Department of Energy & Climate Change

Strategic Environmental Assessment for Further Onshore Oil and Gas Licensing

Post Adoption Statement

June, 2014
Department of Energy and Climate Change

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Any enquiries regarding this document/publication should be sent to us at:

Department of Energy and Climate Change
Area 3B
3 Whitehall Place
London
SW1A 2AW
Telephone: 0300 060 4000

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Preface

This document is the Post Adoption Statement for the Strategic Environmental Assessment of the Department of Energy and Climate Change (DECC) proposals for further onshore oil and gas licensing. The Post Adoption Statement is a requirement[1] of the Strategic Environmental Assessment process to which the proposals has been subject. Strategic Environmental Assessment is an assessment process that supports decision making by identifying, characterising and evaluating the likely significant effects of a plan or programme on the environment and determining how any adverse effects may be mitigated or where any beneficial effects may be enhanced.

[1] Article 9 of the European Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment and Part 4 (regulation 16) of The Environmental Assessment of Plans and Programmes Regulations 2004 (SI2004/1633).

Chapter 1

Introduction

1.1 Onshore Oil and Gas Licensing

The Petroleum Act 1998 vests all rights and ownership to the nation's hydrocarbon resources in the Crown. Under section 3 of the Act, the Secretary of State for Energy and Climate Change can grant licences that confer exclusive rights to "*search and bore for and get*" petroleum. Each licence confers such rights over a limited area and for a defined period.

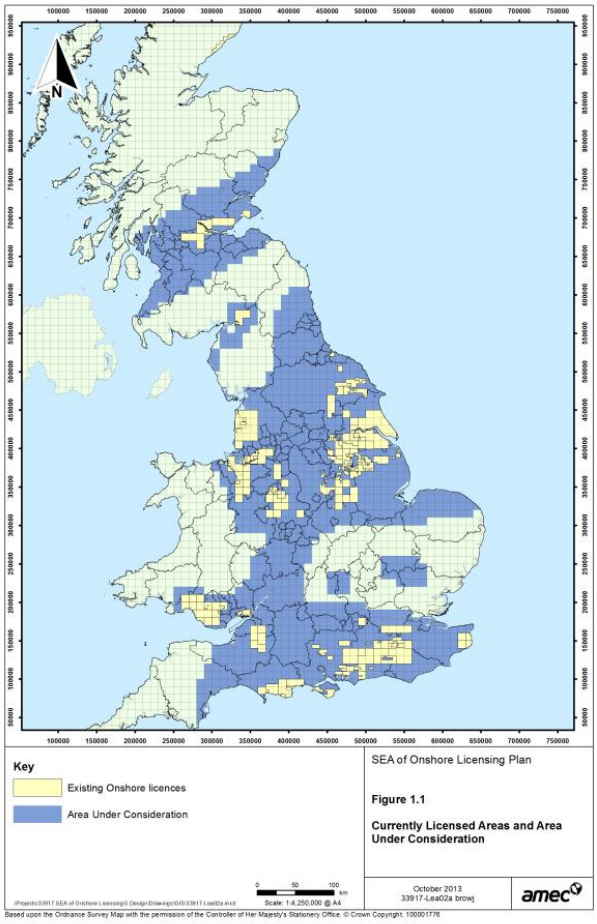
DECC is responsible for administering the oil and gas licensing system in Great Britain and it is the Secretary of State for Energy and Climate Change that periodically offers licences to search for, and extract, the hydrocarbon resources. Current onshore oil and gas production licences are called Petroleum Exploration and Development Licences (PEDLs). The last round of onshore licensing, the 13th, was conducted in 2008, and the Department began preparations in 2010 for a 14th Round. Having taken account of the findings of the Environmental Report published on 17th December 2013 and the comments received from the prescribed statutory bodies and from the public, the Department has now adopted the Licensing Plan, subject to the mitigation measures proposed in the Report. It will accordingly make an announcement shortly inviting applications for oil and gas licences in the areas of England, Scotland and Wales identified in Figure 1.1, so far as not already licensed.

With the exception of two estuarine areas, that of the Dee/Afon Dyfrdwy and the Forth, only landward areas above the low water line are included in the Licensing Plan. The areas included comprise those areas in the mainland Great Britain where the underlying geology is considered to offer some potential to host resources of oil and gas.

The purpose of any exploration and appraisal activity within a licensed area would be to identify commercially viable resources of oil and gas. The types of activities that might follow on the issue of licences would comprise:

- conventional oil and gas exploration and production;
- shale oil and gas exploration and production;
- virgin coalbed methane (VCBM) exploration and production; and
- natural gas storage in hydrocarbon reservoirs.

Figure 1.1 Areas Available for Consideration and Currently Licensed Areas



The award of a PEDL gives exclusivity in respect of oil or gas exploration or production in the licensed area, that is to say, no person other than the holder of the licence may carry out these activities within the area of the licence. The award of a licence does not waive any other statutory or legal requirement necessary for these activities. In particular, the licensee has to obtain access rights from landowners (e.g. a wayleave) and his activities are subject to statutory planning [2], environmental [3] and other permitting regimes.

In addition, the licences provide that licensees may not conduct activities such as the drilling of wells, installation of facilities or production of hydrocarbons without the authorisation of the Secretary of State for Energy and Climate Change. Licensees are required to demonstrate to DECC that the relevant planning and other permissions and consent(s) have been obtained, before such consents are granted.

[2] See, for example, Communities and Local Government (2013) *Planning practice guidance for onshore oil and gas*, available from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/224238/Planning_practice_guidance_for_onshore_oil_and_gas.pdf. This document provides a relevant policy framework for the development of oil, gas, coalbed methane and underground gas storage facilities in England.

[3] See for example, Environment Agency (2013), *Onshore oil and gas exploratory operations: technical guidance Consultation Draft*, August 2013 from https://consult.environment-agency.gov.uk/portal/ho/climate/oil/gas?pointId=2582509#document-2582509

1.2 Applying Strategic Environmental Assessment to Onshore Oil and Gas Licensing

DECC has taken a proactive stance on the use of Strategic Environmental Assessment (SEA) as a process to integrate environmental considerations appropriately into decision making on plans and programmes in the energy sector. Although the SEA Directive (Directive 2001/42/EC) was not incorporated into UK law until 2004 (The Environmental Assessment of Plans and Programmes Regulations 2004, and equivalent Regulations of the devolved administrations), SEAs have been carried out by DECC of licensing rounds since 1999 in accordance with its requirements. In the context of onshore licensing, SEA is not strictly required, since the licences do not set the framework for the development decision. But for consistency with the pattern of offshore licensing, DECC performs SEAs for onshore licensing also.

In 2010, DECC published and consulted on a SEA Environmental Report in preparation for a 14th onshore licensing round, but the SEA process was suspended following the seismic tremors encountered during hydraulic fracturing operations at Preese Hall in Lancashire. In his statement to Parliament on 13th December 2012 announcing the introduction of new controls to mitigate against seismic risks, the Secretary of State for Energy and Climate Change confirmed that the SEA process would be restarted in the light of new information arising since the 2010 consultation.

Following a competitive tendering process, AMEC Environment and Infrastructure UK Ltd were commissioned to carry out the further assessment and to prepare the updated Environmental Report.

A revised Environmental Report was accordingly prepared, taking account of the outcome of consultation on the previous 2010 Environmental Report, new information arising since the earlier 2010 Report (such as information on seismic risks), and the views of the relevant statutory bodies on the revised scope of assessment (which had reflected the additional information). It was published on 17th December 2013 for public consultation. The consultation closed on 28th March 2014 after lasting fourteen weeks. Responses were received from a wide variety of individuals, organisations and bodies and totalled 2,419.

In accordance with Article 8 of the Strategic Environmental Assessment Directive, DECC has taken into account the findings of the two Environmental Reports (on the draft Licensing Plan and the reasonable alternatives assessed as part of that process) and the consultation responses to those reports, in coming to its decisions on the final form of the Licensing Plan and its adoption.

1.3 Purpose of the Post Adoption Statement

Article 9 of the Strategic Environmental Assessment Directive requires that when a plan or programme is adopted (in this case, the Licensing Plan), the consultation bodies, the public and any other Member States consulted on the Environmental Report are informed and the following specific information is made available:

- the plan as adopted;
- a statement summarising:

  (i) how environmental considerations have been integrated into the draft Licensing Plan;

  (ii) how the Environmental Report has been taken into account;

  (iii) how opinions expressed in response to the consultation on the Environmental Report have been taken into account;

  (iv) the reasons for choosing the Licensing Plan, as adopted, in the light of the other reasonable alternatives dealt with; and

  (v) the measures that are to be taken to monitor the significant environmental effects of the implementation of the Licensing Plan.

The purpose of this Post Adoption Statement is to provide the specific information outlined under each of the points listed (i) to (v) above and which is presented in the following sections of this statement.

1.3 The Plan as adopted

The Plan as adopted is to

1. invite applications for licences in any part of the defined areas of England, Scotland and Wales not already subject to license;

2. require applicants to submit as part of their applications a Statement of Environmental Awareness as detailed in Chapter 3 (Table 3.2), and to consider only those applications for which a satisfactory Statement is submitted;

3. award licences according to DECC's normal criteria for licensing, without any pre-determined limit on the aggregate restriction of the total area of such licences.

Chapter 2

How environmental considerations have been integrated into the plan

2.1 Environmental Considerations in the Licensing Plan

The UK Government's 2011 Carbon Plan[4] sets out how the UK will make the transition to a low carbon economy. By moving to a more efficient, low carbon economy with a more diverse range of energy sources, the Government aims to increase energy security and reduce exposure to fluctuating and uncertain fossil fuel prices, as well as to cut greenhouse gas emissions and minimise costs to consumers. The electricity market reforms contained in the Energy Act 2013[5] will encourage investment in a range of low carbon technologies so that they generate an increasing proportion of UK electricity.

The Licensing Plan is set within the context of these energy supply and greenhouse gas reduction efforts; however, even as decarbonisation proceeds, oil and gas will continue to provide an important contribution to UK energy supplies for years to come. Energy projections for the period 2020 to 2030 show continued reliance on oil and gas for over two thirds of the UK's total energy needs [6] even with the target to source 15% of UK energy from renewables in 2020. The UK Government's 2012 Gas Generation Strategy[7] (2012) sets out the important role gas has to play to maintain adequate capacity margins, meet demand and provide supply-side flexibility whilst keeping emissions within the limits set out in the Carbon Budgets[8].

The objectives of the Licensing Plan are to make a further contribution towards the comprehensive exploration and appraisal of UK oil and gas resources and the economic development of identified reserves, together with developing further gas storage capacity in hydrocarbon reservoirs, without compromising biodiversity, ecosystem functioning and the interests of nature and heritage conservation, and other material assets and users. Ensuring that the draft Licensing Plan has been subject to SEA has aided DECC to reflect these objectives within the Plan's development and to ensure, in accordance with the Directive, that any significant effects on the environment

[4] HM Government (2011) *The Carbon Plan: Delivering our low carbon future*. December 2011.
[5] See http://services.parliament.uk/bills/2012-13/energy/documents.html
[6] DECC (2013) *Updated Energy and Emissions Projections September 2013*.
[7] DECC (2012) *Gas Generation Strategy*. Published December 2012.
[8] See https://www.gov.uk/government/policies/reducing-the-uk-s-greenhouse-gas-emissions-by-80-by-2050/supporting-pages/carbon-budgets

of implementing the Plan have been taken into account during its preparation and before its adoption.

Environmental considerations extend to the licensing process itself, through the requirement for a Statement of Environmental Awareness as part of the applications. Applicants who fail to submit a satisfactory Statement will not be considered for the award of a licence.

Following completion of the licence application assessment process including Habitats Assessments, the Secretary of State for Energy and Climate Change will issue the licences. Activities which might have impacts on the environment however, such as drilling or production, cannot take place without planning permission and environmental regulation which will address the specific circumstances, including the particular activities and locality proposed.

2.2 Environmental Considerations in the Strategic Environmental Assessment

To provide the context for the assessment, and in compliance with the Strategic Environmental Assessment Directive, the relevant aspects of the current state of the environment and its evolution without the Licensing Plan were considered, along with the environmental characteristics likely to be significantly affected. Key environmental considerations identified from this process are summarised in **Table 2.1**.

Table 2.1 Key Issues Relevant to Onshore Oil and Gas Licensing

Topic	Summary of Key Issues
Biodiversity and Nature Conservation	• The status of UK priority habitats and species in 2008 indicates that the decline of biodiversity is a major issue. For example, only 31% of the 45 priority habitats and 44% of the 391 priority species were judged to be stable, stable and probably increasing, or increasing, and of those that are stable, some may have populations well below what is recommended; • Over the period 1999-2005, the national conservation agencies carried out a programme of monitoring the designated features of SSSI, SACs, SPAs and Ramsar sites. 57% of SSSI sites were reported in favourable condition, with 37% of SACs, 86% of Ramsar site and 73% of SPAs reported as favourable; Key pressures and risks in respect of biodiversity and nature conservation that are particularly relevant to onshore oil and gas licensing include, inter-alia: ○ habitat destruction and fragmentation by development; ○ direct (e.g. - disturbance, displacement, direct mortality) and indirect (e.g. – through reduced numbers of prey species) impacts on features of protected sites ○ water abstraction, drainage and hydrological functionality; ○ inappropriate coastal management; ○ lack of appropriate habitat management; ○ atmospheric pollution (acid precipitation, nitrogen deposition); ○ water pollution; ○ climate change and sea level rise.

Topic	Summary of Key Issues
Population	• The growing population within the UK will increase population densities and, in-turn, the likelihood of communities being within close proximity to onshore oil and gas development. This could increase the likelihood of operations having, or being perceived to have, a negative impact on communities; • There is a need to maximise the local employment benefits of oil and gas development.
Health	• Health inequalities exist in many communities, often exacerbated by poor access to or use of health services.
Land Use, Geology and Soils	• Mining activities in all of the SEA Areas have left a legacy of hazards such as landslips, subsidence, contamination of ground and surface water sources from metals such as tin, copper and arsenic, and radon gas and flooding; • A key challenge is to ensure the correct identification and selection of geological sites, based on a risk assessment of specific geological features and of potential uncertainties associated with the long-term presence of hydraulic fracturing fluid in the underground; • There is currently increasing pressure on rural and agricultural land from developers as urban areas expand. Future population growth leading to an increase in the need for housing and related urban development infrastructure will put more pressure on protected land including important geological sites; • Soils in England continue to be degraded by human actions including intensive agriculture, historic levels of industrial pollution and urban development, making them vulnerable to erosion (by wind and water), compaction and loss of organic matter; • Of UK land, 5.6% is currently classed as 'built up.' Development pressure remains a constant factor in parts of the country, and it is not expected that previously-developed land will be able to fully deliver the UK's future needs. This will continue to place development pressures in rural areas and the urban fringe.
Water & Flood Risk	• There is considerable pressure on water resources in many parts of the UK; • There is a legacy of groundwater pollution in the UK from historical mining and other industrial activities; • A large percentage of surface waters currently do not meet biological standards due to a wide range of pressures such as over-abstraction, eutrophication and morphological alterations; • Significant proportions of the UK population are at risk from flooding, around 10% of properties in England and Wales and 4% in Scotland, although the degree of risk varies. Flood risk presents a significant planning issue in the development of major infrastructure projects, both in terms of potential direct impacts on the project itself and indirect impacts associated with works (such as increased run-off); • Climate change is expected to have significant impacts on the water environment. Areas where the underlying geology is generally impermeable are expected to be particularly affected as river flows would be likely to fall to low levels in drier periods and quickly react to rainfall episodes.
Air	• Air quality has improved in the UK over the last sixty years as a result of the switch from coal to gas and electricity for heating of domestic and industrial premises, stricter controls on industrial emissions, higher standards for the composition of fuel and tighter regulations on emissions from motor vehicles. However, poor air quality - particularly from vehicles - remains a significant issue for community health and for biodiversity, especially in/downwind of urban areas and major transport networks.
Climate Change	• The UK's carbon dioxide (CO_2) footprint reached its peak in 2004 at 852 mt CO_2 and since then has fallen 15% to 722 mt CO_2, with a notably large dip occurring in 2009. Although UK CO_2 emissions have declined to ~8% below 1990 levels they are still the largest at 85% of all greenhouse gas emissions; • Energy security is becoming a significant emerging issue for the UK as national fossil fuel resources are depleted; • The UK's Climate Projections (UKCP09) show that the country as a whole is likely to experience hotter drier summers, warmer wetter winters and rising sea levels, particularly in the South East of England. This is likely to have a significant effect on a range of environmental conditions, including the water environment; • Sensitive ecosystems and UK water resources are likely to come under increasing pressure as a result of climate change.

Topic	Summary of Key Issues
Waste and Resource Use	• Reuse and recycling rates for industrial wastes are increasing, due to the combined effects of statutory, reputational and financial drivers.
Cultural Heritage	• In England, there has been a steady decrease in the number of assets identified as being at risk compared to a slight decline in Scotland in Wales; • Scheduled Monuments in rural areas are at risk from agricultural practices, land disturbance and unrestricted plant, scrub or tree growth; • Challenging economic conditions are reducing the funds available to conserve and manage heritage assets; • The settings of heritage assets are at risk from new development.
Landscape	• Over the last century the following landscape character trends have been experienced in the UK: o a gradual erosion of local distinctiveness in some areas, through a process of standardisation and simplification of some of the components that make up landscape character; o a loss of some natural and semi-natural features and habitats such as ancient woodlands and unimproved grassland; o a decline in some traditional agricultural landscape features such as farm ponds and hedgerows, and a loss of archaeological sites and traditional buildings; o increased urbanisation, often accompanied by poor design standards and a decline in the variety of building materials, and the importation of urban and suburban building styles into rural areas. • A loss of remoteness and reduced tranquillity because of built development and traffic growth. As part of the most recent Countryside Quality Counts (2007) survey, 29% of National Character Areas in England were identified as having a changing landscape character, many of which were altering in a direction which could be regarded as inconsistent with those key characteristics which contribute to the character and local distinctiveness of an area. A similar study of landscape change is not available for Scotland or Wales, though changes have undoubtedly taken place in areas relevant to the SEA in these countries also; • Light pollution appears to have increased considerably over the last 30-40 years over much of the UK. The growth of urban areas, road networks and industrial areas are all major contributors to increased light levels.

All the environmental topics listed in the Strategic Environmental Assessment Directive and Regulations were found to be relevant for the assessment of the Licensing Plan.

In line with the Office of the Deputy Prime Minister (now Department for Communities and Local Government) Practical Guide to the Strategic Environmental Assessment Directive[9], the assessment process predicted the significant environmental effects of the Licensing Plan and the activities that could follow licensing.

Specifically, the assessment considered the effects associated with the following six exploration and production stages, for conventional oil and gas, shale gas and oil, VCBM and gas storage in-turn:

- Non-intrusive exploration;
- Exploration drilling;

[9] ODPM (2005) *A Practical Guide to the Strategic Environmental Assessment Directive*. Published September 2005.

- Production development;
- Production/operation/maintenance;
- Decommissioning of wells; and
- Site restoration and relinquishment.

To give some sense of scale to the effects considered, low and high activity scenarios were developed. These scenarios were informed by historical trends, industry practice and published research. The effects were also considered within the context of five broad geographic areas (SEA Areas). The five SEA Areas were as follows:

- SEA Area 1: Scottish Midlands (including the Inner Forth);
- SEA Area 2: West Midlands, North West England and Southern Scotland;
- SEA Area 3: East Midlands and Eastern England;
- SEA Area 4: North and South Wales (including the Dee/Afon Dyfrdwy); and
- SEA Area 5: Southern and South West England.

The assessment identified the likely changes to the baseline conditions as a result of the draft Licensing Plan and the activities that might follow licensing, using the scenarios to quantify the magnitude of effects and the 5 SEA Areas to consider the spatial implications of such effects, taking into account the characteristics of each area. These changes have been described (where possible) in terms of their extent, the timescale over which they could occur, whether the effects would be temporary or permanent, positive or negative, short, medium and/or long-term. Secondary, synergistic and cumulative effects have also been considered. Where numerical information was not available, the assessment was based on professional judgement and with reference to relevant legislation, regulations and policy.

This analysis was set out in Appendix B of the revised Environmental Report and summarised in the main body of the report.

Chapter 3

How the Environmental Report has been taken into account

The key findings of the revised Environmental Report are summarised in **Table 3.1** together with DECC's response and how these have been taken into account in the Licensing Plan.

Table 3.1 Key Findings of the Environmental Report and DECC's Response

No.	Key Environmental Report findings	Response
1.	The assessment of the draft Licensing Plan identified that no significant positive or negative environmental effects are expected under conventional oil and gas exploration and production or gas storage lifecycles given the assumed level of activity that is to occur.	Noted.
2.	Likely significant positive effects were identified for unconventional oil and gas exploration and production on the population assessment objective (from additional employment and community benefits) and the resource assessment objective (from identification of the additional hydrocarbon reserves) when compared to the effects from the existing oil and gas sector or at the local community level.	Noted. However, consultation responses questioned whether the inclusion in the assessments of employment benefits and community benefits is consistent with EU jurisprudence. DECC notes that the jurisprudence cited in support of this view arises in relation to a different Directive, and is of the view that the socio-economic factors taken into account in the assessments are appropriate within the objectives of the relevant Directive (2001/42/EC). Nevertheless, in the interests of removing any doubt as to the basis of decisions on the Licensing Plan, and of avoiding any further delay in the opening up of further licensing opportunities, DECC has disregarded these categories of benefits in making these decisions . It has also disregarded the benefit to the resource assessment objective, to which similar considerations apply.
3.	For unconventional oil and gas exploration and production, significant negative effects were identified in relation to the climate change and waste SEA objectives when compared to the effects from the existing oil and gas sector or at the local community level.	Noted. In respect of the effects as compared to the existing oil and gas sector, however, DECC notes that the effects at national level are nonetheless not significant. In respect of the effects at local community level, DECC expects that the operation of existing planning and environmental permitting controls will ensure that the effects in practice experienced in any locality will not be unacceptable, and that proposals for activities which are considered likely to have unacceptable effects at the locality proposed will not be permitted (see finding 5 below).
4.	Minor negative effects were identified on population, health, land use, geology and soils, water, air, resource use and landscape. These effects have the potential to be significant depending on many factors that are uncertain at this stage, including: • the scale of exploration and production activity; • the location, distribution and phasing of sites and any associated infrastructure;	Noted. DECC expects that the operation of existing planning and environmental permitting controls will ensure that the effects in practice experienced in any locality will not be unacceptable, and that proposals for activities which are considered likely to have unacceptable effects at the locality proposed, will not be permitted (see finding 5 below).

No.	Key Environmental Report findings	Response
	and • the nature, quality and proximity of sensitive receptors (communities, habitats, landscapes).	
5.	Existing regulatory requirements, provided they are followed, will ensure that effects at the project level will be identified, assessed and mitigated to an acceptable level.	Noted. DECC gives particular weight on this point to the findings of the report by the Royal Academy of Engineering and the Royal Society on the hazards of hydraulic fracturing for shale gas.
6.	The alternative that seeks to restrict the licensing area, provided that it does affect the scale of activity, could lead to a reduction in the magnitude of the environmental effects identified.	Noted. DECC expects that the operation of existing planning and environmental permitting controls will ensure that the effects in practice experienced in any locality will not be unacceptable, and that proposals for activities which are considered likely to have unacceptable effects at the locality proposed, will not be permitted (see finding 5 above).
7.	The mitigation measures proposed for the likely significant environmental effects should be drawn to the attention of licence applicants, and they should be invited to indicate, in the Environmental Awareness Statements which are already required as part of their applications, to indicate how they intend to incorporate these measures into their planning and operations.	Accepted.
8.	The following two mitigation measures are recommended for action by DECC: • Research should be undertaken with a view to developing more effective extraction techniques for shale gas which would minimise whole-life cycle greenhouse gas emissions. Including techniques such as improved Reduced Emissions Completions (REC) and self-healing cements, reduced water consumption and vehicle demand. • The feasibility of measures to reduce greenhouse gas emissions through and related to the licensing process should be considered. These measures may include, for example, development of guidance and discussion with regulators on appropriate mandatory requirements.	Accepted.

The assessment identified a range of measures which could be implemented to avoid or minimise any potential negative effects, and to enhance positive effects. **Table 3.2** presents those mitigation measures identified to address the likely significant negative effects outlined in the assessment which are considered appropriate within the scope of the Licensing Plan. A wider range of potential mitigation measures were suggested in Appendix B to the Environmental Report, which may be found useful at project level**.**

Table 3.2 Mitigation Measures Proposed to Address the Likely Significant Negative Effects of the Licensing Plan

Measure	Resource Type	Stage(s)	SEA Objective	Responsibility
During the site selection process, careful consideration should be given by the operator to the avoidance of carbon sinks (e.g. peats) in order to minimise loss of carbon sequestration.	Unconventional, VCBM	Stage 2, Stage 3	Climate Change	Operator#
Where possible, measures should be taken to offset (at least in part) GHG emissions arising from construction and operational activities. These measures may include, for example, use of construction materials with low embodied carbon, limiting the volume of construction waste on site.	Unconventional, VCBM	Stage 2, Stage 3, Stage 4	Climate Change	Operator#
Operators should adopt the principle of reducing emissions to as low a level as reasonably practicable (ALARP). In particular, "reduced emissions completions" (RECs) or "green completions" should be adopted.	Unconventional, VCBM	Stage 2, Stage 3, Stage 4	Climate Change	Operator (and DECC for use of RECs)
Research should be undertaken with a view to developing more effective extraction techniques for shale gas which would minimise whole-life cycle GHG emissions including techniques such as improved REC and self-healing cements, reduced water consumption and vehicle demand.	Unconventional	Stage 2, Stage 3	Climate Change	DECC
The feasibility of measures to reduce GHG emissions through and related to the licensing process should be considered. These measures may include, for example, development of guidance and discussion with regulators on appropriate mandatory requirements.	Unconventional, VCBM	Stage 2, Stage 3, Stage 4	Climate Change	DECC
It is envisaged that the use of Best Available Techniques (BAT) will be adopted as part of a Waste Management Plan to transport and treat flowback (generated during hydraulic fracturing) and produced water to minimise negative effects from the significant volumes of wastewater produced following hydraulic fracturing. If treatment is required at a regional waste water treatment centre, early discussion should take place with the relevant water company to ensure there is adequate capacity to accommodate the additional demand.	Unconventional VCMB	Stage 2, Stage 3, Stage 4	Waste	Operator
Best practice construction techniques should be used in order to minimise visual effect. Techniques may include minimising the vertical height of drilling equipment and site screening through existing features or use of planting and landscaping.	Conventional Unconventional, VCBM	Stage 2, Stage 3	Landscape	Operator#

Measure	Resource Type	Stage(s)	SEA Objective	Responsibility
Light pollution effects should be mitigated by use of screening, shielding and down lighting and where practical minimising working practices that require lighting.	Conventional, Unconventional, VCBM	Stage 2, Stage 3	Landscape	Operator#
Careful consideration should be given during the site selection process to the avoidance of adverse impacts on sensitive land uses that may be affected by construction activity and drilling. Locational criteria should be used to avoid sensitive sites such as European designated conservation sites or Groundwater Source Protection Zone 1 locations.	Unconventional, VCBM	Stage 2, Stage 3	Land Use	Operator#
Options to consider the treatment and re-use of flowback back should be considered as part of an overall Water Management Plan.	Unconventional	Stage 2, Stage 3, Stage 4	Water	Operator#
Given the relatively high consumption of water during hydraulic fracturing, the timing of water consumption should be considered in light of local conditions so as to reduce the risk of abstractions occurring during low flow periods. Discussion should take place with the relevant water company regarding the effects on existing mains supply and consideration given to the future demands in the relevant water resource zone.	Unconventional	Stage 2, Stage 3, Stage 4	Water	Operator
Measures should be taken to reduce the emissions from vehicles and machinery. For example: the use of transport plans, shut down engines when not in use, the use of low emissions vehicles and low suphur fuels for electricity generators and and fracturing equipment where possible.	Unconventional, VCBM	Stage 2, Stage 3	Air quality	Operator#
Careful consideration should be given to the effects of vehicle movements arising during well site construction and development on local communities adjacent to sites or on routes to sites. Mitigation could include, for example: the preparation of Transport Plans; the identification of alternative routes; the phasing and timing of movements; the optimisation of movements to/from the site.	Conventional, Unconventional, VCBM	Stage 2, Stage 3	Population	Operator#

#It is envisaged that the operator's approach to these issues will be scrutinised as appropriate during the planning process.

Licence applicants will be invited to indicate, in the Statements of Environmental Awareness which are already required as part of their applications, how they intend to incorporate these measures into their planning and operations.

Chapter 4

How consultation on the Environmental Reports has been taken into account

4.1 Overview

As part of the environmental assessment of the Licensing Plan, there has been consultation with the statutory consultation bodies on the scope and level of detail of the initial and revised Environmental Reports, followed by a public consultation on both Environmental Reports.

Detailed responses to the first Environmental Report on the draft Licensing Plan, published in July 2010, were provided by consultees and summarised in the revised Environmental Report, published in December 2013 (see Appendix A of the revised Environmental Report).

The consultations and how they have been taken into account is summarised below.

4.2 Scoping Consultation

Public Consultation on the Previous Environmental Report

Detailed responses to the initial Environmental Report published in July 2010 were provided by consultees. Responses were received from Natural England, Environment Agency, English Heritage, Scottish Environment Protection Agency, Scottish Natural Heritage, Historic Scotland, Countryside Council for Wales (now Natural Resources Wales) and an individual consultee.

A high level overview of the key issues raised by consultees, and how these were addressed in the revised Environmental Report, is provided in **Table 4.1**.

Table 4.1 Summary of Consultation Responses on the previous Environmental Report carried out in 2010

Issue	Summary of Consultation Responses to the Previous Environmental Report	How these Comments were Addressed in the Revised Environmental Report
Alternatives	The **Scottish Environment Protection Agency (SEPA)** suggested that consideration should be given to potential synergies in terms of use of existing infrastructure across different exploration areas. Other options were also suggested including the prioritisation of areas for development that would allow such synergies. **Scottish Natural Heritage (SNH)** felt that the comparison of alternatives was too simplistic and the conclusions of the Environmental Report not justified. SNH commented that it would have been preferable to explore the differences between realistic spatial and temporal restrictions on licensing, and/or between realistic conditions that could be applied to the licences, to determine which would have given the best result.	Section 2.6 of the revised Environmental Report sets out the alternatives considered for the draft Licensing Plan. These reflect those proposed in the initial 2010 Environmental Report, the consultation responses, along with the response made to the 2013 Scoping Report. Each alternative is considered in turn, and the reasons given for selecting those considered reasonable and which are taken forward in the assessment. Reasons are also provided regarding those not taken forward. The SEA has included consideration of the effects of in 5 broad geographic areas where the effects of the activities that follow licensing could take place. These are: • SEA Area 1: Scottish Midlands (including the Inner Forth); • SEA Area 2: West Midlands, North West England and Southern Scotland; • SEA Area 3: East Midlands and Eastern England; • SEA Area 4: North and South Wales (including the Dee/Afon Dyfrdwy); • SEA Area 5: Southern and South West England. Baseline information is provided under each of the SEA topics considered for each of the 5 SEA areas. The Environmental Report contains an assessment of the effects against each of these 5 areas which is also presented in the topic chapters.
Environmental Baseline	A number of consultees highlighted a range of additional information for inclusion within the environmental baseline. A range of additional plans and programmes were also identified by **SEPA** and the **Environment Agency (EA)**.	Appendix B of the revised Environmental Report presents the updated baseline containing additional and updated information to the initial 2010 Environmental Report.
SEA Approach	Consultees including **Natural England**, the **EA** and **Countryside Council for Wales (CCW)** suggested a range of additional indicators and amendments to the wording of the SEA objectives used during the assessment.	Section 4.3.1 of the revised Environmental Report presents the assessment objectives and guide questions. These were revised following the completion of the initial 2010 Environmental Report and revisions to the contextual information. The revised assessment objectives and guide questions were then subject to further consultation as part of the consultation on the 2013 Scoping Report. These were then further amended with the outcomes discussed with consultees on the 25th September 2013.
Assessment of Effects	Consultees highlighted both topics (e.g. climate change) and different technologies/activities that, in their opinion, needed further consideration in terms of potential environmental effects. Consultees requested clarification of assessment findings in some instances.	Chapter 5 of the revised Environmental Report outlines the findings of the assessment of the effects of the activities that follow licensing. These are presented for conventional oil and gas, unconventional oil and gas and underground gas storage. Chapter 5 also details the cumulative effects

Issue	Summary of Consultation Responses to the Previous Environmental Report	How these Comments were Addressed in the Revised Environmental Report
	CCW noted that the impacts of different licensing activities were scored on magnitude and duration, with only those considered to have major negative or major positive impacts considered as significant. They requested that further consideration be given to this as an acceptable approach, as the cumulative impact of multiple minor negative impacts may also be significant but will not have been assessed. **CCW** also highlighted that many activities can adversely affect sites that would not be considered within or adjacent to those activities and that adverse effects can therefore be wider than was stated in the assessment.	of the plan for the scenarios considered. Appendix B of the revised Environmental Report presents the detailed findings of the assessment of effects of the licensed activities against each of the 10 topic areas considered.
Cumulative Effects	Consultees suggested that further consideration should be given to cumulative effects including in respect of potential interrelationships with other industrial activities and plans and programmes and the potential impacts of the grouping of several licences in one block.	Table 4.7, of the revised Environmental Report provides definitions of secondary, cumulative and synergistic effects that have been used in the assessment, and which then are reflected in Chapter 5 of the report. Effects of grouping some well pads together have been considered in the assessment of effects against the 5 SEA areas (see Section 5 Water of Appendix B for example).
Hydraulic Fracturing	Concerns were raised by a number of consultees in relation to the potential impacts of shale gas exploration and production and in particular effects associated with hydraulic fracturing on, for example, water resources and public health. Consultees highlighted the need for further investigations in this regard with one respondent requesting that operations involving hydraulic fracturing should be removed from the draft Licensing Plan.	The revised Environmental Report includes a consideration of the effects from activities arising from licensing for the following: • conventional oil and gas; • shale oil and gas; • virgin coalbed methane; and • natural gas storage in hydrocarbon reservoirs.
Mitigation	The need to identify mitigation measures beyond existing planning controls and regulations was identified including in respect of strategic level mitigation.	Section 5.7 of the revised Environmental Report presents a summary of mitigation and enhancement measures, related to the significant effects identified, corresponding to the stages in exploration and production, along with identification of which party should action. Further mitigation measures are outlined in the topic chapters contained in Appendix B of the revised Environmental Report.
Habitats Regulations Assessment	**EA** and **CCW** were of the opinion that the draft Licensing Plan should be subject to Habitats Regulations Assessment.	Section 1.4 of the revised Environmental Report sets out how the obligations under the Habitats Directive have been addressed to date with regards to the Licensing Plan and that these will extend to the consideration of the effects on European designated conservation sites (including Ramsar sites) of individual licence applications in consultation with the relevant statutory bodies.

Revised Environmental Report Scoping Consultation

Following resumption of the SEA process (after the Secretary of State's announcement), the approach to scoping was reviewed and revised to reflect more recent information made available following the completion of the 2010 Environmental Report. A Scoping Report containing the revised approach

was sent directly to those UK statutory and other bodies identified in **Box 4.1** for consultation over a 6 week period in July and August 2013.

Box 4.1 SEA Scoping Consultees

- Environment Agency;
- English Heritage;
- Natural England;
- Scottish Natural Heritage;
- Historic Scotland;
- Scottish Environment Protection Agency;
- Scottish Government;
- Natural Resources Wales;
- Cadw (Welsh Government historic environment service);
- Welsh Government;
- Department of the Environment's 'Environment and Heritage Service', Northern Ireland;
- Royal Society for the Protection of Birds;
- Friends of the Earth;
- World Wide Fund for Nature; and
- Greenpeace.

A meeting was also held on the 25th July 2013, to which all consultees were invited to discuss the approach to scoping and to help inform consultees' subsequent submissions.

Detailed responses to the scoping consultation were received from 11 of the consultees. A summary of key points raised by the consultees are shown in **Table 4.2** below along with how these comments were addressed within the revised Environmental Report.

Table 4.2 Overview of the Issues Raised in the Scoping Consultation

Issue	Summary of Scoping Report Consultation Responses	How has this been Addressed in the Revised Environment Report
Environmental Baseline	Suggestions were made for amendments and additional information for biodiversity and land use topic chapters	Where relevant, the amendents or additional baseline information were included within the topics chapters (Appendix B of the revised Environmental Report).
SEA Approach	Several respondants (including **Natural England, Environment Agency, Natural Resources Wales, World Wildlife Fund**) suggested that the Flood Risk objectives would be better represented either within the water topic or in its own topic chapter than within the climate change topic. Additions were suggested to the flood risk guide questions by **Environment Agency** to include	Section 7 (The Climate Change and Flood Risk) topic of Appendix B of the revised Environmental Report was split with the flood risk information transferred to the water topic (Section 5 of Appendix B). Changes were made to the flood risk guide questions to account for suggestions made.

Issue	Summary of Scoping Report Consultation Responses	How has this been Addressed in the Revised Environment Report
	additional factors. Several respondants suggested a suggested a review of water guide questions (including **Environment Agency, Greenpeace, Natural Resources Wales**) to ensure that issues are clearly defined. Concerns were raised by **Natural England** on the initial wording at the start of all guide questions was not clear. **Royal Society for the Protection of Birds** requested that the description for postive and negative should have the word minor inserted before them Minor amendments to the wording of the cultural heritage guide questions were suggested by **English Heritage** and an additional guide question was suggested related to historic landscape character. **Natural Resources Wales** suggested that biodiversity guide questions should make reference to habitat connectivity and suggested an additional guide question related to ancient woodlands.	Changes were made to the guide questions to address these suggestions. The start of guide questions was changed from *Will the Licensing Plan proposals….* to *Will the activities that follow the licensing round* …Text was amended in line with the suggestion from the Royal Society for the Protection of Birds. Amendments to the wording of cultural heritage guide questions were made and an additional guide question was added. References to habitat connectivity were added to the biodiversity guide questions and an additional guide question was added.
Flowback	Several respondants were concerned that assumptions on water use and flowback were underestimated and that a range of estimates would be more appropriate to **Friends of the Earth** felt that the assumption that each well uses 10 ML of water per well was an underestimate.	Assumption was changed to 10-25 ML for water used per hydraulic fracture and to 30% to 75% for flowback to reflect the uncertainty and range shown in the literature.
Alternatives	**Friends of the Earth** expressed concern that the range of alternatives included in the scoping report were too limited and suggested additional alternatives to consider.	Section 2.6 of the revised Environmental Report sets out the alternatives considered for the draft Licensing Plan. These reflect those proposed in the initial 2010 Environmental Report, the consultation responses, along with the response made to the 2013 Scoping Report. Each alternative is considered in turn, and the reasons given for selecting those considered reasonable and which are taken forward in the assessment. Reasons are also provided regarding those not taken forward.
Habitat Regulations Assessment (HRA)	Several respondants (including **Natural England, Royal Society for the Protection of Birds, Friends of the Earth and Greenpeace**) were of the opinion that the draft licensing plan should be subject to a HRA.	Section 1.4 of the revised Environmental Report sets out how the obligations under the Habitats Directive have been addressed to date with regards to the Licensing Plan and that these will extend to the consideration of the effects on European designated conservation sites (including Ramsar sites) of individual licence applications in consultation with the relevant statutory bodies.

4.3 The Revised Environmental Report

Public consultation on the revised Environmental Report on the Licensing Plan ran from 17th December 2013 until 28th March 2014 (a consultation period of fourteen weeks).

The revised Environmental Report indicated that DECC welcomed, in particular, views on:

1. Whether the updated Environmental Report identified the significant environmental effects of the activities that could follow the licensing round? If not, what other significant effects were identified for inclusion?
2. Whether consultees agreed with the conclusions of the updated Environmental Report and the recommendations for avoiding, reducing or off-setting significant effects of the activities that could follow the licensing round?
3. Whether consultees agreed with the proposed arrangements for monitoring the significant effects of the activities that could follow the licensing round, as detailed in the updated Environmental Report?

During the consultation period, four workshops were held with key consultees to discuss the findings of the revised Environmental Report and support consultees in making responses to the consultation questions. This included all the organisations who were invited to participate in the scoping consultation. Attendees are outlined in **Table 4.3**.

Table 4.3 Attendees at Consultation Events

Date	Attendees
17th February 2014	UK Onshore Operators Group, eCorp, Celitque, Reach CSG, Egdon, Cuadrilla, Countryside Alliance
20th February 2014	Natural England, English Heritage and the Environment Agency
21st February 2014	National Trust, Royal Society for the Protection of Birds and Campaign to Protect Rural England
25th February 2014	Bath and North East Somerset Council, Defra, DCLG, Health and Safety Executive, Lancashire County Council, Somerset County Council, South Downs National Park

At the end of the consultation period, a total of 2,419 responses were received through a number of routes:

- 1,342 direct emails to the Department;
- 1,029 responses using the DECC consultation website;
- 48 hard copy letters sent to the Department.

Of these, 2,367 were from individuals including one MP, with the remaining 52 being submitted from organisations represented by the following categories:

- **Statutory SEA Consultees** (the Environment Agency, Historic Scotland, Natural England, Natural Resources Wales, Northern Ireland Environment Agency, Scottish Natural Heritage, Scottish Environmental Protection Agency, Welsh Government).

- **Other Government Bodies** (Public Health England).

- **Local Authorities (including Minerals Planning Authorities and National Park Authorities) and local bodies** (Bath and North East Somerset Council, Campaign for National Parks, Cranborne Chase Area of Outstanding Natural Beauty (AONB), Hampshire County Council, Isle of Wight Council, Lancashire County Council, Manchester City Council, National Association of AONBs, North Yorkshire Moors National Park Authority, Peak District National Park Authority, Somerset County Council, South Downs National Park Authority, Yorkshire Dales National Park Authority).

- **Industry** (Anglian Water, Chemical Industry Association, INEOS, Network Rail, Scottish Water, UK Onshore Operators Group, Water UK).

- **Non-Government Organisations and Campaign Groups** (Campaign to Protect Rural England (CPRE), CPRE-Kent, Concerned Communities of Falkirk, Frack Free Balcombe Residents Association, Frack Free Lincolnshire, Frack Free Wales, Friends of the Earth (FoE), FoE Scotland, the Geological Society, Gower Society, Greenpeace, Keep Kirdford and Wisborough Green, National Trust, the Planning Officers Society, Royal Society for the Protection of Birds, Safety in Fossil Fuel Exploitation Alliance, Scottish Environment LINK, Stretton Climate Care, Sussex Wildlife Trust, Swansea Environmental Forum, Transition Mayfield, Transition Town Louth, Woodland Trust).

The 1,342 direct email responses to the Department reflected an organised campaign by an NGO to oppose any further onshore unconventional oil and gas activity. These responses were essentially identical and did not address the questions posed in the consultation. The views from these respondents were clear that they did not want any further licensing activity to take place. Reasons for this related to concerns regarding the effects of hydraulic fracturing on the UK's wildlife and the impacts of fossil fuel use on the UK's climate change commitments.

The 1,029 responses made through the DECC consultation e-portal included two separate campaign group responses (one comprised of 346 duplicate responses and the other 49 duplicate responses). Key points raised by these two submissions concerned the adequacy of the assessment and the effects identified the robustness of the existing regulatory framework and the need for greater independence in monitoring the effects of individual projects.

An analysis of the responses indicated that a substantial majority were against the Licensing Plan being adopted because of concerns over environmental effects of oil and gas exploration activities, predominately

centred on the use of hydraulic fracturing. A majority of respondees who answered the question 'Did the Environmental Report identify the significant environmental effects of the activities that could follow the licensing round' did not agree that the Environmental Report had identified the likely significant effects. Concerns centred on the effects on landscape, biodiversity, water resources and traffic. Similarly, a substantial majority did not agree with the proposed mitigation measures or proposed monitoring measures.

A summary of the comments received from organisations on the updated Environmental Report and DECC's response is presented in **Table 4.4** below. Comments are structured by consultation question. Further details of the comments received along with more fulsome responses are set out in **Appendix A**.

Table 4.4 Summary of Consultation Responses to the Revised Environmental Report and DECC's Response

Issue/Consultation Question	Summary of consultation responses to the revised Environmental Report	Response
The overall approach taken to Strategic Environmental Assessment	A number of the SEA statutory consultees noted that comments made at the scoping stage were addressed and that they were generally content with the assessment methodology, baseline information and policy context utilised in the assessment. However, **Campaign for the Protection of Rural England** was concerned that the Report failed to provide a sufficiently robust evidence base and assessment, as required by the SEA Directive. Other campaign groups and individuals opposed to hydraulic fracturing made similar points.	Noted. The assessment has been completed consistently with the requirements of the SEA Directive and the UK regulations. The main body of the report contains 103 referenced footnotes and draws on a 638 page Appendix B which provides information on all SEA topics. It is DECC's view that, within the limitations necessarily entailed by the fact that the specific nature and location of subsequent activities is not known at the licensing stage, it is a substantial, robust and compliant assessment which is appropriate to inform decisions on the final form of the Licensing Plan.
Reasonable alternatives	**Friends of the Earth** welcomed the consideration of the alternatives to the Licensing Plan that various consultees suggested during the scoping stage. However, they stated "*that the arguments used in the Environmental Report to then suggest that these alternatives are not reasonable – and to return to the alternatives that have been considered in all previous SEAs for oil and gas are weak…. the reasons for eliminating at least some of the reasonable alternatives are spurious, and have been made so as to reach the pre-agreed preferred alternative*".	The approach to the reasonable alternatives available to DECC is clearly set out in Section 2.6 of the revised Environmental Report. This includes reference to the original three alternatives considered in the initial 2010 Environmental Report, those proposed in the 2013 Scoping Report and those proposed by consultees at Scoping. The reasons for the selection and rejection of alternatives are clearly stated with reasons given including statutory commitments, uncertainty, legal challenge and practicality. DECC did not have any predetermined view on the number or form of alternatives to be considered and assessed and it remained open to any alternatives that could be considered reasonable, . given the objectives of the Licensing Plan

Did the Environmental Report identify the significant environmental effects of the activities that could follow the licensing round?	The **Environment Agency, Natural Resources Wales, Department of Environment Northern Ireland, Historic Scotland** and the **Scottish Environmental Protection Agency** stated that they were content that the significant environmental effects have been adequately identified and assessed in the updated Environmental Report. Others consultees, such as **Bath and North East Somerset Council,** stated that it was comprehensive and covered a wide field of topics. The **Geological Society** stated that "*the report realistically identifies and assesses the potential environmental effects of onshore oil and gas licensing*". **Scottish Water** commented that the Environmental Report rightly considers water and waste water issues as major topics within the SEA and gives adequate consideration to these in the relevant sections of the report. **INEOS** stated that the SEA was a very comprehensive examination of the salient environmental issues related to exploiting unconventional oil and gas reserves in the UK.	The positive comments by consultees on the assessment of effects within the revised Environmental Report are welcomed.
Effects on biodiversity	**Royal Society for the Protection of Birds** and many of the individual respondees, were of the view that the Environmental Report did not appear to identify likely significant effects on biodiversity. The apparent reliance on later stages (planning system, regulatory regimes) in securing avoidance, mitigation and compensation was questioned.	Section 5 of the revised Environmental Report did identify the potential for activities during Stage 2 (exploration drilling with coring and hydraulic fracturing) and Stage 3 (production development) of the unconventional oil and gas exploration and production lifecycle to have significant negative effects on biodiversity, particularly under the high activity scenario. However, this would be dependent on the location and distribution of well pad sites and any associated infrastructure and the sensitivity of the receiving environment (e.g. the proximity of recognised conservation assets), which is currently unknown. As these matters and any related assessment of effects on biodiversity are site and location specific, it is not possible to address them in more detail at the licensing stage, but it is clear that they can be expected to be addressed fully during the planning process.
Effects on human health	**Public Health England** stated that "*In our opinion the Report does not address all of the potentially significant negative environmental and subsequent health impacts that shale gas extraction could have on groundwater if operations are not properly run and regulated. …. These include the potential for contamination of groundwater with injected fracturing chemicals and flowback water (e.g. leakage through the vertical borehole), surface spills and accidents above ground (e.g. waste fluids, chemical additives in concentrated form, blowout or flowback water*)".	The revised Environmental Report (including the detailed assessment of the draft Licensing Pan on health contained at Appendix B) identified the potential risk of release of fracturing fluids and other accidental discharges and which could have negative effects on health including through the contamination of water supply. DECC notes the findings of Public Health England's (2014) report "Review of the Potential Public Health Impacts of Exposures to Chemical and Radioactive Pollutants as a Result of Shale Gas Extraction", that the potential risks to public health are low if operations are properly run and regulated.

Inclusion of socio-economic effects	**Campaign to Protect Rural England, Friends of the Earth, the Royal Society for the Protection of Birds, Scottish Natural Heritage, Sussex Wildlife Trust** and campaign groups (such as the **Concerned Citizens of Falkirk**) questioned the inclusion of employment estimates and the financial contribution of the community benefits within the population topic.	In the interests of removing any doubt as to the basis of decisions on the Licensing Plan, DECC has disregarded these categories of benefits in making these decisions. See p. 13 of this Statement.
Effects on induced seismicity	**Campaign to Protect Rural England – Protect Kent, National Trust and Transition Mayfield** stated that there was an absence of the consideration of key effects, such as seismicity, within the report. Bath and North East Somerset Council considered that the report "*played down the inconvenience that induced seismicity might cause to the general public*".	Section 5.3.1 of the revised Environmental Report summarises the assessment of the effects of the draft Licensing Plan against land use, geology and soils including consideration of induced seismicity. This was assessed in more detail in Appendix B4 'Land Use, Geology and Soils'. The Reports notes that the independent review (Green *et al* 2012) concluded that the maximum magnitude of induced seismicity arising from hydraulic fracturing operations would be not greater than M_L=3 which would be equivalent to a passing truck, being felt by few people and resulting in negligible, if any, surface effects. Other studies (Davies *et al* (2013) and AEA 2012) conclude that the risks of hydraulic fracturing causing felt seismicity (M_L>3) are low or "very small" . New controls announced in December 2012 include the requirement for operators to: • conduct a prior review of information on seismic risks and the existence of faults; • submit to DECC a hydraulic fracturing plan showing how any seismic risks are to be addressed; • carry out seismic monitoring before, during and after hydraulic fracturing; and • implement a 'traffic light' system. These measures implement the recommendations of the independent experts engaged by DECC, and the relevant recommendations of the Royal Academy of Engineering/Royal Society report..
Effects on water resources	**South Downs National Park Authority, Friends of the Earth, Sussex Wildlife Trust** and individual submissions have raised concerns over the assessment of the effects on existing water resources from the increased demand from high volume hydraulic fracturing and the potential effects on contaminated groundwater resources.	The assessment has identified the potential for water abstraction associated with hydraulic fracturing in particular to affect habitats and species and that these effects could be more pronounced in water stressed areas and/or during times of water stress. However, as set out at page 95 of the revised Environmental Report and in the more detailed assessments contained in the topic chapters at Appendix B, it is expected that any such effects would be avoided through limits on supply imposed by water companies (if water is supplied from a mains) or through abstraction licensing (where licenses will only be granted by the relevant regulator where such effects are acceptable and any net addition to demand or abstraction does not exceed sustainable levels). In this respect, cooperation between the water industry and operators under the Water UK and UK Onshore Operators Group Memorandum of Understanding (MoU) is expected to help identify and address any potentially locally significant effects on water resources. It should also be noted that demand for water could be substantially

		reduced if it could be met from recycling and reuse of flowback. The industry is also not expected to be at substantial scale before the 2020s. This will allow time for any necessary new investment in water supply infrastructure.
Effects on climate change	**Campaign to Protect Rural England, Campaign to Protect Rural England -Protect Kent, Friends of the Earth, Friends of the Earth – Scotland, Greenpeace, Royal Society for the Protection of Birds and Scottish Environment LINK** highlighted concerns that the effects on greenhouse gas emissions were understated and that the significant effects on climate change (including fugitive emissions) were not sufficiently identified, assessed and reported.	The revised Environmental Report identified likely significant negative effects arising from the activities that could follow licensing for unconventional oil and gas in relation to climate change when compared to the effects from the existing oil and gas sector. These effects are associated with: pad preparation and drilling; emissions of carbon dioxide (CO_2) and methane associated with disturbance to soils; the potential loss of carbon sequestration (i.e. of carbon absorbed in soils and growing plants); and in particular the volume of emissions arising from hydraulic fracturing and well completion. During production, emissions are likely to be associated with gas production and arising from power generation, the use of machinery, transportation, fugitive emissions and from flaring and venting. Estimates of greenhouse gas emissions used in the Environmental Report are based on MacKay and Stone's (2013) report 'Potential Greenhouse Gas Emissions Associated with Shale Gas Extraction and Use'. DECC recognises that estimates vary, and the Environmental Report therefore adopts MacKay and Stone's median estimate. The Government has accepted in full the recommendations of the MacKay and Stone (2013) report concerning potential greenhouse gas emissions associated with shale gas extraction and use. It should also be noted that the UK Onshore Operators Group has developed guidelines for shale gas operations, which set out good practice for minimising fugitive emissions.
Do you agree with the conclusions of the Environmental Report and the recommendations for avoiding, reducing or off-setting significant effects of the activities that could follow the licensing round?	The **Environment Agency, Historic Scotland** and **Scottish Natural Heritage** stated that they agreed with the broad conclusions of the Environmental Report, whilst the **Scottish Environmental Protection Agency** stated that they were content that the mitigation measures aimed at operators were appropriate. **Anglian Water** and **Water UK** stated that the focus on encouraging operators to promote water recycling will reduce the overall burden of shale gas extraction on water resources. **Scottish Water** agreed with the conclusions of the Environmental Report and the proposed recommendations. The **UK Onshore Operators Group** welcomed the SEA mitigation proposals as a positive set of principles to be developed as the industry grows and highlighted that many of the identified mitigation measures are already in use.	Noted.

	Many respondents, including **The Campaign for National Parks, The Campaign for the Protection of Rural England, Concerned Communities of Falkirk, Friends of the Earth, Peak District National Park Authority,** and **Caroline Lucas MP** suggested that National Parks, Areas of Outstanding Natural Beauty, World Heritage Sites and internationally designated wildlife sites (SPAs, SACs and Ramsar sites) should be excluded from licensing. **The Royal Society for the Protection of Birds** and **The National Trust**, supported by others, suggested that shale gas development should be subject to exclusion zones including these sites and other conservation or wildlife sites. **Bath and North East Somerset Council** requested specific protection for the Bath area and its geological context because of the special importance of the hot springs to its status as a World Heritage Site.	Noted. The Government recognises there are areas of outstanding landscape and scenic beauty where the environmental and heritage qualities need to be carefully balanced against the benefits of unconventional hydrocarbon development. Accordingly, the Department of Communities and Local Government has made clear its approach to planning for unconventional hydrocarbons in National Parks, the Broads, Areas of Outstanding Natural Beauty and World Heritage Sites, by providing new planning guidance. Proposals for such development must recognise the importance of these sites. The guidance is available on the Minerals section of the Government's planning guidance website at: http://planningguidance.planningportal.gov.uk/blog/guidance/minerals/planning-for-hydrocarbon-extraction/determining-the-planning-application/#paragraph_223. To ensure that the Government's intentions are given appropriate effect, CLG will give particular attention, in recovering planning appeals over the next twelve months, to recovering appeals for such developments. DECC will add further to the requirements for the Environmental Awareness Statements which all applicants have to submit with their applications, making clear that the Department will require these Statements to be particularly comprehensive and detailed where the areas applied for are in or adjacent to any National Park, the Broads, any Area of Outstanding Natural Beauty or World Heritage Site. As regards internationally designated sites, these are in any case subject to special protections under the Habitats Directive. See response below on Habitats Regulations Assessments.
	Concerned Citizens of Falkirk, Frack Free Balcombe Residents Association and **Royal Society for the Protection of Birds** raise questions over the adequacy of the existing regulatory framework to manage any of the identified risks to the environment and human health.	The Government's view, consistent with that of the Royal Academy of Engineering and the Royal Society, and that of Public Health England, is that the UK's existing regulatory framework provides a robust and comprehensive set of measures to avoid, minimise, mitigate and control the effects arising from onshore oil and gas exploration.
	A number of consultees (**Gower Society, Royal Society for the Protection of Birds**) requested for a well funded, independent regulator able to consent or refuse all proposals for exploration and development at all stages that place greatest weight on local community concerns within its decision making. It was suggested that shale gas extraction companies pay for the world-class regulatory regime.	The Government considers that the regulatory regime is world class, and the regulators (DECC, EA and HSE) have many years of experience in addressing the regulatory issues arising from onshore oil and gas. All have powers to recover the costs of regulation of specific operations.
	Bath and North East Somerset Council requested that the mitigation measures identified be made binding.	Bearing in mind that the activities which might have actual impacts on the environment are subject to control through later permissioning and consenting regimes, DECC considers it appropriate and sufficient at the licensing stage that applicants should be required to

		submit an Environmental Awareness Statement indicating how the recommended measures will be integrated into their planning for such activities. See also next response.
	Friends of the Earth Scotland and **Scottish Environment LINK** requested that the measures be strategic rather than site specific in nature. A number of consultees considered that the proposed mitigation lacks detail and there was too much emphasis on passing on environmental considerations to the site-specific level.	The mitigation measures presented in Table 5.6 of the revised Environmental Report are those which are considered appropriate at the licensing level. It is clear that other mitigation measures, including locally specific measures, would be required at project level. The determination of appropriate mitigation measures in each case will be a matter for the relevant regulatory authorities, for example in the conditions attached to environmental permits. It would not be possible to determine these conditions at licensing level, when the location and specific character of the operations is not known.
Did you agree with the proposed arrangements for monitoring the significant effects of the activities that could follow the licensing round	Statutory consultees identified some additional minor amendments to the proposed monitoring measures. Others went further. Public Health England, for example, requested that arrangements, including comprehensive noise and air quality monitoring and associated assessments of health risks, are made throughout the life cycle of activities, to inform regulation of each phase of the operation.	The monitoring measures adopted for the Licensing Plan have been revised to reflect comments and suggestions made by consultees.
Effects from abandoned wells	**Campaign to Protect Rural England** raised concerns over how the effects from abandoned wells will be considered and monitored.	The Government has accepted the recommendations in the 2012 Royal Academy of Engineering/Royal Society report which included ensuring arrangements for monitoring abandoned wells are developed, effective and adequately resourced.
Habitat Regulations Assessment (HRA)	**Natural England** and **Natural Resources Wales** question the approach to HRA. Natural Resources Wales stated '*We still believe that the continued lack of a Habitats Regulations Appraisal (HRA) of the Plan represents a significant gap, despite the justification given in the Environment Report. We appreciate the difficulties in carrying out such an Appraisal on high level Strategic plans such as this. However, it is our view that an HRA screening should be undertaken£*. Natural England indicated concern that the requirements of the Habitats Regulation part 61 (5), namely: "*In the light of the conclusions of the assessment, and subject to regulation 62 (considerations of overriding public interest), the competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site or the European offshore marine site (as the case may be)*" Cannot be satisfied while the further assessment to be undertaken is dependent upon licence applications being received. Natural England would welcome	Section 1.4 of the revised Environmental Report sets out how the obligations under the Habitats Directive have been addressed to date with regards to the Licensing Plan. DECC concludes that the Licensing Plan itself, that is the inviting of applications for licences, and the award of licences, can have no effects on any protected site because the licences do not authorise any activities which could have these effects. However, DECC will carry out appropriate assessments before any licence is issued. Once applications for licences have been received and their geographical proximity to any protected site can be established, the appropriate statutory bodies will be consulted on the form and scope of the assessments which should be performed before any decision is made on the award of a licence. No decision on the award of any individual licence will be made until any necessary assessment of the effects of the proposed award has been completed.

	further information on how the proposed assessment of the areas for which licences might be issued, will take place and how compliance with regulation 61 will be ensured.	

In the light of the findings of the assessment as reported in the revised Environment Report, the comments received from consultees and the framework for environmental protection and planning that is in place, DECC is content that environmental considerations have been adequately incorporated into the Licensing Plan. As explained in Chapter 6, where significant effects and/or uncertainty have been identified, a programme of monitoring has been proposed to enable future consideration of whether any additional mitigation or intervention is needed.

Chapter 5

The reasons for choosing the plan as adopted, in the light of the other reasonable alternatives dealt with

5.1 The Reasonable Alternatives for the Licensing Plan

The initial Environmental Report on the Licensing Plan, published for consultation in July 2010, suggested three alternatives for the licensing round. These were:

1. Not to offer any blocks for licensing;
2. To proceed with the licensing programme as proposed; and
3. To restrict the area licensed temporally or spatially.

Responses to the consultation suggested a number of other alternatives (see Appendix A and Section 2.6 of the revised Environmental Report) including restricting the number of licences available, taking a phased approach and restricting licences based on the UK's carbon commitments. Each of the alternatives was considered in-turn for consistency with existing statutory and policy commitments, consistency with all the objectives of the Licensing Plan and technical feasibility. In compliance with Article 5(1) of the Strategic Environmental Assessment Directive, the following alternatives for the Licensing Plan were taken forward for the updated assessment within the revised Environmental Report:

- **Unlimited award of licences (the draft Licensing Plan as proposed):**

  To place no restriction on the number of licences awarded or the area subsequently covered by licensing blocks, other than necessitated by the requirements of the Petroleum Act 1988 with regard to PEDLs; or

- **Limited the area of land available to be licensed:**

  To limit the area of land available to be licensed in any one round of licensing by establishing a 'ceiling' figure for the total area of land to be licensed, for example a limit of 50% of the aggregate area of current licences. PEDLs would then be awarding in merit order up to that limit; or

- **No award of licences** under this onshore licensing round.

5.3 The Reasons for Choosing the Licensing Plan in light of the other Reasonable Alternatives dealt with

DECC has carefully considered each of the reasonable alternatives and the environmental effects assessed in relation to those reasonable alternatives, as set out in the revised Environmental Report. In doing so, DECC has taken account of the consultation responses to both the initial and the updated Environmental Reports. DECC welcomes the comments on both of those reports and has incorporated suggested improvements to the monitoring arrangements. The summary of consultation responses set out in this Statement shows that statutory consultees welcomed the rigorous approach to assessment of environmental effects.

None of the responses to the consultation on the updated Environmental Report has led DECC to conclude that the assessments of the environmental effects of the Licensing Plan, and the reasonable alternatives to the Plan, set out in the updated Environmental Report, are inadequate to inform decisions on the Licensing Plan. However, since questions have been raised about the inclusion of certain economic benefits (see Table 3.1, second item), DECC has disregarded these benefits in coming to decisions on the Plan.

On this basis, DECC has considered each of the reasonable alternatives, and the environmental effects assessed in relation to those reasonable alternatives, as follows:

1. On the option of awarding no licences – this option would avoid any risk of compromise to biodiversity, etc., but would make no contribution to the exploration and appraisal of national oil and gas resources or to economic development, etc.;

2. On the option of limiting the aggregate area of any new licences awarded – this would be likely to reduce the overall impact of the negative environmental effects of activities which may be carried out later in the new licence areas, but might reduce the contribution which might otherwise be made to appraisal of petroleum resources, etc.

3. On the option of awarding licences with no limitation of aggregate areas – this option would make the best contribution to the exploration and appraisal of national oil and gas resources and to economic development, etc. And in this light of the protections to the environment afforded by the scrutiny and controls which will be imposed on any proposed activities by the operation of the planning and environmental regulatory regimes, this is expected to be accomplished without any unacceptable compromise of biodiversity, of ecosystem functioning, or of the interests of nature or heritage conservation.

The third option therefore represents the best balance between the exploration and development aims of the Plan and the proper protection of environmental assets and interests, and is therefore the alternative which has been adopted.

Chapter 6

The measures decided concerning monitoring

Monitoring of the effects of the Licensing Plan will focus on:

- The significant effects identified in the assessment contained in the updated Environmental Report; and

- Uncertain effects where monitoring would enable preventative or mitigating measures to be undertaken.

Consistent with the proposals of the updated Environmental Report, potential effects against all the environmental topics have been included in the monitoring framework. Specific additional monitoring suggestions were made by consultees and are included in the summary of consultation in **Appendix A**. The final measures are presented in **Appendix B**.

The monitoring programme will use existing regulatory regimes and data collection processes to provide information for these potential environmental effects. For example, the Environment Agency's requirements under the Water Framework Directive, Natural England's responsibilities under the Habitats Directive, local authority requirements with regard to Air Quality Management Areas and the operators' requirements under existing permitting and consenting requirements (such as the Waste Plan, fracking plan and seismic monitoring). The metrics are proposed in part to minimise any additional burdens associated with collection and analysis of monitoring data.

Glossary and Abbreviations

Term	Definition
ALARP	As Low As Reasonably Possible. This involves weighing a risk against the trouble, time and money needed to control it. Thus, ALARP describes the level to which see workplace risks should be controlled.
AONB	An Area of Outstanding Natural Beauty (AONB) is an area of high scenic quality which has statutory protection in order to conserve and enhance the natural beauty of its landscape
AQMA	Air Quality Management Area. These are areas which have been identified by local authorities as unlikely to reach national air quality objectives.
BAT	Best Available Technique. BATs are required to be considered (under EC Directive 96/61) in order to avoid or reduce emissions resulting from certain installations and to reduce the impact on the environment as a whole
CEMP	Construction Environment Management Plan. A Plan which details management measures to adopt and implement during construction activities to avoid and manage construction effects on the environment and surrounding communities.
CO	Carbon monoxide (a colourless, odourless and toxic gas)
CO_2	Carbon dioxide. A naturally occurring gas, also a by-product of burning fossil fuels and other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance.
Conventional Oil and Gas	Refers to hydrocarbons which have been previously sought in sandstone or limestone.
Cumulative effects	Effects that occur where several individual activities which each may have an insignificant effect, combine to have a significant effect.
DCLG	Department for Communities and Local Government.
DECC	Department of Energy and Climate Change.
Drilling fluids / drilling mud	Fluid or lubricant added to the wellbore to facilitate the drilling process by suspending cuttings or controlling pressure for example.
EA	Environment Agency. A non-departmental public body of the Department for Environment, Food and Rural Affairs within England responsible for environmental regulation, flood and coastal risk management, water quality and resources, fisheries and inland river, estuary and harbour navigations.
EH	English Heritage. The executive non-departmental public body sponsored by the Department for Culture, Media and Sport, responsible for the management of the National Heritage Collection of historic sites, monuments and assets and for providing advice to government and local authorities on the protection and promotion of heritage.
Flowback water	Water and excess prop pant that flow back up to the surface after the hydraulic fracturing procedure is complete.
FTE	Full Time Equivalent. This is a unit to measure employed persons in a way that makes them comparable although they may work a different number of hours per week. It is obtained by comparing an employee's average number of hours worked to the average number of hours of a full-time worker.

Term	Definition
Gas Storage	There are three types of large-scale underground natural gas storage facilities: salt caverns; depleted/depleting gas or oil fields; and aquifers. However, this SEA only covers licensing for gas storage in depleted gas or oil fields since the other options are subject to different regulatory regimes.
GHG	Greenhouse gases. These gases absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect.
Green Completions	Green Completions are techniques used to complete wells to reduce the emissions of gases to air (also known as Reduced Emissions Completions; REC).
GWD	The Groundwater Directive. Directive 2006/118/EC on the protection of groundwater against pollution and deterioration.
H2S	Hydrogen sulphide (a colourless, toxic, highly flammable gas).
Ha	Hectare; a metric unit of area defined as 10,000m2
HGV	Heavy Goods Vehicle. Typically these vehicles are designed or adapted to have a maximum weight of 3,500 kg when in normal use.
HRA	Habitats Regulation Assessment. A HRA is required under the Habitat Regulations to be carried out on any proposed plan or project that has the potential to cause impacts on a Natura 2000 site (e.g. – SAC, SPA).
HS	Historic Scotland is an executive agency of the Scottish Government charged with safeguarding the nation's historic environment and promoting its understanding and enjoyment on behalf of Scottish Ministers.
HSE	Health & Safety Executive; the independent regulator for work-related health, safety and illness.
Hydraulic Fracturing	Hydraulic fracturing or "fracking" is a technique that uses fluid, usually water, pumped at high pressure into the rock to create narrow fractures to create paths for the gas to flow into the well bore and to surface. The water normally contains small quantities of other substances to improve the efficiency of the process, e.g. to reduce friction. Once the fractures have been created, small particles, usually of sand, are pumped into them to keep the fractures open.
Induced seismicity	Earthquake and tremor activity caused by human activity.
IED	Industrial Emissions Directive. Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control)
IPPCD	Integrated Pollution Prevention and Control Directive. Directive 2008/1/EC concerning integrated pollution prevention and control
LNG	Liquefied Natural Gas. Natural Gas compressed at moderate pressure but cooled to -258oF to remain liquid to reduce its volume (the volume of natural gas as liquid is 1/600th its volume as gas).
ML	Megalitre; a unit of volume defined as a million litres.
M_L	M_L (local magnitude) from the Richter magnitude scale (often shortened to Richter scale) developed to quantify the energy released during an earthquake. The scale is a base-10 logarithmic scale. An earthquake that measures 5.0 on the Richter scale has a shaking amplitude 10 times larger than one that measures 4.0, and corresponds to a 31.6 times larger release of energy.
MWD	Mining Waste Directive. Directive 2006/21/EC on the management of waste from extractive industries and amending Directive 2004/35/EC

Term	Definition
Mt CO_2 eq	Millions of tonnes of carbon dioxide equivalent. This is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global warming potential by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.
NE	Natural England. A non-departmental public body of the Department for Environment, Food and Rural Affairs within England and the statutory advisor to government on the natural environment.
NRW	Natural Resources Wales; sponsored by Welsh Government to be responsible for the management of the natural resources of Wales.
NTS	Non-Technical Summary.
NORM	Natural Occurring Radioactive Material. Material that contains radioactive elements of natural origin. NORM primarily contains uranium and thorium (elements that also release radium and radon gas once they begin to decay) and potassium.
NOx	NOx is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts
NVC	National Vegetation Classification is a common standard developed for nature conservation agencies which provides classification and description of the plant communities of Britain.
PEDL	Petroleum Exploration and Development Licences; the name of onshore oil and gas production licences which are generally offered within Licensing Rounds.
Produced water	Water that returns from the well along with the natural gas after fracturing has taken place. The water may be naturally occurring and may contain residual fracturing fluid.
Proppant	Solid material, typically treated sand or man-made ceramic materials, designed to keep an induced hydraulic fracture open.
Ramsar	Ramsar sites are wetlands of international importance, designated under the Ramsar Convention.
REC	Reduced Emissions Completions are techniques used to complete wells to reduce the emissions of gases to air (also known as green completions).
SEA	Strategic Environmental Assessment
SEAD	Strategic Environmental Impact Assessment Directive. Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment
SEPA	Scottish Environmental Protection Agency; Scotland's environmental regulator
SNH	Scottish Natural Heritage;
SO_2	Sulphur Dioxide (a toxic and odorous gas).
SAC	Special Areas of Conservation are strictly protected sites designated under the EC Habitats Directive
Secondary effects	Effects that do not occur as a direct result of the draft Licensing Plan's implementation but occur at distance from the direct impacts or as a result of a complex pathway.
SPA	Special Protected Areas are strictly protected sites classified in accordance with Article 4 of the EC Birds Directive.

Term	Definition
SPZ1	Groundwater Source Protection Zone 1. SPZs are areas defined by the Environment Agency as areas that highlight the risk of groundwater contamination from any activities that might cause pollution in the area. SPZ1 is the inner protection zone; it is defined as the 50 day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres.
SSSI	Site of Special Scientific Interest, is an area notified by nature conservation agencies as an area of land which is 'of special interest by reason of any of its flora, fauna, or geological or physiographical features'
Synergistic effects	Effects that interact to produce a total effect that is greater than the sum of the individual effects.
TDS	Total dissolved solids.
UKCP09	UK Climate Projections 09 provides projections on climate change based on methodology designed by the Met Office. The projections are designed to help plan how to adapt to a changing climate.
UKOOG	United Kingdom Onshore Operators' Group, the representative body for the UK onshore oil and gas industry.
Unconventional oil and gas	Refers to hydrocarbons which are located in tight sands, shale or coal which are now the focus of unconventional exploration. However, the techniques used to extract hydrocarbons are essentially the same. What has changed are advancements in technology over the last decade (e.g. – hydraulic fracturing) which have made shale gas development economically viable.
VCBM	Virgin Coal Bed Methane; a coalbed methane derived from coal seams which have otherwise been untouched (i.e. they have not been previously mined), and is generally worked from surface boreholes.
WRZ	Water Resource Zone; describes an area within which the management of supply and demand of water is largely self-contained (apart from agreed bulk transfers of water).
WFD	Water Framework Directive. Directive 2000/60/EC establishing a framework for Community action in the field of water policy

Appendix B

Monitoring Indicators

Table B1 Strategic Environmental Assessment topics, monitoring indicators and sources of information

Strategic Environmental Assessment Topics	Monitoring Indicators	Source(s) of Information
Biodiversity, Flora and Fauna	Annual (where information allows) trends in: • Condition of designated sites • Threatened habitats and species • Populations of countryside birds • Surface water biological indicators In locations adjacent to the exploration and production sites	Joint Nature Conservation Committee report under Article 17 of the Habitats Directive (completed every 6 years) on the conservation status of protected habitats Joint Nature Conservation Committee http://www.jncc.gov.uk/page-4241) http://jncc.defra.gov.uk/page-4239 http://jncc.defra.gov.uk/page-4238 http://jncc.defra.gov.uk/page-4235 http://www.sssi.naturalengland.org.uk/Special/sssi/report.cfm?category=R,RF Department for Environment, Food and Rural Affairs (Defra) http://www.defra.gov.uk/statistics/environment/inland-water/ The Environment Agency (EA) are responsible for monitoring water quality under the Water Framework Directive
Population	Annual (where information allows) trends in: • Traffic activity levels around sites (annual average daily traffic flows)	Operators, subject to conditions in planning permission [NB as certain economic factors have been disregarded when making the decision on the Licensing Plan (p. 13 of the Post Adoption Statement), the proposed measures in the revised Environmental Report (Table 6.1) relating to employment and community benefits have therefore not been included in the final monitoring indicators.]
Human Health	Annual (where information allows) trends in: • Noise levels during hydraulic fracturing, drilling, construction and decommissioning • Number of nuisance complaints received • Traffic activity levels around sites (annual average daily traffic flows)	Operator Relevant local authority's environmental health department/Annual Monitoring Report Local Authority Operators, subject to conditions in planning permission

Strategic Environmental Assessment Topics	Monitoring Indicators	Source(s) of Information
Soil and Geology	Seismic monitoring, before, during and after hydraulic fracturing	Operator
	Number of times traffic light" system has been activated requiring reassessment, or halting, of operations	Operator
Water	Annual (where information allows) trends in:	
	• Groundwater quality monitoring throughout the lifecycle of onshore oil and gas exploration and production.	Environment Agency (EA), Scottish Environment Protection Agency (SEPA), Natural Resources Wales (NRW)
	• Surface water quality monitoring throughout the lifecycle of onshore oil and gas exploration and production.	Operator, Environment Agency (EA), Scottish Environment Protection Agency (SEPA), Natural Resources Wales (NRW)
	• Volumes of water consumption during hydraulic fracturing from exploration and production sites	Operator, Environment Agency (EA), Scottish Environment Protection Agency (SEPA), Natural Resources Wales (NRW)
	• Volumes and content of wastewater water (including flowback)	Operator, Environment Agency (EA), Scottish Environment Protection Agency (SEPA), Natural Resources Wales (NRW)
	• Consented/permitted aqueous discharges from exploration and production sites	Operator, Environment Agency (EA), Scottish Environment Protection Agency (SEPA), Natural Resources Wales (NRW)
Air	Annual (where information allows) trends in:	
	• Air quality monitoring (including NOx, hydrocarbons, CO, PM, methane, SO2, radon, VOCs and ozone) from the exploration and production site	Operator (at site), Public Health England and Local Authority (ambient monitoring)
	• Traffic activity levels around wellsites (annual average daily traffic flows)	Operators, subject to conditions in planning permission
Climatic factors	Annual (where information allows) trends in:	
	• Energy consumption from the exploration and production site	Operator
	• Emissions of greenhouse gases (included any fugitive methane emissions)	Operator
Material Assets	Annual (where information allows) trends in:	
	• Volume of construction waste and proportions recycled	Operator (via Waste Plan)/EA/ EA, NRW and/or SEPA
	• Volume of hazardous waste	Operator (via Waste Plan)/EA/ EA, NRW and/or SEPA
	• Volume of controlled wastes and	

Strategic Environmental Assessment Topics	Monitoring Indicators	Source(s) of Information
	proportions recycled • Volumes of wastewater (including from flowback) • Quantity of materials ordered by sites	Operator (via Waste Plan)/EA/ EA, NRW and/or SEPA Operator (via Waste Plan)/EA/ EA, NRW and/or SEPA
Cultural heritage, including architectural and archaeological heritage	Annual (where information allows) trends in: • % of heritage assets of different types that are at risk • The impact on significance of historic assets in locations adjacent to the exploration and production sites	English Heritage 'Heritage at risk report' English Heritage, Historic Scotland, Cadw
Landscape and Townscape	Annual (where information allows) trends in: • Delivery of AONB/National Park/National Scenic Areas Management Plan targets • Delivery of National Character Area Statements of Environmental Opportunity • Percentage who are very or fairly satisfied with local area in locations that include or are adjacent to the exploration and production sites	National Park authorities, AONB Management Units and Scottish Natural Heritage Natural England Office for National Statistics (proposed measures of wellbeing)