore wind farms which have a much larger spatial and temporal footprint than oil and gas exploration activities.

4.3 Underwater noise[23]

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 oil and gas activities that generate underwater sound, deep geological seismic survey (2D and 3D) is of primary concern due to the high amplitude, low frequency and impulsive nature of the sound generated over a relatively wide area. Typical 2D and 3D seismic surveys consist of a vessel towing a large airgun array, made up of sub-arrays or single strings of multiple airguns, along with towed hydrophone streamers. Total energy source volumes vary between surveys, most commonly between 1,000 and 8,000 cubic inches, with typical broadband source levels of 248-259 dB re 1μPa (OGP 2011). Most of the energy produced by airguns is low frequency: below 200Hz and typically peaking around 100Hz; source levels at higher frequencies are low relative to that at the peak frequency but are still loud in absolute terms and relative to background levels. As detailed in Section 2.2.1 work programmes relating to the three relevant 32nd Round Blocks include the intention to conduct 3D seismic survey.

[22] http://jncc.defra.gov.uk/pdf/Joint_SNCB_Interim_Displacement_AdviceNote_2017.pdf
[23] Note that all underwater noise effects fall within the “underwater noise change” and “vibration” pressure definitions.

In addition to seismic surveys, relevant sources of impulsive sound are restricted to the smaller volume air-guns and sub-bottom profilers (SBPs) used in high-resolution geophysical surveys (HRGS, e.g. rig site surveys) and well evaluation (i.e. Vertical Seismic Profiling, VSP), and also potentially from conductor-piling during drilling (see Table 2.2). Compared to deep geological survey, these sources tend to generate sound of lower amplitude, are typically complete within several hours or a single day, are conducted from either a fixed point (VSP) or cover a small area (rig site surveys) and, in the case of some SBPs, operate at a higher frequency than air-guns[24]. Consequently, the overall magnitude and area of risk from sound effects is considerably smaller than in the case of deep geological seismic surveys.

Sources such as 'pingers', 'chirp' or parametric SBPs, along with other sources used in site surveys such as side-scan sonar and multi-beam echosounders (MBES), produce a computer-controlled frequency-amplitude modulated acoustic waveforms, which do not exhibit the steep rise time characteristic of impulsive waveforms. These sources are more directional and have dominant frequencies higher than those of air guns such that, even at high source levels, sound levels outside the main beam are much reduced, rapidly attenuate at higher frequencies[25]. Therefore, they pose a very low risk of injury to sensitive marine species and very limited propagation of levels which might result in behavioural disturbance (e.g. Cotter *et al*. 2019). SBPs of the 'boomer' and 'sparker' type generate a true broadband seismic pulse of low frequency, although the peak pressures produced by these small devices are considerably lower than those generated by airguns. Two studies commissioned by the US Bureau of Ocean Energy Management investigated sound generated by equipment commonly used in HRGS. Calibrated source levels were measured under controlled conditions in a test tank (Crocker & Fratantonio 2016, Crocker *et al*. 2019); acoustic characteristics of several example pieces of equipment tested are provided in Table 4.1. These measurements confirm the much lower source levels of SBPs and seafloor mapping equipment used in site surveys relative to airgun sources.

Table 4.1: Measured acoustic characteristics for example sources used in high-resolution geophysical surveys

Source tested	Category; signal type	Source levels (dB re 1μPa@1m)[1]		Approximate frequency range of dominant energy (kHz)	-3dB beam width (degrees); across track
		$SPL_{peak\text{-}peak}$	SEL		
Delta Sparker	SBP 'sparker'; impulse	206-225	163-185	0.3 - 1.5	n/a
Applied Acoustics 251	SBP 'boomer' (single plate); impulse	208-216	166-174	3 - 5	49-76
EdgeTech 512i	SBP 'chirper'; FM chirp	176-191	145-160	1 - 9	51-80

[24] It should be noted that airgun (including VSP) and sub-bottom profiling site surveys undertaken in relation to licences issued under the *Petroleum Act 1998* require consent under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), but side-scan sonar and multibeam echosounder surveys only require to be notified to the Regulator (JNCC 2017).
[25] For example, the absorption coefficient alone in seawater is approximately -36dB/km at 100kHz, rising to -61dB at 200kHz (Lurton 2016).

Source tested	Category; signal type	Source levels (dB re 1μPa@1m)[1]		Approximate frequency	-3dB beam width
Reson Seabat 7111	MBES; tone burst	197-233	152-197	100	~160
EdgeTech 4200	Side-scan sonar; tone burst	206-216	165-205	100 or 400	~50 (1.6-2.6 along track)

Notes: 1. Values represent minimum and maximum according to different source configurations (e.g. power level, pulse width or centre frequency); maximum values typically correspond to the highest power level tested. SBP = sub-bottom profiler; MBES = multibeam echosounder. Source: Crocker & Fratantonio (2016).

The test tank experiments were followed by measurements in shallow (≤ 100m depth) open-water environments to investigate sound propagation (Halvorsen & Heaney 2018). Problems during the open-water testing resulted in a lack of calibration in the reported sound source levels (Labak 2019). The accompanying advice note (Labak 2019) emphasises that these uncalibrated data should not be used to provide source level measurements, and consequently the reported isopleths (summarising sound propagation) should not replace project-specific sound source verifications. A further project to calibrate these measures and provide an expanded assessment of propagation commenced in 2019. Despite these caveats, some general patterns were observed. In all test environments, broadband received levels from all MBES, side-scan sonar and SBP ‘chirper’ or ‘boomer’ devices tested were rapidly attenuated with distance from source, with particularly pronounced fall-off for directional sources when the receiver was outside of the source’s main beam. Acoustic signals from the SBP ‘sparkers’ tested showed slightly greater propagation, as would be expected from the lower-frequency and less directional impulsive signals produced. The greatest propagation was generally observed at the deepest test site (100m water depth) from sources generating low frequencies (<10kHz); by contrast, at 100m water depth, some of the highest frequency sources (>50kHz) experienced such attenuation that they were only weakly detectable or undetected by recording equipment. While acknowledging that these results require refinement, for all the aforementioned devices, broadband sound levels recorded a few hundred metres of the source were of a considerably lower intensity than the criteria for permanent or temporary hearing loss (Southall *et al*. 2019). These preliminary results, combined with the calibrated source measurements in test tanks, suggest that SBPs and other sources used in HRGS have a very low potential for significant disturbance of sensitive marine fauna. Until further information becomes available, the JNCC advise the use of a precautionary 5km marine mammal deterrence radius in assessments of potential effects of SBPs and other HRGS sources.

Direct measurements of underwater sound generated during conductor piling are limited, although the evidence which does exist supports the assertion that the low hammer energies and pile diameters relative to the piling of monopiles for offshore wind foundations results in much lower amplitude underwater noise. Jiang *et al.* (2015) monitored conductor piling operations at a jack-up rig in the central North Sea in 48m water depth and found peak sound pressure levels (L_{pk}) not to exceed 156dB re 1 μPa at 750m (the closest measurement to source) and declining with distance. Peak frequency was around 200Hz, dropping off rapidly above 1kHz; hammering was undertaken at a stable power level of 85 ±5 kJ but the pile diameter was not specified (Jiang *et al.* 2015). MacGillivray (2018) reported underwater noise measurements during the piling of six 26” conductors in 365m water depth off southern California. After initially penetrating the seabed under its own weight, each conductor was driven approximately 40m further into the seabed (silty-clay and clayey-silt) with hammer energies that increased from 31 ±7 kJ per strike at the start of driving to 59 ±7 kJ per strike. Between 2.5-3 hours of active piling was required per conductor. Sound levels were recorded by fixed hydrophones at distances of 10-1,475m from the source and in water depths of 20-370m, and by a vessel-towed hydrophone. The majority of sound energy was between 100-1,000Hz, with peak sound levels around 400Hz. Broadband sound pressure levels recorded at 10m from source and 25m water depth were between 180-190dB re 1μPa (SEL = 173-176dB re 1μPa·s), reducing to 149-155dB re 1μPa at 400m from source and 20m water depth (SEL = 143-147dB re 1μPa·s).

Drilling operations and support vessel traffic are sources of continuous noise (non-impulsive), of a comparable amplitude, dominated by low frequencies and of a lower amplitude than deep geological seismic survey. Sound pressure levels of between 120dB re 1μPa in the frequency range 2-1,400Hz (Todd & White 2012) are probably typical of drilling from a jack-up rig, with slightly higher source levels likely from semi-submersible rigs due to greater rig surface area contact with the water column. In general, support and supply vessels (50-100m) are expected to have broadband source levels in the range 165-180dB re 1μPa@1m, with the majority of energy below 1kHz (OSPAR 2009). The use of thrusters for dynamic positioning has been reported to result in increased sound generation (>10dB) when compared to the same vessel in transit (Rutenko & Ushchipovskii 2015).

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, physiological injury and mortality. While generally the severity of effects tends to increase with increasing exposure to noise, it is important to draw a distinction between effects from physical (including auditory) injury and those from behavioural disturbance. In addition to direct effects, indirect effects may also occur, for example via effects on prey species, complicating the overall assessment of significant effects. Marine mammals, and in particular the harbour porpoise, are regarded as the most sensitive to underwater noise effects and it is considered appropriate to focus on marine mammals when assessing risk from underwater noise. However, high amplitude impulsive noise also poses potential risks to fish and diving birds.

There are no sites with marine mammal or fish qualifying features screened in for the West of Shetland region, and the Blocks applied for are not within areas of particular high use by seals associated with sites in Shetland and Orkney (Russell *et al*. 2017). Consequently, the following discussion focuses on potential effects of underwater noise on diving birds and their fish prey.

Diving birds

Direct effects from seismic exploration noise on diving birds could potentially occur through physical damage, or through disturbance of normal behaviour, although evidence for such effects is very limited. Deeper-diving species which spend longer periods of time underwater (e.g. auks) may be most at risk of exposure to high-intensity noise from seismic survey and consequent injury or disturbance, but all species which routinely submerge in pursuit of prey and benthic feeding opportunities (i.e. excluding shallow plunge feeders) may be exposed to anthropogenic noise. Diving species relevant to sites and Blocks addressed in this AA for the West of Shetland region include guillemot and puffin.

Very high amplitude low frequency underwater noise may result in acute trauma to diving seabirds, with several studies reporting mortality of diving birds in close proximity (i.e. tens of metres) to underwater explosions (Yelverton *et al*. 1973, Cooper 1982, Stemp 1985, Danil & St Leger 2011). However, mortality of seabirds has not been observed during extensive seismic operations in the North Sea and elsewhere. While seabird responses to approaching vessels are highly variable, flushing disturbance would be expected to displace most diving seabirds from close proximity to seismic airgun arrays, particularly among species more sensitive to visual disturbance such as scoter, divers and cormorant (Garthe & Hüppop 2004). Therefore, the potential for acute trauma to diving birds from seismic survey is considered to be very low.

Data relating to the potential behavioural disturbance of diving birds due to underwater noise are very limited. The reported in-air hearing sensitivity for a range of diving duck species, red-throated diver and gannet have been tested for tone bursts between frequencies of 0.5-5.7kHz; results revealed a common region of greatest sensitivity from 1-3kHz, with a sharp reduction in sensitivity >4kHz (Crowell e*t al.* 2015). Similar results were observed for African penguin; tests of in-air hearing showed a region of best sensitivity of 0.6-4kHz, consistent with the vocalisations of this species (Wever *et al*. 1969). Testing on the long-tailed duck underwater showed reliable responses to high intensity stimuli (> 117 dB re 1μPa) from 0.5-2.9kHz (Crowell 2014). An underwater hearing threshold for cormorant of 70-75 dB re 1μPa rms for tones at tested frequencies of 1-4kHz has been suggested (Hansen *et al*. 2017). The authors argue that this underwater hearing sensitivity, which is broadly comparable to that of seals and small odontocetes at 1-4kHz, is suggestive of the use of auditory cues for foraging and/or orientation and that cormorant, and possibly other species which perform long dives, are sensitive to underwater sound. The use of acoustic pingers mounted on the corkline of a gillnet in a salmon fishery, emitting regular impulses of sound at *ca.* 2kHz, was associated with a significant reduction in entanglements of guillemot, but not rhinoceros auklet (Melvin *et al*. 1999). In a playback experiment on wild African penguins, birds showed strong avoidance behaviour (interpreted as an antipredator response) when exposed to killer whale vocalisations and sweep frequency pulses, both focussed between 0.5-3kHz (Frost *et al*. 1975).

McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic noise in some species (e.g. penguins, considered as a possible proxy for auk species) would be high, hence individuals might be adversely affected only in close proximity to the source. A study investigated seabird abundance in Hudson Strait (Atlantic seaboard of Canada) during seismic surveys over three years (Stemp 1985). Comparing periods of shooting and non-shooting, no significant difference was observed in abundance of fulmar, kittiwake and thick-billed murre (Brünnich's guillemot). More recently, Pichegru *et al*. (2017) used telemetry data from breeding African penguins to document a shift in foraging distribution concurrent with a 2D seismic survey off South Africa. Pre/post shooting, areas of highest use (indicated by the 50% kernel density distribution) bordered the closest boundary of the seismic survey; during shooting, their distribution shifted away from the survey area, with areas of higher use at least 15km distant to the closest survey line. However, insufficient information was provided on the spatio-temporal distribution of seismic shooting or penguin distribution to determine an accurate displacement distance. It was reported that penguins quickly reverted to normal foraging behaviour after cessation of seismic survey activities, suggesting a relatively short-term influence of seismic survey activity on these birds' behaviour and/or that of their prey (Pichegru *et al*. 2017).

These data are limited, but the observed regions of greatest hearing sensitivity for cormorants in water and other diving birds in air are above those low frequencies (i.e. <500Hz) which dominate and propagate most widely from geological survey. While there is some evidence of noise-induced changes in the distribution and behaviour of diving birds in response to impulsive underwater noise, these have been temporary and may be a direct disturbance or reflect a change in prey distribution during that period (possibly as a result of seismic survey activities).

Fish

Many species of fish are highly sensitive to sound and vibration and broadly applicable sound exposure criteria have recently been published (Popper *et al.* 2014). Studies investigating fish mortality and organ damage from noise generated during seismic surveys are very limited and results are highly variable, from no effect to long-term auditory damage (reviewed in Popper *et al.* 2014). Behavioural responses and effects on fishing success ("catchability") have been reported following seismic surveys (Pearson *et al.* 1992, Skalski *et al.* 1992, Engås *et al.* 1996, Wardle *et al*. 2001). Following a review of relevant studies, MMS (2004) consider that the "consensus is that seismic airgun shooting can result in reduced trawl and longline catch of several species when the animals receive levels as low as 160dB". These reduced catches are temporary in nature and likely reflect temporary displacement and/or altered feeding behaviour. No associations of lower-intensity, continuous drilling noise and fishing success have been demonstrated, and large numbers of fish are typically observed around producing installations in the North Sea (e.g. Løkkeborg *et al*. 2002, Fujii 2015) and elsewhere (e.g. Stanley & Wilson 1991).

A key prey species of many seabirds, including those qualifying features of the Seas off Foula pSPA, is the sandeel. Studies on the hearing abilities of sandeels and their responses to noise are very limited. Hassel *et al.* (2004) observed startle responses from caged sandeels in response to seismic survey noise in the North Sea; no sandeels took refuge in the sand during seismic shooting, and no increased mortality was observed in comparison with controls. A study of the auditory thresholds of the closely related Japanese sandeel (*Ammodytes personatus)* reported an ability to detect low frequency tone bursts at ≤500Hz, although their sensitivity was less than that of other fish species (Suga 2005). The sandeel's lack of a swim bladder is considered to be responsible for their observed low sensitivity to underwater noise.

5 Assessment

The screening process (BEIS 2019a) identified a number of sites to the west of Shetland where there was the potential for likely significant effects associated with proposed activities that could follow licensing of Blocks offered in the 32nd Round. The further assessment of two sites in relation to three Blocks applied for in the west of Shetland area is given below. This assessment has been informed by the evidence base on the environmental effects of oil and gas activities (Section 4), and the assumed nature and scale of potential activities (Table 2.2).

5.1 Relevant sites

A description of each of the relevant sites is provided below based on the site citation and site selection information, which has been augmented by additional information from grey and primary sources relevant to site qualifying features. The assessment of these sites in relation to the 32nd Round west of Shetland Blocks is documented in Sections 5.2-5.4.

Seas off Foula pSPA

The seaward boundary of the Seas off Foula pSPA is based on the extent of the important aggregation for great skua with the other qualifying species which form part of the breeding or non-breeding assemblage found within the area used by great skua. Water depths over the proposed site range between 50m and 150m; shallow areas with less than 50m depth occur only around Foula and 10km north of it, while depths of more than 150m are only reached in the northwest[26]. Water depths across the relevant Blocks range between 200-400m. The medium and shallow parts of the site are therefore within a depth range which is favoured by sandeel (30-80m, Wright *et al*. 2000). The combined effect of currents and waves creates moderate-energy seabed environment in the west, and a high-energy seabed in the east of the site. The site comprises a mosaic of subtidal coarse sediments and moderate-energy circalittoral rock, with some sand and muddy sand habitats in the northwest (McBreen *et al*. 2011).

Different studies suggest that the site fully (Ellis *et al.* 2012), or at least in its southern extent (Coull *et al*. 1998), overlaps with low intensity spawning and nursery grounds of sandeels. Sandeels form an important part of the diet of great skua (Furness & Hislop 1981, Votier *et al*. 2007). Due to the reliance of many of the qualifying seabird species on locally available sandeels, the maintenance of both sandeel habitat and associated populations is important to ensure the ability of the site to support the qualifying species in the long term[27]. Additionally, the Shetland-Orkney thermal front overlaps with the site, suggesting that this feature might

[26] http://jncc.defra.gov.uk/pdf/SAS_Departmental_Brief_Foula.pdf
[27] https://www.nature.scot/sites/default/files/2017-12/Marine%20Protected%20Area%20%28Proposed%29%20-%20Conservation%20Objectives%20and%20Advice%20-%20Seas%20off%20Foula.pdf

create relatively predictable foraging habitat for seabirds and other marine predators (Begg & Reid 1997) and be an important driver of the regular aggregations of seabirds in the area.

Foula SPA

The island of Foula provides habitat for more than 190,000 seabirds; the land mass and immediately surrounding waters have been protected as the Foula SPA[28] since 1995, with the Seas off Foula pSPA extending this protection to cover 3,412km^2 of waters surrounding the island[29]. These waters provide foraging habitat for several species of seabird in both breeding and non-breeding seasons. Analyses of European Seabirds at Sea (ESAS)[30] data found that some 1,500 great skuas regularly use Seas off Foula during the breeding season, corresponding to approximately 4% of the estimated biogeographic population and satisfying criteria for designation as a SPA (JNCC 2016). Analyses of movement data from great skua (n=12) tagged at Foula (Thaxter *et al*. 2011, Wade *et al*. 2014) provided further evidence of the importance of this area to foraging birds during the breeding season. ESAS data also indicated a qualifying seabird assemblage during the breeding season (listed species include fulmar, Arctic skua, guillemot and puffin) and non-breeding season (listed species include great skua, fulmar, guillemot). All species are distributed throughout the entire extent of the proposed site, albeit in variable densities (JNCC 2016). While the highest predicted densities of great skua (1.1 bird per km^2) are closer to the island of Foula, densities of 0.25-0.5 birds per km^2 are predicted at the edges of the site. Puffin predicted densities are lowest in the northwest of the site and increase to the southeast, with the highest densities just south of Foula. Guillemot densities are lowest in the north of the site and its southeast extent; highest values occur predominately southwest of Foula. Densities of fulmar are low across most of the site, with higher values in the west and southeast, while the highest densities of Arctic skua are towards Shetland and an area 20km northeast of Foula.

Counts of breeding pairs of great skua at Foula between 1986 and 2000 remained between *ca*. 2,100-2,500, with a lower number of 1,657 breeding pairs reported in 2007; no more recent counts are available. Numbers of great skuas among four other Shetland colonies (Hermaness, Noss, Mousa and Fair Isle) in 2013 showed an increase of 27% over 2007 counts, and the latest (2015) assessed condition of breeding great skua at Foula SPA is listed as *favourable recovered* (SiteLink website[31]); however, the data for sites across Scotland illustrate a complicated picture with no clear trend (JNCC website[32]). With the exception of red-throated diver (*favourable maintained*, assessed in 2013), all of the other seabird species listed for the Foula SPA (Arctic tern, Leach's storm petrel, great skua, guillemot, puffin and shag) were assessed as *unfavourable declining* (majority assessed 2015/2016 with Leach's

[28] http://jncc.defra.gov.uk/pdf/SPA/UK9002061.pdf
[29] Initial consultation on the proposed SPA closed in January 2017, with subsequent consultation on proposed Special Protection Areas in Scotland is underway: https://consult.gov.scot/marine-scotland/sea-and-site-classification/
[30] http://www.seabirds.net/esas.html
[31] https://sitelink.nature.scot/site/8504
[32] https://jncc.gov.uk/our-work/great-skua-stercorarius-skua/

storm petrel assessed 2001), as was the breeding seabird assemblage (which also included fulmar, kittiwake, razorbill, Arctic skua and Arctic tern).

5.2 Assessment of physical disturbance and drilling effects

5.2.1 Blocks and sites to be assessed

The nature and extent of potential physical disturbance and drilling effects are summarised in Section 4.2. On the basis of this information, in conjunction with the location of the west of Shetland Blocks applied for in the 32nd Round and the sites with relevant qualifying features, potential likely significant effects are considered to remain for three Blocks, in respect of two sites (Figure 5.1). These are assessed in Section 5.2.2.

5.2.2 Implications for site integrity of relevant sites

The conservation objectives and other relevant information relating to site selection and advice on operations has been considered against the work programmes for the Blocks applied for (see Section 2.2.2) to determine whether they could adversely affect site integrity. The results are given in Table 5.1 below. All mandatory control requirements (as given in Section 2.3.1) are assumed to be in place as a standard for all activities assessed here.

Figure 5.1: Sites and Blocks to be subject to further assessment for physical disturbance and drilling effects

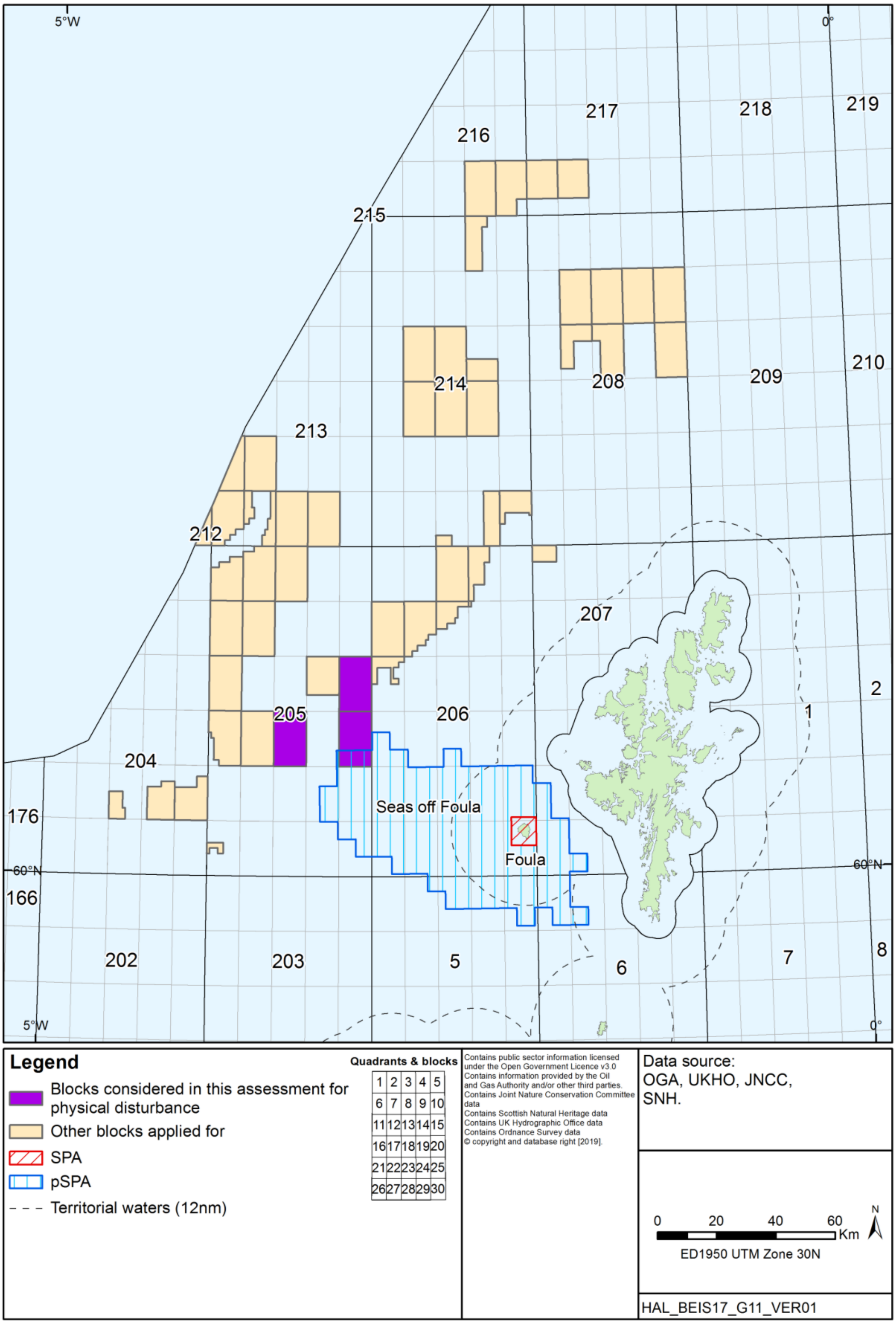


Table 5.1: Consideration of potential physical disturbance and drilling effects and relevant site conservation objectives

Seas off Foula pSPA
Site information
Area (ha): 341,215 **Relevant qualifying features: Breeding great skua. Breeding (including fulmar, Arctic skua, great skua, guillemot and puffin) and overwintering (including fulmar, great skua and guillemot) seabird assemblages. See SPA site selection document for details of qualifying features[33].** **Draft conservation objectives:** To avoid significant deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, subject to natural change, thus ensuring that the integrity of the site is maintained in the long term and makes an appropriate contribution to achieving the aims of the Birds Directive for each of the qualifying species. This contribution would be achieved through delivering the following objectives for each of the sites qualifying features: • Avoid significant mortality, injury and disturbance of the qualifying features, so that the distribution of the species and ability to use the site are maintained in the long-term; • Maintain the habitats and food resources of the qualifying features in favourable condition.
Relevant Blocks for physical disturbance and drilling effects
205/15, 205/18, 205/20
Assessment of effects on site integrity
Rig siting **(*Relevant pressures: penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion and abrasion/disturbance of the substrate on the surface of the seabed*)** Blocks 205/15 and 205/18 are 7km and 10km respectively from the site boundary and given the assumed distance from a semi-submersible rig within which effects may occur (1.5km, see Table 2.2), rig installation will not cause significant deterioration of the habitats and food resources of the qualifying species. Block 205/20 has significant areas outside the site boundaries in which rig siting would be possible, and therefore interaction with the habitats of the qualifying species could be avoided. For those parts of Block 205/20 within the site, whilst the assumed area within which effects may occur is quite large (19.6km^2, given 2.5km radius), the actual seabed footprint of physical damage associated with semi-submersible rig anchoring is relatively small (*ca*. 0.1km^2, see Table 2.2), relative to the overall site area (covering 0.003%). Recovery from physical disturbance of the scale associated with rig anchoring is expected to be relatively rapid given the moderate to high energy seabed environment. The small scale and temporary nature of the potential physical disturbance will not have a significant effect on the extent and quality of the supporting habitats in the longer term[34] and therefore there will be no adverse effect on site integrity. **Drilling discharges** ***(Relevant pressures: abrasion/disturbance of the substrate on the surface of the seabed; changes in suspended solids (water clarity); smothering and siltation rate changes (light); physical change (to another sediment type); habitat structure changes – removal of substratum (extraction), contamination)*** It is assumed that effects relating to drilling discharges occur within 500m of the well location (Table 2.2). Therefore, drilling discharges related to Blocks 205/15 and 205/18 will not cause significant deterioration of the habitats and food resources of the qualifying species due to their distance from the site boundary. With respect to Block 205/20, as mentioned above there are significant areas outside the site in which drilling discharges would not impact the site. For those parts of Block 205/20 within the site, the maximum spatial footprint within which smothering by drilling discharges may occur (0.8km^2) is small (representing 0.02% of the total site area) and given the dynamic nature of the site, redistribution of drilling discharges and recovery from smothering would be rapid. The small scale and temporary nature of potential smothering, and mandatory mitigation requirements with

[33] https://www.nature.scot/sites/default/files/2017-12/Marine%20Protected%20Area%20%28Proposed%29%20-%20Site%20Selection%20document%20-%20Seas%20off%20Foula.pdf
[34] http://jncc.defra.gov.uk/pdf/SAS_Conservation_Objectives_and_Reg_18_Foula.pdf

respect to drilling chemical use and discharge (Section 2.3.1), will ensure that the extent and quality of the supporting habitats are not impacted in the longer term and therefore there will be no adverse effect on site integrity.

Other effects
(Relevant pressures: *visual disturbance, above water noise)*

Of the qualifying features, guillemot is moderately sensitive to disturbance by ship and helicopter traffic with the other features being of low sensitivity (Garthe & Hüppop 2004, Furness *et al*. 2013). Block 205/20 is the only Block where there is the potential for a rig to be present within the site and this coincides with an area of low guillemot density (<3 birds/km^2)[35]. All of the relevant Blocks are currently exposed to very low shipping densities[36]. Therefore, the temporary and localised nature of drilling activities and limited number of associated supply vessel and helicopter trips (see Table 2.2) are not likely to impact the Seas off Foula qualifying features' distribution and use of the site such that their ability to survive and/or breed is compromised in the longer term[37]. However, further control measures are available (Section 5.2.3) and will be required, where appropriate, to ensure that the site conservation objectives of the linked Foula SPA are not undermined and there is no adverse effect on site integrity.

In-combination effects
No intra-plan in-combination effects are likely with respect to the spatial footprints associated with rig siting and drilling discharges given that Block 205/20 is the only one within the site. There is the potential for in-combination effects associated with the presence and movement of supply vessels to rigs within each of the Blocks. However, given the existing very low shipping densities, the low to moderate sensitivity of the qualifying features and the limited and temporary supply vessel traffic, intra-plan effects are not considered likely for the three Blocks. Further control measures are also available (Section 5.2.3) and will be required, where appropriate, to ensure that site conservation objectives are not undermined and there is no adverse effect on site integrity. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

Foula SPA

Site information

Area (ha): 7,985.49
Relevant qualifying features: Breeding Arctic tern, Leach's storm petrel, great skua, guillemot, puffin, shag and red-throated diver. Breeding seabird assemblage (including kittiwake, razorbill, Arctic skua, fulmar, puffin, guillemot, great skua, shag, Leach's storm-petrel, Arctic tern). See Natura 2000 standard data form for details of qualifying features[38].

Conservation objectives:
To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
To ensure for the qualifying species that the following are maintained in the long term:

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

Relevant Blocks for physical disturbance and drilling effects

205/15, 205/18, 205/20

Assessment of effects on site integrity

Block 205/20 is *ca*. 50km from the site boundary with Blocks 205/15 and 205/18 between 60 and 70km from the site. The site and Blocks were screened in for appropriate assessment due to the site's functional link with the Seas off Foula pSPA, which surrounds the site and provides foraging grounds for the SPA's qualifying features. The assessment of effects for the Foula SPA and relevant Blocks is therefore covered by that undertaken for the Seas off Foula pSPA (above).

35 http://jncc.defra.gov.uk/pdf/SAS_Departmental_Brief_Foula.pdf
36 https://www.ogauthority.co.uk/media/1419/29r_shipping_density_table.pdf
37 http://jncc.defra.gov.uk/pdf/SAS_Conservation_Objectives_and_Reg_18_Foula.pdf
38 http://archive.jncc.gov.uk/pdf/SPA/UK9002061.pdf

5.2.3 Further mitigation measures

Further mitigation measures are available which would be identified through the EIA process, operator's environmental management system and the Departmental permitting processes. These considerations are informed by project specific 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 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 statutory consultation phase on these assessments[39].

For those Blocks where proposed activities could result in the physical disturbance of sensitive qualifying features by vessels and aircraft traffic, available mitigation measures include, as far as possible, strict use of existing shipping and aircraft routes, and timing controls on temporary activities to avoid sensitive periods (these are identified in Table 5.1 above). Operators must demonstrate awareness of relevant seasonal sensitivities, and that these have been taken into account in the planning of their operations to avoid highly sensitive periods (see BEIS 2019b). In areas of high sensitivity, the Department expect operators to liaise with relevant SNCBs on the timing of their intended activities to minimise or avoid effects on seasonally sensitive qualifying interests.

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 the Department (and its advisors) to make a decision on whether the activities could lead to a likely significant effect.

5.2.4 Conclusions

Likely significant effects identified with regards to physical damage to the seabed, drilling discharges and other effects (see Section 5.2.2) when considered along with project level mitigation (Section 5.2.3) and relevant activity permitting requirements (see Section 2.3), 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[40] 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.

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

[40] he *Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended)*

Taking into account the information presented above, it is concluded that activities arising from the licensing of Blocks 205/15, 205/18 and 205/20, insofar as they may generate physical disturbance and drilling effects, will not cause an adverse effect on the integrity of the Seas off Foula pSPA or Foula SPA. 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.

5.3 Assessment of underwater noise effects

5.3.1 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 the west of Shetland Blocks applied for in the 32nd Round and the sites with relevant qualifying features, potential likely significant effects are considered to remain for three Blocks, in respect of two sites (Figure 5.2). These are assessed in Section 5.3.2. A description of the Foula SPA and Seas off Foula pSPA and their qualifying features, which is also assessed for physical and drilling effects, is provided in Section 5.1.

5.3.2 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 (see Section 2.2.1) to determine whether they could adversely affect site integrity, i.e. impacts the site features, either directly or indirectly, and result in altering the ecological structure and functioning of the site and/or affects the ability of the site to meet its conservation objectives. The results are given in Table 5.2 below. All mandatory control requirements (as given in Section 2.3.2) are assumed to be in place as a standard for all activities assessed at this stage.

Figure 5.2: Sites and Blocks to be subject to further assessment for underwater noise effects

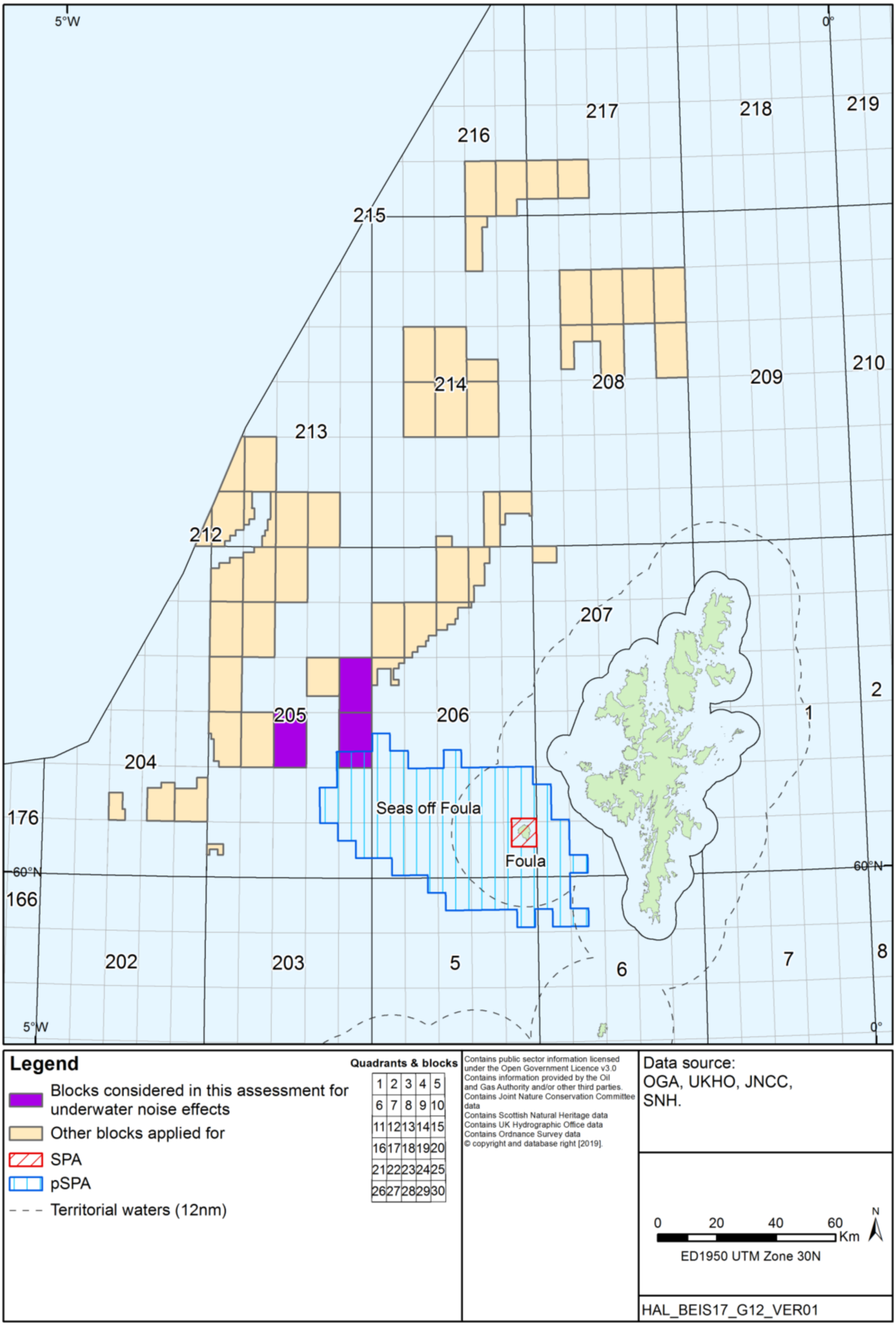


Table 5.2: Consideration of potential underwater noise effects and relevant site conservation objectives

Seas off Foula pSPA
Site information
Area (ha): 341,215 **Relevant qualifying features (diving species listed only): Breeding (including guillemot and puffin), and overwintering (including guillemot) seabird aggregations.** **Conservation objectives: See Table 5.1 above.**
Relevant Blocks for underwater noise effects
205/15, 205/18, 205/20
Assessment of effects on site integrity
Blocks 205/15 and 205/18 are 7km and 10km respectively from the northwest site boundary. Block 205/20 partially overlaps the northwest part of the site. The application(s) relating to the Blocks include a work programme to shoot 3D seismic. **Impulsive noise (2D/3D seismic survey, rig site survey, VSP, conductor piling)** *(**Relevant pressures:** underwater noise change, vibration)* Puffin and guillemot forage within Block 205/20 and surrounding waters, and therefore have the potential to come into close proximity to seismic survey activities. In terms of their relative densities across the site, it is noted that the northwest part of the site experiences the lowest densities of puffins at <2 birds/km^2, compared to up to 50 birds/km^2 in the southeast (JNCC 2016). Guillemot are also distributed throughout the site; in the breeding season the highest densities are around Foula itself; in the winter the species is more dispersed across the site (JNCC 2016, Kober *et al*. 2010, Cleasby *et al*. 2018). Given: (i) the distribution of puffin and guillemot within the site relative to the relevant Blocks; (ii) the evidence (albeit limited) of low hearing sensitivity and a lack of reported injury or disturbance effects; and (iii) the likely avoidance of the physical presence of survey vessel(s) and airguns, the risk of mortality, injury or significant disturbance is very low. Vessel avoidance behaviour of guillemot may be reduced during the post-breeding flightless moult stage (August to mid-October); this period may be considered through the activity consenting process, although such activities during this period are not considered likely to result in an adverse effect on site integrity. Negative indirect effects of seismic survey activities on qualifying features may arise through effects on prey species, primarily sandeels and other small fish, if these prey are subject to injury or disturbance which reduce their availability to qualifying seabirds. While there is evidence that a reduction in fish catches can be associated with seismic survey activity, these are temporary in nature, and the sensitivity of sandeels to underwater noise is considered to be low. The disturbance of sensitive spawning periods will be considered through the activity consenting process. As such, any underwater noise effects on fish associated with licensing Blocks 205/15, 205/18 and 205/20 are not anticipated to result in significant effects on the food resources of the qualifying seabird features. Considering the limited potential for effects of 2D/3D seismic survey on diving birds identified above and in Section 4.3.2, and the lower amplitude, shorter duration and smaller geographic footprint associated with other impulsive noise such as VSP, rig site survey and conductor piling, it is concluded that these activities, in any of the relevant Blocks, will not result in an adverse effect on the integrity of the site or its source colony sites. **Continuous noise (drilling, vessel & rig movements)** *(**Relevant pressures:** underwater noise change, vibration)* No significant effects on guillemot or puffin are anticipated from continuous underwater noise from drilling and vessel movements, due to the lower amplitude and non-impulsive nature of the sound resulting in no potential for acute trauma and no evidence of significant disturbance. **In-combination effects** Intra-plan in-combination underwater noise effects are considered highly unlikely given the low potential for effects identified above and that the Block-site overlap is restricted to a single Block. Section 5.4 provides a consideration of potential Block activities in-combination with other relevant plans and projects.

Foula SPA
Site information
Area (ha): 7,985.49 **Relevant qualifying features: Breeding guillemot and puffin. Breeding seabird assemblage (including guillemot and puffin). See Natura 2000 standard data form for details of qualifying features[41].** **Conservation objectives: See Table 5.1 above.**
Relevant Blocks for underwater noise effects
Direct: none. **Indirect:** 205/15, 205/18, 205/20 due to proximity to Seas off Foula pSPA, which has connectivity for breeding guillemot and puffin.
Assessment of effects on site integrity
Block 205/20 is 50km from the site boundary while Blocks 205/15 and 205/18 are *ca.* 60-70km from the site. The site and Blocks were screened in for appropriate assessment due to the site's link with the Seas off Foula pSPA which surrounds the site and provides foraging grounds for the SPA's qualifying features. The assessment of effects for the Foula SPA and relevant Blocks is therefore covered by that undertaken for the Seas off Foula pSPA (above).

5.3.3 Further mitigation measures

The assessment concluded that no further mitigation measures were required beyond existing regulatory controls (see Section 2.3.2) in order to avoid adverse effects on the integrity of the relevant sites. The Department 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. Due to the temporary nature of the activities, mitigation measures could include activity timing to avoid the most sensitive periods. Operators must demonstrate how seasonal sensitivities have been taken into account when planning their operations (see BEIS 2019b). The information provided by operators must be detailed enough for the Department (and their advisors) to make a decision on whether the activities could lead to a likely significant effect, and whether the activities should require 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, the Department may undertake further HRA to assess the potential for adverse effects on the integrity of sites at the activity specific level. A standard consent condition requires operators to follow the JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys.

Consent for project-level activities will not be granted unless the operator can demonstrate that the proposed activities, which may include 3D seismic survey, rig site survey, VSP and drilling (including conductor piling), will not have an adverse effect on the integrity of relevant sites.

5.3.4 Conclusion

The risks of injury and disturbance to relevant qualifying features is limited both by the nature of the indicative work programmes for the Blocks applied for and controls currently in place; such that it is concluded that activities arising from the licensing of Blocks listed in Table 5.2,

[41] http://archive.jncc.gov.uk/pdf/SPA/UK9002061.pdf

insofar as they may generate underwater noise effects, will not cause an adverse effect on the integrity of the relevant sites identified. Consent for project specific activities will not be granted unless the operator can demonstrate that the proposed activities will not have an adverse effect on the integrity of relevant sites. These activities may be subject to activity level EIA and, where appropriate, HRA.

5.4 In-combination effects

5.4.1 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[42] and BEIS 2018). There are a number of potential interactions between activities that may follow licensing and those existing or planned activities in the west of Shetland area, for instance in relation to fishing, shipping and other oil and gas exploration and production activity. These activities are subject to individual permitting or consenting mechanisms or are otherwise managed at a national or international level.

The relevant Blocks are located in Scottish waters and therefore the Scottish National Marine Plan policies, adopted in March 2015, are relevant to the management of oil and gas and other offshore activities. With regards to the co-existence of activities, policies within the Scottish National Marine Plan include GEN4 Co-existence, "Pr*oposals which enable coexistence with other development sectors and activities within the Scottish marine area are encouraged in planning and decision making processes, when consistent with policies and objectives of this Plan*", and more specifically, OIL&GAS3, which states "*Supporting marine and coastal infrastructure for oil and gas developments, including for storage, should utilise the minimum space needed for activity and should take into account environmental and socio-economic constraints*".

The potential for intra-plan in-combination effects was considered for those sites subject to AA in Sections 5.2 and 5.3 (i.e. that multiple Blocks have the potential to be licensed within the same site). The following section considers the potential for in-combination effects with other relevant plans and programmes.

5.4.2 Sources of potential effect

Projects for which potential interactions with operations that could arise from the licensing of 32nd Round Blocks 205/15, 205/18 and 205/20 have been identified. Interactions were identified on the basis of the nature and location of existing or proposed activities and spatial datasets in a Geographic Information System (GIS).

[42] Note that an intermediate assessment was published by OSPAR in 2017: https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/

5.4.3 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 5.2 and include the siting of semi-submersible drilling rigs and drilling discharges.

Existing or proposed oil & gas projects

Existing oil and gas infrastructure in the west of Shetland area is limited both in density and footprint (Figure 5.3). Several existing pipelines and telecommunication cables traverse the relevant Blocks but not where they overlap with the Seas off Foula pSPA (at least a distance of 6km). Site survey would inform rig placement so as to avoid such areas. The closest field developments include Clair Ridge (Block 206/8), the Schiehallion redevelopment (Block 204/20) and the Lancaster Field (Block 205/21); these are at least 30km distant from the Blocks and sites relevant to this assessment. A number of blocks within 10km of the Seas off Foula pSPA have been licensed since the 28th Round, including Blocks 205/19, 205/23, 205/24, 205/25, 206/11, 206/16, 206/17 and 206/21 following HRA[43] (note that Blocks 205/23 and 205/24 awarded out of round in 2016). Two wells have been drilled to date that relate to these current licences, in Blocks 205/23 (2017) and 206/21 (2019). An exploration well (Craster) was previously drilled in Block 205/15 in 2017 under a licence acquired in the 27th Round which was subsequently relinquished.

Given the small and temporary seabed footprint associated with drilling activities which may follow the licensing of Block 205/20 (the only Block of relevance to physical effects, see Section 5.2.2) and those standard and additional mitigation measures set out already in Section 2.3 and 5.2.3, significant in-combination effects associated with those limited other oil and gas projects discussed are not expected.

With respect to drilling discharges, previous discharges of WBM cuttings in 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. In view of the scale of the proposed activity, extent of the region, the water depths and currents, discharges are considered unlikely to be detectable and to have negligible cumulative ecological effect (DECC 2016). Similarly, the potential for in-combination effects relating to chemical usage and discharge from exploratory drilling is controlled by the existing legislative and permitting mechanisms, which the UK Marine Strategy[44] has identified as making an ongoing contribution to managing discharges.

[43] https://www.gov.uk/guidance/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process#appropriate-assessment
[44] https://www.gov.uk/government/publications/marine-strategy-part-three-uk-programme-of-measures

Figure 5.3: Other projects relevant to this AA

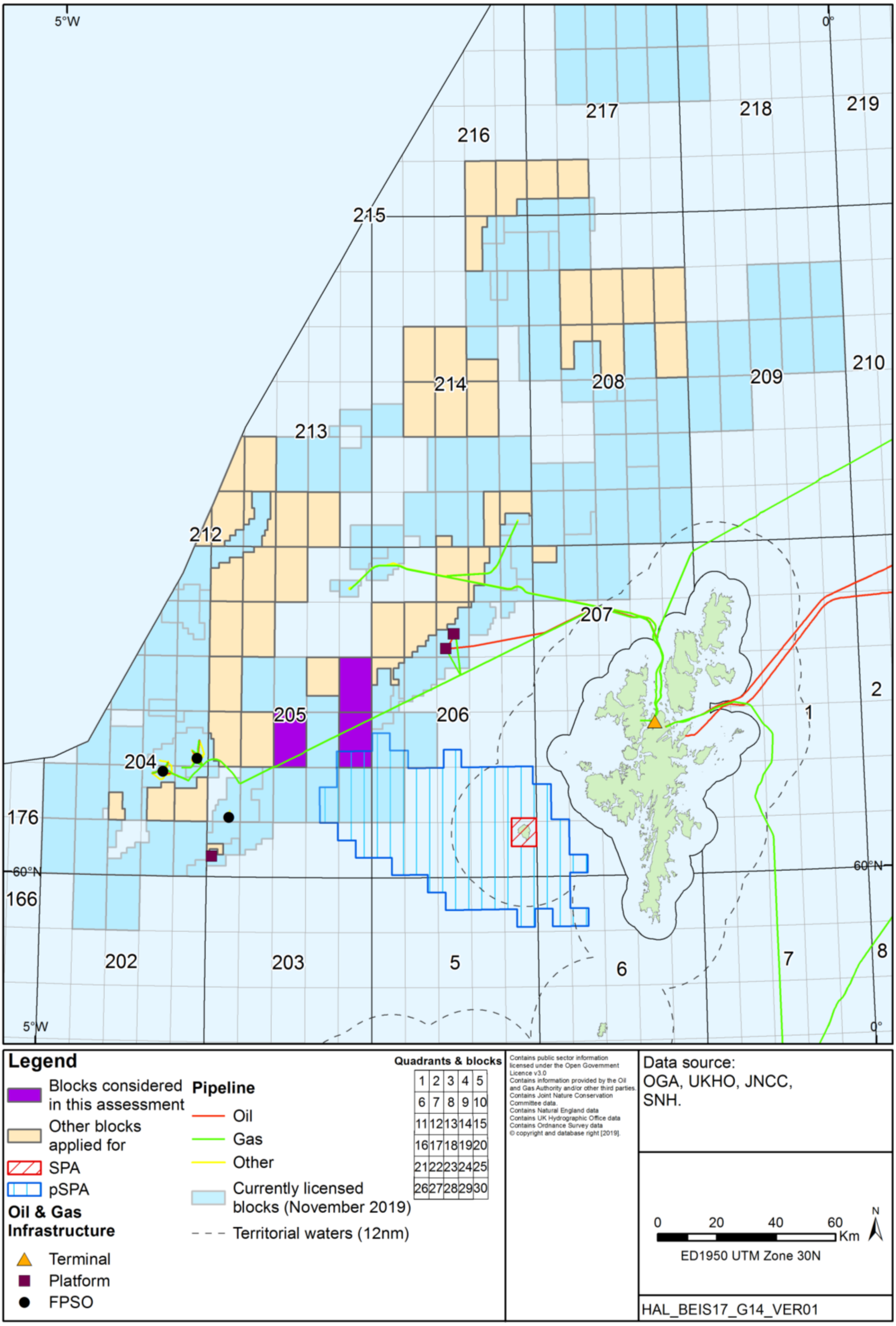
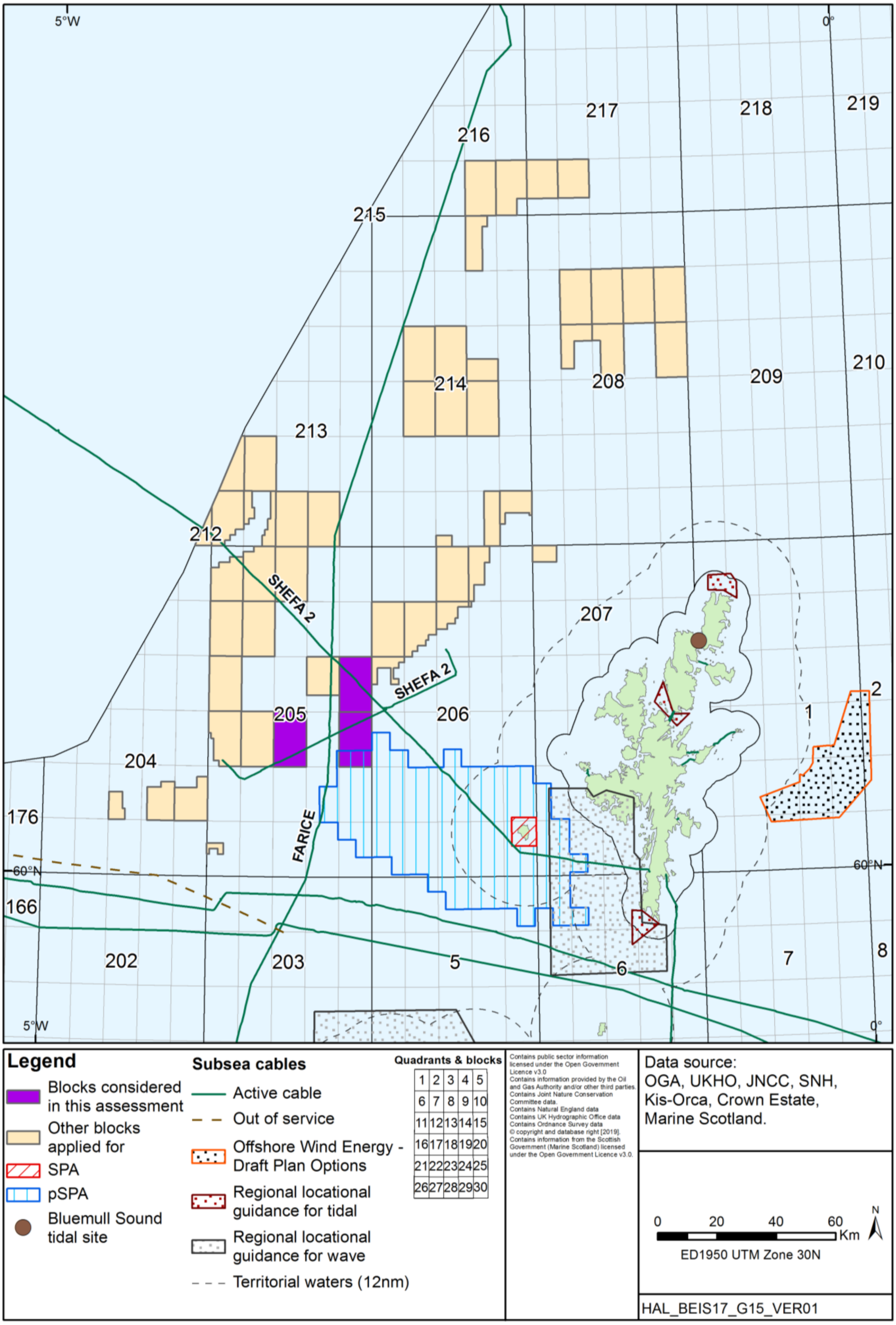


Figure 5.4: Other projects relevant to this AA (continued)



Offshore renewables

Lease areas for offshore renewables are some distance from the Blocks (>100km), and those areas identified by the Scottish Government as being more suitable for wind, wave and tidal development are similarly distant (Figure 5.4), including draft plan options identified for Scotland's sectoral offshore wind plan (currently subject to consultation)[45]. There are no foreseeable in-combination effects with these activities and the licensing of 32nd Round Blocks.

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[46]. The updated UK assessment, which was subject to consultation between May and June 2019, indicates that while there have been some improvements in commercial fish stocks, there remain issues such that Good Environmental Status (GES) will not be achieved by 2020[47]. This is in keeping with an earlier request by the UK for an exemption to achieving GES by 2020 due to the time it would take stocks to respond to measures to be implemented by the UK. Specific to the consideration of conservation sites, the initial assessment of 2012 noted that depending on the nature of future measures (e.g. in relation to MPA management in the wider environment and within MPAs[48]), the effects of fisheries are likely to be reduced and therefore some improvement in benthic habitats could be expected[49]. 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[50] has sought to implement steps to ensure that they are managed in accordance with Article 6.

In Scotland, fisheries management is coordinated by Marine Scotland (note that for the present any measure which may influence vessels of EU Member States can only be adopted after consultation with the Commission, EU 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[51].

[45] https://www.gov.scot/publications/draft-sectoral-marine-plan-offshore-wind-energy/
[46] https://www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status
[47] https://consult.defra.gov.uk/marine/updated-uk-marine-strategy-part-one/
[48] For example, see the MMO strategic management table for MPAs: https://www.gov.uk/government/publications/marine-protected-areas-strategic-management-table and measures proposed by the Scottish Government: https://www.gov.scot/Topics/marine/marine-environment/mpanetwork/SACmanagement
[49] https://www.gov.uk/government/publications/marine-strategy-part-three-uk-programme-of-measures
[50] 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
[51] See: http://ec.europa.eu/environment/nature/natura2000/marine/docs/fish_measures.pdf Also refer to Regulation (EU) No. 1380/2013 on the Common Fisheries Policy. Note the approach to the management of fisheries in UK waters may change within the timescale of the 32nd Round depending on the nature of the UK's exit from the EU.

There is fishing activity within the Seas off Foula pSPA, with both mobile and static gear types. This includes trawling, traps, nets and line fishing, to which the features may be sensitive[52]. Of these, longline fishing is considered most likely to affect the qualifying features[53]. In the period from 2009 to 2013, fishing effort with longline gears was concentrated in the western part of the pSPA, reflecting the distribution of the target species (hake) which generally occurs in relatively deep water. Evidence suggests northern fulmar is susceptible to bycatch in longline fisheries (ICES 2013). Sandeels which are listed as a prey resource in the Conservation Objectives are also sensitive to trawl fishing (although little sandeel fishing currently occurs), and to other activities which may cause seabed changes through abrasion or sedimentation.

A safety zone with a radius of 500m extends around an oil and gas surface structure (fixed and floating installations). These are created under the *Petroleum Act 1987* and excludes other activities from taking place within the zone, including fisheries. This covers mobile drilling rigs and is notified to other users of the sea (e.g. through notices to mariners and Kingfisher charts).

In view of the nature and scale of the exploration activities which could follow the licensing of Block 205/20 (the only Block of relevance to physical effects, see Section 5.2.2) and the mitigation which is available to avoid effects (see Sections 2.3.1 and 5.2.3), significant in-combination effects with respect to physical disturbance are not considered likely.

5.4.4 Physical presence

Physical presence of offshore infrastructure and support activities may potentially cause behavioural responses in birds and fish (see Section 5.6 of BEIS 2019a). Previous SEAs have considered the majority of 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 across the entire UKCS) and as the majority are a substantial distance offshore. In the west of Shetland area, the potential for large numbers of individual surface or submerged structures associated with renewable energy developments is currently limited, as indicated by the Scottish Government regional locational guidance for offshore renewables (Figure 5.4). With respect to the Seas off Foula pSPA, the closest renewable energy project is the proposed 10MW tidal array at Lashy Sound on Orkney which is 75km to the south and currently at a pre-application stage[54]. The presence of rotating turbine blades and their location in relation to coastal breeding or wintering locations for waterbirds, are important considerations. Video monitoring of the three turbines in Bluemull Sound (over 4,000 hours of footage) has not observed marine wildlife colliding with the blades[55]. Given the limited nature of renewable energy development and the location of the Blocks, it is not regarded that the temporary addition of drilling rigs and associated shipping will lead to adverse effects on the integrity of relevant sites considered in this AA.

52 http://jncc.defra.gov.uk/pdf/SAS_Conservation_Objectives_and_Reg_18_Foula.pdf
53 http://jncc.defra.gov.uk/pdf/SAS_Management_Options_paper_Foula.pdf
54 http://www.gov.scot/Topics/marine/Licensing/marine/scoping/LashySound
55 http://www.gov.scot/Resource/0053/00530133.pdf

Shipping densities over the relevant Blocks are very low. Additional vessels associated with drilling and site 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.

5.4.5 Underwater noise

Evidence suggests the primary concern for underwater noise impacts on diving birds is that of acute trauma due to close proximity to very high amplitude impulsive noise sources (see Section 4.3). Therefore, the potential for in-combination effects with activities which may follow the licensing of 32nd Round Blocks are limited to those known to generate high-amplitude impulsive noise (see DECC 2016).

There are no relevant offshore wind energy projects (either planned or under construction) in the west of Shetland area which could introduce high amplitude underwater noise through pile driving of foundations. The closest consented project (*ca.* 180km to the south) is the small Dounreay Trì Floating Wind Demonstration Project, *ca*. 6km off Dounreay, Caithness consented in March 2017[56], where embedment anchors rather than piles are proposed to be used to anchor the floating foundation. It is presently not clear whether this project will proceed to development.

There are military practice areas (airforce danger areas) to the south of the Seas off Foula pSPA, around the Orkney Islands. Qualifying features of the site may occasionally be present in these military practise areas and therefore have the potential to be exposed to associated noise; however, given the distance from the site, their numbers are likely to represent a small proportion of those using the site. Furthermore, it is suggested that the level of military activity in the area is limited[57].

There is the potential for seismic surveys to take place in adjacent Blocks which are yet to be fully explored or which have been developed (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.

In addition to those activities which may follow licensing of the west of Shetland Blocks, there are a variety of other existing (e.g. oil and gas production, fishing, shipping, military exercise areas) noise-producing activities in overlapping or adjacent areas. Despite this, the Department is not aware of any projects or activities which are likely to cause cumulative and in-combination effects that, when taken in-combination with the number and scale of activities likely to result from Block licensing (Section 2.2), 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, the Department 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

[56] http://www.gov.scot/Topics/marine/Licensing/marine/scoping/DTFWDP/decision-letter
[57] http://jncc.defra.gov.uk/pdf/SAS_Management_Options_paper_Foula.pdf

strengthened by recent Regulations[58] amending the offshore EIA regime which came into force in May 2017. These 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".

5.4.6 Conclusions

Available evidence (see e.g. UKBenthos database and OSPAR 2010) for the west of Shetland area indicates that past oil and gas activity and discharges has not led to adverse impacts on the integrity of European sites in the area. Any activities relating to the work programmes, and any subsequent development that may occur if site appraisal is successful, will be judged on its own merits and in the context of wider development in the 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.

The Department will consider the potential for in-combination effects whilst considering project specific EIAs and, where appropriate, through HRAs. This process will ensure that, if consented, projects will not result in adverse effects on integrity of European Sites. Therefore, it is concluded that the in-combination effects from activities arising from the licensing of Blocks 205/15, 205/18 and 205/20 with those from existing and planned activities in the west of Shetland area will not adversely affect the integrity of relevant European Sites.

[58] *The Offshore Petroleum Production and Pipe-lines (Environmental Impact Assessment and other Miscellaneous Provisions) (Amendment) Regulations 2017*

6 Overall conclusion

Taking account of the evidence and assessment presented above, it has been determined that the licensing through the 32nd Licensing Round of the three 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 the Department have no objection to the OGA awarding seaward licences (subject to meeting application requirements) covering Blocks 205/15, 205/18 and 205/20. 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 5), 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 2.3, 5.2 and 5.3).

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 the Department 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 site integrity has been reached at plan level, the potential for likely significant effects on any relevant site would need to be revisited at the project level, once project plans are known. New relevant site designations, new information on the nature and sensitivities of interest features within sites, and new information about effects including in-combination effects may be available to inform future project level HRA.

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