Sizewell C

Proposed Nuclear Development

Sizewell C EIA Scoping Report

April 2014

Planning Inspectorate Ref: EN010012

Request for a formal scoping opinion in accordance with Regulation 8 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (EIA Regulations 2009) (as amended)

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1. INTRODUCTION

1.1 The Sizewell C Project

1.1.1 EDF Energy[1] is proposing to build a new nuclear power station comprising two UK EPRs at Sizewell in Suffolk, known as Sizewell C. Located to the north of the existing Sizewell B power station, Sizewell C would have an expected electrical capacity of approximately 3,260 megawatts (MW). This would meet approximately 7% of the UK's electricity needs, the equivalent of supplying approximately 5 million homes.

1.2 Intention to apply for a Development Consent Order at Sizewell

1.2.1 EDF Energy intends to submit an application to the Planning Inspectorate for a Development Consent Order (DCO) to develop Sizewell C. In addition to the nuclear power station, the application will seek consent for on-site and off-site associated developments that are considered necessary for the construction and operation of the plant. The application will comprise details of all development proposals and will be accompanied by an Environmental Statement (ES) conforming to the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (SI 2263) (as amended) (the EIA Regulations) and other relevant documents.

1.3 Purpose of this Scoping Report

1.3.1 The scoping process forms an important early stage of the Environmental Impact Assessment (EIA) process. This report sets out the proposed content, methodologies to be adopted and the key matters to be considered in the EIA.

1.3.2 A Scoping Opinion is requested from the Secretary of State to inform the ES which will be submitted as part of the application for development consent. Through the scoping process the views of statutory consultees and other relevant organisations on the proposed scope of the assessment will be sought.

1.4 Request for a Scoping Opinion

1.4.1 This report accompanies a written request to the Planning Inspectorate for a Scoping Opinion in accordance with Regulation 8(1) of the EIA Regulations.

1.4.2 As detailed in Regulation 8(3) of the EIA Regulations, this request for a Scoping Opinion includes:

- a plan sufficient to identify the proposed development sites (i.e. the Sizewell C site and the off-site associated developments) (see **Figure 1.1.1**); and
- a brief description of the nature and purpose of the proposed development (see **Section 3**), an outline description of the environmental baseline, the work that has

[1] NNB Generation Company Limited, whose registered office is at 40 Grosvenor Place, London, SW1X 7EN (referred to in this document as 'EDF Energy').

been undertaken or that is planned to further inform this baseline, and a preliminary view of the potential effects of the proposed development on the environment (see **Sections 6 to 8**).

1.5 Consultation

a) The consultation process

1.5.1 EDF Energy is undertaking pre-application consultation in accordance with the Planning Act 2008 (as amended), having regard to the Department for Communities and Local Government's Guidance on the Pre-application Process (2013) and other relevant guidance, including the Planning Inspectorate's Advice Note 16 (2012) which provides advice on the applicant's pre-application duties.

1.5.2 EDF Energy is undertaking pre-application consultation in formal stages with the local community, statutory consultees and other interested parties. Stage 1 consultation on EDF Energy's initial proposals and options took place between November 2012 and February 2013. A second stage of consultation is proposed in 2014 and will focus on EDF Energy's emerging proposals. Feedback from these stages will help inform development of the proposals and further consultation due to take place subsequently on EDF Energy's preferred proposals. This will provide more detailed information in relation to the technical and environmental considerations. EDF Energy will consult the Suffolk local authorities on a revised Statement of Community Consultation for the Sizewell C Project this year.

1.5.3 In addition to the formal stages of pre-application consultation, EDF Energy will continue to hold informal discussions with the key statutory consultees and other interested parties, as appropriate. This ongoing consultation continues to inform and refine the development proposals.

b) Consultation to date

i. Scoping Report 2008

1.5.4 British Energy (a predecessor of EDF Energy) submitted a Report to inform a Scoping Opinion to BERR in November 2008. A subsequent Scoping Opinion was received from DECC (which was formed to take responsibility for the UK's energy supply) in February 2009. The Scoping Opinion has helped to inform the EIA process for the Sizewell C Project.

ii. Draft Scoping Report 2010

1.5.5 EDF Energy consulted upon a draft Scoping Report for Sizewell C with a limited number of statutory stakeholders in November 2010. Stakeholder responses have been considered in the development of this formal EIA Scoping Report.

iii. Stage 1 consultation

1.5.6 Stage 1 consultation set out EDF Energy's broad plans for the Sizewell C Project. It presented both the elements of the proposals that are unlikely to change (e.g. location of the power station and the design of the reactors) and options for the associated developments. Responses to Stage 1 consultation continue to inform the ongoing development of EDF Energy's proposals for Sizewell C.

1.5.7 A number of responses to the Stage 1 consultation informed the proposed scope of the EIA. EDF Energy continues to hold regular meetings with stakeholders.

1.6 Structure of the EIA Scoping Report

1.6.1 The structure of this report is as follows:

- **Section 2** describes the legislative and regulatory regime for the proposed development and other assessments that will be undertaken in support of the application for development consent;
- **Section 3** sets out a description of the proposed development;
- **Section 4** summarises the alternatives considered;
- **Section 5** details the proposed approach to the EIA, including potential inter-relationships and cumulative effects, for the Sizewell C Project;
- **Sections 6** details the baseline, approach to the assessment and potential environmental issues for those environmental topics that will be considered on a Project-wide basis (socio-economics and transport);
- **Section 7** presents the baseline, approach to the assessment and potential environmental issues for all environmental topics that will be considered for the Sizewell C Main Development Site;
- **Section 8** presents the baseline, approach to the assessment and potential environmental issues for the off-site associated developments. Each off-site associated development site is considered in turn, addressing environmental topics as appropriate; and
- **Section 9** presents the proposed next steps.

2. CONSENTING REGIMES AND ENVIRONMENTAL ASSESSMENT

2.1 Nationally Significant Infrastructure Projects

a) Development Consent Order

2.1.1 Nationally Significant Infrastructure Projects (NSIPs) require a Development Consent Order (DCO) under the Planning Act 2008. Applications for a DCO are determined by the Secretary of State following a detailed examination of the proposed development by the Planning Inspectorate (acting on behalf of the Secretary of State).

b) Environmental Impact Assessment

2.1.2 EIAs for NSIPs are governed by the EIA Regulations, which divide development into two classes: Schedule 1 projects where EIA is always required; and Schedule 2 projects requiring EIA only if the particular project in question is judged likely to give rise to significant environmental effects.

2.1.3 The proposed development is classified as a Schedule 1 development, as identified in the EIA Regulations Part 1(b). Therefore, an EIA will be undertaken and an ES will be submitted in support of the application for development consent.

c) The need for new nuclear development

2.1.4 In the 2008 White Paper on Nuclear Power (BERR, 2008) the Government made clear that new nuclear power stations should have a role to play in the UK's energy mix, alongside other low-carbon sources. Nuclear power can contribute to meeting the UK's binding targets for emissions reductions, and at the same time contribute to diversity and security of supply.

2.1.5 Nuclear power is a technology that the UK has exploited for more than 50 years for electricity generation which, at its peak in 1998, accounted for 26% of UK generation. However, as the older nuclear power stations reach the end of their lives, this share will continue to decline. In 2012, nuclear power provided 18% of UK electricity. On current plans, only one of the existing fleet of nine nuclear power stations will be operational beyond 2023.

2.1.6 The Government's Overarching National Policy Statement (NPS) for Energy (EN-1) states that for the Government to meet its energy and climate change objectives, there is an urgent need for new electricity generating stations. It is Government policy that new nuclear power should be able to contribute as much as possible to the UK's need for new capacity. New nuclear power stations will help to ensure a diverse mix of technology and fuel sources, which will increase the resilience of the UK's energy system. It will reduce exposure to the risks of supply interruptions and of sudden and large spikes in electricity prices that can arise when a single technology or fuel dominates electricity generation.

2.1.7 The NPS for Nuclear Power Generation (EN-6) (referred to as the Nuclear NPS) identifies eight potentially suitable sites for deployment of new nuclear power stations by 2025. These sites were identified on the basis of a strategic siting assessment (SSA) carried out by Government. The Sizewell C site was nominated by EDF Energy and is included as one of the eight potentially suitable sites.

2.1.8 EDF Energy's proposed nuclear power development at Sizewell C would provide approximately 7% of the UK's electricity requirements, would avoid the emission of around 10 million tonnes of carbon dioxide during each year of operation and would thus represent a significant contribution towards the Government's energy policy and climate change goals.

d) Suitability of the Sizewell C site

2.1.9 EDF Energy nominated the Sizewell C site and the Government's SSA process concluded that the site is suitable at a strategic level. Key attributes of the site include:

- its siting adjacent to an existing nuclear operation;
- there is sufficient land area within the nominated boundary to provide essential infrastructure;
- Sizewell is connected to the National Grid's high voltage transmission network, although local modifications and wider network reinforcement are likely to be required;
- the site is coastal and seawater is available for direct cooling;
- there is scope for transporting materials and equipment needed for the construction of a new nuclear power station by sea and rail;
- the site does not occupy any Ministry of Defence (MoD) areas and is not in proximity to any MoD assets or activities;
- a power station development within the development site boundary can be protected against the risk of external hazards throughout its lifetime;
- a new nuclear power station at the site can be protected against flood risk throughout its operational lifetime;
- the development site can be protected against the potential effects of climate change, storm surge and tsunami;
- a nuclear power station at the site can be protected against coastal erosion, including the potential effects of climate change, for the lifetime of the site. Mitigation of the effects of coastal processes may be possible through appropriate design and construction of defences or the positioning of elements of the infrastructure on the site;
- the proposed development site is not in the vicinity of any upper tier Control of Major Accident Hazards (COMAH) establishments, based on Health and Safety Executive records; and
- a nuclear power station development within the nominated development site boundary can be protected against risks from civil aircraft movement, and that the effects of air traffic and aerodromes can potentially be mitigated.

2.1.10 The SSA concluded that the nominated Sizewell site is suitable for the deployment of new nuclear power stations by the end of 2025. This assessment, in conjunction with the Nuclear NPS, avoids a requirement for the Secretary of State to consider alternative sites in his or her determination of the DCO application (see **Section 4**). The Nuclear NPS also provides guidance at a generic and site-specific level on nuclear-specific impacts, potential impacts and siting issues intended to aid the Planning Inspectorate's assessment of new nuclear power stations.

2.1.11 Guidance set out within the Overarching Energy NPS and Nuclear NPS has been considered in this Scoping Report. These NPSs have provided important context and have helped inform the topic coverage and scope of the EIA.

2.1.12 The Nuclear NPS was also subject to a Government Habitats Regulations Assessment (HRA) as it is considered a "plan" under the Habitats Directive (European Commission, 1992). The HRA concluded that there is potential for adverse effects on the integrity of European Sites adjacent to or with the proximity of the potential sites identified in the NPS. In line with the requirements set out in Article 6(4) of the Habitats Directive the Government considered potential alternatives to the plan and identified sites, and concluded that there were no alternatives that would better respect the integrity of European Sites and deliver the objectives of the NPS.

2.1.13 The Government has confirmed that it is satisfied that there are Imperative Reasons of Overriding Public Interest (IROPI) in making these identified sites available as potential sites for development and listing them in the Nuclear NPS, even though at this stage potential adverse impacts on European Sites cannot be ruled out. This IROPI case is based on fulfilling the Government's energy policy objectives whilst contributing to wider European Union (EU) goals for sustainable low-carbon sources of energy as a means of reducing the damaging effects of climate change and ensuring security of energy supplies.

2.2 Other relevant consents

a) Licensing

i. Purpose of the Licence

2.2.1 The Nuclear Installations Act 1965 (as amended) requires that Licensees are regulated by the Office for Nuclear Regulation (ONR). The ONR regulate Licensees via the Nuclear Site Licence (NSL).

2.2.2 The NSL sets out 36 standard licence conditions for which the Licensee develops and implements arrangements. These conditions are available on the ONR website. Prior to being granted an NSL, the Licensee must demonstrate that it complies with its arrangements to meet the licence conditions and have appropriate organisational capabilities and governance in place to ensure nuclear safety. Licensees must also be able to demonstrate they have control over the site in terms of security of tenure. The arrangements are proportionate to the activities being carried out by the Licensee.

ii. Obtaining the Licence

2.2.3 The ONR provides guidance on its website to assist potential applicants. The NSL must be in place prior to any construction activity that may impact on nuclear safety, since this requires ONR permission in the form of consents. An NSL can be sought at the earliest possible opportunity to allow the ONR to advise the Licensee, including development of its arrangements. Once granted, the NSL is an obligation until the site is de-licensed.

iii. Transport

2.2.4 The ONR is responsible for regulating safety with regards to Nuclear Transport and Security arrangements.

iv. Security

2.2.5 The ONR includes a specialist Civil Nuclear Security (CNS) organisation. The CNS is the security regulator for the UK's civil nuclear industry, ensuring that the requirements of the Nuclear Industries Security Regulations (NISR) 2003 (as amended) are met by operators. The ONR (CNS) approves Construction Site Security Plans, Nuclear Site Security Plans, Transport Security Plans and Temporary Security Plans.

b) Permitting

2.2.6 Under the Environmental Permitting (England and Wales) Regulations 2010 (as amended), EDF Energy requires a number of operational permits, granted by the Environment Agency, to operate Sizewell C. These will be subject to public consultation. The three key permits are to:

- dispose of radioactive waste, known as the Radioactive Substances Regulation (RSR) permit;
- discharge cooling water effluents, known as the operational Water Discharge Activity (WDA) permit; and
- the operation of the emergency diesel generators, known as the Combustion Activity (CA) permit.

2.2.7 Additional permits will be required to support the construction and commissioning activities.

i. Generic Design Assessment

2.2.8 The Generic Design Assessment (GDA) process is carried out jointly by the ONR and the Environment Agency separate to the licensing process. Under the GDA process, the ONR and Environment Agency engage with nuclear reactor vendors on the generic aspect of their design, perform technical assessment work on their submissions, consult with overseas regulators, implement a comments process and consult. This is done in order to assess the environmental, safety and security aspects of reactor designs before construction of the reactor starts.

2.2.9 In December 2012 the ONR issued a Design Acceptance Confirmation (DAC) and the Environment Agency issued a Statement of Design Acceptability (SoDA) for the UK EPR Reactor Design, concluding the corresponding GDA process.

2.3 Related assessments

2.3.1 In addition to the EIA, the proposed development will be subject to assessment pursuant to other regulatory regimes, including the Habitats Regulations and Water Framework Directive (European Commission, 2000). Further information on these regimes is provided below.

a) Habitat Regulations Assessment

2.3.2 The European 'Habitats Directive' on the Conservation of Natural Habitats and Wild Flora and Fauna (92/43/EEC) and the European 'Birds Directive' on the conservation of wilds birds (79/409/EEC – as amended by Directive 2009/147/EC) aim to put in place a network of habitats and species of European importance and to require the competent authorities of Member States to undertake 'Appropriate Assessment (AA)' of any plan or project not directly connected with or necessary to the management of a European site but likely to have a significant effect thereon, either individually or in combination with other plans or projects. This requirement has been transposed into UK law through 'The Conservation of Habitats and Species Regulations 2010' (as amended), referred to in this Scoping Report as the 'Habitats Regulations.

2.3.3 An AA carried out by the Secretary of State for inclusion of Sizewell C in the NPS found that potential significant adverse effects on certain European sites could not, at that stage, be ruled out. It was noted that a project-specific AA would need to be carried out. This NPS AA will be used by EDF Energy as a basis to agree an 'Evidence Plan' for Sizewell C with Natural England and other relevant stakeholders. This new voluntary process is designed to agree upfront the evidence needed for project-specific AA that will need to be undertaken in the context of the DCO application and applications for environmental permits.

b) Flood Risk Assessment

2.3.4 A Flood Risk Assessment (FRA) will be undertaken and will form part of the application for development consent. In accordance with the National Planning Policy Framework (NPPF), the FRA will assess the flood risk both to and from the proposed development and demonstrate how that flood risk, from all sources, will be managed over the lifetime of the site, taking into account the effects of climate change, including sea-level rise. Decommissioning would be the subject of a separate FRA.

2.3.5 In accordance with the NPPF, the FRA will consider potential sources of flooding from: fluvial; coastal; groundwater; surface water resulting from intense rainfall (pluvial) events; sewers (also resulting from intense pluvial events); and non-natural water bodies (i.e. canals and reservoirs), either from individual or multiple sources. The FRA will also take account of any future geomorphological change, including the potential for increased flooding risk due to coastal erosion.

c) Water Framework Directive

2.3.6 The EU Water Framework Directive (WFD) (2000) was transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. Two 'daughter' directives, one aimed at protecting groundwater, the second aimed at reducing pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on a list of priority substances, have been adopted at European level. The requirements of the WFD

will be taken into account in the planning of all new activities that may impact on the water environment.

2.3.7 To meet the requirements of the WFD, the competent authority (the Environment Agency) has set Environmental Objectives for each water body. A default objective in all water bodies will be to prevent deterioration in either the 'Ecological Status' (for natural water bodies) or the 'Ecological Potential' (for heavily modified or artificial water bodies). A WFD Compliance Assessment for the proposed development will be prepared in consultation with the Environment Agency and appended to the ES in order to ensure that it meets the requirements of this directive.

d) Transport Assessment

2.3.8 The DCO application for Sizewell C will be accompanied by a Transport Assessment (TA). This will include assessments of the construction and operational phases, with particular focus on the construction phase as this would have a greater traffic impact than the operational phase.

2.3.9 The TA will assess the impact of the Sizewell C Project on road and network capacity, the operation of junctions and journey times both locally, and where necessary, in the wider context, taking account of the transport strategy adopted for the Sizewell C Project and the proposed mitigation. The TA and the associated traffic modelling which supports the assessment will form the basis of the transport chapter included within the ES, as well as supporting other chapters such as noise and air quality, which are dependent on information such as traffic figures. The transport section of this EIA Scoping Report summarises the approach to the TA and traffic modelling being adopted and the status of discussions with the local highway authority (Suffolk County Council).

e) Health Impact Assessment

2.3.10 Health Impact Assessment (HIA) is a multidisciplinary process which considers air quality, noise, transport and socio-economics, as well as more intangible elements important to good health and well-being. It is designed to identify and assess the potential health outcomes (both adverse and beneficial) of a project and to deliver evidence-based recommendations that reduce or remove potential adverse impacts on health and well-being.

2.3.11 The NPS for Nuclear Power Generation (EN-6) identifies Human Health as a potential 'Nuclear Impact' which decision-makers must consider (paragraph 3.12.7).

2.3.12 Although not a formal regulatory requirement of the UK planning process for NSIPs, EDF Energy has voluntarily commissioned an HIA which will be undertaken in consultation with the relevant bodies to demonstrate how the requirement to consult and assess impacts has been addressed. The HIA that will be submitted in support of the application for development consent will identify any significant impacts on health.

f) Community and Equalities

2.3.13 The socio-economic assessment in the ES will cover community impacts and equalities impacts, as required by Section 5.12 of EN1 and Section 3.11 of the Nuclear NPS. This will include a description of the spatial impact of the Sizewell C

Project on communities within the area, as well as other environmental impacts on human receptors, as relevant.

g) Sustainability Strategy and Appraisal

2.3.14 EDF Energy believes that the sustainability of nuclear new build is founded on its attributes of low carbon emissions, secure electricity supply, and stable, affordable prices once nuclear stations are constructed. Building on these inherent benefits, EDF Energy will apply a strategy to enhance the sustainable delivery of Sizewell C, as appropriate, exploiting opportunities available in design, procurement and construction.

2.3.15 An appraisal will form part of the application for development consent, which will have regard to:

- the Government's Appraisal of Sustainability (AoS) of the NPS for Nuclear Power Generation (EN-6) and the AoS Site Report for Sizewell;
- relevant legislation and planning policy;
- EDF Energy's own corporate sustainability policy;
- best practices set by other major infrastructure projects in the UK; and
- the views and interests of stakeholders.

3. DESCRIPTION OF THE PROPOSED DEVELOPMENT

3.1 Introduction

3.1.1 This section of the Scoping Report describes the Sizewell C proposed development. The Main Development Site is located mainly to the north of the existing Sizewell B power station and comprises the nuclear power station, access road and temporary development required for construction. An area of land to the west/south-west of Sizewell B and east of Leiston will also be required during the construction phase. In addition, land may be required permanently or temporarily for associated development, such as a Visitor Centre, accommodation campus, and park and ride facilities.

3.1.2 The overall development proposals are summarised in the following two sections:

- Main Development Site; and
- off-site associated development.

3.1.3 Large scale projects are complex and it is not possible to define all aspects of the final project design at the time an application for development consent is made. There is always the necessity for some flexibility and, as a result, a number of options within the project design will remain under consideration until after a decision is made by the Secretary of State on the application for development consent and following further geotechnical investigations, detailed engineering design and procurement processes have taken place.

3.1.4 To accommodate this, the EIA is based on the established principle of the 'Design Envelope'. This approach is set out in the cases of R v Rochdale Metropolitan Borough Council ex p Milne (2000) and R v Rochdale Metropolitan Borough Council ex p Tew (1999).

3.1.5 PINS Advice Note Nine (2012) sets out a number of key principles that describe the level of detail that a project must provide to enable a proper assessment of potential impacts and the subsequent development of mitigation, where necessary.

3.1.6 The Design Envelope is determined based on project design parameters, which in turn are used to assess the maximum adverse scenarios for each receptor (the 'worst case scenario'). The worst case scenario differs from topic to topic and is based on the full range of design options which will be set out in the project description chapter of the ES.

3.1.7 The approach to be adopted within the assessment will be to identify the realistic worst case scenario, using the design parameters for the Project.

3.1.8 This approach will ensure that the EIA is based on clearly defined parameters that govern the full range of development possibilities. Therefore, the Secretary of State can be assured that the environmental impacts of the project would be no greater than those identified in the ES. This approach is consistent with the objectives of the

EIA Directive and EIA Regulations, as well as following the guidance provided by Advice Note Nine.

3.2 Main Development Site

a) Permanent development

3.2.1 The permanent development within the Sizewell C Main Development Site would include the following key operational elements:

- two UK EPRs comprising reactor buildings and associated buildings (the 'Nuclear Island');
- turbine halls and electrical buildings (the 'Conventional Island');
- cooling water pumphouses and associated buildings;
- Operational Service Centre; and
- fuel and waste storage facilities, including interim storage for radioactive waste and spent fuel.

3.2.2 Together with:

- external plant, including storage tanks;
- internal roads;
- ancillary, office and storage facilities;
- drainage and sewerage infrastructure; and
- National Grid 400kV Substation, plus the addition of one National Grid pylon, removal of an existing pylon and associated realignment of overhead lines.

3.2.3 In addition, the permanent development would include the following elements, which would be sited away from the main station platform:

- cooling water infrastructure (including cooling water tunnels extending out to sea, intake and outfall headworks on the sea bed, and the outfall associated with a fish recovery and return system);
- access road to join the B1122 and related junction arrangements;
- a bridge connecting the power station to the new access road to the north;
- car parking, some ancillary buildings and a helipad;
- flood defence and coastal protection measures;
- a beach landing facility to receive deliveries of Abnormal Indivisible Loads (AILs) by sea throughout the power station's operational life;
- Simulator Building/Training Centre;
- options for a Visitor Centre; and
- landscaping of the areas to be restored following their use during construction.

3.2.4 The proposed operational layout has been developed to make the most efficient use of land within the constraints presented by the site itself and by those associated with

the design of the UK EPR. The permanent development would be built at a platform height of approximately 6.4 metres (m) Above Ordnance Datum (AOD).

b) Temporary development

3.2.5 During the construction of Sizewell C, areas of land would be required temporarily in order to facilitate the construction process. The temporary land uses would include:

- construction working areas: laydown areas, workshops, storage and offices;
- temporary structures, including concrete batching plant;
- management of spoil/stockpile arrangements, including potential sourcing on-site of construction fill materials;
- temporary bridge between the power station and adjacent construction areas;
- a temporary jetty for the transport of bulk construction materials, equipment and AILs by sea;
- options for a temporary rail route extending into the construction site (see off-site associated development in **Section 8.4**);
- works areas on the foreshore for the installation of flood defence and coastal protection measures;
- construction roads, fencing, lighting and security features;
- site access arrangements and coach, lorry and car parking; and
- a development site accommodation campus.

3.2.6 Upon completion of construction, land used temporarily would be restored once the Sizewell C power station is operational in line with a Landscape Strategy, which will be submitted as part of the application for development consent. This strategy would also cover the wider EDF Energy Estate. The landscape strategy is likely to include the creation of a mosaic of grassland, heathland, scrub and woodland involving the reinstatement, where appropriate, of existing fields.

3.2.7 **Figure 3.2.1** illustrates the areas for construction and operation on the Main Development Site, including the accommodation campus site.

3.3 Off-site associated development

3.3.1 To support the construction and/or operation of Sizewell C, EDF Energy would also need to use additional land for associated development. Since Stage 1 consultation EDF Energy has progressed in its consideration of the potential off-site associated development sites and, where a lead option has been identified, these are considered in **Section 8**. The lead sites are the likely, but not definite, associated development sites that EDF Energy has identified for further consultation and which are being taken forward for further assessment. For off-site associated development where a lead site has not been identified, all options have been considered and will be taken forward for further assessment.

3.3.2 The off-site associated development currently proposed includes:

- two temporary park and ride sites; one to the north of Sizewell C and one to the south. EDF Energy's lead options are a site at Darsham for the northern park and ride (see **Figure 8.2.1**) and a site at Wickham Market for the southern park and ride (additional land has been identified at Wickham Market since Stage 1 consultation, pending the outcome of archaeological assessments to confirm the site can be taken forward – see **Figure 8.3.1**). In addition, a postal consolidation facility and construction induction centre may be located at one of the park and ride sites; and
- a temporary extension of the existing Saxmundham to Leiston railway line into the construction site (two potential routes are being considered; green or blue) or a new rail terminal and freight laydown area north of King George's Avenue, Leiston (see **Figure 8.4.1**).

3.3.3 EDF Energy is progressing design work on the rail route options both within and outside the construction area of the Main Development Site. This includes consideration of how any affected areas of the highway network would be crossed, which in turn has implications for the precise horizontal and vertical alignment adopted and the associated land take. In addition to the land required for the rail route itself there is likely to be some requirement for storage of surplus earthworks adjacent to the routes in some locations – again the precise extent and location of these is subject to further work. EDF Energy will publish more detailed rail proposals as part of the Stage 2 consultation.

3.3.4 EDF Energy has also considered the need for permanent improvements to the A12 as a result of the Sizewell C-generated traffic. Preliminary findings are that traffic associated with Sizewell C could increase the potential for congestion and exacerbate safety concerns associated with the narrow bend at Farnham and that mitigation measures may be justified in this area. The Stage 1 consultation identified three possible solutions:

- a Farnham bypass;
- road widening at Farnham Bend; and
- HGV traffic controls at Farnham Bend.

3.3.5 These options, shown on **Figure 8.5.1**, are subject to ongoing assessment which will inform EDF Energy's position on road improvements at Stage 2 consultation. Further work is being undertaken on these options, including establishing a precise alignment for the bypass option in more detail along with any associated junction arrangements for connecting the bypass to the A12. Such work will establish more precisely the permanent land take and the land required during construction. EIA work will reflect any evolution in the design and alignment going forward.

3.3.6 The final potential off-site associated development is the proposed Visitor Centre. It is envisaged that the Visitor Centre would be a joint facility with Sizewell B, replacing the current Visitor Centre associated with the existing station. EDF Energy has developed its siting options for the Visitor Centre since Stage 1 and potential options being considered are:

- a site at Coronation Wood which could be used to serve both construction and operational phases of the proposed development; and

- a two-phased siting approach involving the temporary use of land either east of Leiston or within Leiston town (for the construction phase only) and a site at Goose Hill (within the Main Development Site construction area for the operational phase) which would be constructed after completion of construction of the power station (see **Figure 8.6.1**).

3.3.7 It is likely that the construction of the off-site associated development will be undertaken as part of the early works of the construction phase. Following cessation of use, these facilities would be removed (with the exception of the highway improvements).

3.4 Construction phase

3.4.1 In order to prepare the Sizewell C site for development, some works would need to take place before construction of the power station commences. These works would include relocation of some buildings and activities north of the Sizewell B power station to make space for the new power station. Areas being considered for relocation of these buildings and activities include the Sizewell B power station site and part of Coronation Wood.

3.4.2 Construction work would commence with site clearance and preparation. The works would include: construction of a new access road into the site from the B1122; establishment of temporary construction areas; permanent and temporary bridges linking these to the main platform on which the power station would be built; construction of a jetty; and commencement of earthworks including platform development, construction of a cut-off wall, deep excavations, stockpiling and grading of materials prior to re-use and backfilling.

3.4.3 Prior to the jetty becoming operational and the construction of any temporary extension of the Saxmundham-Leiston branch line into the construction site (or new railhead north of King George's Avenue in Leiston), construction materials could be delivered and exported either by rail via the existing railhead in Leiston or by road.

3.4.4 Small-scale refurbishment of the existing railhead is likely to be required to facilitate rail deliveries prior to the completion of any additional rail development.

3.4.5 The construction of the power station would involve the excavation of large amounts of spoil comprising soil, made ground, peat, alluvium and Crag sand to reach the foundation depths for the buildings and structures within the Main Development Site. EDF Energy will develop a Materials Management Plan (MMP) to re-use as much of this spoil as possible on-site, subject to the material being suitable for the intended use and the activity not causing harm to the environment or human health. An additional source of engineering fill would be required to raise the level of the Main Development Site platform to 6.4m AOD. This extra material would either be won from within the temporary construction area, or sourced from off-site. The excavated peat and alluvium may either be retained on-site to help balance the earthworks, or could be used within a new nature reserve currently being created at Wallasea Island in Essex, in which case it would be transported there by barge via the jetty.

3.4.6 The main construction phase would include the erection of the key buildings and ancillary facilities and the installation of the mechanical and electrical plant.

3.4.7 Following site preparation, it is anticipated that main construction of the proposed development would take seven to nine years. At peak, EDF Energy would expect the construction workforce to comprise about 5,600 people. Following construction the land used temporarily would be landscaped in line with the wider landscape strategy.

3.5 Operational phase

3.5.1 The Sizewell C power station would have a design life of 60 years. The electrical capacity of the nuclear power station would be approximately 1,630 megawatts (MW) per unit, giving a total site capacity of 3,260MW. During operation, it is expected that approximately 900 staff would be employed. Approximately 1,000 additional staff would be employed during planned refuelling and maintenance outages which take place approximately every 18 months for each UK EPR reactor unit and last typically between one and three months.

3.6 Decommissioning

a) Sizewell C site

3.6.1 At the end of electricity generation at Sizewell C the site would be decommissioned. The process of decommissioning would be divided into a number of activities leading to the clearance and de-licensing of the site and ultimately its release for re-use.

3.6.2 The UK EPR has been designed with decommissioning in mind, enabling radioactive waste quantities to be limited when decommissioning takes place.

3.6.3 The decommissioning strategy to be employed for Sizewell C would be “early site clearance”. Decommissioning would begin as soon as practicable after the end of electricity generation at the site. The decommissioning of Sizewell C, with the exception of the Interim Spent Fuel Store (ISFS), could be achieved within approximately 20 years of the end of generation.

3.6.4 The ISFS would continue to operate until a UK Geological Disposal Facility is available and the spent fuel is ready for disposal.

3.6.5 The decommissioning chapter of the Sizewell C ES would include a high level environmental assessment of decommissioning, which would identify and summarise the types of environmental impacts anticipated to occur during decommissioning. Before decommissioning could take place, EDF Energy would need to obtain separate consent from the ONR under the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (as amended). This requires the submission of an ES following an EIA and a period of public consultation.

3.7 Conventional waste management

3.7.1 The following objectives have been developed for the management of conventional waste at Sizewell C, during both the construction and operational phases:

- prevent and reduce the volumes of waste produced through the application of the waste hierarchy;
- maximise re-use and recycling within the wider development; and
- minimise the impact upon the existing waste management infrastructure.

3.7.2 All waste arisings would be managed in a responsible manner throughout all phases of the development, with a clear intention to prevent and reduce waste streams in accordance with applicable legislation, policy and guidance.

3.7.3 EDF Energy will undertake an assessment to determine the potential impact of conventional waste arisings associated with the construction and operation of Sizewell C. This will include the construction and operation of the Sizewell C Main Development Site, as well as the construction, operation and, as far as reasonably practicable, the post-operation phase of the off-site associated development sites.

3.7.4 The waste assessment will aim to:

- identify the main waste streams and predicted volumes likely to arise from the construction, operation and post-operation phases of the Sizewell C Project;
- identify any potential impacts upon existing waste infrastructure;
- identify measures that would be implemented to prevent and minimise waste generation; and
- provide the basis upon which to develop a conventional waste strategy for the Sizewell C Project.

3.8 Spent fuel and radioactive waste management

3.8.1 EDF Energy would ensure that the management of spent fuel and radioactive waste generated at Sizewell C protects both people and the environment and is consistent with UK policy and legislation.

3.8.2 The UK EPR design generates less spent fuel than other nuclear reactors in the UK per unit of electricity generated. It optimises fuel use which, when coupled with fuel design and manufacture, ensures that less spent fuel is created.

3.8.3 Spent fuel removed from the reactor would initially be stored underwater in a reactor fuel pool. Following this initial storage period, the spent fuel assemblies would be transferred to the separate on-site ISFS where they would be safely stored until a UK Geological Disposal Facility is available and the spent fuel is removed for final disposal.

3.8.4 The ISFS would be designed for a life of at least 100 years, which could be extended if necessary. The ISFS would be designed to be capable of operating independently of other parts of the power station in recognition that its lifetime would, under current assumptions, extend beyond the operational life and decommissioning of the other facilities on-site.

3.8.5 The design of the UK EPR planned for Sizewell C includes a number of measures aimed at limiting the amount of radioactive waste generated. Radioactive waste

generated at Sizewell C would fall into two categories – Low Level Waste (LLW) or Intermediate Level Waste (ILW).

3.8.6 LLW would be disposed of as soon as reasonably practicable, following treatment to limit its volume and then appropriate conditioning or packaging to allow its safe transport and disposal.

3.8.7 ILW would be conditioned and packaged on-site throughout the operational phase. The packages would be safely stored in the ILW Interim Storage Facility until a UK Geological Disposal Facility is available to accept waste from Sizewell C for disposal.

3.8.8 As with the ISFS, it would be possible to extend the life of the ILW Interim Storage Facility.

4. CONSIDERATION OF ALTERNATIVES

4.1 Introduction

4.1.1 Schedule 4 of the EIA Regulations states that an ES should include *'an outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental effects.'*

4.1.2 As part of the Overarching NPS for Energy (EN-1) and the NPS for Nuclear Power Generation (EN-6) the Government has set out the need for all types of energy NSIPs, including new nuclear power stations. As the Government has established this need, alternative options to nuclear power generation will not be considered as part of this EIA.

4.1.3 The Government has assessed all of the sites listed in the NPS EN-6, including the Sizewell C site, as part of a SSA. All of the sites listed are considered to be suitable for the deployment of a new nuclear power station by the end of 2025. Given that the Sizewell C proposed development site meets the SSA criteria and is identified in NPS EN-6 as potentially suitable for new nuclear development, no alternative sites for the proposed Sizewell C nuclear power station will be considered as part of this EIA. However, it will focus on the principal site-specific and design alternatives.

4.1.4 There are legal requirements to consider alternatives in some circumstances, for example under the Habitats Directive. The ES will outline the main alternatives studied by EDF Energy and detail the principal reasons for the applicant's choice, taking into account the environmental, social and economic effects.

4.1.5 In addition, it is good practice to consider the 'no development' alternative; this refers to the option of leaving the proposed development site in its current state. The ES will consider and provide a summary of the 'no development' alternative in the context of the development need.

4.2 New nuclear power station at Sizewell

4.2.1 Sizewell B was designed and developed with an expectation that a further nuclear power station would be constructed adjacent to the site on the northern boundary. This is also reflected in the previous proposals for a power station at the site (prepared in the 1990s). The ES will review the potential alternative layouts of the new nuclear power station, particularly for the land required during construction.

4.2.2 The UK EPR reactor developed by AREVA and EDF Energy is proposed for Sizewell C. This reactor has completed the UK's GDA process with the award of a Design Acceptance Confirmation (DAC) from the ONR and a Statement of Design Acceptability (SoDA) from the Environment Agency. Therefore, no alternative designs for the nuclear reactor will be considered.

4.3 On-site associated infrastructure

4.3.1 The design of the on-site associated infrastructure is developing and a number of options are being explored in order to reach the best design solution. The ES will

describe this process and refer to the options considered for associated infrastructure and why they were discounted.

4.3.2 Key alternative design options for the on-site associated infrastructure include consideration of:

- masterplan design concepts and layout of the Main Development Site;
- landscaping;
- sea defences along the eastern edge of the site;
- length, location and design of the cooling water intakes and outfall structures;
- transmission infrastructure;
- length, structure and location of a beach landing facility;
- length, structure and location of a temporary jetty;
- on-site interim storage of spent fuel;
- access road alignment and design of the bridges;
- drainage strategies; and
- the location of temporary construction areas.

4.4 Off-site associated development

4.4.1 As detailed in **Section 3.3**, off-site associated development would be required to support the construction and/or operation of the Sizewell C nuclear power station development.

4.4.2 EDF Energy is undertaking a robust process to identify potential suitable sites for associated development and then to consider their advantages and disadvantages in terms of their location, size, operational and technical requirements, as well as planning and environmental considerations. EDF Energy's initial proposals on the options for each type of associated development were presented at Stage 1 consultation.

4.4.3 Since Stage 1, EDF Energy has progressed in its consideration of the potential off-site associated development sites. The feedback from Stage 1 consultation has been considered alongside further environmental assessment of the site options and informal consultation with stakeholders. For a number of the off-site associated development categories, EDF Energy has now selected the 'lead' site and 'reserve' site(s). Lead sites are the likely, but not definite, associated development sites that EDF Energy has identified for further consultation and which are being taken forward for further assessment. The lead sites are presented in **Section 8**.

4.4.4 The reserve site(s) would only be progressed should the relevant lead site be unable to progress and is discontinued. Currently EDF Energy does not anticipate the need to further consider the reserve site(s) further.

4.4.5 Where EDF Energy has not yet decided upon a lead site all options continue to be considered. These sites are therefore presented in **Section 8**. Fixed options and

locations will be determined following further environmental assessment and consultation on each site.

4.4.6 A possible need for a temporary freight management facility was identified at Stage 1 consultation, in order help control traffic flows in and out of the Main Development Site and provide somewhere to hold vehicles temporarily, for example, if there is an incident on the highway network. However, EDF Energy anticipates that HGV movements to site could potentially be managed through the use of electronic and camera based systems to manage, monitor and control movements to approved routes and within agreed limits. This could reduce the requirement for additional associated development sites and, therefore, the sites identified have not been considered further.

4.4.7 EDF Energy will report on its consideration of the off-site associated development site options in the ES.

5. APPROACH TO THE EIA

5.1 General assessment approach

5.1.1 Establishing the scope of the assessment in a rigorous and transparent manner is a key step in the assessment process; and consultation is an essential element of this process. Therefore, this EIA scoping report has been prepared to provide stakeholders with sufficient information to form an opinion over the adequacy of the proposed scope of assessment and to ensure that issues potentially giving rise to 'likely significant effects' will be addressed by the EIA.

5.1.2 Schedule 4 of the EIA Regulations requires the ES to include a description of the '*likely significant effects of the development on the environment. This should cover the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the development*', as well as a description of the forecasting methods used to assess the effects on the environment. Schedule 4 also identifies a number of aspects of the environment that should be considered, namely '*population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the interrelationship between the above factors'.* A proposal of how these aspects will be considered and assessed in the EIA is included in the following sections.

5.1.3 Issues that are scoped into the EIA are judged likely, without effective mitigation, to have the potential to cause significant effects. Issues that are scoped out of the EIA are those which it is considered are not likely to lead to significant effects, regardless of mitigation. Where insufficient information is available in relation to a particular issue to make a reasonable judgement at this stage, a precautionary approach is adopted and that issue is scoped in. The decision to scope out issues is based upon factors such as a high degree of development-receptor separation, the lack of impact pathways or the known low value or low sensitivity of impacted resources/receptors. The case to scope out topics, or particular aspects of topics, will be clearly made and supported by appropriate evidence.

5.1.4 It is not anticipated that it will be possible to scope out any aspects of the assessment for the Main Development Site, although there is potential to do so for each of the off-site associated developments. However, as the assessment proceeds, topics will be reviewed and their potential significance may be re-evaluated in response to additional information or changes to the project definition.

5.2 Determination of the scope

a) Spatial scope

5.2.1 Clear definition of the study area for the EIA is a key part of the process. The geographical extent of the study area varies depending on the environmental topic and specific receptors under consideration for that topic. For each topic the study area is of sufficient size to encompass the spatial extent over which impacts relevant to that topic and the related receptors might operate.

b) Temporal scope

5.2.2 The assessment will have regard to the project programme and will evaluate the environmental effects of the proposed development at the key stages of construction and operation. These are, where appropriate, then compared to the situation prevailing before the Project is commenced (i.e. the current baseline), and to the situation that would prevail in the future without the proposed development (i.e. the projected future baseline).

5.2.3 Each environmental topic chapter of the ES will define the baseline against which the environmental effects of the proposed development will be assessed. The baseline conditions to be assessed for each topic are outlined in the relevant section of this report.

5.2.4 Future assessment years that will be considered for the Main Site (i.e. Sizewell C) include:

- future baseline in the absence of development;
- construction; and
- operation.

5.2.5 The future baseline is the theoretical situation that would exist in the absence of the development. It is typically based upon extrapolating the current baseline using technical knowledge of changes to predict this (e.g. habitat change over time, traffic and waste growth over time, etc). It will likely cover the first year of operation.

5.2.6 The decommissioning chapter of the ES would include a high level environmental assessment of decommissioning. Regardless of this, the decommissioning of Sizewell C would be subject to an EIA under the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (as amended) at the point of end of generation.

5.2.7 Future assessment years that will be considered for the off-site associated development include:

- future baseline in the absence of development;
- construction of the off-site associated development;
- operation of the off-site associated development; and
- post-operation of the off-site associated development.

5.3 Assessment of effects and determining significance

5.3.1 It should be noted that in the context of this assessment and the general methodology utilised, the terms *'impact'* and *'effect'* are distinctly different. The EIA Regulations state that an assessment of project environmental impacts is required; however, the impacts of the proposed development may or may not result in significant effects on the environment. It is an assessment of effects that is required by Schedule 4 of the EIA Regulations.

5.3.2 For consistency, and in an attempt to allow comparison between topics, the methodology described in this section will be applied where appropriate. The

methodology followed by most environmental topics is designed to consider whether impacts of the proposed development would have an effect on any resources or receptors. Assessments broadly consider the magnitude of impacts and sensitivity of resources/receptors that could be affected in order to classify effects according to the categories shown in **Table 5.3** and **Table 5.4**.

5.3.3 For each topic area of assessment which fully or in part utilises the methodology, the categories of resource/receptor sensitivity and magnitude of impact will be appropriately described and defined. The following sections provide the generic criteria for the definition of resource/receptor sensitivity, impact magnitude and scale of effect. Each environmental topic area will provide greater detail on the approach to the assessment and specific guidelines for the definition of impact magnitude and resource/receptor sensitivity. Environmental topics will broadly follow the approach set out in the following sections and any deviations from this approach are explained and justified where appropriate.

a) Receptor sensitivity

5.3.4 **Table 5.1** sets out the generic guidelines for the assessment of sensitivity. Where appropriate, relevant guidelines are provided for each environmental topic.

Table 5.1: Generic guidelines for the assessment of sensitivity

Value/ sensitivity	Guidelines
High	Value: Feature/receptor possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site/receptor (e.g. designated features of international/national importance, such as World Heritage Sites, Areas of Outstanding Natural Beauty (AONB), Special Areas of Conservation (SACs), Special Protection Area (SPAs), Ramsar sites, Sites of Special Scientific Interest (SSSIs), Scheduled Ancient Monuments, Air Quality Management Areas, Grade I and Grade II* Listed Buildings. Sensitivity: Feature/receptor has a very low capacity to accommodate the proposed form of change.
Medium	Value: Feature/receptor possesses key characteristics which contribute significantly to the distinctiveness and character of the site/receptor (e.g. designated features of regional or county importance, such as County Wildlife Sites (CWSs), Local BAP, Conservation Areas, Grade II Listed Buildings, Heritage Coast and Special Landscape Areas etc.) Sensitivity: Feature/receptor has a low capacity to accommodate the proposed form of change.
Low	Value: Feature/receptor only possesses characteristics which are locally significant. Feature/receptor not designated or only designated at a district or local level (e.g. local nature reserve, locally Listed Buildings). Sensitivity: Feature/receptor has some tolerance to accommodate the proposed change.
Very Low	Value: Feature/receptor characteristics do not make a significant contribution to local character or distinctiveness. Feature/receptor not designated. Sensitivity: Feature/receptor is generally tolerant and can accommodate the proposed change.

b) Magnitude

5.3.5 **Table 5.2** sets out the generic guidelines for the assessment of magnitude. Where appropriate, relevant guidelines are provided for each environmental topic.

Table 5.2: Generic guidelines for the assessment of magnitude

Magnitude	Guidelines
High	Large-scale, permanent/irreversible changes, over the whole development area and potentially beyond (i.e. off-site), to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact certain or likely to occur.
Medium	Medium-scale, permanent/irreversible changes, over the majority of the development area and potentially beyond, to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact certain or likely to occur.
Low	Noticeable but small-scale change, permanent or temporary changes over a partial area, to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact would possibly occur.
Very Low	Noticeable, but very small-scale change, or barely discernible changes for any length of time, over a small area, to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact unlikely or rarely to occur.

c) Significance

5.3.6 **Table 5.3** details the matrix used for the classification of effects and **Table 5.4** sets out the generic definitions of effect. Where appropriate, relevant guidelines are provided for each environmental topic.

Table 5.3: Classification of effects

Magnitude	Value and sensitivity of receptor			
	Very Low	Low	Medium	High
Very low	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

Table 5.4: Generic effect definitions

Effect	Description
Major	Very large or large change in environmental or socio-economic conditions. Effects, both adverse and beneficial, which are likely to be important considerations at a national to regional level because they contribute to achieving national/regional objectives, or, which are likely to result in exceedance of statutory objectives and/or breaches of legislation.
Moderate	Intermediate change in environmental or socio-economic conditions. Effects that are likely to be important considerations at a regional and local level.
Minor	Small change in environmental or socio-economic conditions. These effects may be raised as local issues but are unlikely to be of importance in the decision making process.
Negligible	No discernible change in environmental or socio-economic conditions. An effect that is likely to have a negligible or neutral influence, irrespective of other effects.

5.3.7 Following the classification of an effect using this methodology, a clear statement is then made as to whether that effect would be 'significant' or 'not significant'. As a general rule, major and moderate effects are considered to be significant, whilst minor and negligible effects are considered to be not significant (as detailed by the colour coding in **Table 5.3**). However, professional judgement can also be applied where necessary, including taking account of whether the effect is permanent or temporary.

5.4 Mitigation and residual effects

5.4.1 The ES will include a description of the measures envisaged to prevent, reduce and, where relevant, offset any significant adverse effects. The approach adopted for the proposed development will take the form of a hierarchy, whereby priority is given to preventing effects, and then (if this was not possible) to reducing or abating them followed, if necessary, through repair (restoring or reinstating) or compensation. Each of these means of reducing potentially significant effects falls under the broad heading of 'mitigation'.

5.4.2 Mitigation opportunities will be identified throughout the evolution of the proposed development and the EIA process, whereby significant adverse effects will be fed back into the design process to verify whether they can be avoided or otherwise mitigated in accordance with the hierarchy.

5.4.3 It would be possible to incorporate some mitigation measures into the scheme design, and the proposed development would respond to key environmental considerations. These measures will be included within the proposed development plans and drawings and are therefore referred to as 'embedded' or 'incorporated' mitigation. In addition to the mitigation that will be developed to address specific local issues, mitigation will be applied to the proposed development as a whole to avoid impacts at source wherever practicable.

5.4.4 Where other mitigation is required to reduce or eliminate a significant effect, this will be referred to as 'additional mitigation'. These will generally be measures which have not been incorporated in the design of the proposed development, and will not appear on any development plans.

5.4.5 The ES will report on the anticipated effects of the proposed development following the implementation of mitigation measures, which are known as 'residual effects'. A clear statement will be made as to whether the residual effects are significant or not significant. It should be reiterated that not all such effects will be adverse and some will be beneficial.

5.5 Inter-relationships and cumulative effects

5.5.1 As required by the EIA Regulations, the assessment will also have regard to cumulative effects. Whilst the technical chapters will address the environmental effects for each environmental discipline, the ES will also consider:

- 'inter-relationships' that occur between the individual environmental effects of the proposed development and have the potential to combine together with one another on resources/receptors and lead to significant effects; and
- 'cumulative effects' that arise as a result of the proposed development in combination with other large scale developments and/or projects in the vicinity of the site.

5.5.2 Inter-relationships will be considered within the environmental topic chapters of the ES or will be summarised in the inter-relationships and cumulative effects volume of the ES.

5.5.3 The assessment of cumulative effects will consider other relevant major developments and/or projects on the basis of those that are either:

- under construction;
- permitted application(s), but not yet implemented;
- submitted application(s), not yet determined;
- identified in the relevant development plan (and emerging development plans – with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited; and
- identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

5.5.4 The assessment will include consideration of developments and projects in the surrounding area with the potential to result in cumulative effects (e.g. the Galloper Wind Farm project, a proposed offshore wind generating station and its associated electrical connection).

5.5.5 To inform the assessment of cumulative effects, the maximum geographical area around the Main Development Site and the off-site associated development sites where there is potential for impacts to occur will be identified through the derivation of a Zone of Influence (ZOI) for each environmental topic area.

5.6 Transboundary effects

5.6.1 Under Regulation 24 of the EIA Regulations and the Espoo Convention and EU Directive 2011/92/EU on the Assessment of the Effects of Certain Public and Private

Projects on the Environment (codification) (the EIA Directive), the Planning Inspectorate is obliged to form a view on the potential for transboundary impacts and consult with relevant European Member States.

5.6.2 The EIA Directive implemented new requirements on transboundary consultation and requires that all significant transboundary issues set out in the EIA Directive be assessed through the EIA process. The Planning Inspectorate's Advice Note 12 (April 2012) provides further information on the requirements, and sets out how the Planning Inspectorate will meet its obligations in this regard. A wide range of activities are listed in Annexe 1 of the Espoo Convention, which includes thermal power stations with a heat output of 300MW and all nuclear power stations. As such, it is necessary to consider whether the proposed development is likely to have a significant transboundary effect.

5.6.3 EDF Energy will consider whether there is any potential for significant effects on the environment in other European Economic Area (EEA) states by completion of a transboundary screening matrix (as detailed in the Planning Inspectorate Advice Note 12).

5.7 EIA assumptions and limitations

5.7.1 Assumptions specific to each topic specific assessment are detailed in the relevant sections of this report.

5.7.2 It is anticipated that the EIA would be subject to limitations, including:

- baseline conditions (in relation to the existing site) are specific to each technical aspect of the EIA and are considered to be accurate at the time of the physical surveys but, due to the dynamic nature of the environment, conditions may change during the different stages of the Sizewell C Project; and
- the assessment of cumulative impacts would be reliant on the availability of information relating to all of the identified cumulative schemes (whether submitted for planning, consented or under construction).

6. EIA – PROJECT-WIDE CONSIDERATIONS

6.1 Introduction

6.1.1 EDF Energy has undertaken a range of socio-economic and transport studies which have informed, and continue to inform, the development proposals and transport strategy. Given the way in which these studies have influenced the proposed development, and the strategic nature of these topics, it has been decided to address socio-economics and transport on a project-wide basis for the purposes of EIA Scoping.

6.2 Socio-economics

a) Introduction

6.2.1 This section details the approach to assessing socio-economic effects of the proposed development. The assessment will consider the potential employment, economic, population, accommodation and demographic effects at a project-wide scale, as the nature of both effects (for example, employment growth) and receptors (for example, the economy/labour market) for socio-economics are not limited to site-specific features.

b) Work undertaken to date

6.2.2 Work has been undertaken in developing an initial Gravity Model, workforce profile and worker distribution assumptions. Additionally, baseline studies have been undertaken which draw on extensive work on the socio-economic impacts of many of the UK's nuclear power stations, including an eight-year longitudinal study monitoring the socio-economic impacts of building Sizewell B, socio-economic studies for the proposed Hinkley Point C nuclear power station in the late 1980s, and studies on the decommissioning of Hinkley Point A. Studies of the local socio-economic impacts of the early years of the construction stage of the EDF EPR project at Flamanville 3 provide some current comparative experience (Impact Assessment Unit, Oxford Institute for Sustainable Development, Oxford Brookes University, 2011).

6.2.3 **Table 6.2.1** outlines the socio-economic technical work undertaken so far.

Table 6.2.1: Work undertaken to date

Study	Scope of Study
Research – construction and energy sectors in East of England	Research into average commuting profile and demographic factors of construction workforce in the UK, including major project effects and subsequent socio-economic effects encountered.
Study of labour market within Construction Daily Commuting Zone	Baseline studies into current economic activity, size and profile of existing labour market.
Stage 1 baseline and definition of approach / spatial effects in respect of:	Work to feed in to the establishment of datasets and assumptions to model the expected spatial distribution of the construction workforce.

Study	Scope of Study
a) Workforce Profile; b) Gravity Model; c) Accommodation.	Includes: a) Baseline study of accommodation supply and availability; b) Development of skills profile and workforce temporal requirements; c) Development of distribution assumptions and constraints.

c) Approach and methodology

i. Legislation, policy and guidance

6.2.4 There is no UK legislation that specifies the detailed content required for socio-economic assessments or provides appropriate standards and thresholds for significance of effects. However, there are a number of guidelines of relevance to socio-economic assessment in the context of an EIA. Additionally, the National Planning Policy Framework (NPPF), the Overarching NPS for Energy (EN-1) and Nuclear Power Generation (EN-6) include policy in relation to consideration of socio-economic effects.

ii. Study areas

6.2.5 The spatial extent of the study area will include the Main Development Site, all off-site associated development sites and the surrounding area as well as administrative geography defined by each socio-economic topic. The precise areas used will be partly influenced by data availability and in some cases also reflect the boundaries of relevant service planning areas, e.g. for school or health facilities. The spatial/geographic scope of the socio-economic baseline studies varies by impact category:

Administrative areas

6.2.6 In terms of socio-economic baseline data, the study area is based on areas of administrative geography including national (England and Wales), regional (East), County (Suffolk, Norfolk and Essex) and local authority/district (Suffolk Coastal, Waveney, Mid Suffolk, Ipswich). These will form the basis of the assessment of impacts on the local labour market (wider economic impacts), housing market and public services.

Construction workforce spatial distribution areas

6.2.7 Some analysis will be conducted on a ward-based approach, based on areas derived from the initial Gravity Model. This broadly includes inputs from the socio-economic assessments on the workforce profile, skills profile of the resident workforce, and accommodation location and availability. It then, based on travel times, allocates the workforce across the area.

- **60-minute travel time**: representing the estimated extent of daily travel to the construction site by non-home-based workers, by ward. A sub-set of ward clusters will likely be defined to identify impacts of non-home-based construction workers

on local population, employment dynamics and public services at a local scale (e.g. Leiston). This area will cover Suffolk Coastal and parts of Mid Suffolk, Waveney and Ipswich.

- **Construction Daily Commuting Zone (CDCZ)**: Primarily used to define the home-based labour market, based on research into the mobility of UK construction workers. This will be, for the majority of home-based workers, up to 90 minutes (with an allowance for a very small proportion of workers travelling longer distances). The CDCZ will therefore cover all of Suffolk, much of Norfolk and north Essex.

iii. Baseline information

6.2.8 Data on the local socio-economic baseline is derived mainly from published information from public sources, including the Office of National Statistics (ONS) (e.g. Census, Annual Business Inquiry, Annual Population Survey, sub-national population projections), Department for Communities and Local Government (DCLG) and other public bodies at the national, regional and local scales.

Population/Demography

6.2.9 The combined working-age (16-64) population of Suffolk Coastal, Waveney and Ipswich and Mid-Suffolk is 288,474 (Census, 2011), having increased by 10.7% since 2001. Latest sub-national population projections produced by ONS forecast a growth of around 16,300 working age people in this area from 2011-2021 (4.8% increase).

Employment and Labour Market

6.2.10 There are approximately 1.22 million working age people living in the indicative CDCZ[2], with an employment rate of 62%.

6.2.11 Based on latest economic forecasts, total employment across this area is projected to increase from 806,300 in 2011 to 878,100[3] in 2021. The size of the labour market is about 200,000 greater than when Sizewell B was built, and is broadly comparable to that at Hinkley Point C.

6.2.12 Approximately 2.6% (36,000) of the working age population living in this area is currently seeking work (job-seekers allowance (JSA) claimant count Jan 2014), of which more than a quarter (around 9,765) is looking for work in occupations relevant to the proposed development.

Accommodation

6.2.13 Initial research has started into the availability and affordability of accommodation within 60 minutes of the Main Development Site, drawing on a number of sources including publicly available datasets (Census 2011), information managed on behalf

[2] Based on a selection of Local Authorities (Babergh, Breckland, Broadland, Colchester, Great Yarmouth, Ipswich, Mid Suffolk, North Norfolk, Norwich, South Norfolk, St Edmondsbury, Suffolk Coastal, Tendring, Waveney) as indicated by Stage 1 Gravity Model outputs (to be refined).

[3] Figures show total employment (including employees and self-employed jobs). *2012 Economic Forecasts*, Oxford Economics, East of England Forecasting Model (EEFM)

of the East of England Tourist Board and telephone surveys of accommodation providers.

Table 6.2.2: Accommodation supply within Suffolk Coastal, Mid Suffolk, Waveney and Ipswich

Tourist accommodation	Suffolk Coastal	Mid Suffolk	Waveney	Ipswich	Total
Self-Catering Bed Spaces	2,200	400	1,400	0	**4,000**
Serviced Bed Spaces	1,300	800	1,200	1,000	**4,300**
Caravan, Holiday & Touring Park Bed Spaces	5,700	200	7,000	0	**12,900**
Sub Total	**9,200**	**1,400**	**9,600**	**1,000**	**21,200**
Private rented accommodation	**Suffolk Coastal**	**Mid Suffolk**	**Waveney**	**Ipswich**	**Total**
Bedrooms	20,000	13,100	19,200	27,000	**79,300**
Owner occupied accommodation	**Suffolk Coastal**	**Mid Suffolk**	**Waveney**	**Ipswich**	**Total**
3+ Bedroom Households	30,200	23,500	25,600	25,900	**105,200**
TOTAL SUPPLY	**59,400**	**38,000**	**54,000**	**53,900**	**205,700**

Source: Census ONS 2011, East of England Tourist Accommodation Database 2011 (Rounded)

iv. Planned further survey/studies

6.2.14 Baseline information for the socio-economic assessment will be updated as new public datasets from the 2011 Census and other sources are released, including travel-to-work data and 'moving groups' data, which will inform the mobility of the labour force and level of underlying year-on-year change in the population respectively. These will in turn help to define sensitivity thresholds for the various assessments of impact.

6.2.15 A number of studies/surveys and research streams are planned, or underway, which will define the central socio-economic case to be assessed, the existing baseline conditions of socio-economic receptors, and the spatial extent of impacts, which all form part of the socio-economic assessment of the proposed development. Work will be ongoing throughout the EIA process to identify potential impacts that arise as a result of this process and to develop a suite of implementation/management/enhancement strategies.

Table 6.2.3: Planned further work

Study	Scope of study
Further accommodation studies (private-rented, tourist and latent)	This includes a survey of tourist accommodation providers to understand the extent of un-rated tourist accommodation and other price, occupancy and location factors.
Gravity Model development	Refine Gravity Model based on feedback from Gravity Model Technical Group and new datasets.
Workforce profile development	Continue to develop our understanding of the workforce profile and skills requirements, in order to build a central case for the characteristics of the construction workforce at peak.

Study	Scope of study
Production of Technical Notes to outline the methodology, approach and in some cases set the baseline on a number of socio-economic work areas, as detailed below (to be appended to the socio-economic assessment):	
Accommodation datasets and assumptions	Defining and explaining the approach to data for accommodation sectors likely to be utilised by construction workers, feeding into the Gravity Model.
Workforce profile (project-wide and associated developments)	Description of the approach taken to estimating the skills profile, quantum and other factors of the construction workforce throughout the construction phase of the proposed development.
Spatial distribution of the workforce	Summarising the outputs of the Gravity Model; identifying the predicted temporary residential location of non-home-based workers by ward, in order to assess socio-economic impacts.
Demographic benchmarks	Identifying localised construction workforce effects on existing population, bringing together policy, research and data analysis for demographic change.
Sport and leisure audit and estimated demand	Identifying, by sub-area, the current provision of sport and leisure facilities and estimating the potential effect of the distributed construction workforce on their capacity/operation.
Work to identify an approach to address social and community issues through a number of socio-economic strategies. These strategies may be appended to the socio-economic assessment or be 'stand-alone' documents, outlining how elements of the proposed development will be implemented, managed and/or enhanced, as detailed below:	
Accommodation Strategy	Including an Accommodation Management Strategy, to identify the overall approach to managing the effects on accommodation and EDF Energy's approach.
Economic Strategy	Including an assessment of wider economic impacts, supply chain and local procurement strategies in consultation with the District and County Councils to identify and enhance the economic legacy. These will be led through consultation as suggested by the Joint Councils in their response to Stage 1 consultation.
Leisure and Tourism Strategy	In consultation with relevant authorities, identifying the approach to managing the effects of the proposed development on leisure and tourism.
Skills and Training Strategy	Including consultation with relevant stakeholders including the District and County Councils, and specifically the development of education and workforce strategies and interventions to maximise the opportunities for local residents and mitigate any disbenefits.

v. Assessment methodology

6.2.16 The assessment of socio-economic impacts and effects are determined by the nature of the development, the locality (baseline), and national and local policy. The socio-economic impact assessment will include a full assessment of policy including NPS (for example, EN-1 outlines details of the assessment process for socio-economic

impacts) and other relevant national policy, and local policy as identified when undertaking the assessment, including local authority planning and regeneration strategies, housing and development policies and community strategies.

6.2.17 Potential socio-economic effects will be assessed for both the construction and operational phase. Effects during the construction phase are temporary, but likely to be greater due to the workforce requirements. Therefore the assessment will primarily focus on the impacts at peak construction (the phase of the workforce profile when approximately 5,600 construction workers will be employed at the proposed development, for a period of approximately two years). The assessment of effects at peak construction will be based on a 'central case' of assumptions, such as the assumed project timescale, peak workforce, skill profile, construction workforce demography, commuting patterns, and accommodation sector and spatial distribution breakdown of works, which will be informed by further engagement with public authorities. Operational phase effects will be smaller, but longer term.

6.2.18 A key tool for assessing the spatial scale of impacts is the development of a Gravity Model. This is being developed in consultation with Suffolk County Council (SCC), Suffolk Coastal District Council (SCDC) and Waveney District Council (WDC) to estimate the likely distribution of home-based and non-home-based construction workers at the peak of the construction phase. This is based on a number of factors, drawing on the workforce profile and including accommodation supply and availability, assumptions on travel time, split of home-based/non-home-based workforce, accommodation campus for non-home-based workers and likely split between accommodation sectors.

6.2.19 The Gravity Model will help to estimate the residential location of construction workers and, therefore, the level of impact on receptors such as accommodation markets, demography and public services.

6.2.20 Overall, an adaptive assessment process is required, using a 'plan-monitor–management' approach to reflect the dynamic nature of this environment and effects on socio-economic receptors.

Sensitivity

6.2.21 The main sensitive receptors for the socio-economic assessment are the housing and labour markets, public services and communities at a number of spatial levels. It is not possible to ascribe a relative 'value' to each of these receptors as impacts could be felt at all spatial scales and are as important to individuals and communities in a local area as they are at the regional scale.

6.2.22 There will therefore be a focus on the "sensitivity" of each receptor and, in particular, on their ability to respond to change based on recent rates of change and turnover. The socio-economic environment is a dynamic and adaptive one with constant background change and turnover, for example people moving into and out of the area and changing jobs. This is a particular feature of the construction sector.

6.2.23 The baseline assessment will identify the extent of this background change and then, where possible, the scale of likely impacts will be benchmarked against this change.

6.2.24 The quantitative significance criteria will be dependent on the receptor and the baseline conditions. For example, the impact of a percentage change in population will be dependent on the current capacity of the housing market, or of local schools/other community provision to respond to these. This capacity is dependent on wider economic and demographic trends which can vary between location and over time. The socio-economic work stream – which will include public service providers and other partners – will consider such information as it is produced and the final significance criteria will be informed by this.

6.2.25 Labour market and housing receptors are dynamic, and sensitivity is based on ability to respond to change (based on recent average change/turnover). The baseline will reflect the 'background change' and benchmark the scale of likely impacts against this.

Magnitude and Significance

6.2.26 For the socio-economic assessment, the significance will be a product of the magnitude of change caused by the project impact (for example, the peak construction workforce) and the ability of the receptor to withstand/respond to change (for example, set against the level of pre-existing construction employment and turnover in the sector). These will be considered in terms of whether they are permanent or temporary, adverse or beneficial, and cumulative.

6.2.27 Following the classification of an effect using this methodology, a clear statement will then be made as to whether that effect would be 'significant' or 'not significant'. As a general rule, major and moderate effects are considered to be significant, whilst minor and negligible effects are considered to be not significant. However, professional judgement can also be applied where necessary, including taking account of whether the effect is permanent or temporary. For example, a significant (major or moderate) effect would be likely to be: of major or moderate magnitude, affect a wide area, be permanent or irreversible, and difficult to absorb in the relevant area.

6.2.28 Some impacts cannot be quantitatively assessed; in such cases a qualitative assessment will be used. In addition, the magnitude of the impact will not necessarily correlate with the scale of effect, with other key influences taken into account such as the geographical extent, duration and reversibility, capacity of receptor to absorb change, and recent rates of change.

vi. Assumptions and limitations

6.2.29 The proposed development is likely to have complex impacts; therefore, a detailed set of assumptions will be produced to support the 'central case' of this assessment.

6.2.30 The 'central case' approach is based on the effects at peak construction. This will enable it to demonstrate the maximum scale of beneficial impacts and ensure mitigation measures meet the worst case for adverse impacts.

6.2.31 As with any data, the data used in this assessment represent a single point in time and can change due to wider changes in economic conditions and demographic trends. As far as possible the assessment will aim to reflect the dynamic nature of this environment by using future projections and identifying sensitivities to change.

Workforce Profile, skills and accommodation

6.2.32 EDF Energy is developing an indicative workforce profile to outline the number of construction workers expected to be working on the Sizewell C Project, by skill set, over the construction phase. This will then be used to inform the anticipated numbers of home-based and non-home-based workers. At peak construction, the total number of workers required on-site is estimated to be around 5,600, with a total of 5,000 required for almost two years.

6.2.33 This model is based on EDF Energy's experience of building new nuclear reactors elsewhere, including Flamanville, and some initial knowledge of construction activities at Hinkley Point C.

6.2.34 Assumptions on the split of home-based and non-home-based construction workers throughout the construction phase will be based on the workforce profile and Census 2011 data on skill sets of the population of the CDCZ.

d) Potential impacts and effects

i. Construction

6.2.35 The assessment of likely significant effects during the construction phase will refer to likely changes from the baseline conditions and the effects of those changes as a result of the proposed development. Many of the potential effects will be positive, such as the creation of direct and indirect employment, spending and wider economic effects. The assessment will consider the potential impacts identified in **Table 6.2.4**.

Table 6.2.4: Potential socio-economic impacts

Population/Demography	Impact
Demographic change	Change in size and structure of the local population throughout the construction phase.
Economy	**Impact**
Employment	Direct and indirect job creation.
Regional and local economy and labour markets	Increased expenditure, income and demand for labour, including changing levels of labour market capacity and skill levels.
Businesses and supply chains	Increased demand for and transportation of goods and services, such as increased business growth, competition for workers, road congestion during the construction phase and potential changes in the perception of Suffolk.
Tourist economy	Changing levels of access to tourist destinations, workers accessing tourist accommodation and issues related to changes in the perception of Suffolk.
Wider economic effect	Potential effects on key economic sectors (construction, tourism and agriculture), and on the development potential and image of the area.
Accommodation	**Impact**
Tourist sector	Increased demand for tourist accommodation, not only during peak

Population/Demography	Impact
	tourist season but also through full year.
Private rented sector	Workers accessing private rented accommodation, and subsequent potential issues related to local housing provision, homelessness and affordability.
Owner occupied sector	Workers accessing owner occupied accommodation.
Latent accommodation	Uptake of currently un-rated tourist or other accommodation (e.g. rooms in private homes).
Public Services and Community Resources	**Impact**
Education and training	School capacity and integration arising from workers' children requiring places; and investment in skills and training.
Leisure	Workers using existing leisure facilities and demand for facilities.
Emergency services/planning	Capacity and operation of emergency services including the police, fire and NHS during the construction phase, on-site and in areas where construction workers live.
Health and wellbeing	Workers accessing healthcare services and any issues relating to the physical and mental wellbeing of workers and residents.
Community cohesion	Community integration and equity of access to information and services, housing issues and cultural issues.

ii. Operation

6.2.36 The assessment of operational impacts and effects will be predominantly based on assumptions of permanent operational employees and temporary staff during outages.

6.2.37 Impacts on the labour market will relate to the extent of local recruitment and the type of jobs (higher value added) created within the study area. Wider labour market effects will also be assessed, including local indirect employment (through earnings), re-structuring of the labour profile and skills base, and business development and supply chain effects.

6.2.38 Impacts on accommodation provision will relate to the extent to which permanent staff use accommodation in the local area, where and in what sector.

e) Potential mitigation

6.2.39 In parallel with the socio-economic assessment, EDF Energy will work with local authorities and other public agencies to identify and plan for activities to mitigate any significant adverse effects and enhance beneficial effects.

6.2.40 Some of these actions are regarded as basic good management practice and, as such, will be included as part of the "central case" against which impacts will be assessed (for example employment and training activities to secure local recruitment, and a worker code of conduct to help govern worker behaviour).

6.2.41 If, after undertaking these activities, significant adverse effects are still assessed as likely, further mitigation measures will be identified.

6.2.42 Establishing a monitoring system to enable effects to be managed to avoid exceeding acceptable limits, or setting in place thresholds after which additional mitigation measures would be triggered, will be an important element in the adaptive and precautionary approach to assessment for the Sizewell C Project, where there are uncertainties.

6.2.43 It is anticipated that a suite of additional documents will be produced and appended to the socio-economic assessment, which will include implementation of strategies related to accommodation, community safety and economic, education, skills and supply chain management. These will provide details of the approach to managing effects on specific sub-topics.

6.2.44 Where likely significant effects are identified but specific strategies not required, EDF Energy will identify additional required mitigation measures, likely to be controlled through the use of Requirements or development consent obligations (pursuant to a legal agreement).

f) Approach to cumulative assessment

i. Inter-relationships

6.2.45 Impacts are likely to arise from a number of other environmental topics, which will potentially have significant socio-economic effects. Such topics include noise and vibration, transport, amenity and recreation, air quality and landscape and visual.

ii. Cumulative effects

6.2.46 The cumulative assessment for socio-economic effects will take a different approach to other topics in that it will utilise broader “macro” projections of cumulative influences relevant to particular potential impacts (e.g. impact on local and regional labour market), rather than focusing on potential cumulative impacts of specific developments on individual receptors. These fall into a number of categories, including:

- labour market; and
- housing growth, population change and impact on services.

6.3 Transport

a) Introduction

6.3.1 During the construction of the proposed development there would be significant movement of freight and people to support the construction programme. It is currently estimated that the construction workforce would peak at around 5,600 people and very large volumes of bulk and other construction materials would require transportation to and from the construction sites.

6.3.2 The construction of the proposed development therefore has the potential to give rise to significant transport and transport-related effects, both in terms of traffic on the local road network (increased levels of congestion, journey time, accidents etc) and traffic-related environmental effects, including severance, pedestrian delay and amenity, noise and air quality. While traffic movements during the operation of the proposed development would be substantially lower than during construction, there is potential for transport effects during the operational phase as well.

6.3.3 EDF Energy will therefore prepare a Transport Assessment (TA) as part of the application for development consent, covering both the construction and operational phases. See **Section 2.3** for details.

6.3.4 This section summarises the process and methodology which are being followed to make detailed estimates of the traffic impacts of the Sizewell C Project, as well as setting out in broad terms the proposed assessment methodology and criteria which will be applied in relation to the traffic-related impacts of severance, pedestrian delay, pedestrian amenity, driver delay, and accidents and safety.

6.3.5 Traffic-related impacts in terms of noise and air quality are addressed within the noise and vibration and air quality sections of this Scoping Report. Potential environmental impacts associated with transport-related off-site associated development (e.g. park and ride and rail developments) are also considered in relevant sections of this Scoping Report.

b) Work undertaken to date

6.3.6 EDF Energy is in the process of developing comprehensive traffic modelling of the impact of the construction and operation of Sizewell C. This will support the preparation of the TA and will be used to consider the traffic impacts of Sizewell C, as well as providing input traffic data to be used in the assessment of transport-related environmental effects.

6.3.7 SCC is the highway authority for the road network in the vicinity of Sizewell and discussions with SCC around the modelling approach to be adopted have been ongoing since 2012. The traffic model being developed is a VISUM model. VISUM is one of a number of industry standard software packages used for strategic traffic modelling and is widely used for the purposes of transport assessment and for identifying locations of potential impact which may require more detailed scrutiny using other modelling or assessment approaches.

6.3.8 The VISUM modelling will be compliant with WebTAG and the Design Manual for Roads and Bridges (DMRB) and will provide outputs that can be used in the TA, as well as in the associated air quality and noise assessments as part of the EIA, and to

identify locations which may require more detailed assessment. VISUM also provides a direct means of easily developing a more detailed micro-simulation model of particular areas of the highway network should this prove to be necessary.

6.3.9 The traffic modelling and associated TA of a project of the scale of Sizewell C is by necessity an iterative process. The modelling is progressively updated to reflect the latest project information and proposals as well as additional relevant information or data sources. Further information on the work conducted to date is set out in the following sections.

c) Approach and methodology

6.3.10 The overall process of developing a traffic model of a major development begins with the preparation of a "base model" which aims to reflect the existing conditions on the local road network in question. A process of calibration and validation is undertaken so that the model correlates with the observed existing baseline traffic conditions within the study area.

6.3.11 In the second stage of the process estimates of future traffic growth and assumptions on traffic generated by "committed developments" (major developments with planning permission but not yet built) are added to the model, along with any known transport improvements that are anticipated to be in place by the time of the development in question. The purpose of this stage in the process is to estimate the future baseline conditions on the road network that would apply in the absence of the development (in this case Sizewell C). This model of the future baseline conditions is generally known as the "reference case" model.

6.3.12 In the third stage of the process estimates of traffic generated by the development are added to the reference case model. This "with-development" model can then be used to examine the likely future traffic conditions which would apply if the proposed development were to proceed, as well as allowing comparison with the "reference case" model to establish the impacts that arise from the development itself rather than other factors.

6.3.13 In the case of Sizewell C, in order to ensure that both construction phase and operational phase traffic impacts are considered, reference case and with-development models will be developed both for the peak period of the construction phase of Sizewell C and for a post-construction operational year.

i. Study area

6.3.14 The study area and modelled network for the VISUM model extends to Lowestoft to the north, Ipswich to the south and the A140 to the west. The geographic extent of the model has been agreed with SCC and is shown in **Figure 6.3.1**.

ii. Baseline information

6.3.15 The existing road network in Suffolk is shown in **Figure 6.3.2**.

6.3.16 A wide range of manual classified and automatic traffic counts on the local road network were commissioned by EDF Energy and conducted in May and June 2011. The locations of these traffic counts were published at Stage 1 consultation in the

appendix to the '*Transport Strategy and Supporting Information'* document. These traffic counts were used to help develop an initial VISUM model of the study area.

6.3.17 Since Stage 1 consultation a range of further enhancements to the base model have been discussed and agreed with SCC. These include:

- the incorporation of further data from additional traffic counts conducted in autumn 2012;
- the incorporation of additional data from the existing East of England Regional Model (EERM), population data from the 2011 census and from schools information held by SCC; and
- a range of other detailed adjustments to the network model.

6.3.18 The process of updating the base model to incorporate these changes for a wide set of modelled hours is currently ongoing.

6.3.19 With respect to the seasonality of the local road network, EDF Energy has obtained baseline data from SCC and the Highways Agency (HA) with respect to traffic flows on the A12 and the A14 in August 2011 and 2012. This will be used to consider, outside of the VISUM model, the extent of any seasonal traffic impacts arising from the proposed development.

6.3.20 EDF Energy is also working with SCC to establish the "reference case" assumptions which will be applied to the base modelling to reflect likely future baseline network conditions.

iii. Planned further survey/studies

6.3.21 It is anticipated that the current programme of work will entirely, or very largely complete the steps necessary to develop a robust and comprehensive modelling position in terms of the base and reference case models. A limited number of further traffic count surveys are planned for later in 2014 to establish whether there has been any material change in network conditions since the surveys conducted in 2011 and 2012, and this may lead to some amendment to the base models in due course.

iv. Assessment methodology

6.3.22 A wide range of project-related inputs will be used to generate estimates of Sizewell C-related traffic during construction and operation. This will include estimates of all workforce- and freight-related trips. Workforce trips will include car trips and, during construction, park and ride and direct bus trips and leisure trips relating to the non-home-based workforce. These trips will be spread across the day in accordance with anticipated shift patterns. Freight-related trips will include all heavy goods vehicle (HGV) and other goods vehicle (OGV) movements. These will be incorporated into the Sizewell C VISUM traffic model and the outputs from the model will be used to both assess the traffic impacts of Sizewell C and to provide data to inform assessment of the traffic-related environmental impacts of the project.

6.3.23 With respect to the traffic impacts (i.e. traffic flow and congestion-related impacts) these will be assessed against a range of criteria which will include:

- link flow differences (i.e. the change in the absolute additional number of vehicles and the percentage increase on any given stretch of road);
- impacts on journey times;
- "Ratio of Flow to Capacity" on links; and
- junction "Level of Service".

6.3.24 Ratio of Flow to Capacity and Junction Level of Service are industry standard means of assessing the impact of additional traffic on the capacity of the road network and the operation of junctions. Assessment criteria in this area would be informed by relevant guidance in the Design Manual for Roads and Bridges (DMRB) and wider professional judgement.

6.3.25 With respect to traffic-related environmental impacts a range of approaches will be adopted. Output from the traffic modelling work, including estimates of 24 hour and 18 hour increases in traffic will be provided to noise and air quality experts for assessment of traffic related noise and air quality impacts. See **Section 7.7** and **Section 7.8** for details. With respect to the assessment of transport-related effects of severance, pedestrian amenity, accidents and safety, reference will be had to the Institute of Environmental Management and Assessment (IEMA) '*Guidelines for the Environmental Assessment of Road Traffic*' (1993) as well as relevant sections of DMRB (in particular Volume 11 on Environmental Assessment). These guidelines are widely used in this area and, while they leave room for the professional judgement of the assessor, represent the closest that exists to an industry standard basis for assessment.

6.3.26 The following paragraphs provide further information on how the IEMA and DMRB guidelines will be applied to the assessment in these areas. Within the IEMA guidance, two broad rules are suggested which can be used as a screening process to limit the scale and extent of the assessment:

- Rule 1: include highway links where traffic flows will increase by more than 30% (or the number of heavy goods vehicles will increase by more than 30%).
- Rule 2: include any other specifically sensitive areas where traffic flows have increased by 10% or more.

6.3.27 Where the predicted increase in traffic flows is lower than the above thresholds, the IEMA guidelines suggest the significance of the effects can be stated to be negligible and further detailed assessments are not warranted. Increases in traffic flows below 10% are generally considered to be not significant in environmental terms given that daily variations in background traffic flow may vary by this amount. It should be stressed that these broad rules remain subject to professional judgement and are specifically relevant to the assessment of the traffic-related environmental effects considered in this section. Smaller traffic changes than those set out above may, in some circumstances, be relevant in the consideration of congestion or congestion-related effects.

Sensitivity of receptors

6.3.28 The sensitivity of a road can be defined by the vulnerability of the user groups who may use it, e.g. elderly people or children. A sensitive area may be where pedestrian activity may be high, for example in the vicinity of a school or where there is already

an existing accident issue. It should be noted that the sensitivity of the receptor is judged on the sensitivity of road users (primarily pedestrians). It also takes account of the existing nature of the road, e.g. an existing "A" road is likely to have a lower sensitivity than a minor residential road. **Table 6.3.1** provides a summary of the types of receptors and the sensitivity of each, defined as major, moderate, minor or negligible.

Table 6.3.1: Sensitivity of receptors

Receptor type	Receptor sensitivity
Receptors of greatest sensitivity to traffic flow: schools, colleges, playgrounds, accident clusters, retirement homes, roads without footways that are used by pedestrians.	Major
Traffic flow sensitive receptors: congested junctions, doctors' surgeries, hospitals, shopping areas with roadside frontage, roads with narrow footways, recreation facilities.	Moderate
Receptors with some sensitivity to traffic flow: places of worship, public open space, tourist attractions and residential areas with adequate footway provision.	Minor
Receptors with low sensitivity to traffic flows and those sufficiently distant from affected roads and junctions.	Negligible

6.3.29 A desktop exercise augmented by a number of site visits will be undertaken to identify the sensitive receptors in the study area. All significant or relevant road links within the study area will be assessed and assigned sensitivity. Recognising the quantity of road links within the study area, for ease of review the assessment narratives will focus on the road links that will lead to highest impact.

Magnitude of impact

6.3.30 To assist with the judgement of magnitude of impact, reference will also be made to the IEMA and DMRB guidelines, as well as to professional judgement. These guidelines set out considerations and, in some cases, thresholds, in respect to changes in the volume and composition of traffic to facilitate a subjective judgement of traffic impact and significance. These thresholds are guidance only and provide a starting point via which analysis will inform an overall assessment of the impact magnitude.

Types of impact

6.3.31 The following paragraphs cover each of the impacts that are considered in this section.

Severance

6.3.32 The measurement and prediction of severance is difficult, but relevant factors include road width, traffic flow, speed, the presence of crossing facilities and the number of movements across the affected route.

6.3.33 IEMA guidelines suggests that changes in traffic flow of 30%, 60% and 90% would be likely to produce 'slight', 'moderate' and 'substantial' changes in severance,

respectively. It is advised that these broad indicators should be used with care and regard paid to specific local conditions. DMRB guidance suggests that in reaching a judgement on severance effects reference should also be paid to the number of affected people; the presence of particularly vulnerable groups, such as children, the aged or the disabled; any peak hour impacts; the type of road involved and the provision or otherwise of mitigation.

Pedestrian delay

6.3.34 The guidelines do not set any thresholds, recommending instead that assessors use their judgement to determine the significance of the effect.

6.3.35 The IEMA guidelines refer to a report published by the Transport Research Laboratory (TRL SR356, Goldschmidt, 1976) as providing a useful approximation for determining pedestrian delay. The TRL research concluded that mean pedestrian delay was found to be eight seconds at flows of 1,000 vehicles per hour, and below 20 seconds at 2,000 vehicles per hour, for various types of crossing condition. This research has been reproduced in DMRB Volume 11, Section 3, Part 8. Figure 1 of Part 8 provides predictive mean pedestrian delay based on empirical data taking into account traffic flow and a range of parameters such as crossing width and vehicle speeds.

6.3.36 A two-way flow of 1,400 vehicles per hour will be adopted as a lower threshold for assessment (equating to a mean 10 second delay for a link with no pedestrian facilities in the TRL report). Below this flow pedestrian delay is unlikely to be a significant factor. This is deemed a robust starting point for narrowing down the modelled routes within the study area which may be subject to pedestrian delay so that the routes selected exceed the suggested threshold of analysis in DMRB Volume 11. It should be noted that for controlled forms of pedestrian crossing the pedestrian delays are less.

Pedestrian amenity

6.3.37 The IEMA guidelines suggest tentative thresholds of significance would be where the traffic flow is halved or doubled.

Driver delay

6.3.38 A comparison of journey times on key routes in the VISUM model will be undertaken to establish the increase in driver delay as a result of the Sizewell C Project. These will be reported in the Transport Assessment, which is submitted as part of the DCO application for Sizewell C, and professional judgement will be used to assess the significance of these changes.

Accidents and safety

6.3.39 An assessment of the impact of Sizewell C on accidents and safety will form part of the Transport Assessment for the Sizewell C Project. This will take account of a number of considerations, including existing accident and safety conditions and trends, the extent to which the proposed development will exacerbate or mitigate existing issues or create new issues, and any other relevant specific local circumstances and characteristics of the affected area of the road network.

6.3.40 **Table 6.3.2** summarises the criteria that will be used to determine magnitude of impacts- these are based on the guidelines described above. However, the absolute level of an impact is also important, e.g. the total flow of traffic or HGVs on a link. Comment will be made on this in the analysis.

Table 6.3.2: Magnitude of impact criteria

Impact	Magnitude of impact			
	Negligible	Minor	Moderate	Substantial
Severance	Change in total traffic or HGV flows of less than 30%.	Change in total traffic or HGV flows of 30-60%.	Change in total traffic or HGV flows of 60-90%.	Change in total traffic or HGV flows over 90%.
Pedestrian delay	Two way traffic flow < 1,400 vehicles per hour.	A professional judgement based on the road links with two way traffic flow exceeding 1,400 vehicles per hour in context of the individual characteristics.		
Pedestrian amenity	Change in total traffic or HGV flows < 100%.	A professional judgement based on the routes with >100% change in context of their individual characteristics.		
Driver delay	A professional judgement based on the VISUM journey time assessment.			
Accidents and safety	A professional judgement based on the findings of the analysis of the accident and road safety impact of the Sizewell C Project.			

Significance of effects

6.3.41 The significance of the effect is judged on the relationship of the magnitude of impact to the assessed sensitivity and/or importance of the receptor. The approach to the predicted significance of the environmental effects is identified in **Section 5**.

Construction

6.3.42 Sizewell C is unusual in that the greater traffic impact would occur during the construction phase. This is because of the substantial peak workforce required for construction and the large volumes of freight and materials that would require movement during the construction phase.

6.3.43 The TA, as well as the assessment of associated traffic-related environmental effects, will focus particularly on the construction phase. Traffic modelling will consider the peak period of the construction phase both in terms of workforce and freight, taking account of any mitigation measures that are anticipated to be in place by this time. This will ensure that the assessment is robust and considers the period in which construction traffic impacts will be at their highest – at many points in the construction programme traffic will be considerably lower than that which will be assessed. A “gravity model” will be used to estimate the geographic distribution (residential location) of the construction workforce at peak construction and estimates of HGV and OGV movements will be made, taking account of material quantity estimates and assessment of the scope for using non-road-based options for the transport of bulk and other construction materials.

6.3.44 EDF Energy has been discussing the hours on the local road network that will be modelled with SCC and it is currently anticipated that these will cover three hours in the morning period (6am – 9am) and four hours in the afternoon/evening period (3pm – 7pm). These hours have been agreed with SCC based on an assessment of existing network peaks, along with those hours anticipated to contain the largest volumes of development traffic, taking account of the proposed shift patterns.

6.3.45 As set out in earlier sections, the assessment will compare the traffic impacts of Sizewell C with the reference case – i.e. those future baseline conditions predicted in the absence of the development. Reference case traffic modelling for the peak construction phase will be developed taking account of any major known developments in the pipeline with planning permission (committed development) as well as standard assumptions on underlying traffic growth.

6.3.46 The assessment will also consider the seasonality of the local road network and the potential impact of seasonal effects alongside the construction of Sizewell C. Additionally, it will take account of the temporary nature of the construction phase, albeit recognising that the construction phase is substantially longer than for most construction projects, but that traffic generated will vary through the construction phase. If it proves necessary to inform the assessment, other periods of the construction phase could be examined.

Operation

6.3.47 An assessment of the long-term traffic impacts of Sizewell C during the operational phase will also be undertaken. This is anticipated to show substantially reduced impacts due to the much-reduced workforce compared to the peak period of the construction phase (900 operational workers compared to 5,600 peak workforce) and the greatly reduced requirement for materials movements to and from the site.

6.3.48 As with the construction phase this assessment will be made against a reference case assessment of predicted traffic conditions without Sizewell C. Estimates of the residential location of the operational workforce will be made based on existing location patterns for the currently operational Sizewell B power station. The hours to be modelled for the operational phase assessment will be subject to further discussion with SCC, linked to consideration of the likely shift patterns for operational workers and any existing network peaks. At this stage it is envisaged that the modelled hours will be more limited and may be restricted to a single hour in the am and pm peak.

v. Assumptions and limitations

6.3.49 As with any traffic modelling exercise of this kind, the analysis and assessment process relies on a very wide range of input data, including those relating to the existing condition of the road network, the extent of future traffic growth and the scale of traffic generated by the proposed development.

6.3.50 Inevitably these input assumptions and data sources are subject to a range of uncertainties which cannot be entirely eliminated. The overall approach, therefore, will be to utilise a range of robust assumptions. These include the following:

- selection of the busiest existing times of day/week on the road network for use within the base modelling;
- reference case assumptions which use Department for Transport WebTAG guidelines on traffic growth (these assumptions assume steady continued growth in road traffic-related to population and economic growth (recent history has indicated relatively stable trends in traffic volumes in the Suffolk area) as well as assuming that major developments with planning permission in the area are built out); and
- robust estimates of construction-related traffic, considering the peak period of construction both in terms of workforce and freight.

6.3.51 The combined effect of the use of a wide range of robust inputs means that the assessment of traffic impacts, and in particular construction phase impacts, should be robust. In all likelihood, many periods of the construction phase would experience significantly lower traffic impacts than those which have been assessed.

d) Potential impacts and effects

i. Construction

6.3.52 During the construction phase there will be substantial volumes of additional traffic relating to both the movement of freight and the construction workforce.

6.3.53 Detailed estimates of the scale of additional traffic are subject to ongoing traffic modelling work and wider project development, and initial estimates for all materially affected local roads are expected to be published alongside the next stage of public consultation. These estimates will be further refined as appropriate in line with wider project development with the latest estimates included within the Transport Assessment and used to inform supporting assessment of traffic-related environmental effects as set out in this and related sections of this Scoping Report.

6.3.54 Based on the work conducted to date and the proposals published at Stage 1 consultation, the potentially most significant traffic impacts during the construction phase would be predicted to occur on the A12 en route to Sizewell (between Ipswich to the south and Lowestoft to the north) and on the B1122, which was proposed at Stage 1 consultation as the main access road to the construction site from the A12. Other local roads in the vicinity of the construction site are also likely to experience some increases in car traffic but should be very largely protected from increases in HGV or bus traffic by EDF Energy's transport strategy proposals for the construction phase.

ii. Operation

6.3.55 During the operational phase increases in traffic associated with Sizewell C are anticipated to be substantially lower than those arising from the construction phase, due to the much-reduced operational workforce (900) compared with peak construction (5,600), as well as very substantially lower requirements for goods/freight deliveries. Typical weekday traffic impacts during operation will be assessed and included within the TA.

6.3.56 Traffic impacts during the operational phase will be somewhat greater during temporary outage periods. These are used to conduct plant maintenance and reactor

refuelling, and will occur approximately every 18 months for each reactor, lasting for between one and three months, with a peak additional workforce for an outage of around 1,000 workers.

e) Potential mitigation

6.3.57 EDF Energy's Stage 1 consultation proposed a range of measures for reducing and managing the traffic impacts of the construction phase on the local road network. These measures can be considered as embedded mitigation for traffic impacts and form an important part of the overall Sizewell C Project proposals.

6.3.58 With respect to the movement of freight the main measures proposed include:

- a temporary jetty to facilitate the sea delivery of bulk materials and AILs and potential export of excavated materials;
- investment in rail infrastructure to extend the Saxmundham-Leiston branch line into the construction site on a temporary basis, or to provide a new enlarged rail-head north of King George's Avenue in Leiston. These measures would facilitate the delivery by rail of bulk materials and containerised goods;
- support to Network Rail to deliver a new passing loop on the East Suffolk Line near Wickham Market station – this will facilitate the provision of additional train paths allowing the capacity for up to around five freight trains per day to deliver goods to the Sizewell construction site;
- ongoing consideration of the scope to use materials sourced within the construction area as engineering fill material within the Main Development Site – reducing the requirement to import bulk materials/aggregates; and
- HGV movements to the construction site to be limited to approved routes.

6.3.59 With respect to the movement of the construction workforce the main mitigation measures proposed include:

- an on-site accommodation campus to substantially reduce the volume of construction workers requiring movement to and from the site on a daily basis;
- two park and ride developments located adjacent to the A12, one to intercept trips on the A12 from the south and one to intercept trips on the A12 from the north. These developments, the size of which would be informed by the output from the Gravity Model, would significantly reduce the amount of peak construction worker-related traffic on local roads and through local villages;
- direct bus services operating on designated routes from Ipswich and Lowestoft – the two largest population centres nearest to the construction site; and
- rail pick-up services from Darsham and Saxmundham stations.

6.3.60 These measures, which are focussed on reducing the additional traffic demand generated by the construction phase, are in line with relevant planning policy guidance and in particular Section 5 of the NPS for Energy (NPS EN-1) which states:

> *"where mitigation is needed, possible demand management measures must be considered and if feasible and operationally reasonable, required,*

*before considering requirements for the provision of new inland transport infrastructure to deal with remaining transport impacts" (*paragraph 5.1.38).

6.3.61 EDF Energy has also given preliminary consideration to the residual traffic effects of the construction phase of Sizewell C, taking account of the proposed embedded mitigation measures. Stage 1 consultation contained a number of proposals in this area, including potential improvements to the junction of the A12 with the B1122 and a number of options for addressing the narrow bend at the village of Farnham on the A12, including a bypass of Farnham and the option of property demolition to widen the bend.

6.3.62 As work on the TA and traffic modelling progresses, EDF Energy will continue to give further detailed consideration to the residual traffic effects of the construction phase and may bring forward additional or different mitigation measures as is considered appropriate in light of the ongoing findings of the assessment work. The requirement for mitigation measures will be linked to the impact assessment findings and will be informed by all relevant factors including the nature, scale and estimated length of the predicted significant effects.

6.3.63 EDF Energy will also prepare a number of transport management plans which will set out a range of further practical and working level measures aimed at managing and mitigating the significant traffic effects of the proposed development. These plans will cover issues such as:

- construction traffic management, HGV routing, monitoring of HGV movements and compliance with any project-wide HGV controls;
- traffic management during incidents and accidents affecting access to and from the construction site or the local highway network; and
- workforce travel planning issues during both the construction and operational phases – including measures to facilitate non-car forms of transport and car sharing.

6.3.64 Of the mitigation measures set out above, the jetty, rail infrastructure proposals, accommodation campus, park and ride developments and any bypass of Farnham would all represent developments in their own right. The environmental effects of these developments will also be considered.

f) Approach to cumulative assessment

i. Inter-relationships

6.3.65 This section has discussed how traffic impacts will be considered and how estimates of the traffic increases arising from Sizewell C will be used to inform certain traffic-related environmental effects. It has also noted how traffic modelling will be used to generate data used to assess traffic-related environmental impacts of noise and air quality – the assessment approach in these areas is discussed in **Section 7.7** and **Section 7.8** respectively.

6.3.66 It is recognised that during the construction phase of Sizewell C there is the potential for traffic and traffic-related environmental impacts to be combined with wider environmental and community impacts arising from the construction programme. This is particularly the case for those communities living close to the construction site

or adjacent to any proposed associated developments. These in-combination effects will be considered where appropriate within community-wide assessments of the impacts of Sizewell C – see **Section 2.3** for how this will be addressed in the EIA.

ii. Cumulative effects

6.3.67 There is clearly potential for the traffic impacts of Sizewell C to have a cumulative effect alongside wider traffic growth and traffic arising from other large scale developments. This issue is directly addressed within the development of the reference case traffic modelling, which takes account of both traffic growth arising from general economic development and specific traffic increases arising from any relevant large scale committed development (projects with planning permission but not yet built).

6.3.68 This approach ensures that the traffic impacts of Sizewell C are considered in the context of the potential for wider local and regional traffic growth as well as other known, relevant major developments with planning permission. It should be noted in this context that major developments that are at an earlier stage of development, and do not have planning permission, would not normally be included within the reference case modelling. This is in line with established guidance and reflects the consideration that the sponsors of these developments would be expected to independently assess and mitigate for the traffic impacts of their projects.

7. EIA – MAIN DEVELOPMENT SITE

7.1 Introduction

7.1.1 This section presents the baseline, approach to the assessment and potential environmental issues for all environmental topics that will be considered for the Sizewell C Main Development Site. The off-site associated developments are considered in **Section 8**.

7.2 Terrestrial ecology and ornithology

a) Introduction

7.2.1 This section sets out the proposed scope and methodology for the terrestrial ecology and ornithology assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.2.2 Environmental baseline information relevant to terrestrial ecology and ornithology has been gathered through a comprehensive suite of desk-based studies and field surveys beginning in 2007. This has included surveys of the habitat types present as well as surveys of individual species groups. **Table 7.2.4** details the field surveys that have been carried out to date. **Figure 7.2.1** shows the habitats present within the Main Development Site.

7.2.3 Owing to the age of some of the data collected, it will be necessary to repeat some of this survey work. This is discussed further in this section..

c) Approach and methodology

i. Study area

7.2.4 The study area for this assessment will vary for different ecological and ornithological resources, as it will be dependent upon the sensitivity of the resource in question and the potential impacts associated with the Main Development Site.

7.2.5 The study areas are thus considered in terms of the geographic extent of the scheme's potential influence (from the immediate scheme footprint, for direct impacts, to up to 20km away, for more mobile species, for example bats and distant/indirect impacts such as impacts on designated sites). **Table 7.2.1** describes the study areas for potential ecological resources (see also 'Zone of Influence (ZoI)', below).

Table 7.2.1: Proposed study areas for potential ecological resources

Ecological resource	Study area
Statutory and non-statutory	In general, all statutory designated sites within 20km of the application boundary will be considered within the assessment, though clearly the ecology

Ecological resource	Study area
designated sites	of the qualifying features will be important in determining whether or not impacts are likely. This is especially relevant for sites that are designated for their bat or bird interests (i.e. SPAs or SACs for which Annex 2 bat and bird species are a qualifying feature), as the potential exists for individuals associated with these sites to use the habitats within the application boundary for at least part of their life cycle (e.g. for foraging at certain times of year).
Habitats and plant communities	The direct footprint of the habitat likely to be affected, plus a buffer zone of at least 200m around them; this is especially important with regard to wetland habitats, for which hydrological impacts on neighbouring land could be a key issue, and coastal habitats (shingle and dune communities) where movement of shingle and sand substrate will also be a key issue.
Invertebrates	The direct footprint of the habitat likely to be affected.
Reptiles	The direct footprint of the habitat likely to be affected.
Amphibians	The direct footprint of the habitat likely to be affected with a buffer of up to 500m if breeding great crested newts are suspected.
Bats	For bat populations not associated with designated sites the study area will be 5km from the application boundary, as the potential exists for individuals associated with roosting sites away from the development area to use the habitats within the application boundary for at least part of their life cycle (e.g. for foraging at certain times of year).
Otters and water voles	The direct footprint of any wetland habitat likely to be affected, plus a buffer zone of at least 200m around them; this is especially important with regard to breeding otters which would be vulnerable to disturbance from construction noise.
Badgers	The area within the Main Development Site boundary and within 100m of it.
Breeding birds	The direct footprint of the habitat likely to be affected and a buffer zone which would be determined by the species concerned.
Wintering birds	The direct footprint of the habitat likely to be affected and a buffer zone which would be determined by the species concerned.
Seabirds	The direct footprint of the marine elements of the project and a buffer extending approximately 20km along the coast from Dunwich to Orfordness for wider indirect effects on seabird species.

ii. Baseline information

7.2.6 The part of the Suffolk coastline within which the Main Development Site is situated is ecologically diverse and, as a result, is subject to a range of nature conservation designations. The location of statutory internationally-designated sites (i.e. SAC, SPA, Ramsar Sites) within 20km of the Main Development Site, are shown in **Figure 7.2.2**. The location of statutory nationally-designated sites (i.e. SSSIs and National Nature Reserves (NNR)), also within 20km of the Main Development Site, are shown in **Figure 7.2.3**.

7.2.7 **Figure 7.2.4** shows the locations of non-statutory designated sites in close proximity to the Main Development Site. As these sites are considered to be important in a county (Suffolk) context, a 3km buffer from the Main Development Site was considered an appropriate distance to consider potential effects upon these sites. **Table 7.2.2** and **Table 7.2.3**, respectively, describe the statutory and non-statutory designations that have been identified and are considered most relevant to terrestrial ecology and ornithology, along with the main ecological features associated with each site. It should be noted that not all the sites shown on the figures are likely to be

affected by the Main Development Site, and only those considered most relevant to terrestrial ecology and ornithology are discussed in this section and **Tables 7.2.2** and **7.2.3**.

Table 7.2.2: Key statutory designated sites

Statutory designated Site	Description
Minsmere to Walberswick SPA and Ramsar site, and Minsmere to Walberswick Heaths and Marshes SAC (located adjacent to the north-east boundary of the Main Development Site)	This area has been identified as a Ramsar site as it supports a diverse range of wetland bird species in nationally important numbers. The SPA supports breeding, wintering and passage bird populations of European importance, including breeding populations of marsh harrier (*Circus aeruginosus*), bittern (*Botaurus stellaris*) avocet (*Recurvirostra avosetta*) and little tern (*Sterna albifrons)*. The habitats that are a primary reason for selection of the SAC are 'annual vegetation of drift lines' and 'European dry heaths', whilst 'perennial vegetation of stony banks' are a qualifying feature of the site.
Sandlings SPA (located approximately 0.7km south of the Main Development Site)	The Sandlings SPA supports breeding populations of European importance of both nightjar (*Caprimulgus europaeus*) and woodlark (*Lullula arborea*).
Alde-Ore Estuary SPA and Ramsar and Alde-Ore & Butley Estuaries SAC (located approximately 5.5km south of the Main Development Site)	The Alde-Ore Estuary has been identified as a Ramsar site for its diverse and nationally important wetland bird species, and as an SPA because it supports bird populations of European importance, including breeding populations of avocet, little tern and sandwich tern (*Sterna sandvicensis)*, and over-wintering ruff (*Philomachus pugnax*). The site also supports important migratory populations of lesser black-backed gull (*Larus fuscus*) during the breeding season and redshank (*Tringa tetanus*) during the winter. The primary reason for the SAC designation is the estuary habitat; intertidal mudflats and sandflats and Atlantic salt meadow habitats are also qualifying features.
Outer Thames Estuary SPA (includes the area of open sea adjacent to the eastern boundary of the Main Development Site)	The Outer Thames Estuary SPA qualifies by supporting populations of European importance of wintering red-throated diver (*Gavia stellata*).
Staverton Park and the Thick SAC (located 16km south of the Main Development Site)	This site is representative of old acidophilus oak woods in the eastern part of its range and its ancient oaks (*Quercus* spp.) have rich invertebrate and epiphytic lichen assemblages.
Benacre to Easton Bavents Lagoons SAC (located 14.5km north of the Main Development Site)	Benacre to Easton Bavents Lagoons is designated as an SAC as it supports a series of percolation lagoons on the east coast of England. The lagoons (the Denes, Benacre Broad, Covehithe Broad and Easton Broad) have formed behind shingle barriers and are a feature of a geomorphologically dynamic system. This range of salinity has resulted in a series of lagoonal vegetation types, and associated specialist lagoonal species.
Benacre to Easton Bavents Lagoons SPA (located 14.5km north of the Main Development Site)	Benacre to Easton Bavents is designated as an SPA because they support bird populations of European importance including important numbers of bittern in winter, and breeding little terns which feed substantially outside the SPA in adjacent marine waters.

Statutory designated Site	Description
Stour and Orwell Estuaries SPA and Ramsar Site (located more than 20km south of the Main Development Site)	The Stour and Orwell estuaries have been designated as a Ramsar site for its diverse and nationally important wetland bird species; and as an SPA because they support bird populations of European importance. This includes numbers of breeding avocet. In winter, they hold major concentrations of water birds, especially geese, ducks and waders. The geese also feed, and waders roost, in surrounding areas of agricultural land outside the SPA.
Orfordness to Shingle Street SAC (located approximately 8km south of the Main Development Site)	The habitats that are a primary reason for selection of this site are 'coastal lagoons', 'annual vegetation of drift lines' and 'perennial vegetation of stony banks'.
Minsmere to Walberswick Heaths and Marshes SSSI (adjacent to the north of the Main Development Site)	This SSSI contains a complex series of habitats, notably mudflats, shingle beach, reedbeds, heathland and grazing marsh. These combine to create an area of exceptional scientific interest that supports a diverse breeding and wintering bird assemblage and a diverse range of invertebrates.
Sizewell Marshes SSSI (located within and immediately west of the Main Development Site)	This SSSI is of national importance for the considerable area of lowland unimproved wet meadow it contains. Associated with the wet meadows are outstanding assemblages of invertebrates and breeding birds, along with several nationally scarce plant species. The marshes also support a diverse invertebrate assemblage. Water voles (*Arvicola amphibious*) are present within the SSSI and the SSSI is also used regularly by otters (*Lutra lutra*).
Leiston to Aldeburgh SSSI (located approximately 1km south of the Main Development Site)	This SSSI contains a rich mosaic of habitats, including acid grassland, heath, scrub, woodland, fen, open water and vegetated shingle.

Table 7.2.3: Non-statutory designated sites

Non-statutory designated Site	Description
Southern Minsmere Levels CWS	Supports coniferous woodland and a diverse assemblage of breeding birds, roosting and foraging bats, invertebrates (including the white admiral butterfly (*Limenitis camilla*) and Norfolk hawker dragonfly (*Aeshna isoceles*)) and reptiles.
Sizewell Levels and associated areas CWS	A large area of land, consisting of woodland, plantation, wet meadow, osier beds and scrub. The ground remains waterlogged throughout the winter and numerous dykes provide good cover for high numbers of waterfowl.
Leiston Common CWS	Supports lowland heath, breeding birds and a diverse assemblage of reptiles and invertebrates.
Suffolk Shingle Beaches CWS	Supports coastal sand and shingle habitats, a diverse assemblage of invertebrates, a population of reptiles, and foraging black redstarts.
Dower House CWS	Valuable cliff-top unimproved dry acid/dry maritime grassland. The sward composition includes species typically associated with acid grasslands and heaths such as heath dog violet (*Viola canina*).
Aldringham to Aldeburgh Disused Railway CWS	A section of disused railway line which serves as a public footpath and supports a species diverse flora both on the line of the old track and on the gently sloping embankments.
Sizewell Rigs CWS	Supports a breeding colony of kittiwake (*Rissa tridactyla*).

Non-statutory designated Site	Description
Suffolk Wildlife Trust Reserve	This reserve occupies the same area as the more highly designated Sizewell Belts SSSI and parts of some of the County Wildlife Sites described above.

7.2.8 Although the baseline ecological information pertaining to these sites is already extensive, more detailed information is required about the constituent habitats and species populations, especially where the potential exists for them to be directly or indirectly affected by the proposed development. Further surveys are therefore discussed later in this section. This will include studies to inform both the permanent and temporary aspects of the construction phase of the development.

7.2.9 In addition to gaining further information about these designated sites, the survey work already carried out (described in **Section 7.2(b)**) has also resulted in the development of a comprehensive ecological baseline for non-designated land, which has informed, and will continue to inform, the development and layout of the Main Development Site. **Table 7.2.4** summarises the key findings from the survey work carried out to date, which will inform the scope of further surveys as well as any subsequent assessment. **Figure 7.2.5** identifies the locations within the Main Development Site that are mentioned in **Table 7.2.4.**

Table 7.2.4: Summary of the ecological studies undertaken to date

Ecological studies	Key findings
Habitats and plant communities	The majority of non-designated land within and adjacent to the Main Development Site comprises agricultural farmland with smaller areas of deciduous woodland (such as Ash Wood and Fiscal Policy), coniferous plantation (including Kenton Hills and Goose Hills), acid grassland/lowland heath and neutral grassland and dune and shingle habitats on the coastal frontage. The woodland within Kenton and Goose Hills is dominated by Corsican pine (*Pinus nigra*) with a ground layer of dense brambles (*Rubus fruticosus agg.*) and bracken (*Pteridium aquilinum*). The studies of Sizewell Marshes have recorded in detail the plant composition of the area of the SSSI. This comprises a mosaic of open water, reed bed and wet woodland. The open water and ditches are flower-rich, supporting aquatic plants, including the nationally scarce Soft Hornwort (*Ceratophyllum submersum*), Fen Pondweed (*Potamogeton coloratus*) and Whorled Water-milfoil (*Myriophyllum verticillatum*), with emergent plants such as common reed (*Phragmites australis*), hemp-agrimony *(Eupatorium cannabinum*) and bulrush (*Typha latifolia*). The reedbed areas are relatively species–poor and are dominated by common reed and nettle (*Urtica dioica*. The wet woodland is dominated by alder *(Alnus glutinosa*) with smaller areas of grey willow (*Salix cinerea* and downy birch (*Betula pubescens*). The coast comprises valuable sand and shingle plant communities. Studies have recorded in detail the plant composition of the coastal habitats. These include areas of shingle-supporting species, such as the nationally scarce Sea pea (*Lathyrus japonicus*), Sea-kale (*Crambe maritima*) and Sea campion (*Silene uniflora*). Beyond the shingle are areas of dune ridge supporting a different suite of species, including Marram (*Ammophila arenaria*), Sand sedge (*Carex arenaria*) and Sand Couch *(Elytrigia juncea*).
Invertebrates	Studies have shown that habitats adjacent to and within the Main Development

Ecological studies	Key findings
	Site support a range of invertebrate species, with Sizewell Marshes SSSI and coastal vegetation being especially species-rich. Species of particular note include Norfolk hawker dragonfly (*Aeshna isosceles*), a white admiral butterfly (*Limenitis camilla*), a soldier fly (*Odontomyia ornata*) and a tachinid fly (*Subclytia rotundiventris)*. The coastal habitats supported eight nationally scarce fly species and two species listed in the red data book, together with three nationally scarce beetles and two listed in the red data book.
Reptiles	The habitats adjacent to and within the Main Development Site and, in particular, the woodland rides within Kenton Hills and Goose Hill, support important populations of reptiles comprising four species: adder (*Viper berus*), slow worm (*Angulis fragilis*), common lizard (*Zootoca vivipara*) and grass snake (*Natrix natrix*). Detailed information on the status and distribution of these species has been collected and has been used to inform the development of a comprehensive mitigation strategy for reptiles as discussed and agreed with stakeholders in 2013.
Amphibians	No evidence for the presence of great crested newts (*Triturus cristatus*) has been identified within the habitats adjacent to and/or within the Main Development Site. An introduced population of natterjack toads (*Epidalea calamita*) is present within the EDF Energy Estate but it is not expected to be affected by the proposed development.
Bats	Survey work has investigated the assemblage of bat species present within habitats adjacent to and within the Main Development Site, including the scarce barbastelle and roosts of Natterer's (*Myotis nattereri*), soprano pipistrelles (*Pipistrellus pygmaeus*) and brown long-eared bats (*Plecotus auritus*). In addition, the work has identified the key features of importance, such as roost sites, feeding areas and foraging and commuting routes. As such, a detailed picture of how bats are using the wider landscape is being built up.
Other mammals	The ditches within Sizewell Marshes support a large population of water voles. Survey work (2013) has established that otters use the marshes but no holts or lying up sites were identified within 200m of the Main Development Site. Five badger (*Meles meles*) social groups have been identified within habitats adjacent to and within the Main Development Site.
Breeding birds	Studies have identified that the mosaic of habitats in close proximity to the Main Development Site supports a diverse assemblage of breeding birds typical of the mosaic of habitats present, including protected species such as Cetti's warbler (*Cettia cetti)* within wet woodland in Sizewell Marshes, hobby (*Falco subbuteo*) using mature trees for nesting, black redstart (*Phoenicurus ochruros*) within the existing Sizewell A and B power stations complex, barn owl (*Tyto alba*) foraging widely and crossbill (*Loxia curvirostra*) within coniferous woodland. A total of 13 UK Biodiversity Action Plan (UKBAP) priority species were also recorded holding territory. Marsh harriers have been found to forage over the Sizewell Marshes SSSI. Bitterns are occasional visitors, but there is no evidence that they breed close to the Main Development Site.
Wintering birds	The studies indicate that the habitats present in close proximity to the Main Development Site supports a range of wintering birds. Sizewell Marshes support an important wintering population of gadwall, whilst bearded tit (*Panurus biarmicus*) and kingfisher (*Alcedo atthis*) are also present.
Seabirds	Ongoing seabird surveys are focusing on the behaviour, distribution and abundance of red-throated diver, little tern and Sandwich tern. In addition, survey information concerning the distribution and abundance of other seabirds (including gull species) using the coast adjacent to Sizewell is also been collected

7.2.10 Whilst it is clear that a large amount of data collection has already been carried out, a gap analysis and consultation exercise has identified where further work is needed, either because of the age of the data or due to the change in the geographic scope of the assessment as the scheme has developed.

iii. Planned further survey/studies

7.2.11 It is proposed to carry out the following ecological work and surveys in order to help inform the ongoing design work for the Main Development Site, and to inform the EIA:

- extended phase 1 habitat surveys of areas of the Main Development Site not surveyed to date;
- detailed surveys and invertebrate habitat assessment in the south-west corner of the Sizewell Marshes SSSI, identifying key micro-habitats to inform habitat creation (plus which features to translocate, if any);
- update the breeding bird and wintering surveys of the Main Development Site. It is envisaged that consultation will take place with both the RSPB and Suffolk Wildlife Trust to update and share information;
- consultation with marine specialists to ensure sufficient survey data has been collected for seabird species;
- establish a wider context for the potential effects on the barbastelle bat population by repeating static detector surveys across the proposed development area (to include for additional locations requested by stakeholders), and carrying out a detailed radio-tracking study which will be used to feed into the overall scheme design;
- review and update the National Vegetation Classification (NVC) of the proposed SSSI land take (i.e. south-west corner of the Sizewell Marshes SSSI) and coastal habitats to provide an up-to-date baseline and inform habitat mitigation and restoration proposals;
- review existing survey information concerning the extent and distribution of nationally scarce or rare plant species within and adjacent to the Main Development Site. This information will be used to produce a mitigation strategy to safeguard rare and scarce plant species; and
- update the badger bait-marking studies to include for areas of the Main Development Site not surveyed to date.

7.2.12 Subsequently, there will be a requirement to carry out pre-construction surveys (post-consent) for various legally protected species to inform any licensing requirements and ensure legislative compliance.

iv. Assessment methodology

General assessment approach for ecology

7.2.13 Whilst the ecological impact assessment (EcIA) methodology would be largely consistent with the general approach set out in **Sections 5.1** to **5.3**, it will need to be modified slightly to conform with the industry standard (the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines (CIEEM, 2006).

7.2.14 In accordance with the CIEEM Guidelines, a comprehensive assessment will be carried out which collates all of the existing baseline information and aims to predict confidently all of the significant effects of the construction, operational and decommissioning phases of the proposed development on Key Ecological Resources (KERs), both with and without mitigation.

7.2.15 Where significant adverse effects are predicted, the assessment will present measures to mitigate these effects and/or compensate for them as necessary. In addition, measures will also be developed to address the legislative requirements associated with protected species for which significant effects are not expected, and which are therefore not classified as KERs but which nevertheless warrant mitigation.

7.2.16 A KER can be defined as an ecological resource that is sufficiently important to be material in the decision-making process, and where impacts on that resource that could result from the proposed development, in isolation or in combination with other developments, could generate a significant effect (that is, an effect that could have substantive implications for the integrity or conservation status of the habitat or population involved).

Determination of the scope of the assessment

Spatial scope

7.2.17 The ZoI describes the area over which the activities associated with the proposed development could influence ecological and ornithological resources. This will be established on the basis of a high-level desk-based review of ecological resources in the general vicinity of the Main Development Site, together with the results of field surveys, a review of the likely impact parameters associated with the proposed development, and the outcomes of the consultation exercise.

7.2.18 As with the study area, the ZoI varies with each habitat, species or assemblage identified as a potential KER, and will thus be presented in the ES once these are confirmed.

Temporal scope

7.2.19 To assess the likely impacts of the proposed development, it is necessary to predict how those conditions observed and recorded at the time of the ecological and ornithological surveys (referred to within the assessment as 'existing conditions') would have changed come the time of the commencement of the construction phase of the proposed development. This is referred to as the 'baseline conditions', and is influenced by a number of factors, including future land management and cumulative impacts from other projects.

7.2.20 To assess the impacts of the operational phase, it is necessary to predict how the ecological resources in the local area would be expected to develop over a 25-year period in the absence of the proposed development. This is referred to as the 'future baseline', and is also influenced by the factors described above, as well as climate change.

Assessment of effects and determining significance

7.2.21 This ecological assessment considers the *sensitivity* of resources that could be affected, and the *magnitude* of impacts to which they are likely to be subject, in order to classify *effects* and their *significance*. These issues are addressed in turn in the following paragraphs.

Resource sensitivity ('Determining Value of Ecological Resources' in the CIEEM Guidelines)

7.2.22 In order to determine the likelihood of a significant effect, it is first necessary to identify whether an ecological resource is sufficiently valuable for any impact upon it to be able to generate a significant effect. To achieve this, habitats and species populations will be valued on the basis of a combination of their rarity, status and distribution, using contextual information where it exists. The following frame of reference for the valuation of ecological resources will be used:

- international;
- UK;
- national (England);
- regional (East Anglia);
- county (Suffolk);
- district/borough (Suffolk Coastal);
- local (Sizewell area); and
- within the Main Development Site.

7.2.23 This frame of reference is in accordance with the CIEEM Guidelines. However, it differs slightly from the approach used for other environmental disciplines in this EIA Scoping Report, where a sensitivity level (from 'high' to 'very low') is allocated to each receptor or resource. The value of the resources derived from the CIEEM Guidelines, and the equivalent sensitivity levels used for the other topics in the proposed assessment, have therefore been set out in **Table 7.2.5** to allow for a consistent approach across disciplines.

Table 7.2.5: Guidelines for the assessment of ecological sensitivity

Value/ sensitivity	Equivalent CIEEM value	Description
High	International; UK; National (England)	**Value:** Very high importance and rarity. Feature/resource possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site (e.g. designated features of international/national importance, such as SACs, SPAs, Ramsar sites and SSSIs. **Sensitivity**: Feature/resource has a very low capacity to accommodate the proposed form of change, and very limited potential for substitution.
Medium	Regional (East Anglia); County (Suffolk)	**Value**: Medium importance and rarity, regional scale. Feature/resource possesses key characteristics which contribute significantly to the distinctiveness and character of the site/receptor (e.g. designated features of regional or county importance, such as CWSs, County BAP habitats, etc.).

Value/ sensitivity	Equivalent CIEEM value	Description
		Sensitivity: Feature/resource has a low capacity to accommodate the proposed form of change, and limited potential for substitution.
Low	District/borough (Suffolk Coastal); Local (Sizewell area)	**Value**: Low or medium importance and rarity, local scale. Feature/resource only possesses characteristics which are locally significant. Feature/resource not designated or only designated at a district or local level (e.g. local nature reserve). **Sensitivity**: Feature/resource has some tolerance to accommodate the proposed change.
Very low	Within the application site	**Value**: Feature/resource characteristics do not make a significant contribution to local character or distinctiveness. Feature/resource not designated. **Sensitivity**: Feature/ resource is generally tolerant, can accommodate the proposed change.

7.2.24 In accordance with the CIEEM Guidelines, the assessment will focus on those activities that could potentially generate significant effects on KERs. Within this assessment, those resources considered to be of 'Medium' value or greater will be identified as potential KERs.

7.2.25 Impacts upon resources of lower value will not be assessed in detail. However, consideration will be given separately to 'other ecological resources requiring mitigation'. These will include species within the Main Development Site which do not constitute KERs based upon their nature conservation value, but which will still warrant consideration during the design and mitigation of the proposed development on the basis of their legal protection or other issues such as animal welfare.

Magnitude ('Impact characterisation' in CIEEM Guidelines)

7.2.26 Once the ecological resources within the ZoI have been identified and valued (in order to determine which could possibly be material to decision-making), it will then be necessary to investigate potential effects on those resources in order to understand how they might be affected by the Main Development Site.

7.2.27 The impact assessment will therefore need to be based upon an understanding of the likely activities associated with the Main Development Site, the biophysical changes that could be predicted as a result of these activities, and the area over which such effects might be experienced by different resources. These effects will be considered for the construction and operational phases. They will be characterised and described in detail using the following parameters, as prescribed in the CIEEM Guidelines:

- positive or negative;
- magnitude (the 'size' or 'amount' of an impact);
- extent (the area over which the impact occurs);
- duration (the time for which the impact is expected to last prior to recovery or replacement of the resource or feature); and
- reversibility (permanent or temporary).

Timing and frequency

7.2.28 The likelihood of each impact occurring as predicted will also be considered within the assessment, expressed as a measure of confidence, using the following scale:

- certain/near-certain (probability estimated at 95% or higher);
- probable (probability estimated above 50% but below 95%);
- unlikely (probability estimated above 5% but less than 50%); and
- extremely unlikely (probability estimated at less than 5%).

7.2.29 Furthermore, given the relatively long construction phase associated with the proposed development, it is considered appropriate to provide a project-specific definition of what is meant by 'short', 'medium' and 'long'-term temporary impacts. These would therefore be defined as follows:

- temporary (short-term): those construction-phase impacts that would be experienced over a period of no more than 1-2 years;
- temporary (medium-term): those construction-phase impacts that would be experienced over a period of no more than 3-5 years; and
- temporary (long-term): those construction-phase impacts that would be experienced over a period of more than 5 years.

7.2.30 To ensure consistency with other environmental disciplines in the EIA, the above ecological impact characterisation will be summarised using the same scale (i.e. from 'high' to 'very low') and will be carried out according to the guidelines set out in **Table 7.2.6**.

Table 7.2.6: Guidelines for the assessment of ecological impact magnitude

Magnitude	Guidelines
High	Large-scale, permanent/irreversible changes over a large area affecting key characteristics or features of the particular resource's character or distinctiveness. Relative to the wider habitat resource/species population, a large proportion would be affected. For designated sites, integrity is compromised.
Medium	Medium-scale, permanent/irreversible changes, affecting key characteristics or features of the particular resource's character or distinctiveness. Relative to the wider habitat resource/species population, a small-medium area of habitat, or small-medium proportion of the wider species population, would be affected.
Low	Noticeable but small-scale change, over a partial area, to key characteristics or features of the particular resource's character or distinctiveness. The quality or extent of sites or habitats, or the size of species' populations, experience some small-scale reduction.
Very low	Noticeable, but very small-scale change, or barely discernible changes for any length of time, over a small area, to key characteristics or features of the particular resource's character or distinctiveness. Although there may be some impacts on individuals or parts of a habitat area or designated site, the quality or extent of sites and habitats, or the size of species populations, would experience little or no reduction.

7.2.31 Similarly, the ecological *effects* associated with the above impact magnitude (that is, the implications of these impacts with regard to the nature conservation status of the habitats and/or species affected) will also be couched in the same terms as used elsewhere in this Scoping Report, using the following **Table 7.2.7.**

Table 7.2.7: Ecological effect definitions

Effect	Description
Major	The change permanently (or over the long-term) adversely or beneficially affects the integrity or conservation status of the habitat/species, reducing the ability to sustain the habitat, or the population level of the species, within a given geographic area. Effects, both adverse and beneficial, which are likely to be important considerations at a **national** to regional level because they contribute to achieving national/regional objectives, or, which are likely to result in exceedance of statutory objectives and/or breaches of legislation.
Moderate	The change permanently (or over the long-term) adversely or beneficially affects the conservation status of the habitat/species, reducing the ability to sustain the habitat, or the population level of the species, within a given geographic area. Effects that are likely to be important considerations at a **regional** and **local** level.
Minor	The effects are likely to be within the range of natural variability, and there is not expected to be any permanent change in the conservation status of the species/habitat or the integrity of the designated site. The change is unlikely to affect the nature conservation evaluation of the resource. These effects may be raised as **local** issues but are unlikely to be of importance in the decision-making process.
Negligible	Any effects are likely to be within the range of natural variability, and there would be no short-term or long-term effects on the conservation status of the species/habitat resources or the integrity of the designated site. The change would not affect the nature conservation evaluation of the resource. An effect that is likely to have a negligible or neutral influence, irrespective of other effects.

7.2.32 Following the classification of an effect using the above table, a clear statement can then made as to whether that effect is significant or not significant, and at what geographical scale.

7.2.33 In order to determine which ecological resources could be sufficiently affected by the Main Development Site so that a significant effect could be generated, a preliminary assessment of the likely impacts of the proposed development will be undertaken. Where it is determined that a resource could be sufficiently impacted for a significant effect to be possible, that resource will be 'scoped in' to the detailed impact assessment (as a KER). Those that are not considered to be sufficiently valuable, or where the potential impacts upon them are considered unlikely to generate a significant effect, will be 'scoped out' of the detailed assessment.

Significance

7.2.34 A significant effect is defined as one that is considered likely to affect the integrity or conservation status of a KER. Significance will be determined on the basis of an analysis of the factors that characterise the effect, irrespective of the value of the resource. Where a significant effect is identified, the value of the resource (e.g. local, regional or national importance) will then be used to help determine the geographical scale at which the effect is significant. Thus, any negative effect which significantly

affects the integrity of a resource of, for example, 'national' value will be identified as being a nationally significant effect.

7.2.35 The significance of the likely effects upon the KERs will be assessed both before and after consideration of the mitigation measures. The latter will represent the assessment of the residual effects of the Main Development Site. The approach to determining significance described above is in accordance with the CIEEM Guidelines. However, it differs from the approach used for other environmental disciplines in this Scoping Report, where the significance of an effect is based on a combination of the magnitude of the change and the sensitivity of the receptor or resource.

7.2.36 Again in order to allow a consistent approach across disciplines, the levels of significance derived from the CIEEM Guidelines, and the equivalent significance using the definitions elsewhere in this Scoping Report, are set-out in **Table 7.2.8**.

Table 7.2.8: Significance of ecological effects

Significance following the CIEEM guidelines	Equivalent significance definitions used elsewhere in this Scoping Report
Significant at the international level	Major (= Significant)
Significant at the national level	Major (= Significant)
Significant at the regional level	Moderate (= Significant)
Significant at the county level	Moderate (= Significant)
Significant at the district/borough level	Minor (= Not Significant)
Significant at the local level	Minor (= Not Significant)
Not significant	Negligible (= Not Significant)

v. Assumptions and limitations

7.2.37 In addition to the general assumptions and limitations discussed within **Section 5.7**, the following ecological considerations have been identified:

- the ecological desk study and survey data collected will be sufficiently robust for informing the impact assessment;
- in the unlikely event that construction activities would result in significant airborne emissions (dust, vehicle fumes, etc.), it is assumed that the effects on habitats in the vicinity would be experienced no more than 200m from the source;
- in the unlikely event that pollution events were to occur within a watercourse, it is assumed that the effects on associated fauna and flora could take place up to 5km downstream from the source; and
- the ecological surveys are considered representative and robust, and will be based on the industry-standard best practice survey guidance relevant at the time the surveys are undertaken.

d) Potential impacts and effects

i. Construction

7.2.38 The key construction phase impacts could potentially be as follows:

- Statutory and non-statutory designated sites: The construction phase has the potential to affect these sites causing changes to the associated flora and fauna species that these sites support.
- Habitat loss: This will be especially important with regard to the SSSI but there will also be extensive areas of woodland (largely coniferous plantation) within Goose Hill that will need to be felled, as well as lines of trees and sections of hedgerows (largely those separating the arable fields) that may also need to be removed. Some elements of the coastal habitats may also be affected.
- Habitat fragmentation: The Main Development Site may represent a barrier to the movement of some species, fragmenting habitats either side. This is most likely to be important for those species that require contiguous habitat features or need to access different habitat features in alternative locations at different times (for example, bats roosting in woodland and foraging over wetland habitats).
- Noise, lighting and visual disturbance: This is likely to be relevant to those species that are vulnerable to disturbance or those species that require specific access to the habitat features in close proximity to the Main Development Site.
- Impacts due to the construction of the marine elements: This may include all of the marine construction elements, including pile-driving, tunnelling and increased shipping traffic. These impacts may be particularly pertinent with regard to those species of seabirds that forage off-shore.
- Hydrological impacts: This could potentially be especially important with regard to Sizewell Marshes SSSI and other neighbouring areas of wetland habitat. Changes in the hydrological regime (including the quality and quantity of both ground water and surface water) could alter the plant communities present, affecting associated species such as invertebrates and aquatic mammals.
- Emissions and pollution: Construction activities could result in a variety of emissions, including dust, surface water discharge and accidental spillages from plant. These emissions could affect adjacent species and habitats, for example, dust smothering vegetation or spillages from plant polluting adjacent watercourses. This is particularly important given the ecological value of adjacent habitats.

ii. Operation

7.2.39 The key operational phase impacts are likely to be as follows:

- Changes to the natural environment caused by cooling water discharge: The cooling water discharge will cause some changes to the seawater environment into which it is discharged. This could potentially affect the availability of prey species for seabirds such as red-throated diver and little tern.
- Potential changes to the natural environment caused by noise, lighting and air quality: Noise and lighting may disturb species associated with adjacent

designated sites, and air emissions could potentially affect habitat quality of adjacent designated sites.

e) Potential mitigation

7.2.40 As discussed in **Section 5.4** the ecological impact assessment will follow the principles outlined in relation to mitigation.

7.2.41 The results of the extensive ecological survey work already carried out (as set out in **Table 7.2.4**) have already influenced the evolution of embedded mitigation within the design of the Main Development Site, notably:

- proposals to restore and create habitat following the cessation of construction works; this may include dune and shingle habitat and creation of habitat type's characteristic of the Suffolk Sandlings, thus ensuring habitat connectivity with designated sites and the wider landscape in the long-term;
- the identification of significant bat populations on the EDF Energy Estate, which has resulted in EDF Energy taking decisions to relocate the proposed northern access road out of Kenton Hills, and to incorporate appropriate buffer zones into the landscape strategy to provide further protection for bats;
- the better understanding of the habitats within the Sizewell Marshes SSSI has reaffirmed the need for EDF Energy to seek to limit land take within the SSSI, and the requirement to create appropriate habitat elsewhere in replacement; and
- the enhanced understanding of reptile species distribution has helped to identify the quantity and quality of replacement habitat required, and thus to plan a comprehensive Reptile Mitigation Strategy.

7.2.42 Additional mitigation measures are likely to be required and these will be detailed in the final ecological assessment. At this stage measures being considered include:

- measures to safeguard legally protected species such as bats, reptiles and water voles;
- measures to reduce noise and other disturbance on sensitive species; and
- measures to manage recreational pressure and disturbance.

f) Approach to cumulative assessment

i. Inter-relationships

7.2.43 At this stage the following inter-relationships are being considered:

- inter-relationship with coastal geomorphology and marine ecology;
- direct habitat loss combined with air and water-borne emissions and changes in the hydrological regime causing changes in the wetland communities present in Sizewell Marshes SSSI;
- displacement of foraging seabirds during construction, combined with potential effects on seabird prey species; and
- recreation and landscape - increased recreation pressure could potentially affect some sites and management of recreation and a long-term landscape strategy will be key to minimising impacts.

ii. Cumulative effects

7.2.44 The assessment of cumulative ecological impacts can be defined as an assessment of the predicted changes in the baseline condition of a particular resource, which results from incremental changes caused by other relevant present or reasonably foreseeable actions together with the project under assessment. This is likely to encompass relevant existing developments and those relevant developments that are consented or in planning (i.e. where a planning interest has recently been registered with the relevant local planning authority (LPA) and/or is identified in the relevant development plan or other plans and programmes) within a radius of up to 20km[4] from the DCO application boundary. A detailed cumulative assessment would only be possible for those other developments where a comprehensive ecological assessment has been carried out, for example the Galloper Wind Farm and its potential effects on seabird populations. Where detailed information is not available, a high level assessment of potential cumulative impacts will be carried out.

[4] Given the nature of the development and the statutory sites, 20km is considered an appropriate distance over which effects could potentially occur.

7.3 Landscape and visual

a) Introduction

7.3.1 This section sets out the proposed scope and methodology for the Landscape and Visual Impact Assessment (LVIA) of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.3.2 Draft AONB Review and Analysis Report: EDF Energy, in consultation with the Suffolk Coast and Heaths AONB Partnership, has undertaken a review and analysis of the special qualities and natural beauty of the AONB. These findings will help to inform the landscape and visual impact assessment. The draft report is currently being refreshed to incorporate references to the new AONB Management Plan 2013-2018 and other recently published baseline material including the Touching the Tide Landscape Character Assessment (Alison Farmer Associates, 2012).

7.3.3 Design Principles: EDF Energy has identified Relevant Buildings and established a suite of architecture and landscape design principles for the Main Development Site. The design principles have been subject to consultation with SCC, SCDC and Natural England. The Joint Local Authority Group (JLAG), in association with the National Trust, RSPB, Suffolk Wildlife Trust and the Suffolk Coast and Heaths AONB, has also produced and published a suite of landscape, ecological and management design principles (Suffolk County Council, 2014abc).

7.3.4 Landscape and Visual Baseline: EDF Energy has undertaken a desk- and site-based review of landscape character and views in and around the EDF Energy Estate. Studies undertaken to date have been summarised in the Sizewell C Stage 1 Environmental Report and will be updated and extended to form the Stage 2 submission with reference to the proposed LVIA study area and viewpoints which are both subject to review and agreement by the relevant consultees.

7.3.5 LVIA Consultation: EDF Energy has prepared an initial Zone of Theoretical Visibility (ZTV) model of the Main Development Site structures to understand the potential visual effects of the proposed development. This has been used to inform the extent of the proposed LVIA study area and location of LVIA viewpoints. The proposed LVIA methodology, study area and viewpoints were issued to SCC, SCDC, WDC, Natural England and the Suffolk Coast and Heaths AONB in February 2014 for comment. Landscape Strategy: Initial work leading to Stage 1 consultation has been undertaken to develop a landscape strategy for the EDF Energy Estate, illustrating the proposed character of the landscape during the operational phase of the Main Development Site. The landscape strategy is subject to ongoing design development and work to-date will inform a construction phase masterplan and operation phase landscape strategy for the EDF Energy Estate.

c) Approach and methodology

7.3.6 Section 5.9 of EN-1 refers to landscape and visual impacts of energy projects. It records that a number of guides have been produced to assist in addressing landscape issues and that the landscape and visual assessment should include

reference to any landscape character assessment, associated studies and relevant policies based on these assessments. It adds that the assessment should include the effects during construction of the project and the effects of the completed development and its operation. It also states that the assessment should include the visibility and conspicuousness of the project during construction and of the presence and operation of the project and potential impacts on views and visual amenity including light pollution effects. It also records that in the context of landscape and visual effects, "*references to landscape should be taken as covering seascape and townscape where appropriate".*

7.3.7 Section 5.9 of EN-1 also records that areas designated as an AONB have specific statutory purposes which help ensure their continued protection. It adds that the conservation of the natural beauty of the landscape and countryside should be given substantial weight in deciding applications for development consent in these designated areas and that the duty to have regard to the purposes of nationally designated areas applies when considering applications for projects outside the boundaries of these areas which may have impacts within them.

7.3.8 EN-6 presents details of the Appraisal of Sustainability of the nominated Sizewell site. It records that there is the potential for some long lasting adverse direct and indirect effects on landscape character and visual impacts on the Suffolk Coast and Heaths AONB, with limited potential for mitigation. It adds that this could have an effect on the purpose of the designation and that to further understand these effects, and the effectiveness of the mitigating actions proposed by the nominator of the site, further detailed assessment at the project level is required.

7.3.9 The third edition of the Guidelines for Landscape and Visual Impact Assessment, produced jointly by the Landscape Institute and Institute of Environmental Management and Assessment (IEMA) provides guidance on the scope of a LVIA, which it states is "*a tool used to identify and assess the significance of an the effects of change resulting from development on both the landscape as an environmental resource in its own right and on people's views and visual amenity*" (Swanwick et al, 2013). It also provides references to well-established and recently prepared guidance for assessing the landscape.

i. Study area

7.3.10 Site analysis and initial Zone of Theoretical Visibility (ZTV) modelling (of the Stage 1 Main Development Site proposals) has identified the areas where views to the proposed development may be possible. A study area of 15km (measured from the boundary of the Main Development Site) has been proposed to assess likely landscape and visual effects arising from the development in the LVIA. **Figure 7.3.1** illustrates the landscape and context of the indicative Main Development Site and **Figure 7.3.2** shows the extent of the LVIA study area. The study area may need to be extended in consultation as more detail (of construction phase activity in particular), becomes available.

ii. Baseline information

7.3.11 As illustrated on **Figure 7.3.2** the Main Development Site boundary is located almost entirely within the Suffolk Coast and Heaths AONB and partially within areas defined as the Suffolk Heritage Coast. AONBs are one of several designated landscapes in

England and Wales that the Government has confirmed as having the highest status of protection in relation to landscape and natural beauty. There are no statutory requirements or powers associated with the Heritage Coast definition. A small area of the Main Development Site boundary is located within an area designated as a Special Landscape Area (SLA) (within SCDC's administrative area), which is a saved policy (Suffolk Coastal District Local Plan, 2013).

7.3.12 Landform within the LVIA study area is shown on **Figure 7.3.3**. Within the 15km LVIA study area land generally slopes eastwards towards the coast. Rivers draining eastwards towards the sea create a relatively regular pattern of higher plateau areas and lower lying valleys that open out to form expansive estuaries and low lying landscapes along the coastal strip in places.

7.3.13 The LVIA study area is characterised by a diverse range of land cover and land use types, reflecting human interventions over the years, and the underlying variations in geology, soils and topography. Land use and land cover is dominated by arable farmland, with more localised areas of permanent and improved pasture, typically around villages and farms and along valleys. Areas of heathland/acid grassland are sporadic with larger and more continuous areas of heath notable in some areas. Low lying areas are characterised by open water, drainage ditches, grazing marsh and reed beds, interspersed with wet woodland. Woodland cover varies with large coniferous plantations evident along with more widely distributed deciduous/mixed woodlands and scrub areas, often closely associated with areas of parkland or permanent pasture and close to farms and settlements. Along the coast, low cliffs, vegetated dunes and shingle beaches mark the boundary between land and sea.

7.3.14 In the vicinity of the Main Development Site boundary buildings associated with the existing Sizewell A and B power stations complex form prominent features in the local landscape. The main reactor structures are surrounded by ancillary buildings, car parks and areas of hard standing, which are largely screened from views from the surrounding landscape. The EDF Energy Estate also includes a number of farms, farm buildings and dwellings including, Upper Abbey, Lower Abbey and Ash Wood Cottages. Leiston is the principal settlement in the immediate vicinity of the EDF Energy Estate, with Saxmundham located further inland. A number of villages, hamlets and more isolated dwellings are distributed throughout the wider landscape. There is limited settlement along the coast, with the exception of the small hamlet of Sizewell, south of Sizewell A, and the coastal towns of Thorpness, Aldeburgh, Dunwich and Southwold. Other notable built development in the LVIA study area is the 20th century military research establishments at Orford Ness.

7.3.15 The LVIA study area is located entirely within the Suffolk Coast and Heaths National Character Area (NCA), which extends along the Suffolk coast. Further inland to the west extends the South Norfolk and High Suffolk Claylands NCA. NCAs are illustrated on **Figure 7.3.4**. At the regional scale of assessment the East of England Landscape Typology (Landscape East, 2011) presents an overview of the region's diverse landscape character within the broad framework of the NCAs. At the more local scale several published studies have been undertaken by the local authorities to map and describe the character of the landscape of the County and SCDC administrative areas and the Suffolk Coast and Heaths AONB. The key reference is the Suffolk County Landscape Character Assessment (illustrated on **Figure 7.3.5**) which identifies 30 landscape types (excluding urban). Other landscape character

assessments relevant to the study area include the simplified assessment presented in the Suffolk Coast and Heaths AONB Management Plan 2013-2018, the Touching the Tide Landscape Character Assessment (2012), Landscape Character Guidelines for the Suffolk Coast and Heaths AONB, Suffolk Coast and Heaths Landscape Assessment and Waveney District Landscape Character Assessment.

7.3.16 The Seascape Character Assessment of the East Inshore and East Offshore Marine Plan Areas (URS Scott Wilson, 2012) presents a strategic overview of coastal and marine character. The LVIA study area includes the Suffolk Coastal Waters character area and East Anglian Shipping Waters character area (see **Figure 7.3.4**). No county or district scale seascape character assessment has been prepared for the LVIA study area. However, the Touching the Tide Landscape Character Assessment maps and describes ten Coastal Character Areas.

7.3.17 There are variations in the visual character of the LVIA study area due to the nature of topography, built form, vegetation and land use patterns. For example, from locations on the coast, views out to sea and along the coast are characteristically expansive, whereas those inland are restricted by cliffs, shingle banks and vegetated dunes. These variations in visual character influence the nature and extent of views to the existing Sizewell power stations, and by extension to any proposed development in the vicinity. Field surveys indicate that a variety of visual receptors are located in the study area. Visual receptor types include residents; those visiting the area for recreational and amenity purposes; those travelling through the area; and those engaged in work. The majority of the visual receptors are located onshore, but there is also potential for receptors engaged in activities offshore, such as those working on boats and those engaged in recreational boating and yachting. The location of LVIA viewpoints is to be agreed with SCC, SCDC, Suffolk Coast and Heaths AONB and Natural England in due course.

iii. Planned further survey/studies

7.3.18 Baseline Landscape Character: Review and update landscape/seascape and visual baseline covering planning policy context, landscape/seascape character and visual environment with reference to ZTV modelling and LVIA viewpoints agreed with relevant consultees (spring 2014).

7.3.19 Landscape Strategy: Develop a landscape strategy for the Main Development Site and wider EDF Energy Estate for the operational phase and Landscape Strategy for construction phase – both incorporating proposed mitigation measures (ongoing).

iv. Assessment methodology

7.3.20 The LVIA method draws upon the established Institute of Environmental Management and Assessment and the (third edition) Landscape Institute's Guidelines for Landscape and Visual Impact Assessment (GLVIA3) and Countryside Agency landscape character assessment methodology, and other recognised guidelines, in particular Natural England's 'Approach to Seascape Character Assessment', Scottish Natural Heritage's 'Visual Representation of Wind Farms Good Practice Guidance' and the Landscape Institute Advice Note 'Photography and photomontage in landscape and visual impact assessment'.

7.3.21 The LVIA methodology has been developed to conform with GLVIA3, which describes the LVIA process as having four key (overlapping) stages:

- baseline studies;
- identifying and describing effects;
- assessing the significance of effects; and
- mitigation.

Baseline studies

7.3.22 The existing nature of the landscape and visual environment in the study area is established, including any relevant changes likely to occur independently of the proposed development. It includes information on the value attached to the different environmental resources. The key terms used in the baseline include susceptibility, value and sensitivity.

7.3.23 **Susceptibility** is assessed for both landscape receptors such as designated areas and landscape character areas, and for visual receptors (people). It indicates the ability of a defined landscape or visual receptor to accommodate the proposed development *"without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies*."

7.3.24 Susceptibility of landscape character areas/types is influenced by their characteristics and is frequently considered (though often recorded as 'sensitivity' rather than susceptibility) within documented landscape character assessments and capacity studies. Susceptibility of designated landscapes is influenced by the nature of the special qualities and purposes of designation and/or the valued elements, qualities or characteristics, indicating the degree to which these may be unduly affected by the development proposed. Susceptibility of accessible or recreational landscapes is influenced by the nature of the landscape involved; the likely activities and expectations of people within that landscape and the degree to which those activities and expectations may be unduly affected by the development proposed. Susceptibility of visual receptors is primarily a function of the expectations and occupation or activity of the receptors. Susceptibility is rated on the following scale:

Table 7.3.1: Susceptibility

Susceptibility	Definition
High	Undue consequences are likely to arise from the proposed development.
Medium	Undue consequences may arise from the proposed development.
Low	Undue consequences are unlikely to arise from the proposed development.

7.3.25 **Landscape value** is "*the relative value that is attached to different landscapes by society…*". Landscape value is rated in **Table 7.3.2**.

Table 7.3.2: Landscape value

Landscape value	Definition
National/international	Landscapes which are nationally or internationally designated for their landscape value – including National Parks, Areas of Outstanding Natural Beauty, World Heritage sites, Heritage Coast and National Scenic Areas.
Local	Locally or regionally designated landscapes (e.g. Area of High Landscape Value, Regional Scenic Areas); also areas which local evidence indicates as being more valued than the surrounding area.
Community	'Everyday' landscape which is appreciated by the local community but has little or no wider recognition of its value.
Limited	Despoiled or degraded landscape with little or no evidence of being valued by the community.

7.3.26 **Landscape sensitivity** is rated within the range of high, medium, low, very low and is assessed by combining the considerations of susceptibility and value described above. **Table 7.3.3** illustrates the judgement process for landscape receptors.

Table 7.3.3: Landscape sensitivity

		Susceptibility		
		High	Medium	Low
Value	National/international	High	High-Medium	Medium
	Local/district	High-Medium	Medium	Medium-low
	Community	Medium	Medium-low	Low
	Limited	Low	Low-Very low	Very low

7.3.27 For **visual receptors**, judgements of susceptibility and value are closely interlinked considerations; for example, the most valued views are likely to be those which people go and visit because of the available view and it is at those viewpoints that their expectations will be highest. For this reason, the sensitivity of visual receptors is rated in a single step process which combines both factors as follows:

Table 7.3.4: Sensitivity of visual receptors

Sensitivity of visual receptors	Definition
High	Visitors to valued viewpoints which people might visit purely to experience the view, e.g. promoted or well-known viewpoints, key designed views, panoramic viewpoints marked on maps.
High-Medium	People in locations where they are likely to pause to appreciate the view, such as at home, along public rights of way, from local waypoints such as benches, or at key views to/from local landmarks. Visitors to attractions or heritage assets where views are an important contributor to the experience would also fall into this category.
Medium	Travellers using cycle routes or identified scenic road routes. Visitors staying within an area such as at caravan or camping sites.
Medium-Low	Users of most road and rail routes and rural, outdoor workers.

Sensitivity of visual receptors	Definition
Low	Those with limited opportunity to enjoy the view due either to the speed of travel (on motorways and trunk roads); or because their attention is elsewhere e.g. those engaged in work or sporting activities.
Very low	Receptor is generally tolerant and can accommodate the proposed change.

Identification and description of effects

7.3.28 The effects that are likely to occur from the construction and operational phases are systematically identified and described, including whether they are adverse or beneficial. The key terms used in the identification and description of effects are scale, duration, extent and magnitude.

7.3.29 **Scale** of effects is assessed for all landscape and visual receptors and identifies the degree of change which would arise from the proposed development. It is rated on the scale detailed in **Table 7.3.5**.

Table 7.3.5: Scale of effect

Scale of effect	Definition
Large	Total or major alteration to key elements, features, qualities or characteristics, such that post-development the baseline situation will be fundamentally changed.
Medium	Partial alteration to key elements, features, qualities or characteristics, such that post-development the baseline situation will be noticeably changed.
Small	Minor alteration to key elements, features, qualities or characteristics, such that post-development the baseline situation will be largely unchanged despite discernible differences.
Negligible	Very minor alteration to key elements, features, qualities or characteristics, such that post-development the baseline situation will be fundamentally unchanged with barely perceptible differences.

7.3.30 **Duration** of effect is assessed for all landscape and visual receptors and identifies the time period over which the change to the receptor as a result of the development would arise. It is rated on the scale detailed in **Table 7.3.6**.

Table 7.3.6: Duration of effect

Duration of effect	Definition
Permanent	The change is expected to be permanent and there is no intention for it to be reversed.
Long-term	Effects that would be experienced over a period of more than 10 years and will be reversed, fully mitigated or no longer occurring beyond that timeframe.
Medium-term	Effects that would be experienced over a period of 2-10 years and will be reversed, fully mitigated or no longer occurring beyond that timeframe.

Duration of effect	Definition
Short-term	Effects that would be experienced over a period of 0-2 years and will be reversed, fully mitigated or no longer occurring beyond that timeframe.

7.3.31 The **extent** of effects is assessed for all receptors and indicates the geographic area over which the effects will be felt. It is rated on the scale detailed in **Table 7.3.7**.

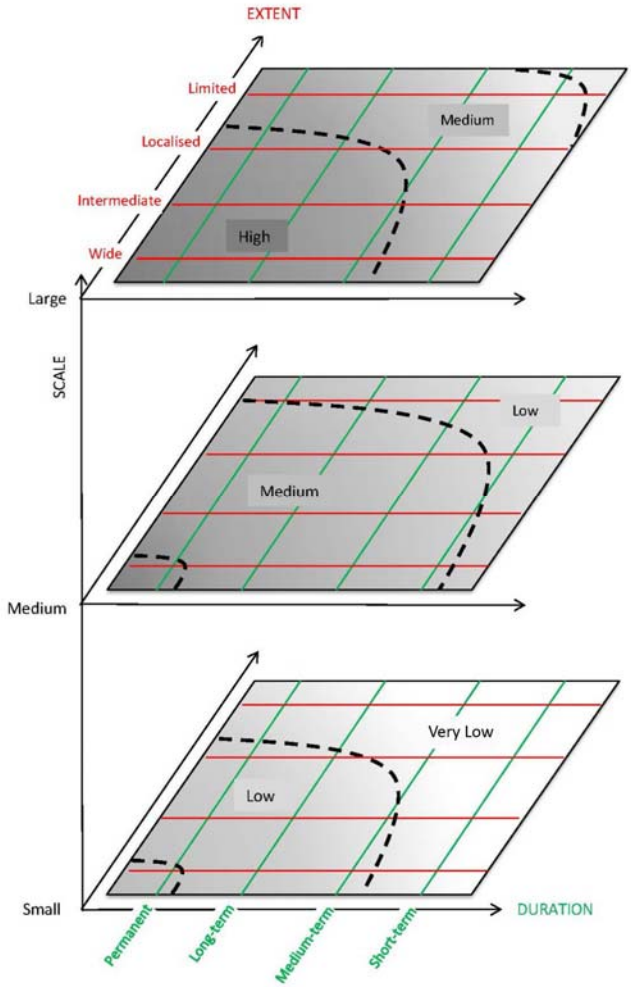
Table 7.3.7: Extent of effect

Extent of effect	Definition
Limited	Site, or part of site, or small part of a receptor area (< approx. 10%).
Localised	Site and surroundings up to 2km, or part of receptor area (up to approx. 25%).
Intermediate	Up to approx. 2-4km, or around half of receptor area.
Wide	Beyond 4km, or more than half of receptor.

7.3.32 Representative viewpoints are used as 'samples' on which to base judgements of the scale of effects on visual receptors. As these viewpoints represent a range of different types of visual receptors, duration and extent are not judged at representative viewpoint locations. Thus, the scale of effect is assessed at representative viewpoints, but duration and extent are judged only when assessing impacts on the visual receptors. For specific viewpoints, duration and extent are assessed, with extent reflecting the extent to which the development affects the valued qualities of the view from the specific viewpoint. For example a very distant development would typically be judged to have a limited extent of effect on a 360 degree panoramic view; but might be judged to have a greater extent if it appeared within the focal area of a channelled or designed view.

7.3.33 The **Magnitude** of effect is rated within the range of high, medium, low, very low and is informed by combining the scale, duration and extent of effect. **Table 7.3.8** illustrates the judgement process.

Table 7.3.8: Magnitude of effect



7.3.34 Where the scale of effect is judged to be negligible the magnitude is assumed to be very low and no further judgement is required.

7.3.35 **Significance** indicates the importance or gravity of the effect. The process of forming a judgement of significance of effect is based upon the assessments of magnitude of effect and sensitivity of the receptor to come to a professional judgement of how important this effect is. This judgement is illustrated by the table in **Table 5.3**.

7.3.36 Effects that are major-moderate or major are considered to be significant. Effects of Moderate significance or less are "*of lesser concern*" (Swanick et al, 2012). It should also be noted that whilst an effect may be significant, that does not necessarily mean that such an effect would be unacceptable, or should necessarily be regarded as an 'undue consequence'. Where intermediate ratings are given, e.g. moderate-minor, this indicates an effect that is both less than moderate and more than minor, rather than one which varies across the range. In such cases, the higher rating will always be given first; this does not mean that the effect is closer to that higher rating, but is done to facilitate the identification of the more significant effects within tables.

7.3.37 **Positive/adverse/neutral:** Effects are defined as adverse, neutral or positive. Neutral effects are those which overall are neither adverse nor positive, but may incorporate a combination of both.

7.3.38 **Landscape designations:** In considering the effects on designated areas, a number of factors need to be considered. The effects on the component landscape character types/areas and the effects on views from within and towards the designated area need to be understood. These effects are then considered in light of the documented special qualities, valued elements or characteristics, and the purposes of the designation in order to arrive at a judgement of the effects on the designated landscape or landscape element.

7.3.39 **Site:** The effects of physical changes to the site are assessed in terms of the effects on the physical fabric.

v. Assumptions and limitations

7.3.40 In addition to the general assumptions and limitations discussed within **Section 5.7**, the following considerations have been identified:

- Professional judgement will be used at all times, including during the interpretation of desk study and field survey, assessment of potential impacts, the significance of effects, and the likely mitigation measures.
- The assessment of construction phase activities will be based on area and height parameters with descriptions of activities likely to take place within the parameters to enable a robust assessment to be undertaken.

d) Potential impacts and effects

7.3.41 The proposed development will have effects on the landscape as a resource and on views and visual amenity of receptors. The significance of effects will vary as a result of numerous interrelated factors including the sensitivity of the landscape or visual receptors and the magnitude of change resulting from the development (which will vary dependent on issues such as scale, duration and extent).

7.3.42 The effects of construction and the permanent development during operation on tranquillity will be considered in the LVIA where tranquillity is a characteristic of the landscape or is identified as one of the special qualities of an area. Tranquillity will be assessed in the amenity and recreation chapter of the ES.

7.3.43 The main effects arising from the development are likely to result from the loss of landscape features/elements and the introduction of new features/elements either temporarily or in the long-term.

i. Construction

7.3.44 Landscape and visual effects during construction may potentially result from the following:

- movement of machinery and traffic to and around the construction site;
- felling of trees and removal of hedgerows as part of site clearance and preparation;

- localised changes to topography due to excavation and the stockpiling and storage of excavated materials;
- construction working areas, laydown areas, workshops, storage and offices;
- temporary structures, including concrete batching plant;
- new infrastructure including access roads, bridges, jetty and rail extension;
- works area on the foreshore;
- construction roads, fencing, lighting and security features;
- site access facilities and coach, lorry and car parking;
- site accommodation campus;
- restoration of construction areas and establishment of the post construction phase landscape (in line with the EDF Energy landscape strategy); and
- construction of the permanent Main Development Site structures.

7.3.45 Effects at night may also be experienced as a result of security and other lighting to structures, access and perimeter fencing.

ii. Operation

7.3.46 Landscape and visual effects during operation will result from the elements of permanent development within the Main Development Site which includes the two UK EPR, turbine halls and electrical buildings, cooling water pumphouses and associated buildings, Operational Service Centre and fuel and waste storage facilities together with external plant, internal roads, ancillary, office and storage facilities, National Grid Substation, National Grid Pylon, flood defences and coastal protection measures.

7.3.47 Landscape and visual effects during operation will also result from elements sited away from the main station platform, comprising bridge, car parking, ancillary buildings and helipad, as well as the access road, including related improvements at the B1122 junction.

7.3.48 Effects at night may also be experienced as a result of security and other lighting to buildings, structures, access and perimeter fencing.

e) Potential mitigation

7.3.49 Where possible, proposals to mitigate the effects of development on landscape and visual receptors will be embedded within the design. These measures are likely to include:

- planning the construction and operational phases of the development to optimise land use to reduce/mitigate landscape and visual effects where reasonably practicable;
- architectural design and treatment of structures (that have the ability to be changed), including lighting, access and fencing, to minimise landscape and visual effects including at night;

- retaining existing screening landscape features where reasonably practical and promote appropriate new landscape design (planting and landform) to mitigate landscape and visual effects of the development;
- establishment of new planting at the earliest reasonable opportunity;
- maintaining and strengthening landscape character and coherent ecological networks through the design and implementation of operation phase landscape strategy and construction phase masterplans; and
- utilising the proposed sea defences and northern mound to screen views of the Main Development Site from the coast.

f) Approach to cumulative assessment

i. Inter-relationships

7.3.50 Potential effects from inter-relationships, as considered at this stage, include:

- effects of noise, light fugitive dust and vibration on landscape character, and visual receptors. Tranquillity is discussed within **Section 7.4** – amenity and recreation;
- effects on heritage assets resulting from changes to views/landscape character; and
- effects on biodiversity resulting from the retention/loss of vegetation and proposals for mitigation as part of the operation phase landscape strategy/ construction phase Landscape Strategy.

ii. Cumulative effects

7.3.51 Cumulative landscape and visual effects arise as a result of the proposed development in combination with other relevant large scale developments in the vicinity of the Main Development Site. Potential cumulative effects arising from the Main Development Site and other major developments may include Galloper Wind Farm sub-station.

7.3.52 Relevant minor applications within 1km of the Main Development Site will also be considered as part of a cumulative LVIA.

7.3.53 The scope of the cumulative assessment will be agreed with relevant consultees in due course.

7.4 Amenity and recreation

a) Introduction

7.4.1 This section sets out the proposed scope and methodology for the amenity and recreation assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.4.2 AONB review and analysis report: EDF Energy has undertaken a review of published documents and consulted the AONB Partnership to identify and document the natural beauty criteria and special qualities of the Suffolk Coast and Heaths AONB. The draft report is currently being refreshed (March 2014) to incorporate references to the new AONB Management Plan 2013-2018 and other recently published baseline material including the Touching the Tide Landscape Character Assessment.

7.4.3 Amenity and recreation baseline: EDF Energy has undertaken an initial desk and site based review of amenity and recreation assets and activities in the proposed study area including Permissive paths and Public Rights of Way (PRoW) within the EDF Energy Estate and study area. Studies undertaken to date were summarised in the Sizewell C Stage 1 Environmental Report; these will be updated and extended to form the Stage 2 submission and will be informed by the proposed amenity and recreation study area (see below).

7.4.4 Amenity and recreation consultation: EDF Energy has defined an initial amenity and recreation study area boundary which has been informed by initial ZTV modelling of the Main Development Site structures and extended noise survey locations. The Amenity and Recreation study area has also informed the suggested Rights of Way survey area locations. The proposed amenity and recreation assessment methodology, study area, nature of stakeholder consultation meetings to support the establishment of baseline information, suggested Rights of Way survey locations and the content of the survey questionnaire will be consulted upon in due course with relevant consultees, to include SCC, SCDC, Ramblers Association, SUSTRANS, Natural England and the Suffolk Coast and Heaths AONB.

7.4.5 Landscape Strategy: Initial work leading to Stage 1 consultation has been undertaken to develop a Landscape Strategy for the EDF Energy Estate, illustrating the proposed character of the landscape following the construction phase. The Landscape Strategy will evolve and inform both a construction phase masterplan, which will include proposed PRoW and Permissive path diversions, and an operational phase Landscape Strategy for the EDF Energy Estate, which will include consideration of PRoW and Permissive paths and provision for recreation.

c) Approach and methodology

i. UK Legislation and Policy

7.4.6 UK legislation of relevance includes:

- The Marine and Coastal Access Act 2009;

- The Countryside and Rights of Way (CRoW) Act 2000;
- The Highways Act 1980;
- The Wildlife and Countryside Act 1981; and
- Equality Act 2010.

7.4.7 The Overarching NPS for Energy (EN-1) (DECC, July 2011) and the NPS for Nuclear Power Generation (EN-6) (DECC, July 2011) provide the primary basis for decisions taken by the Planning Inspectorate on applications for nuclear power stations.

7.4.8 Section 5.10 of EN-1 identifies that the Government's policy is to ensure there is

> *"adequate provision of high quality open space (including green infrastructure) and sports and recreation facilities to meet the needs of local communities."*

7.4.9 It further sets out that rights of way, National Trails and areas of access land are important recreational facilities and that mitigation measures should be considered as necessary. It also sets out the importance for consideration of coastal recreation and access to the coast. Furthermore, it identifies that consideration will be given to the implications for development of the creation of a continuous signed and managed route around the coast, as set out in the Marine and Coastal Access Act 2009.

7.4.10 NPS EN-6 sets out that in assessing the site, that there were some concerns in relation to coastal access and whether access to the heritage coastal path would be lost and the effect on local tourism, in particular during the construction phase. It adds that mitigation measures may take the form of siting certain elements of the station away from public footpaths and/or the provision of realignments to existing or planned rights of way.

ii. Study area

7.4.11 Initial site analysis and desk top studies have identified a study area of approximately 2km, measured from the boundary of the Main Development Site. The extent of the amenity and recreation study area is presented on **Figure 7.4.1.**

7.4.12 The study area captures PRoW and Permissive paths, local roads and open air recreation assets. It is anticipated that consideration of local roads where footpaths adjoin or where these roads are used for recreational cycling or walking will also be included and agreed during consultation. Routes and recreational assets identified during consultation that lie outside the proposed 2km study area may also be included in the assessment.

iii. Baseline information

7.4.13 The existing amenity and recreation resources within the study area will be mapped and subject to further desk based analysis will include: Public Rights of Way (PRoW, including footpaths, bridleways, byways and or numbered National Cycle Routes) for walking, with some having extra rights such as horse riding, cycling or vehicular use, Permissive paths, local lanes, accessible land, including Open Access Land, Permissive Access Land and registered Common Land. Two long distance paths, the Suffolk Coastal Path and Sandlings Walk, extend through the study area, the former located to the east along the coastal edge, the latter through Goose Hill and

Kenton Hills before travelling north. Permissive routes include those around Goose Hill and Kenton Hills. A number of areas of Open Access Land occur beyond the Main Development Site boundary and within the study area, including land near Leiston Common, Sizewell Common land to the north-west of Dower House, much of the Walks and Aldringham Common, with scattered areas, notably to the south of Leiston. Scattered areas of Registered Common Land are also evident, mainly to the south and east of Leiston. PRoW, Open Access Land and Common Land are illustrated on **Figure 7.4.1**.

7.4.14 Other existing recreation and amenity resources within the study area include areas of nature interest including designated Sites of Special Scientific Interest (SSSIs) and nature reserves. The key assets in terms of visitors and recreation are the Minsmere RSPB Reserve and North Warren RSPB Reserve which are managed for their nature conservation value, and to provide recreational and educational opportunities. The baseline appraisal will also include, subject to the outcome of ongoing research, consideration of sports and recreation clubs and facilities. Beach and waterborne recreation includes fishing, swimming, sailing and water-sports, such as windsurfing and kayaking.

7.4.15 Recreational users include local residents and tourists (day visitors and holiday makers). The amenity and recreation study area include areas of the Suffolk Coast and Heaths AONB, and areas defined as Heritage Coast. AONBs are one of several designated landscapes in England and Wales that the Government has confirmed as having the highest status of protection in relation to landscape and natural beauty. The Suffolk Heritage Coast is largely contained within the AONB, but extends some distance offshore. There are no statutory requirements or powers associated with the Heritage Coast definition: the purpose of the definition is similar to that of an AONB. However, the definition also includes objectives for conserving environmental health and biodiversity of inshore waters and beaches and to extend opportunities for recreational, sporting and tourist activities. The Suffolk Coast and Heaths AONB designation is considered to be an important asset for tourism.

7.4.16 A survey of Rights of Way is proposed, subject to consultation with SCC, SCDC and other relevant consultees.

7.4.17 The extent of the Suffolk Coast and Heaths AONB, Suffolk Heritage Coast and SLA are illustrated on **Figure 7.3.2**.

iv. Planned further survey/studies

7.4.18 Baseline recreation and amenity research including field survey and desk top analysis will be undertaken during early summer 2014 following the Easter holiday break, and autumn/winter 2014 and will include the identification of:

- cycle routes and their use;
- the extent and use of PRoW and Permissive paths;
- the extent and use of Common Land;
- user surveys for PRoW, Permissive paths and recreational assets (to be agreed in consultation) – surveys will be qualitative, rather than quantitative;

- preparation of principles for construction phase based on those developed for Main Development Site;
- preparation of initial diversion strategy related to temporary works (construction phase) masterplan; and
- amenity strategy within the Landscape Strategy for permanent works masterplan for the EDF Energy Estate.

v. Assessment methodology

7.4.19 The assessment will be undertaken in accordance with the relevant EIA Directive, regulations and guidance documents (as referred to in **Sections 2 and 5**).

7.4.20 The assessment will consider, as a minimum, impacts and effects during the construction and operational phases on:

- Rights of Way, which will include consideration of temporary and permanent obstruction and the potential need for diversions and potential disturbance to recreation receptors (both temporary or permanent). The assessment will also include consideration of the likely alteration in amenity experience with reference to the landscape and visual (see **Section 7.3**) and noise environment (see **Section 7.7**); and
- outdoor passive and active recreation assets, including beaches, nature reserves, sports clubs/facilities, and water bodies and water-based recreation facilities.

7.4.21 The assessment of effects will also consider the duration of the impact, for example, some impacts may not be present for the full duration of the various project phases.

7.4.22 The chapter will also assess the likelihood of deflection of recreation uses and in particular pedestrian and cycle activity, into the surrounding area during the construction phase and the interaction with ecological receptors, where necessary.

7.4.23 The amenity and recreation chapter will also address and assess effects on tranquillity as an amenity matter and draw on technical chapters including noise and LVIA to inform the assessment.

7.4.24 The key terms used within the amenity and recreation chapter relating to value/sensitivity, magnitude, effects and significance are described and defined below.

7.4.25 Value: the value or potential value of a resource is a function of a number of factors, for example, something may be of community value, or may be designated and therefore be of regional importance.

7.4.26 Sensitivity: the sensitivity of an amenity or recreation receptor is defined by its ability to continue to function and or maintain its intrinsic value subject to any changes caused by the proposed development and related activities.

7.4.27 Value/sensitivity are rated within the range high, medium, low, very low with reference to the definitions in **Table 7.4.1**.

Table 7.4.1: Value/sensitivity assessment

Receptor Value/Sensitivity	Receptor type
High	**Value:** Resource possesses key characteristics which contribute significantly to the distinctiveness and character of the locality, e.g. footpath of national significance, and possesses significant social/ community value. Resource is extremely rare. **Sensitivity:** Receptor has a very low capacity to accommodate the proposed form of change.
Medium	**Value:** Resource possesses key characteristics which contribute significantly to the distinctiveness and character of the locality, e.g. footpath of regional significance, and possesses significant social/ community value. Resource is rare. **Sensitivity:** Receptor has a low capacity to accommodate the proposed form of change.
Low	**Value:** Resource possesses characteristics which are locally significant e.g. local PRoW network and possesses moderate social/community value. Resource is relatively common. **Sensitivity:** Receptor has some tolerance of the proposed change subject to design and mitigation.
Very low	**Value:** Resource does not make a significant contribution to local character or distinctiveness and not designated. Resource is common. **Sensitivity:** Receptor identified as being generally tolerant of proposed change.

7.4.28 The magnitude of effect based on the effects that the proposed development would have upon the amenity and recreation resource/receptor, is considered within the range of high, medium, low, very low. Consideration is given to scale, duration of impact/effect (e.g. for construction, short-term for 1-2 years, medium-term for 3-5 years, long-term for 5 years and greater and permanent, dependent upon project timeframes) and extent of proposed development with reference to the definitions in **Table 7.4.2**.

Table 7.4.2: Magnitude assessment

Magnitude	Description
High	Large-scale, permanent/irreversible changes, over the whole development area and potentially beyond (i.e. off-site), to key characteristics, features or distinctiveness of amenity and recreation assets/receptors.
Medium	Medium-scale, permanent/irreversible changes, over the majority of the development area and potentially beyond, to key characteristics, features or distinctiveness of amenity and recreation assets/receptors.
Low	Noticeable but small-scale change, over a partial area, to key characteristics, features or distinctiveness of amenity and recreation assets/receptors.
Very low	Noticeable, but very small-scale change, or barely discernible changes for any length of time, over a small area, to key characteristics, features or distinctiveness of amenity and recreation assets/receptors.

7.4.29 The assessment of effects is based upon the assessments of magnitude of effects and sensitivity of the resource/receptor to come to a professional judgement of how important this effect is, as set out in **Section 5** of this Scoping Report. The definition of effects in relation to amenity and recreation is provided in **Table 7.4.3**.

Table 7.4.3: Definition of effects

Effect	Description
Major	Very large or large change in the amenity or recreation resource/receptor. Effects both adverse and beneficial, which are likely to be important consideration at the national to regional level as they contribute to achieving national/regional objectives, or, which are likely to result in exceedance of statutory objectives and/or breaches of legislation.
Moderate	Intermediate change in the amenity or recreation resource/receptor. Effects that are likely to be important consideration at a regional and local level.
Minor	Small change in in the amenity or recreation resource/receptor. These effects may be raised as local issues but are likely to be of importance in the decision making process.
Negligible	No discernible change in the amenity or recreation resource/receptor. An effect that is likely to have a negligible or neutral influence, irrespective of other effects.

7.4.30 Significance: generally, major and moderate effects are considered to be significant, whilst minor and negligible effects are considered to be not significant. However, professional judgement can also be applied where necessary and justified.

vi. Assumptions and limitations

7.4.31 Professional judgement will be used at all times, including during the interpretation of desk study and field surveys, assessment of potential impacts, determining effects and whether they are significant or otherwise, and the likely effects of mitigation measures.

7.4.32 The assessment of construction phase activities will be parameters-based with sufficient detail to undertake a robust assessment.

d) Potential impacts and effects

7.4.33 The proposed development has the potential to affect the recreational and amenity assets and receptors as detailed below.

7.4.34 The effects of construction phase works and the permanent development during operation on tranquillity will also be considered in the Amenity and Recreation assessment with reference to other technical chapters, notably LVIA (see **Section 7.3**) and noise and vibration (see **Section 7.7**).

i. Construction

7.4.35 Potential impacts during construction may result from the following:

- closure or diversion of PRoW and Permissive paths;
- disturbance of nearby PRoW resulting from construction activities including increased traffic along the road network, construction noise, dust and other emissions, and visual disturbance resulting from changes to baseline views and visible construction plant/activity;
- impact on water-based recreational resources and restricted access to the foreshore and open water immediately surrounding the Main Development Site;
- disturbance to sports and recreational facilities, open access land, public open space from a range of activities, including construction noise, traffic noise, dust and other emissions and visual disturbance; and
- diminished sense of tranquillity.

7.4.36 Effects at night would also be experienced as a result of security and other lighting to structures, access and perimeter fencing.

ii. Operation

7.4.37 Potential impacts during operation may result from the following:

- diminished amenity of PRoW in the vicinity of the development resulting from noise emissions and views to the development; and
- diminished sense of tranquillity.

7.4.38 Effects at night would also be experienced as a result of security and other lighting to structures, access and perimeter fencing.

e) Potential mitigation

7.4.39 Where possible, proposals to mitigate the effects of development on amenity and recreation resources and receptors will be embedded within the design, for example where the Landscape Strategy makes provision for footpath proposals. Measures to prevent/avoid, reduce and offset, remedy or compensate effects will be achieved through primary measures, developed through the iterative design process and integrated into the project design; standard construction and operational management practices; and secondary measures intended to address significant residual adverse effects but not built into the final development proposals. The iterative design process, informed by ongoing analysis and testing of proposals, will be documented in the design information accompanying the ES.

7.4.40 In relation to amenity and recreation, mitigation measures are likely to include the following:

- orchestration of Rights of Way closures and diversions and provision of a comprehensive construction phase masterplan to reduce effects where practicable during the construction phase;
- re-establishment of former PRoW and realignment of Permissive paths where practicable and establishment of recreation areas as part of the EDF Energy Estate Landscape Strategy;

- plan the construction and operational phases of the development to optimise land use to reduce/mitigate recreation and amenity effects where reasonably practicable;
- architectural design and treatment of temporary structures, such as the site accommodation campus, including amenity and office building and accommodation blocks, and permanent structures (that have the ability to be changed) and associated infrastructure, including lighting, access and fencing, to minimise recreation and amenity effects including at night;
- retain existing screening landscape features where reasonably practical and promote appropriate new landscape design (planting and landform) to mitigate landscape and visual effects of the development therefore ensuring visual amenity of footpaths and recreation assets is addressed;
- establish new planting and landform at the earliest reasonable opportunity;
- maintain and strengthen landscape character and coherent ecological networks through the design and implementation of operation phase Landscape Strategy and construction phase masterplans, ensuring the visual amenity of footpaths and recreation assets is addressed and maintained where appropriate; and
- utilise the proposed sea defences and northern mound to screen views of the Main Development Site from the coast.

f) Approach to cumulative assessment

i. Inter-relationships

7.4.41 The assessment of amenity impacts relating to other technical disciplines/EIA topic chapters will be addressed in the relevant chapter and sign posted in the amenity and recreation chapter. The amenity and recreation chapter will not repeat the amenity assessment for each topic but, where appropriate, will draw together technical topic findings in assessing overall amenity and effects on recreation.

7.4.42 Potential inter-relationships are predicted to occur with noise and vibration, air quality, landscape and visual, ecology, transport, historic environment and socio-economics.

ii. Cumulative effects

7.4.43 Cumulative effects arise as a result of the proposed development in combination with other relevant large scale developments in the vicinity of the Main Development Site. Potential cumulative effects arising from Sizewell C and other major developments may include the Galloper Wind Farm sub-station.

7.4.44 Relevant minor applications within 1km of the Main Development Site will also be considered as part of a cumulative assessment.

7.4.45 The scope of the cumulative assessment will be agreed with relevant consultees in due course.

7.5 Terrestrial historic environment

a) Introduction

7.5.1 This section sets out the proposed scope and methodology for the terrestrial historic environment assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.5.2 A review and gap analysis of the available baseline data (AMEC 2010a) was undertaken to identify any significant gaps, allow effective engagement with statutory consultees and inform the assessment methodology.

7.5.3 A desk-based assessment (DBA) was initially undertaken in 2010 to establish the historic environment baseline for the Main Development Site (AMEC 2010b). The study area for the DBA extended 2-3km from the boundaries used as part of the Government's SSA.

7.5.4 Detailed documentary research was undertaken to establish the extent of coastal erosion and land loss, in particular relating to the Sizewell settlement (AMEC 2011a). Desk studies have also been undertaken to establish the baseline for the settings of designated heritage assets (AMEC 2012a) within an extended study area agreed in consultation with Suffolk County Council Archaeological Service (SCCAS) and English Heritage.

7.5.5 Geophysical survey, comprising detailed magnetometer survey, was carried out on agricultural fields within the Main Development Site (Stratascan 2011). A LiDAR survey was undertaken on the wooded areas to identify potential archaeological remains, and across agricultural fields to augment data from the geophysical survey (AMEC 2012b). A detailed resistivity tomography survey, supported by investigatory geoarchaeological boreholes, was undertaken on the Main Development Site to develop an initial deposit model (AMEC 2013a).

7.5.6 An archaeological trial trench evaluation in advance of construction of wildlife ponds at Upper Abbey Farm revealed evidence for post-medieval quarrying but no archaeological features (Heard 2010).

7.5.7 Geoarchaeological monitoring of 29 peat trial auger holes did not recover any artefactual remains (AMEC 2012c). However, the recorded peat and fine-grained mineral-rich deposits have the potential to provide a detailed reconstruction of the environmental history of the Main Development Site and its environs, supporting the results of previous geoarchaeological investigations in 2008 and 2009.

c) Approach and methodology

i. Study area

7.5.8 The study area for the terrestrial historic environment assessment will be based upon that for the 2010 DBA, and extended to include the redline boundaries for the Main Development Site and off-site associated development. The study area will extend a

minimum of 1km beyond the proposed redline boundaries to establish archaeological and historical context and assess the potential for undesignated buried archaeological remains. The study area for the Main Development Site is shown in **Figure 7.5.1**.

7.5.9 The study area for the settings assessment includes Covehithe, to the north of the River Blythe, and Southwold to the north of the Main Development Site, and extends south beyond Aldeburgh and the River Alde to include Orford and Orford Ness. The A12 trunk road forms the western boundary of the study area and the current coast line was used as the eastern boundary. Coastal views towards the existing power station complex extend beyond the study area identified above. The study area for the settings assessment is shown in **Figure 7.5.2**.

ii. Baseline information

7.5.10 There is evidence for human occupation and utilisation of the landscape surrounding Sizewell from the Prehistoric through to the Second World War (WWII), including a number of heritage assets identified from cropmarks on aerial photographs, as well as findspots and built heritage assets.

7.5.11 The resistivity tomography geophysical survey and associated geoarchaeological ground investigation identified the presence of a wide channel, floodplain and rising topography to the south. This represents a former buried landscape, with the potential for both prehistoric and historic activity and therefore the potential for survival of associated archaeological remains beneath the Main Development Site.

7.5.12 A detailed magnetometer survey recorded potential buried archaeological remains and former landscape features extending across the Main Development Site.

7.5.13 There are no Scheduled Monuments within the redline boundary of the Main Development Site.

7.5.14 Leiston Abbey and moated site is a Scheduled Monument located approximately 600m to the west of the Main Development Site boundary. The Abbey was relocated from its original site due to coastal erosion in the 14th century AD. The remains of St Mary's Abbey, which forms part of the Scheduled Monument, is a Grade I Listed Building. Within the abbey complex the Retreat House, Barn and Guesten Hall are all Grade II Listed Buildings.

7.5.15 Three Grade II Listed Buildings (Upper Abbey Farmhouse, Barn at Upper Abbey Farm and Abbey Cottage) are located close to or within the boundary of the Main Development Site.

7.5.16 The designated heritage assets baseline study identified over 300 designated assets within the study area.

7.5.17 To the north and east of the Main Development Site are the Grade I Listed Church of St. Peter, Grade II* Theberton House and numerous Grade II Listed Buildings within Theberton and Eastbridge.

7.5.18 Old Leiston Abbey, the original 12th century site of St Mary's Abbey, is located on Minsmere approximately1.5km to the north. The standing remains of the chapel, and an integrated WWII pillbox, is a Scheduled Monument.

7.5.19 Further to the north, Southwold Conservation Area, particularly the Marine Villas Character Area, has views to the south down the coast from Gun Hill towards the existing power station complex. The Grade I Listed Church of St. Andrew, Covehithe, is located approximately 6km to the north of Southwold.

7.5.20 There are a number of designated and undesignated heritage assets within Leiston and Sizewell. These include the Grade II* Listed Leiston House, the Grade II Listed Long Shop and Church of St. Margaret.

7.5.21 There are long distance views from the south, across Thorpeness Conservation Area towards the existing power station complex. Designated assets of particular note in Thorpeness include The House in the Clouds, a Grade II Listed former water tower, which is now a holiday home, The Westbar, Westgate and Thorpeness Mill, which are Grade II Listed.

7.5.22 Further south, views can be afforded from Aldeburgh Conservation Area to the north along the coast from the seafront promenade and the Grade I Listed Moot Hall. Orford Castle is a Scheduled Monument and Grade I Listed Building, while the Parish Church of St Bartholomew is Grade I Listed. The military installation at Orford Ness is undesignated. Orford Ness Lighthouse dates from the 18th century and is Grade II Listed.

iii. Planned further survey/studies

7.5.23 Further desk studies will be carried out to update and expand the existing baseline to include construction site boundaries, highways improvements and rail routes will be completed in 2014.

7.5.24 Where geophysical surveys have been undertaken, a programme of trial trenching for these areas has been agreed with SCCAS to confirm the presence/absence of archaeological remains, establish the nature, date and extent of any archaeological remains within the site boundaries and inform proposals for mitigation to be agreed with SCCAS and English Heritage and included in the ES.

7.5.25 An additional geophysical survey will be carried out on areas not previously surveyed. Once the additional geophysical work is completed, an additional programme of trial trenching will be agreed as above. Trial trenching will be carried out ahead of the DCO submission.

7.5.26 Site visits to identify offsite heritage assets for which settings assessments will be required will be carried out in conjunction with English Heritage and Conservation Officers.

7.5.27 The representative viewpoints for the LVIA assessment will be used to inform the settings assessment where appropriate. The need for site specific heritage viewpoints for certain heritage assets (e.g. Leiston Abbey) will be discussed and agreed with English Heritage and Conservation Officers and added to the assessment where required.

7.5.28 The ES chapter will cross-reference the LVIA ES chapter and other workstreams (including noise) where appropriate to ensure an integrated approach to assessment.

iv. Assessment methodology

7.5.29 The assessment, and all supporting surveys, would be conducted in accordance with standards and guidance issued by the Institute for Archaeologists (IfA), English Heritage and other relevant documents, which set standards for all phases of archaeological assessment. Key guidance will include, but not be limited to:

- Standard and Guidance for Historic Environment Desk-Based Assessment (IfA 2012);
- Standard and Guidance for Archaeological Geophysical Survey (IfA 2012);
- Standard and Guidance for An Archaeological Watching Brief (IfA 2008); and
- Standard and Guidance for Archaeological Field Evaluation (IfA 2008).

7.5.30 There is, as yet, no standard or guidance published by the IfA or English Heritage specifically relating to EIAs for archaeology and cultural heritage.

7.5.31 The Design Manual for Roads and Bridges (DMRB), Volume 11: Environmental Assessment, Section 3, Part 2, Cultural Heritage (Highways Agency June 1993, amended 2007) contains guidance for assessing the effects of road schemes on cultural heritage.

7.5.32 DMRB 11.3.2 includes criteria for determining the value of heritage assets and assessing the magnitude of impacts on the heritage resource.

7.5.33 Heritage assets will be assigned a level of importance (value) in accordance with the historic environment definitions given in **Table 7.5.1**. The criteria described in **Table 7.5.1**, are adapted from DMRB.

7.5.34 As there are no internationally important sites within the study area (e.g. World Heritage sites), the DMRB category of “Very High Importance” has not been applied.

Table 7.5.1: Criteria used to determine importance (value)

Importance	Description
High	Ancient monuments scheduled under the Ancient Monuments and Archaeological Areas Act 1979, or archaeological sites and remains of comparable quality, assessed with reference to the Secretary of State’s non-statutory criteria, as set out in DCMS Guidance on Scheduled Monuments, Annex 1 (Ref. 23.1). Historic buildings that can be shown to have exceptional qualities in their fabric or historical association (for example Grade I or II* Listed Buildings). Well preserved historic landscapes preserving visible elements from medieval or earlier patterns.
Medium	Archaeological sites and remains which, while not of national importance, fulfil several of the Secretary of State’s criteria and are important remains in their regional context. Historic buildings that can be shown to have important qualities in their fabric or historical association (for example many Grade II Listed Buildings). Averagely well-preserved historic landscapes.
Low	Archaeological sites and remains that are of low potential or minor importance. Historic buildings of modest quality in their fabric or historical association. Historic landscapes with specific and substantial importance to local interest groups, but with limited wider importance.

Importance	Description
Very low	Buildings of no architectural or historical merit. Areas in which investigative techniques have produced negative or minimal evidence for archaeological remains, or where previous large-scale disturbance or removal of deposits can be demonstrated. Almost wholly modern landscapes created through the removal of historic boundaries.

7.5.35 Magnitude of impacts will assess the consequence that the proposed development would have on the historic environment resource. Magnitude will be considered in terms of high, medium, low and very low (see **Table 7.5.2**).

7.5.36 Potential impacts will also be considered in terms of permanent or temporary, adverse (negative) or beneficial (positive) and cumulative.

Table 7.5.2: Guidelines for the assessment of magnitude

Magnitude	Description of change
High	Complete removal of an archaeological site. Severe transformation of the setting or context of a designated heritage asset or serious loss of key components in a monument group.
Medium	Removal of a major part of an archaeological site's area and loss of research potential. Partial transformation of the setting or context of a designated heritage asset or partial loss of key components in a monument group. Introduction of considerable noise or vibration levels to a designated site, increased traffic, and/or reduction in air quality leading to changes to amenity use, economic viability, accessibility or appreciation of an archaeological site. Diminished capacity for understanding or appreciation (context) of a designated heritage asset site.
Low	Removal of an archaeological site where a minor part of its total area is removed, but that the site retains a meaningful future research potential. Minor change to the setting of a designated heritage asset.
Very Low	No notable physical impact or change. No notable change in setting or context. No impact from changes in use, amenity or access.

7.5.37 The magnitude of impact will be assessed against the value of the asset using a matrix to determine the resulting effect on the heritage resource, without mitigation.

7.5.38 Following the classification of an effect using this methodology, a clear statement will then be made as to whether that effect would be 'significant' or 'not significant'.

7.5.39 As a general rule, major and moderate effects are considered to be significant, whilst minor and negligible effects are considered to be not significant. However, professional judgement can also be applied where necessary, including taking account of whether the effect is permanent or temporary.

7.5.40 Mitigation will be proposed, which would enable the residual effect (whether adverse or beneficial) to be determined.

7.5.41 For the assessment of potential impacts to the settings of designated and, where appropriate, undesignated heritage assets, reference will be made to *The Setting of Heritage Assets* (English Heritage, 2011).

7.5.42 The assessment of impacts to settings would also take account of the National Planning Policy Framework (NPPF), which sets out that development may give rise to harm to heritage assets through change to the setting of that asset, even where no physical damage or disturbance occurs. The NPPF further distinguishes between 'harm' and 'substantial harm', and sets out how development that gives rise to harm should be considered within the planning process.

v. Assumptions and limitations

7.5.43 There are no known assumptions and limitations at this stage.

d) Potential impacts and effects

i. Construction

7.5.44 The nature and extent of buried archaeological remains across the construction site has not yet been determined. However, there is the potential for the permanent loss of buried archaeological remains and palaeoenvironmental deposits during construction.

7.5.45 There is the potential for temporary impacts to the settings of designated heritage assets, both in the vicinity of the Main Development Site and further along the coast to the north and south.

7.5.46 These works are anticipated to last for the duration of the construction programme. Although the length of the construction phase of the proposed development would not allow results to be categorised as 'short-term', effects arising from the perceptual presence of the proposed development will be reversible on completion of construction.

ii. Operation

7.5.47 There is the potential for impacts to the settings of designated heritage assets, both in the vicinity of the Main Development Site and further along the coast to the north and south.

e) Potential mitigation

7.5.48 For buried archaeological remains and palaeoenvironmental deposits mitigation would usually entail preservation in-situ or, where this would not be feasible, preservation by record to mitigate any significant adverse effects during construction. This would usually reduce the nature of the adverse residual effect but would not result in a beneficial effect.

7.5.49 Any significant effects on the settings of heritage assets would usually be mitigated through sensitive design, landscape planting or screening. Where this would not be

feasible, enhancements to the asset or its immediate setting may be considered to offset the overall effect.

f) Approach to cumulative assessment

i. Inter-relationships

7.5.50 The inter-relationships between increased traffic, noise, vibration and dust from construction would be considered during the assessment of impacts on the settings of heritage assets.

ii. Cumulative effects

7.5.51 The scope of the cumulative assessment will be agreed with English Heritage, SCCAS and relevant consultees (e.g. local authority Conservation Officers). The cumulative assessment will include consideration of relevant major developments that are permitted but not yet implemented and relevant submitted applications not yet determined.

7.5.52 It is anticipated that the cumulative assessment will focus on impacts to the settings of designated heritage assets, where it has been identified that the main development is likely to result in a change to the asset's setting.

7.5.53 The cumulative assessment will cross-reference to the LVIA where appropriate. The cumulative assessment will also consider effects on settings where developments may be viewed sequentially in relation to or from designated heritage assets.

7.6 Marine historic environment

a) Introduction

7.6.1 This section sets out the proposed scope and methodology for the marine historic environment assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.6.2 A marine historic environment desk-based assessment has been prepared for the proposed development (AMEC 2014). The study area encompasses an area of approximately 400km^2 (20km x 20km), with the Main Development Site at its central point, in order to gain a broad understanding of the context of the available data.

7.6.3 The study comprises a review of available literature (including previous DBAs; environmental assessments; regional syntheses; published and unpublished academic material), supplemented by the archaeological assessment of new geophysical (swath bathymetry and backscatter data), and geomorphological (LiDAR, georectified historic maps) data of the offshore region and the adjacent coastline.

7.6.4 Coastal and Offshore Archaeological Research Services (COARS), University of Southampton, was commissioned on behalf of EDF Energy to undertake an archaeological assessment of the impact of investigatory work associated with the proposed locations of the cooling water infrastructure for the proposed development. COARS assessed existing geophysical data to identify features or zones of high archaeological potential and determine potential impacts associated with offshore borehole drilling and recovery at two areas licensed by the Marine Management Organisation. No direct conflicts with known archaeological targets, or features/zones of high archaeological potential, were identified at either of the two licensed areas (AMEC 2013c).

c) Approach and methodology

i. Study area

7.6.5 The study area for the marine historic environment DBA encompasses an area of approximately 400km^2 (20km x 20km) with the Main Development Site at its centre.

7.6.6 The study area provides the marine and terrestrial archaeological context for evidence situated below the mean high water mark (MHWM). The study area for the assessment of the marine historic environment is shown in **Figure 7.6.1**.

ii. Baseline information

7.6.7 The Marine Historic Environment DBA (AMEC 2014) concluded that the potential for archaeological remains below MHWM is medium-high.

7.6.8 A total of 162 wrecks were identified within the marine study area, although the proposed development is not expected to directly impact any of these.

7.6.9 Of particular significance is the presence of the Dunwich Bank wreck, a designated wreck site situated approximately 4.5km to the north of the Main Development Site.

iii. Planned further survey/studies

7.6.10 Surviving archaeological remains and palaeo-environmental deposits of archaeological interest (if present) are likely to be submerged beneath a considerable sedimentary overburden. Consequently, COARS will complete an assessment of the recovered core material from the 2013 offshore geotechnical borehole campaign, in order to produce an initial deposit model in 2014.

7.6.11 Where additional sub-bottom profile and core data is acquired for geotechnical purposes, this will be analysed by COARS to enable a more accurate assessment of the potential presence or absence of archaeological remains/deposits in the offshore and intertidal zone.

7.6.12 The scope of the marine historic environment assessment will be discussed and agreed with the English Heritage Marine Consents Officer and the Regional Scientific Advisor.

iv. Assessment methodology

7.6.13 For the offshore and intertidal historic environment assessment key guidance will include, but not be limited to:

- Standard and Guidance for Historic Environment Desk-Based Assessment (IfA 2012);
- Historic Environment Guidance Note for the Offshore Renewable Energy Sector (COWRIE 2006);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (COWRIE 2011)); and
- Marine Geophysics Data Acquisition, Processing and Interpretation (Plets et al, 2013).

7.6.14 There is, as yet, no standard or guidance published by the IfA or English Heritage specifically relating to EIAs for archaeology and cultural heritage.

7.6.15 Assessment of the importance, or value, of heritage assets is based upon existing designations, the potential to contribute to the aims of the Marine and Maritime Historic Environment Research Framework (Dix and Sturt, 2013) and the criteria described in **Table 7.6.1**, which is based on the DMRB.

7.6.16 As there are no internationally important sites within the study area (e.g. World Heritage sites) the DMRB category of “Very High Importance” has not been applied.

Table 7.6.1: Criteria used to determine importance (value)

Importance	Description
High	Ancient monuments scheduled under the Ancient Monuments and Archaeological Areas Act 1979, or archaeological sites and remains of comparable quality, assessed with reference to the Secretary of State’s non-statutory criteria, as set out in DCMS Guidance on Scheduled Monuments, Annex 1.

Importance	Description
	Sites protected under the Protection of Wrecks Act 1973. Wreckage covered by the Protection of Military Remains Act 1986. Well preserved sites/features not previously detected but considered to be of high importance based upon arguments made in relevant research frameworks.
Medium	Archaeological sites and remains which, while not of national importance, fulfil several of the Secretary of State's criteria and are important remains in their regional context.
Low	Archaeological sites and remains that are of low potential or minor importance.
Very low	Areas in which investigative techniques have produced negative or minimal evidence for archaeological remains, or where previous large-scale disturbance or removal of deposits can be demonstrated.
Unknown	Areas that may contain potential for significant archaeological remains

7.6.17 Magnitude of impacts will assess the consequence that the proposed development would have on the historic environment resource. Magnitude will be considered in terms of high, medium, low and very low (see **Table 7.6.2**).

7.6.18 Potential impacts will also be considered in terms of permanent or temporary, adverse (negative) or beneficial (positive) and cumulative.

Table 7.6.2: Guidelines for the assessment of magnitude

Magnitude	Description of change
High	Complete removal of an archaeological site.
Medium	Removal of a major part of an archaeological site's area and loss of research potential.
Low	Removal of an archaeological site where a minor part of its total area is removed, but that the site retains a significant future research potential.
Very low	No notable physical impact or change.

7.6.19 The magnitude of impact will be assessed against the value of the asset using a matrix to determine the resulting effect on the heritage resource, without mitigation.

7.6.20 Following the classification of an effect using this methodology, a clear statement will then be made as to whether that effect would be 'significant' or 'not significant'.

7.6.21 As a general rule, major and moderate effects are considered to be significant, whilst minor and negligible effects are considered to be not significant. However, professional judgement can also be applied where necessary, including taking account of whether the effect is permanent or temporary.

7.6.22 Mitigation will be proposed, which would enable the residual effect (whether adverse or beneficial) to be determined.

v. Assumptions and limitations

7.6.23 There are no known assumptions and limitations at this stage.

d) Potential impacts and effects

i. Construction

7.6.24 The nature and extent of submerged remains / deposits offshore has not yet been determined. However, there is the potential for the permanent loss of buried archaeological remains and palaeoenvironmental deposits during construction.

ii. Operation

7.6.25 There is the potential for impacts to submerged deposits as a result of scour associated with offshore installations.

e) Potential mitigation

7.6.26 Suitable protocols for appropriate mitigation of potential significant adverse effects to the marine archaeology resource will be discussed and agreed with the English Heritage Marine Consents Officer and the Regional Scientific Advisor.

7.6.27 For buried archaeological remains and palaeoenvironmental deposits, mitigation would usually entail preservation in-situ or, where this would not be feasible, preservation by record to mitigate any significant adverse effects from construction. This would usually reduce the nature of the adverse residual effect but would not result in a beneficial effect.

f) Approach to cumulative assessment

i. Inter-relationships

7.6.28 The marine historic environment chapter will cross reference the coastal geomorphology and hydrodynamics chapter in order to assess possible impacts, such as scour, on submerged heritage assets.

7.6.29 Assessment of impacts on Historic Seascape Character will cross reference to other chapters, including LVIA, where relevant.

ii. Cumulative effects

7.6.30 The scope of the cumulative assessment will be agreed with English Heritage, Marine Consents Officer and the Regional Scientific Advisor.

7.6.31 The cumulative assessment will include consideration of relevant major developments that are permitted but not yet implemented and relevant submitted applications not yet determined.

7.7 Noise and vibration

a) Introduction

7.7.1 This section sets out the proposed scope and methodology for the noise and vibration assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.7.2 The initial baseline survey was carried out at eight locations around the Main Development Site in 2010 (see survey locations shown on **Figure 7.7.1**). A number of these monitoring locations were also surveyed during the Sizewell B outage in June 2013 (these locations are marked on **Figure 7.7.2**). Both surveys were carried out to the requirements of BS 7445-1:2003.

c) Approach and methodology

i. Study area

7.7.3 The study area is defined in **Figure 7.7.3**. This includes all human receptors identified around the Main Development Site which have the potential to be affected by noise on account of their proximity to the proposed development. It also includes areas potentially important for their quiet character, for example Leiston Abbey, public rights of way (PRoW), and sites of importance for nature conservation (e.g. Sizewell Marshes SSSI).

7.7.4 The study area will also include the A12 en route to Sizewell (between Ipswich to the south and Lowestoft to the north) and on the B1122, which was proposed at Stage 1 consultation as the main access road to the construction site from the A12. Other roads in the vicinity of the construction site that are likely to experience some increases in car traffic will also be considered as appropriate.

7.7.5 Potential noise and vibration impacts arising from Sizewell C-related rail freight movements on the Saxmundham-Leiston branch line and the East Suffolk Line will also be considered.

ii. Baseline information

7.7.6 Initial baseline survey work took place between 29 March and 14 April 2010 for durations ranging between less than 24 hours to a week. The locations were agreed with SCDC. This was followed up with a further baseline noise survey during the Sizewell B outage in June 2013. The purpose of this survey was to determine potential future baseline conditions without the Sizewell B station operating. The monitoring locations are detailed on **Figure 7.7.1** and **Figure 7.7.2.** The influence of Sizewell B on the baseline noise environment will be further examined following the planned further studies.

iii. Planned further survey/studies

7.7.7 Work carried out to date provides an initial indication of the existing noise climate in the vicinity of the Main Development Site. Further comprehensive surveys of noise

sensitive locations around the site are to be undertaken in 2014. Proposed monitoring locations for the Main Development Site are shown in **Figure 7.7.4** and **Figure 7.7.5** shows road traffic monitoring locations (subject to confirmation and landowner consent). **Tables 7.7.1** and **7.7.2** show a list of planned monitoring locations around the Main Development Site and on the surrounding road network along with a brief explanation of the rationale behind their selection. Vibration impacts are generally dictated by absolute values as opposed to any level of change from an existing baseline. Baseline vibration surveys may, however, be undertaken in certain critical locations, as set out below.

Table 7.7.1 List of monitoring locations around the Main Development Site

Location code	Site name	Future use of baseline data
MS1	Eastbridge South	To assess impact from construction at the Main Development Site at the closest residential location in Eastbridge
MS2	Close to Lower Abbey Farm	To assess local impact from construction at the Main Development Site
MS3	Close to Leiston Old Abbey	To consider impact on quiet character of area (which is a heritage asset and within a SSSI) from construction at the Main Development Site and from operational phase
MS4	Potters Street	To assess local impact from construction at the Main Development Site
MS5	Close to Potters Farm	To assess local impact from construction at the Main Development Site
MS6	Close to The Round House	To assess local impact from construction at the Main Development Site
MS7	Close to Ash Wood Cottages	To assess local impact from construction at the Main Development Site
MS8	Abbeymarshes	To consider impact on quiet character of area (which is within a SSSI) from construction at the Main Development Site and from operational phase
MS9	Coast path north	To consider impact on quiet character of area on a recreational route within an SPA from construction at the Main Development Site and from operational phase
MS10	Bridleway centre	To assess impact of operational site
MS11	Close to Hill Farm	To consider local impact from possible new rail route
MS12	Close to Leiston Abbey/Pro Corda music school	To consider local impact from possible new rail route and construction site entrance on B1122 on the heritage asset and associated music school
MS13	Close to Old Abbey Farm Lodge	To assess impact from construction at the Main Development Site
MS14	Close to Abbey Cottage	To assess impact from construction at the Main Development Site

Location code	Site name	Future use of baseline data
MS15	Close to Old Abbey Care Home	To assess impact from construction at the Main Development Site
MS16	Sizewell Marshes west	To consider impact on quiet character of the SSSI from construction at the Main Development Site and from operational phase
MS17	Sizewell Marshes east	To consider impact on quiet character of the SSSI from construction at the Main Development Site and from operational phase
MS18	Close to Cakes and Ale	To consider local impact from possible new rail route
MS19	Leiston North	To assess rail noise from proposed new rail route
MS20	Coast path at site	To consider impact on quiet character of area from construction at the Main Development Site and from operational phase
MS21	Close to Gate House, Saxmundham Road	To assess local impact from road traffic and rail traffic noise
MS22	Close to Leiston Station	To assess local impact from road traffic and rail traffic noise
MS23	Leiston centre	To assess rail noise impact in Leiston, away from road traffic
MS24	Leiston Valley Rd	To assess rail noise impact local to rail bridge and from possible rail head operations
MS25	Sandy Lane west	To assess impact from possible rail head and from road traffic associated from rail head use at that rail head
MS26	Close to Keepers Cottage	To consider local impact on quiet character of area from construction at the Main Development Site and from operational phase
MS27	Close to Rosery Cottage	To assess impact from construction at the Main Development Site and operational site
MS28	Sizewell Village	To assess impact from construction at the Main Development Site and operational site
MS29	Leiston Rail crossing	To assess impact from possible rail head
MS30	Close to Crown Lodge	To assess impact from possible rail head
MS31	Sandlings	To consider impact on quiet character of area (which is within the AONB and an SPA) from construction at the Main Development Site and from operational phase
MS32	Close to Sizewell campsite	To assess impact from construction at the Main Development Site and construction site at campsite and other locations south of Sizewell
MS33	Leiston West	To assess local rail noise impact

Table 7.7.2 List of monitoring locations for road traffic on the surrounding network

Location code	Site name	Future use of baseline data
RT1	A1120	To assess road traffic noise impact on the A1120
RT2	Yoxford junction	To assess road traffic noise at the junction between A12 and B1122
RT3	B1122 Middleton Moor	To assess road traffic noise impact at Middleton Moor level crossing
RT4	B1122 Middleton	To assess road traffic noise impact on the B1122 in Middleton
RT5	Westleton	To assess road traffic noise impact in Westleton
RT6	B1122 Theberton	To assess road traffic noise impact on the B1122 at Theberton
RT7	Close to Gate House, Saxmundham Road	To assess road and rail traffic noise impact on Saxmundham Road (also shown on Main Development Site monitoring location plan)
RT8	Close to Leiston Station	To assess road and rail traffic noise impact at Leiston station
RT9	Knodishall	To assess road traffic noise impact on Snape Road at Knodishall
RT10	Snape junction	To assess road traffic noise impact on the A1094
RT11	Farnham east	To assess road traffic noise impact on the A12 at Farnham
RT12	Farnham west	To assess road traffic noise impact on the A12 at Farnham
RT13	Glemham	To assess road traffic noise impact on the A12 at Glemham
RT14	Marlesford	To assess road traffic noise impact on the A12 at Marlesford

7.7.8 Monitoring will comprise surveys of noise levels conducted over a 24-hour period, involving both continuous recording of data and spot checks at critical periods. In some cases, principally relating to locations potentially susceptible to vibration from road and/or railway traffic, baseline vibration surveys will be undertaken simultaneously with the noise surveys. The surveys will be manned and unmanned, dependent on the data to be gathered. The potential need for further survey locations beyond those points will be considered, taking account of the results of the VISUM traffic modelling studies.

iv. Assessment methodology

7.7.9 The general approach to assessment for noise and vibration will be to assess impact magnitude and receptor sensitivity and thereby to consider effects. The numerical values determining the impact magnitude will depend upon the activity under consideration and its likely duration. **Table 7.7.3** contains criteria for considering

magnitude of noise impact and **Table 7.7.4** contains criteria for considering vibration impacts. In both cases, these criteria apply across all aspects of the proposed development including the construction and operational phases. **Table 7.7.5** contains criteria for assessing sensitivity to noise and vibration. Where noise or vibration impacts fall outside of the range in **Tables 7.7.3 and 7.7.4**, professional judgement will be used (with fully justified reasoning) to describe the impact. When considering "long-term" impacts for construction noise and vibration, the relevant standard (BS5228-1:2009, referred to below) defines the time period as more than six months. It is intended to adopt this timeframe in the assessment of long-term exposure during construction.

Table 7.7.3: Assessment of magnitude of impact for noise

Magnitude	Criteria
High	Large-scale, permanent / irreversible or medium/long-term changes, to key characteristics or features of the particular environmental aspect's character or distinctiveness. In general, this will equate to a greater than 10 dBA change in sound level or sound produced in excess of 10 dBA above baseline or recommended noise guideline values.
Medium	Medium-scale, permanent/irreversible or medium-term changes to key characteristics or features of the particular environmental aspect's character or distinctiveness. In general, this will equate to a greater than 5 and less than 10 dBA change in sound level or sound produced in between 5 dB and 10 dBA above baseline or recommended noise guideline values.
Low	Noticeable but small-scale change, over a partial area, to key characteristics or features of the particular environmental aspect's character or distinctiveness. In general, this will equate to a greater than 3 and less than 5 dBA change in sound level or sound produced in between 3 and 5 dBA above baseline or recommended noise guideline values.
Very low	Noticeable, but very small-scale change, or barely discernible changes for any length of time, over a small area, to key characteristics or features of the particular environmental aspect's character or distinctiveness. In general, this will equate to a less between 1 dBA and 3 dBA change in sound level or sound produced between 1 dBA and 3 dBA above baseline or recommended noise guideline values.

Table 7.7.4: Assessment of magnitude of impact for vibration

Magnitude	Criteria
High	Large-scale, permanent/irreversible or medium/long-term changes, to key characteristics or features of the particular environmental aspect's character or distinctiveness. In general, this will equate to a vibration dose value where adverse comment is very likely and/or where peak levels of vibration could lead to a likelihood of major building damage.
Medium	Medium-scale, permanent/irreversible or medium-term changes to key characteristics or features of the particular environmental aspect's character or distinctiveness. In general, this will equate to a vibration dose value where adverse comment is probable and/or where peak levels of vibration could lead to a likelihood of minor building damage.
Low	Noticeable but small-scale change, over a partial area, to key characteristics or features of the particular environmental aspect's character or distinctiveness. In general, this will equate to a vibration dose value where adverse comment is possible and/or where peak levels of vibration could lead to a likelihood of cosmetic building damage.
Very low	Noticeable, but very small-scale change, or barely discernible changes for any length of time, over a small area, to key characteristics or features of the particular environmental

Magnitude	Criteria
	aspect's character or distinctiveness. In general, this will equate to a vibration dose value where there is a low probability of adverse comment and/or where cosmetic building damage is unlikely to occur.

Table 7.7.5: Assessment of sensitivity of receptor for noise and vibration

Value/ sensitivity	Description
High	Receptors of greatest sensitivity to noise such as Scheduled Monuments and habitats supporting nationally or internationally important wildlife communities that are highly sensitive to noise disturbance and highly vibration sensitive structures or uses such as certain laboratories medical facilities or industrial processes.
Medium	Noise and vibration sensitive receptors such as dwellings, hospitals, schools, places of quiet recreation. Habitats supporting nationally or internationally important wildlife communities that are somewhat sensitive to noise disturbance, but may habituate.
Low	Receptors with limited sensitivity to noise and vibration such as offices, other workplaces and play areas. Habitats supporting nationally or internationally important wildlife communities that are of low sensitivity to noise.
Very low	Receptors of very low sensitivity to noise and vibration such as industrial or commercial buildings, transient or mobile receptors, open agricultural land and the open sea.

7.7.10 The noise assessment will take place for a number of different phases of the Sizewell C Project and will use a number of 'reasonable worst case scenarios' in each case. These will look at the impact at different times (day and night), as appropriate. Examples of scenarios to be considered include (but are not restricted to) the following: site preparation when the site entrance, northern access road, bridges and jetty are being constructed and site compounds are being prepared; around the main construction site during the Main Development Site excavation and subsequent backfilling stages; loading and unloading at the existing Leiston railhead at the start of construction followed by at the new off-site or on-site railhead during the peak period of the construction phase; and operation of the proposed development once construction is complete. Circumstances will be modelled for each scenario to allow a comparison of predicted levels with target values and mitigation will be designed based on the output from this, as appropriate.

7.7.11 Traffic-related noise impacts will be assessed in relation to the construction peak period with embedded mitigation such as the development site campus, proposed new rail infrastructure, jetty and park and ride sites in place. The need for any further mitigation will be considered based on the outcome of this noise assessment.

7.7.12 The noise environment within the proposed campus accommodation will be designed to ensure reasonable resting and sleeping conditions (with reference to BS8233).

7.7.13 Guideline values and standards that will be taken account of in the noise and vibration assessment include (but may not be limited to):

- For all construction work: BS 5228:2009. Part 1- Noise and Part 2 – Vibration;

- For road traffic: Design Manual for Roads and Bridges 2011 (known as DMRB), World Health Organisation (WHO) Guidelines for Community Noise 1999 and WHO Guidelines for Night Time Noise 2009, as applicable;
- Rail traffic impact: Noise Insulation Regulations Statutory Instrument 1996. No 428 (NIR) and WHO guidelines;
- Operational noise from site: BS4142;
- Vibration: BS6472 (human receptors) and BS7385 (building damage);
- Other impacts (such as noise from the jetty would be considered against WHO Guidelines; and
- Approaches to the assessment of the impact on wildlife and on tranquillity are not standardised in any way and are yet to be finalised as they will depend on the particular sensitivities of a specific location or species.

v. Assumptions and limitations

7.7.14 The standards available are designed for the assessment, in general, of permanent or new impacts and do not always provide guidance for the consideration of short-term impacts (such as any impact occurring over a period of less than a whole day or a whole night); or for a change in an existing situation. In such circumstances, the use of these standards may need to be adapted and this will entail making some assumptions about their applicability.

7.7.15 There is limited information available within the scientific community on the effects of noise and vibration on wildlife. Best available information and professional judgment will be used in the impact assessment.

7.7.16 The assessment of underwater noise will be considered in **Section 7.15**.

d) Potential impacts and effects

7.7.17 The proposed development has the potential to adversely impact upon the noise and vibration climate during the construction and operational phases due to the following activities:

- additional vehicle trips (HGVs, LGVs, buses, cars) and associated vibration and increases in road traffic noise both during construction and operation;
- on-site construction activities resulting in vibration and increased noise levels (for example earthworks, piling, mobile plant, bus transfers, prefabrication etc);
- noise and vibration from additional rail vehicles and noise from marine vessels serving the construction site, including loading and unloading; and
- noise emissions from the operational phase, including power station plant and machinery, as well as vehicular access.

i. Construction

7.7.18 Construction activities have the potential to adversely affect occupiers of dwellings in the immediate vicinity of the Main Development Site (these receptors being primarily located to the north and west of the Main Development Site).

7.7.19 Additional traffic on the surrounding highway network has the potential to adversely affect receptors in proximity to roads, especially in relation to those roads which currently have low traffic flows.

7.7.20 Construction and operation of rail routes and rail heads during the construction phase has the potential to cause adverse impacts on the occupiers of dwellings and other sensitive receptors in close proximity, although only for relatively short durations.

7.7.21 Vibration impacts may be noticeable in close proximity to the construction works, but would be unlikely to pose a risk of damage to structures, even at the closest receptors.

7.7.22 Assessment of effects in all cases will be undertaken using the methodologies, standards and guidance documents as set out above.

ii. Operation

7.7.23 There are potential noise and vibration impacts from operational traffic (staff, delivery traffic, maintenance vehicles etc.) which will be assessed in accordance with the methodologies set out above.

7.7.24 Noise from the operation of the power station itself (machinery noise, transformer etc.) has the potential to cause adverse impacts on nearby receptors, although it is expected that this would be reduced to a minimum by embedded mitigation.

e) Potential mitigation

7.7.25 During the construction phase a 25m environmental buffer zone would be retained along sensitive boundaries of the Main Development Site and the distance attenuation from this would reduce noise levels around the site. Where necessary, acoustic screening (soil bunds or fencing) may also be provided to mitigate noise.

7.7.26 Other potential noise mitigation measures may include:

a) Orientation of noise sources: for example, pointing any particular directional machinery away from noise-sensitive receptors;

b) Phasing of works: for example, creating noise bunds / erecting acoustic fencing or other structures/buildings on the outer fringe of the works area first so that they shield future phases of work;

c) Direction of working: particularly helpful when excavations are performed. Working in a direction towards the receptor maximises the potential for the working face of the excavation to act as a local noise barrier;

d) Working method: employing low noise processes, where feasible;

e) Selection of equipment: use low noise or specifically attenuated plant where feasible. (Compliant with EU Directives on noise emissions), such as silenced compressor units, diesel generators attenuated piling rigs;

f) Use of non-tonal reversing alarms where appropriate; and

g) Siting transportation sources within cuttings, providing timber or similar screens and providing smooth surfaces (road surfaces and rail track continuously welded) to minimise the generation of noise.

7.7.27 In terms of ground-borne vibration associated with ground works, the selection of working methods and plant should take account of ground conditions, proximity of vibration-sensitive receptors, the sensitivity of receptors (including that of buildings), the duration of the works and the period in the day. Vibration can be reduced by adopting non-displacement piling methods if the ground conditions permit. Vibration energy that propagates at or very close to the ground surface can be reduced by trenches set perpendicular to the direction of propagation.

7.7.28 An operational power station would feature a considerable complement of power process and services equipment. Much of the equipment would be within buildings, the fabric of which may be acoustically appropriate for the containment of sound. Ventilation paths and pipes may be fitted with silencing devices to reduce sound before its emergence to atmosphere. Acoustic enclosures may be fitted to external plant. Cooling fans may be selected with noise emissions in mind with larger diameter, slower-running fans selected in preference to smaller high-speed units, where possible.

f) Approach to cumulative assessment

7.7.29 The traffic data that will be used in the assessment of additional vehicle trips will include relevant committed developments. These trips will be included in the 'with and without' construction scenarios and the 'with and without' operation of the proposed development scenarios. Therefore, the effects of the proposed development will be considered in combination with relevant committed developments and thus the noise and vibration assessment can be considered to be inherently cumulative.

7.7.30 Additionally, if a relevant committed development introduces a sensitive receptor (e.g. residential development) into the study area being considered, then predictions would be undertaken for the location.

7.7.31 The potential for cumulative effects to be associated with other construction effects will also be considered to establish whether additional mitigation measures may be required.

7.7.32 In the operational phase the potential for combined effects from noise emissions from Sizewell B and the proposed development will be considered.

i. Inter-relationships

7.7.33 There is recognised to be an interaction between the assessment and mitigation of noise effects and that of transportation, terrestrial ecology and ornithology, air quality, landscape and visual impact assessment, historic environment and recreation and amenity in particular. These interactions will be considered further in the ES.

ii. Cumulative effects

7.7.34 The cumulative assessment will include consideration of relevant major developments that are permitted but not yet implemented and relevant submitted applications not yet determined.

7.8 Air quality

a) Introduction

7.8.1 This section sets out the proposed scope and methodology for the air quality assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.8.2 Air quality monitoring has been undertaken to support the proposed development using continuous monitors for oxides of nitrogen (NO_x), nitric oxide (NO), nitrogen dioxide (NO_2) and particulates (PM_{10}) and also passive diffusion tubes for NO_2 and Sulphur dioxide (SO_2). **Figure 7.8.1** shows the monitoring locations. Overall this monitoring has shown generally good air quality throughout the study area.

7.8.3 Continuous monitoring has also been undertaken for PM_{10} and NO_x at a background site on the Sizewell B power station site (Training Centre), National Grid Reference: 647160, 263850.

7.8.4 The continuous monitoring was undertaken as part of an initial air quality monitoring programme for approximately six months between 4 March and 23 September 2010.

7.8.5 Measurements of hourly mean PM_{10} concentrations were collected using a Beta Attenuation Monitor analyser (BAM). Measurements of hourly mean concentrations of NO_x, NO and NO_2 were made using a Chemiluminescent Analyser. During this period, NO_2 and SO_2 diffusion tubes were also deployed at nine locations.

7.8.6 Following the initial phase of air quality monitoring, two further years of NO_2 and SO_2 monitoring was undertaken between January 2011 and January 2013 using diffusion tubes. Monitoring was undertaken at up to fourteen roadside locations for NO_2 and for NO_2 and SO_2 at the existing Leiston railhead (a potential source of pollutant emissions from rail traffic).

7.8.7 The results of the background continuous monitoring identified that concentrations of NO_2 and PM_{10} were generally well below relevant air quality objectives (i.e. less than 75% of the air quality objective).

7.8.8 The results of the NO_2 diffusion tube monitoring identified that at most locations concentrations of NO_2 were below (i.e. less than 90% of the air quality objective) or well below the annual average air quality objective. At one residential location in Stratford St Andrew concentrations of NO_2 were marginally above relevant air quality objectives.

7.8.9 The SO_2 diffusion tube monitoring recorded concentrations were also well below relevant objectives at all locations.

c) Approach and methodology

7.8.10 The approach to the assessment of construction and operational air quality effects will vary between qualitative screening approaches and full quantitative dispersion modelling, depending on the potential significance of air quality effects expected to

arise from different activities associated with the proposed development. Air quality effects will be considered for the Main Development Site and associated traffic (including roads, rail and marine vessels).

7.8.11 This assessment methodology excludes radiological discharges to air during the operational phase of Sizewell C which is covered in **Section 7.17**.

7.8.12 It is currently anticipated that the following levels of assessment will be undertaken (the pollutants that are anticipated to be considered are also listed):

- screening assessment with targeted quantitative assessment of road traffic emissions using ADMS-Roads (for NO_2 and particulates) at locations such as Stratford St. Andrews;
- quantitative assessment of operational point source emissions using ADMS5 (for NO_2, SO_2, particulates, carbon monoxide (CO), ammonia (NH_3) and volatile organic compounds (VOCs));
- qualitative assessment of construction effects and non-road plant equipment (for dust deposition and airborne particulates);
- qualitative assessment of potential marine emissions (for NO_2, SO_2 and particulates); and
- qualitative assessment of potential rail traffic emissions (for NO_2, SO_2 and particulates).

7.8.13 Calculations will not be undertaken to quantify carbon dioxide or other greenhouse gas emissions for the proposed development. This is because carbon emissions are assessed against national targets, rather than against targets for individual developments, and also because carbon dioxide is not a key pollutant of concern for local air quality. However, it is noted that Sizewell C will make a major contribution towards reducing carbon dioxide emissions from electricity generation in England and Wales as outlined in the National Policy Statement.

7.8.14 The assessment of the above sources and their significance will be undertaken with reference to best practice guidance including:

- Defra (2009), Local Air Quality Management Technical Guidance 2009 LAQM, TG(09);
- Environment Agency (2010), Horizontal Guidance Note H1 – Annex F – Air Emissions;
- Environmental Protection UK (EPUK) 2010 Development Control: Planning for Air Quality, 2010 Update;
- Highways Agency (2007) Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1, HA207/07 Air Quality, dated May 2007;
- Institute of Air Quality Management (IAQM) (2009), Position on the description of air quality impacts and their significance, Institute of Air Quality Management, November 2009; and
- IAQM (2014), Guidance on the assessment of dust from demolition and construction.

i. Study area

7.8.15 The air quality study area will differ for the different types of sources of local air quality pollutants:

- road traffic-related pollutants (construction and operational phases);
- construction dust; and
- point sources (e.g. diesel generator emissions).

7.8.16 The maximum study area around the Main Development Site for construction dust and point sources is shown on **Figure 7.8.2**. The anticipated study area for road traffic air quality effects is described below.

7.8.17 The study area will include the A12 en route to Sizewell (between Ipswich to the south and Lowestoft to the north) and the B1122, which was proposed at Stage 1 consultation as the main access route for HGVs to the construction site from the A12. Other roads in the vicinity of the construction site that are likely to experience some increases in car traffic will also be considered as appropriate.

7.8.18 The locations where targeted ADMS-Roads modelling will be undertaken for the above routes and sensitive receptors will be determined using the screening criteria developed by the Highways Agency and EPUK, together with professional judgement. Locations along the above routes that are considered likely to be subject to ADMS-Roads modelling include the A12 between the proposed southern park and ride at Wickham Market and the proposed northern park and ride at Darsham, as well as the B1122 from Yoxford to the proposed entrance to the Main Development Site.

7.8.19 The study area for potential construction dust emissions will extend up to 200m from the boundary of the Main Development Site and up to 500m along public roads from construction sites, due to the potential for dust-blow and trackout of materials, respectively. Beyond these distances, based on published guidance, dust effects from construction activities can be expected to be negligible.

7.8.20 The study area for point sources will be based upon Environment Agency Guidance (H1, Annex F) and this will include key sensitive locations (e.g. Minsmere – Walberswick SPA and Ramsar site, and Minsmere to Walberswick Heaths and Marshes SAC and Sizewell Marshes SSSI) up to 10km from the Main Development Site. Human health impacts will be assessed up to 3km from the point sources; based on published guidance and the size of the proposed point source emissions, beyond these distances air quality effects can be expected to be negligible.

ii. Baseline information

7.8.21 SCDC has declared two Air Quality Management Areas (AQMAs) due to elevated concentrations of NO_2 but the nearest is approximately 20km from the Main Development Site. This AQMA is located in Woodbridge (including properties near the junction of Lime Kiln Quay Road, Thoroughfare and St John's Street). The second AQMA is located near to the Port of Felixstowe.

7.8.22 SCDC is also in the process of consulting with the Department of Environment, Food and Rural Affairs (Defra) on the need to declare a third AQMA. It is understood that the AQMA would be located on the A12 at the outskirts of Stratford St Andrew as

NO_2 concentrations marginally exceed the annual average air quality objective in this location.

7.8.23 Baseline air quality information will be taken from the following sources:

- Sizewell C Air Quality Monitoring Results obtained between 2011 and 2013;
- SCDC Local air Quality Management Reports;
- Department for Environment, Food and Rural Affairs (DEFRA) Background Pollutant Maps;
- DEFRA Air Quality Management Areas (AQMAs);
- The Automatic Urban and Rural Network (AURN); and
- Air Pollution Information System (APIS).

iii. Planned further survey/studies

7.8.24 The need for further air quality monitoring data and the details of any monitoring (e.g. monitoring locations, techniques and durations) will be agreed in consultation with relevant stakeholders through the preparation of an air quality monitoring strategy.

7.8.25 It is anticipated that data concerning existing dust deposition rates in the vicinity of the Main Development Site may be collected using dust deposition gauges (e.g. Frisbee gauges) to provide a baseline against which the performance of any dust mitigation measures could be evaluated during the course of the construction phase of the development. It is envisaged that dust monitoring sites would include selected locations in proximity to residential dwellings and designated ecological sites (e.g. Minsmere – Walberswick SPA and Ramsar site, and Minsmere to Walberswick Heaths and Marshes SAC and Sizewell Marshes SSSI) subject to confirmation and agreement with landowners.

7.8.26 It is not anticipated that further continuous monitoring for NO_x or PM_{10} monitoring will be required. This is because a review of SCDC local air quality monitoring between the 2009 and 2012 does not suggest a significant change in background conditions since continuous monitoring was undertaken previously for the proposed development.

7.8.27 Monitoring for smaller particulate matter size fractions is also not proposed, due to the low monitored PM_{10} concentrations in the area, as $PM_{2.5}$ is contained within the larger PM_{10} size fraction that has already been measured.

7.8.28 Additional passive NO_2 diffusion tube sampling is not proposed as the combination of NO_2 diffusion tube sampling undertaken previously for the proposed development combined with SCDC's passive diffusion tube sampling data are considered to be sufficient to characterise baseline conditions for road traffic effects.

7.8.29 No additional SO_2 diffusion tube sampling is warranted as monitored values have previously been below relevant air quality objectives and limited emissions of SO_2 are envisaged from the pollutant sources associated with the construction or operation of the proposed development. Additionally, there is no evidence to suggest that baseline conditions will have changed since the time of that survey.

iv. Assessment methodology

7.8.30 This sub-section describes the approach proposed to be utilised to describe air quality effects and the details of the assessment methodology for construction and air quality effects.

Evaluation of Magnitude and Significance

7.8.31 The evaluation of the significance of air quality effects will be based on professional judgement and the criteria outlined in the IAQM publication. There are a number of aspects that must be taken into account when assessing the significance of an effect. These are:

- the magnitude of the change caused by the proposed development;
- the absolute predicted environmental concentration in relation to the air quality objectives;
- the number of people and/or extent of designated ecosystems exposed;
- the likely duration of effects; and
- the level of uncertainty associated with effects (i.e. the extent to which worst case assumptions have been utilised).

7.8.32 **Table 7.8.1** presents the IAQM criteria for the determination of the "magnitude of change", based on the percentage increase in pollutant concentrations due to the proposed development. **Table 7.8.2** presents the significance of potential effects, taking into account the magnitude of change over baseline conditions and the absolute concentration in relation to air quality objectives. The latter has been modified slightly to accommodate the terms high to very low for magnitude of change (where high = large; low = small; and very low = imperceptible compared to the IAQM terminology) and the terms 'Major', 'Moderate' and 'Minor' in relation to significance of effect, to ensure consistency with other disciplines**.**

Table 7.8.1: Determination of magnitude of change – air quality

Magnitude of change	Annual mean concentration NO_2, PM_{10} (µg/m³)	Days PM_{10} >50µg/m3
High	Increase/decrease >4	Increase/decrease > 4
Medium	Increase/decrease 2 - 4	Increase/decrease 2 – 4
Low	Increase/decrease 0.4 - 2	Increase/decrease 1 – 2
Very low	Increase/decrease < 0.4	Increase/decrease < 1

Table 7.8.2: Descriptors for effect of predicted changes in annual mean concentrations of NO_2 and PM_{10} at individual receptors

Absolute concentration in relation to objective/limit value	Change in concentration			
	High	Medium	Low	Very low
Increase with proposed development				
Above Air Quality Standard or	Major Adverse	Moderate	Minor	Negligible

Absolute concentration in relation to objective/limit value	Change in concentration			
	High	Medium	Low	Very low
Guideline with the proposed development (>40 µg/m^3)		Adverse	Adverse	
Just Below Air Quality Standard or Guideline with the proposed development (36 - 40 µg/m^3)	Moderate Adverse	Moderate Adverse	Minor Adverse	Negligible
Below Air Quality Standard or Guideline with the proposed development (30 - 36 µg/m^3)	Minor Adverse	Minor Adverse	Negligible	Negligible
Well Below Air Quality Standard or Guideline with the proposed development (<30 µg/m^3)	Minor Adverse	Negligible	Negligible	Negligible
Decrease with proposed development				
Above Air Quality Standard or Guideline with the proposed development (>40 µg/m^3)	Major Beneficial	Moderate Beneficial	Minor Beneficial	Negligible
Just Below Air Quality Standard or Guideline with the proposed development (36 - 40 µg/m^3)	Moderate Beneficial	Moderate Beneficial	Minor Beneficial	Negligible
Below Air Quality Standard or Guideline with the proposed development (30 - 36 µg/m^3)	Minor Beneficial	Minor Beneficial	Negligible	Negligible
Well Below Air Quality Standard or Guideline with the proposed development (<30 µg/m^3)	Minor Beneficial	Negligible	Negligible	Negligible

7.8.33 The values in **Tables 7.8.1** and **7.8.2** describe the effect and this terminology will be used when referring to effects at individual receptors. The overall effect on air quality sensitive receptors will be determined by professional judgement and the basis of such assessment will be justified fully. Overall effects that are described as major or moderate effects (adverse or beneficial) will be considered as being significant effects. Minor effects and negligible effects will be considered to be not significant.

7.8.34 The National Air Quality Strategy Objectives (AQS) have been set by Government at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, elderly or unwell. As such, the sensitivity of receptors has been considered in the definition of the air quality objective values and therefore no additional subdivision of human health receptors on the basis of the building or location type is required.

7.8.35 Particular significance will be given to a change that takes the concentration from below to above the AQS objective or vice versa because of the importance ascribed to the objectives in assessing local air quality.

7.8.36 Environment Agency guidance (H1: Environmental risk assessment for permits, 2011) indicates that for the assessment of point source emissions, long-term ground level concentrations arising from point sources which are less than 1% of an air quality objective or EAL can be treated as insignificant (or negligible). Similarly, short-term ground level concentrations arising from point sources which are less than

10% of an air quality objective or EAL can also be treated as insignificant (or negligible). Where emissions are not screened as negligible, the descriptive terms for the significance of the effect, outlined in **Table 7.8.2**, will be applied.

7.8.37 The significance of effects of point source emissions on ecological receptors (e.g. Sizewell Marshes SSSI and Sandlings SPA), through deposition of nutrient nitrogen or acidity will be evaluated using the Environment Agency insignificance criterion of 1% of the long-term National Objective for the Protection of Vegetation and Ecosystems, as above. In the event that insignificance cannot be demonstrated using this method, additional assessment of deposition effects will be undertaken, with reference to the Critical Loads of the ecological receptors concerned.

Construction methodology

7.8.38 Additional road traffic on the local and strategic road network around the Main Development Site and off-site associated temporary development during the construction phase have the potential to adversely affect air quality at nearby sensitive receptors (within 200m of the road network). Initially, the level of change in vehicle trips will be evaluated against the Highways Agency and EPUK traffic screening criteria to identify routes were further quantitative air quality assessment may be required or where routes can be screened from further assessment.

7.8.39 Where further quantitative work is required this would be undertaken using the ADMS-Roads model. Modelling will identify the total concentration of key road traffic pollutants at sensitive receptors and also the change in pollutant concentrations. Such studies will only focus on emissions of NO_x and PM_{10}. The ADMS-Roads model outputs will use Defra local air quality management tools and APIS information as appropriate.

7.8.40 Modelling will be undertaken for long-term averages; the potential for short-term air quality objectives to be exceeded will be assessed using empirical relationships outlined in Defra local air quality management guidance for NO_2 and PM_{10}.

7.8.41 The roads modelling predictions will be verified against air quality monitoring data collected for the proposed development and local authority monitoring data as appropriate. Modelling will be undertaken with one year of hourly sequential meteorological data, consistent with the baseline year of the traffic model.

7.8.42 Dust impacts during the construction phase will be assessed by providing a qualitative assessment of the potential sources and effects, together with a risk assessment to identify those receptors most at risk including, but not limited to, residential dwellings, ecological sites and heritage and amenity assets, following the IAQM Guidance for assessing impacts from construction activities. The evaluation of significance resulting from this assessment will use the same terms and definitions as the Sizewell C General Assessment Approach Generic Effect Definitions.

7.8.43 The potential effects of any rail traffic emissions or marine based emissions during the construction phase will be considered utilising the screening criteria outlined in Defra Local Air Quality Technical Guidance. If, following review against the Defra criteria, further quantitative works are required, these would be undertaken using ADMS5, although at this stage it is not envisaged that detailed modelling would be required for these emissions sources.

Operational methodology

7.8.44 In the operational phase the same approach will be utilised to the assessment of air road traffic effects as described for the construction phase, with screening of traffic data followed by quantitative modelling where appropriate.

7.8.45 The assessment of operational point sources associated with the Main Development Site will be based on relevant Environment Agency Guidance (e.g. H1, Annex F) and modelling will be undertaken using the latest version of ADMS.

7.8.46 Point source modelling will be undertaken with the inclusion of representations of buildings as appropriate to capture potential downwash effects and five years of meteorological data will be utilised in accordance with best practice. It is envisaged that modelling will only be undertaken for short-term averaging periods for operational combustion emissions sources as they are expected to only be used as back-up to the main plant on a short-term basis.

v. Assumptions and limitations

7.8.47 The proposed development will be assessed using the following assumptions:

- road traffic air quality modelling (where undertaken) will use traffic datasets derived from the Transport Assessment;
- operational point source modelling will use design information available at that time;
- the latest Defra NO_x to NO_2 conversion factors available at the time of assessment will be used; and
- road traffic air quality model outputs will be adjusted against monitoring data.

7.8.48 Only standard operation scenarios for point source emissions will be assessed as part of the EIA, but additional operation scenarios will be considered in support of the Environmental Permit application process as appropriate.

d) Potential impacts

7.8.49 The proposed development has the potential to adversely affect air quality during the construction and operational phases, as outlined above. Further details are provided in the following two sub-sections.

i. Construction

7.8.50 Additional traffic on the local and strategic road network around the Main Development Site and off-site associated development during the construction phase has the potential to adversely affect air quality at nearby sensitive receptors (within 200m of the road network). For example at locations along the A12 including: Stratford St Andrew, Farnham, Little Glemham and Marlesford and along the B1122.

7.8.51 Dust impacts during the construction stage also have the potential to adversely affect ambient air quality and dust deposition at sensitive receptors locations within 200m of works (e.g. residential dwellings and designated ecological sites).

7.8.52 Additional emissions of particulates, NO_x and SO_2 may also be associated with diesel locomotive and marine vessels during the construction phase. These emissions have the potential to affect receptors in close proximity to these sources.

ii. Operation

7.8.53 There are potential air quality impacts from operational traffic (staff, delivery traffic, maintenance vehicles) which will be assessed in accordance with the methodologies set out above.

7.8.54 Point source emissions, including diesel generators, could include particulates, CO and NO_x. These have the potential to affect sensitive receptors around the Main Development Site. Receptors include residential dwellings, amenity locations and designated ecosystem sites (e.g. Sizewell Marshes SSSI for NO_x emissions).

e) Potential mitigation

7.8.55 The air quality assessment will identify the need for any additional mitigation measures during the construction and operational phase of the proposed development beyond the embedded mitigation measures that will be included within the design of the proposed development that will be assessed as part of the initial assessment. This may include the identification of the following measures:

- a dust management plan would be prepared based on the outcomes of the dust impact assessment. It is envisaged that this would incorporate dust management measures to minimise emissions at source and protect sensitive receptors. It would also consider the need for dust monitoring to confirm the effectiveness of the management approach;
- road transport mitigation measures e.g. HGV controls or road improvements; and
- the use of additional control measures that may represent Best Available Techniques (BAT) for the control of point source emissions at the Main Development Site.

f) Approach to cumulative assessment

7.8.56 The traffic data that will be used in the assessment of additional vehicle trips will include relevant committed developments. These trips will be included in the 'with and without' construction scenarios and the 'with and without' operation of the proposed development scenarios. Therefore, the effects of the proposed development will be considered in combination with relevant committed developments and the air quality assessment can be considered to be inherently cumulative.

7.8.57 Additionally, if a relevant committed development introduces a sensitive receptor (e.g. residential development) into the roads study area being modelled using ADMS-Roads then predictions would be undertaken for that location.

7.8.58 The potential for cumulative effects to be associated with other relevant construction works in the area will also be considered to establish if additional mitigation measures may be required. In particular, consideration will be given to the timing of any outage works associated with Sizewell B.

7.8.59 In the operational phase, the potential for combined effects from point source emissions from Sizewell B and the proposed development will be considered using ADMS.

i. Inter-relationships

7.8.60 There is recognised to be an interaction between the assessment and mitigation of air quality effects and that of transportation, ecology, noise, and recreation and amenity in particular. These interactions will be considered further in the assessment.

ii. Cumulative effects

7.8.61 The cumulative assessment will include consideration of relevant major developments that are permitted but not yet implemented and relevant submitted applications not yet determined.

7.9 Soils and agriculture

a) Introduction

7.9.1 This section sets out the proposed scope and methodology for the soils and agriculture assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.9.2 Published, broad scale mapping of soil types (Soil Survey of England and Wales, 1984) and ALC status (MAGIC website) have been consulted for the study area.

7.9.3 In addition, an agricultural land survey was undertaken in February 2011, covering the majority of the Main Development Site as well as surrounding areas within EDF Energy's Estate.

7.9.4 Not all land within the Main Development Site was surveyed because the full extent of the land required for construction and operation of the proposed development was not appreciated when the survey was undertaken. Nonetheless, the results provide a very good indication of soil conditions and agricultural land quality within the Main Development Site.

7.9.5 Soil sampling was undertaken at a rate of one sample per two hectares of land, on average, with over 100 samples collected in total. **Figure 7.9.1** shows the soil sampling locations. At each sample location, the following site characteristics were recorded:

- vegetation type;
- gradient;
- aspect;
- any indication of surface ponding/wetness; and
- any indication of soil erosion.

7.9.6 Soil sampling was carried out using a hand-held auger up to a depth of 1.1m and the following soil characteristics were recorded at each location, using standard field survey methodologies (Hodgson, 1976):

- soil texture;
- stoniness;
- colour (including local mottle colours);
- consistency;
- structural condition; and
- depth.

7.9.7 Soil Wetness Class was inferred in-situ from the matrix colour.

7.9.8 No soil samples were collected and no laboratory analysis carried out.

7.9.9 To establish the ALC grade, field survey results were combined with data on the topography and climate of the region to provide an assessment according to the standard ALC methodology (MAFF, 1988).

7.9.10 Soil droughtiness was calculated from moisture balance equations using crop-adjusted available profile water (AP) and calculated moisture deficit (MD) for the standard crops: wheat and potatoes.

7.9.11 AP was estimated from soil texture, stoniness, soil structure condition and depth, and then compared to the calculated crop-adjusted MD taken from the tables prepared by The Meteorological Office (The Meteorological Office, 1989).

c) Approach and methodology

7.9.12 The assessment of effects on soils and agriculture would relate to the following key factors:

- the soil types, their quality and, in particular, the ALC likely to be affected by the proposed development;
- the type of farm enterprises and farming/land management practices present, including any agri-environment schemes; and
- the possible presence of crop/soil/animal diseases or noxious weeds, and the risk of spreading such disease/weeds.

7.9.13 The objectives of the assessment would be to:

- characterise the baseline environmental conditions for soils, land-use and agriculture within the study area;
- identify all soils, land-use and agricultural receptors within and adjacent to the Main Development Site that may be affected by the construction and operation of the proposed development;
- assess the likely significant effects of the proposed development on soil, land-use and agriculture, taking account of temporary and permanent land-use requirements and site restoration;
- recommend measures, if appropriate, to mitigate potential significant adverse effects on soil, land-use and agriculture.

i. Study area

7.9.14 The geographical extent of the soils and agriculture study area will include all land within the Main Development Site. The study area will extend to cover land within 200m of the Main Development Site boundary, which could potentially be affected by airborne dust emissions arising from construction activities. **Figure 7.9.2** shows the extent of the proposed study area.

ii. Baseline information

7.9.15 Arable land within the Main Development Site is mainly farmed by contractors who lease the land off EDF Energy. The arable land in the north-west of the Main Development Site and next to Eastlands industrial estate is privately owned. All non-agricultural land within the Main Development Site (including the north-eastern corner

of Sizewell Marshes SSSI) is managed by Suffolk Wildlife Trust on behalf of the landowner EDF Energy.

7.9.16 Field surveys indicate that there are several main soil types within the study area. The main soil type of agricultural land is a sandy loam derived from glacio-fluvial sands. Along the coast, raw, course textured sandy soils derived from beach deposits predominate. In the area of the Sizewell Marshes SSSI soils consist of alluvium (interbedded sand, silt and clay) with lenses of humified peat. **Figure 7.9.3** shows the indicative soil types in the vicinity of the Main Development Site.

7.9.17 The 2011 ALC survey concluded that all of the existing agricultural land surveyed within the Main Development Site comprises Subgrade 3b (moderate quality) soils or lower. Therefore, none of the agricultural land that was surveyed is classified as 'best and most versatile', although further surveys are to be carried out to provide a robust baseline for assessment purposes in the EIA.

7.9.18 Use of this land would be consistent with Para 5.10.8 of the National Policy Statement for Energy that states: "*applicants should seek to minimise impacts on best and most versatile agricultural land and preferably use land in areas of poorer quality…*" (DECC, 2011).

7.9.19 In addition, made ground predominates on land north of Sizewell B power station, including the northern landscape mound. This comprises a mixture of Crag sand and inert arisings from the construction of Sizewell B (stones, brick and concrete rubble).

7.9.20 **Figure 7.9.4** shows the ALC grades and non-agricultural land-uses in the area, based on the findings of EDF Energy's 2011 ALC survey.

iii. Planned further survey/studies

7.9.21 A thorough review will be undertaken of published literature and web-based information to help characterise baseline conditions. In addition to the information sources already consulted, this will include agri-environment schemes and other relevant records held by Defra, for example animal burial pits, records of noxious weeds and the most recent national census of agriculture and horticulture.

7.9.22 In addition, the 2011 ALC survey will be updated to cover the entire Main Development Site area and also to investigate further areas of potential higher and lower quality land based on the 1993 survey.

7.9.23 Consultations will also be held with landowners and land managers within the Main Development Site and in the surrounding area in order to understand farming and land-management practices and issues material to the EIA.

iv. Assessment methodology

7.9.24 There are no established or published methods for assessing the impacts of development upon agricultural receptors.

7.9.25 The soil and agricultural receptors that have the potential to be impacted by the proposed development will be assigned a level of importance in accordance with the quality of the soil and the ALC grade of the land. These are described in **Table 7.9.1**. Where a receptor can reasonably be placed within more than one category,

professional judgment will be used to determine which rating would be most appropriate.

Table 7.9.1: Assessment of the value/sensitivity of receptors for soils and agriculture

Value / sensitivity	Description
High	ALC Grade 1 land. Irrigated agriculture. Stock animals. Higher level agri-environment schemes. Soils with low or no wetness limitation affecting workability (wetness class I or II), where drought is not also a limitation. Soils with a high susceptibility to structural damage and soil erosion throughout the year, including heavily textured, poorly structured soils.
Medium	ALC Grades 2 and 3a land. Non irrigated agriculture. Entry level agri-environment schemes. Soils with low wetness limitation affecting workability (wetness class II), where drought is not also a limitation. Soils with some seasonal susceptibility to structural damage and soil erosion.
Low	ALC Grade 3b. Arable or grassland areas. Soils with moderate wetness limitation affecting workability (wetness class III or IV). Soils with medium to course textures and some resistance to structural damage for most of the year.
Very Low	ALC Grades 4 and 5 land. Non-agricultural land. Soils with high wetness limitation affecting workability (wetness class V or VI). Soils in which droughtiness is a limitation to crop growth. Course textured and stony soils with little potential for structural damage.

7.9.26 The magnitude of impact is based on the consequences the proposed development would have upon soils and agricultural receptors. There is no published guidance on thresholds for assessing what scale of loss should be regarded as significant, but the presence of best and most versatile land is a key factor in the consideration of the sustainability of development proposals as set out in paragraph 112 of the NPPF. **Table 7.9.2** is based on a combination of the generic guidelines proposed for use in the assessment, access timescales of temporary loss and land area loss thresholds previously adopted by MAFF (MAFF, 1988).

Table 7.9.2: Assessment of magnitude of impact on soils and agriculture

Magnitude	Criteria
High	Permanent loss or degradation of over 50ha of best and most versatile land (BMVL), or entire regional resource of BMVL (ALC Grades 1, 2, 3a). Existing land-use would not be able to continue.
Medium	Permanent loss or degradation of 20-50ha of BMVL, or large proportion of regional resource of BMVL.

Magnitude	Criteria
	Existing land-use would be able to continue but with major changes such as loss of yield, additional land management or increased use of fertilisers and herbicides.
Low	Permanent loss or degradation of 10-20ha of BMVL, or small proportion of regional resource of BMVL. Existing land-use would be able to continue but with some changes such as loss of yield, additional land management or increased use of fertilisers and herbicides.
Very Low	Permanent loss or degradation of <10ha of BMVL. Short-term impacts to receptors with no impact on integrity. No material change to existing land-use.

7.9.27 Following the classification of an effect using this methodology, a clear statement will be made as to whether the effect would be 'significant' or 'not significant'. As a general rule, major and moderate effects are considered to be significant, whilst minor and negligible effects are considered to be not significant. Professional judgement will be applied where appropriate, taking account of all relevant factors including whether the effect is permanent or temporary and the context of the effect e.g. a land management strategy designed to enhance biodiversity and landscape character.

v. Assumptions and limitations

7.9.28 It is noted that land-use within and around the Main Development Site is not static so the baseline will change. For example, 50 ha of former arable land north and south of the Main Development Site has recently been converted into grassland/scrub, or is due to be taken out of arable use in 2014.

7.9.29 Socio-economic effects on agricultural businesses are to be assessed in the socio-economic workstream (see **Section 6**).

d) Potential impacts and effects

i. Construction

7.9.30 Potential impacts and effects during construction include:

- permanent loss of agricultural land through landtake;
- degradation of agricultural land used temporarily for construction, for example due to soil handling and storage arrangements;
- impairment of crops/land close to the construction site, for example due to airborne dust emissions, or shading effects;
- indirect effects on surrounding agricultural land caused by changes in site hydrology or hydrogeology, for example leading to a potential increase in poaching of the land by grazing livestock;
- spreading of noxious weeds caused by soil/land management arrangements within the Main Development Site and on other related land, for example that used for ecological mitigation; and
- risk of spreading disease through uncontrolled disturbance of any potential animal burial pits, in the course of the development.

ii. Operation

7.9.31 At the end of the construction phase, the agricultural land will be restored in accordance with the Landscape Strategy. Certain elements of the Landscape Strategy, for example habitat creation for reptiles, are already in the process of being implemented. Whilst some of the land needed temporarily for construction may be restored for agricultural use (either as arable or grassland), the Landscape Strategy proposes further enhancements to biodiversity and landscape character through the creation of a mosaic of permanent grassland, heathland and scrub on existing arable land. Whilst this would represent a loss to agriculture, it represents an overall gain in terms of landscape and biodiversity.

7.9.32 The Landscape Strategy will be developed taking account of all relevant factors, including soil type and ALC grading of the land.

e) Potential mitigation

7.9.33 For areas of land that will be restored to agricultural use, appropriate measures will be taken to reduce impacts on soil quality. This will be enabled through appropriate soil handling (for example in relation to soil stripping, stockpiling and tracking by vehicles). Detailed arrangements will be developed in consultation with relevant stakeholders and in line with established soil management principles such as the Defra code of practice “Protecting Our Water, Soil and Air (Defra, 2013) and set out in a Soil Management Plan.

7.9.34 The Soil Management Plan will also address soils to be used for non-agricultural purposes for example habitat creation.

f) Approach to cumulative assessment

i. Inter-relationships

7.9.35 The key inter-relationships are with landscape and terrestrial ecology and ornithology and relate to the post construction use of former agricultural land in habitat creation for biodiversity and landscape purposes. These proposals will be set out in the Landscape Strategy. In addition there are potential inter-relationships with air quality, in relation to airborne dust emissions that could affect nearby crops, and hydrology and hydrogeology, that could affect the drainage of adjacent land.

ii. Cumulative effects

7.9.36 The cumulative assessment will include consideration of relevant major developments that are permitted but not yet implemented and relevant submitted applications not yet determined.

7.10 Geology and land quality

a) Introduction

7.10.1 This section sets out the proposed scope and methodology for the geology and land quality assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.10.2 A Phase 1 desk-based study was carried out on part of the Main Development Site, centred on the land north of Sizewell B, in 2010. This provided an initial view of the Conceptual Site Model (CSM) and potential contamination sources using publicly available information such as Envirocheck, published geological and hydrogeological maps and previous site investigation reports.

7.10.3 This was followed by a Phase 2 intrusive investigation focusing on the land to the north of Sizewell B power station where Sizewell C would be developed. In addition the investigation included land further north and to the west in order to help develop the CSM and target other potential areas of contamination identified in the Phase 1 desk-based study, e.g. a former sand pit. A programme of exploratory holes (including trial pits and cable percussive boreholes) was undertaken between 15 July 2010 and 16 March 2011.

7.10.4 The aims of the Phase 2 intrusive investigation were to:

- characterise the ground and groundwater conditions within the study site (inclusive of soil type, composition, depth, thickness and groundwater flow direction);
- characterise the contamination status of the soils and groundwater and the ground gas regime;
- assess the risks posed by identified contamination through a Tier 1 risk assessment with respect to soil, water and gas;
- assess the suitability of the soils for re-use within the proposed development with respect to contamination status; and
- revise and refine the preliminary CSM derived from the Phase 1 desk-based assessment.

7.10.5 Samples were taken from over 150 exploratory holes and scheduled for non-radiochemical and radiochemical laboratory analysis. Non-radiochemical data were compared to relevant Tier 1 soil screening values (SSVs). Activity levels were compared against 'out of scope' limits as defines in the Environmental Permitting (England and Wales) (Amendment) Regulations 2011. Ground gas levels were screened against Construction Industry Research and Information Association (CIRIA) C665 (UK Technical Guidance).

7.10.6 The monitoring locations of the Phase 2 intrusive investigation are shown in **Figure 7.10.1**.

c) Approach and methodology

i. Study area

7.10.7 The study area will comprise the following elements:

- Main Development Site: to take account of potential sources of contamination arising on-site that could pose a risk to on-site or off-site receptors;
- surrounding land within a radius of 1km from the Main Development Site boundary: in order to include all potential contamination source-pathway-receptor linkages; and
- the coastline between Southwold, to the north of the Main Development Site, and Orford Ness to the south, which is susceptible to erosion due to coastal change, and which could potentially be exacerbated by the proposed development.

7.10.8 The proposed study area is shown in **Figure 7.10.2.**

ii. Baseline information

7.10.9 Published geological records show that the solid geology beneath the Main Development Site comprises Red Crag; part of a sequence of Crag deposits present along the Norfolk and Suffolk coastline. This is separated from the underlying Chalk by Palaeogene deposits, including London Clay (part of the Harwich Formation) and the Lambeth Group. Bedrock geology in the area dips towards the south-east. The Palaeogene deposits become thinner in a westerly direction from the Main Development Site, becoming absent at a distance of approximately 8-10km.

7.10.10 The land north of Sizewell B power station sits in a former river basin where the Crag sand bedrock has been eroded and infilled with superficial deposits (alluvium and peat). Diamicton (Glacial deposits – boulder clay overlying glacial sands and gravels) overlies the Crag sand in the west of the site; as ground levels decrease to the east, the sands and gravels become exposed.

7.10.11 **Table 7.10.1** summarises the published geological records for the Main Development Site.

Table 7.10.1: Summary of geological conditions at the Main Development Site

	Name	Description	Location
Superficial deposits	Alluvium	Highly organic soil, with variable clay, silt and sand content. Contains significant amounts of humified peat.	North-eastern part of the Main Development Site branching towards the central northern part of the Main Development Site, coincident with areas of marsh, including Sizewell Marsh and the Sizewell Belts.
	Lowestoft formation	Diamicton (boulder clay), overlying sands and gravels.	Present mainly on higher ground in an arc from the north-west through to the south-west and south of the existing Sizewell A and Sizewell B power stations. The Lowestoft Formation is absent in lower-lying areas immediately to the west of the existing power station site.
	Beach deposits	Sands and gravels.	Narrow strip (approximately 100m) along the eastern (coastal) side of the Main Development Site.

	Name	Description	Location
	Tidal flat deposits	Silt and clay.	Eastern part of the Sizewell C Main Development Site, extending approximately 500m inland (west) of the beach deposits.
Bedrock	Crag Group (Red Crag Formation)	Sand, with minor gravel, silt and clay layers.	Present along the eastern coast of Norfolk and Suffolk and as such, underlies the entire Main Development Site. Overlain in western areas of the Main Development Site by the Lowestoft Formation, Peat or other superficial deposits. In parts of the eastern and northern sections of the Main Development Site, no superficial deposits overlie the Red Crag. The Red Crag is not homogeneous and contains two low permeability layers within the Main Development Site, one of which is known as Chillesford Clay, the other is unnamed.
	Palaeogene Deposits (Harwich and Lambeth Group)	Layered deposits comprising sands, silts, clays, volcanic ash and pebble beds.	The Palaeogene Deposits underlie the Main Development Site and are present throughout the region, thinning to the west and become absent at a distance of approximately 8-10km west of the Main Development Site.
	Chalk	Soft, white porous limestone with extensive fissuring, flint beds, marl layers and hard ground ("Chalk Rock").	Chalk is present throughout the region and as such, underlies the entire Sizewell C Main Development Site. The Chalk is overlain by the Palaeogene Deposits at the Main Development Site, however to the west, where the Palaeogene Deposits are absent, Chalk is overlain by the Red Crag.

7.10.12 Made ground is present to the north of the existing Sizewell B power station overlying the alluvium. This area was used as a contractor's compound during the construction of Sizewell B and comprises re-worked Crag sand and beach deposits, and inert construction materials, such as bricks, stone and concrete.

7.10.13 Phase 2 investigations showed no evidence of significant sources of non-radiological contamination. No asbestos fibres were recorded in any exploratory hole. Occasional localised sources of contaminants such as heavy metals and hydrocarbons were identified mainly within areas of Made Ground. The radiochemical analyses demonstrated that activity levels were consistent with background and below adopted screening values. Risks to humans from current use, during construction and operation were assessed as negligible.

7.10.14 The peat is a potential source of ground gas (methane and carbon dioxide).

7.10.15 Much of the Main Development Site is green field and agricultural and the risk of anthropogenic contamination is therefore expected to be low. **Table 7.10.2** summarises the main potential sources of contamination within the Main Development Site.

Table 7.10.2: Potential sources of anthropogenic contamination

Potential source of contamination	Associated contaminants
Agricultural land including widespread application of fertilisers, pesticides etc.,	Pesticides and fertilisers.

Potential source of contamination	Associated contaminants
localised spills of fuel from machinery.	Oils and diesels.
Infilled former small scale aggregate workings.	Various contaminants from filling materials, depending on material used/deposited. Ground gas (methane/carbon dioxide).
Spoil/construction materials from construction of the Sizewell B power station.	Various contaminants from spoil, depending on what the spoil contained. Potential for ground gas generation if organic/biodegradable materials present.
Rifle range.	Potential for small-scale lead depositions from shot.
Contractors' storage/works area, including machinery storage, concrete batching.	Diesel/oils. Various contaminants from storage areas, depending on what was used/stored.

iii. Planned further survey/studies

7.10.16 The Phase 1 desk based study will be updated to cover the entire Main Development Site and local surrounding area within a radius of 1km of the Main Development Site boundary.

7.10.17 The land north of Sizewell B power station has already been subject to a comprehensive Phase 2 (intrusive) ground investigation as outlined above. Subject to a detailed review of the existing geo-environmental information, development of the CSM, and consultations with the Environment Agency, the need for further intrusive investigations will be determined, focussing on areas of identified or suspected anthropogenic contamination.

7.10.18 In addition, a desk-top review will be undertaken of all statutory and non-statutory sites of geological interest within the study area, along the coastline, in order to evaluate baseline conditions and assess their potential to be affected by the proposed development. Sites to be considered include:

- Alde-Ore Estuary SSSI;
- Pakefield to Eastern Bavants SSSI;
- Regionally Important Geodiversity Sites (RIGS); and
- County Geodiversity Sites (CGS).

iv. Assessment methodology

Contaminated Land Assessment

7.10.19 It is intended to assess impacts from potential contaminated land using a risk-based approach outlined above rather than to assess against receptor value/sensitivity and impact magnitude matrices as befitting other aspects.

7.10.20 The approach and methodologies to be used within the assessment would be in accordance with the phasing and guidance contained within CLR 11: Model Procedures for the Management of Land Contamination (Defra and the Environment

Agency, 2004). Intrusive ground investigations will be carried out in accordance with BS10175:2011 Investigation of Contaminated Sites – Code of Practice, as amended.

7.10.21 The assessment would include the following aspects:

- Review and update of the existing Phase 1 desk based study;
- Development of CSM: recognising that this will be an iterative process taking account available intrusive site information;
- Review of available Phase 2 (intrusive) site information;
- Gap analysis with further intrusive investigation if appropriate;
- Human Health Risk Assessment based on the Contaminated Land Exposure Assessment (CLEA) Model (Environment Agency, 2009);
- Controlled Water Risk Assessment: with reference to relevant Environmental Quality Standards, i.e. Drinking Water Standards (DWS) for groundwater and Environmental Quality Standards (EQS) for surface water;
- Ground Gas Risk Assessment: in accordance with the guidance document 'Assessing the Risk Posed by Hazardous Ground Gases to Buildings' (CIRIA, 2004); and
- Phytotoxic Risk Assessment in the context of the re-use of soil/materials to restore the construction area under the Landscape Strategy: focussing on the potentially phytotoxic contaminants boron, copper, nickel and zinc in accordance with thresholds given in the Sludge (Use in Agriculture) Regulations 1989 and ICRCL Guidance Note 59/83 (ICRCL, 1987).

7.10.22 The potential use of peat and alluvium excavated from the land north of Sizewell B to backfill any excavations required to win construction materials from elsewhere within the construction area will be assessed using a proprietary contaminant fate and transfer model such as Landsim.

Designated Geological Sites

7.10.23 The consideration of impacts on statutory and non-statutory designated geological sites will be based on results of the sedimentology/coastal change assessment carried out in **Section 7.13** Coastal Geomorphology and Hydrodynamics which will identify areas of coastline naturally at risk of erosion and consider the likelihood and magnitude of any development-induced effects **Table 7.10.3** sets out the proposed criteria for assessing receptor value/sensitivity and **Table 7.10.4** sets out the proposed criteria for assessing impact magnitude.

Table 7.10.3: Assessment of value and sensitivity of designated geological sites/features

Value / Sensitivity	Criteria
High	Geology has a national designation and is highly sensitive to damage caused by coastal change.
Medium	Geology has a national designation but is not highly sensitive to damage caused by coastal change. Non-statutory designated sites of regional importance that are highly sensitive to damage caused by coastal change.

Value / Sensitivity	Criteria
Low	Non-statutory designated sites of regional importance that are not highly sensitive to damage caused by coastal change. Non-statutory designated sites of local importance that are highly sensitive to damage caused by coastal change.
Very Low	Non-statutory designated sites of local importance that are not highly sensitive to damage from coastal change. Undesignated geological features/sites.

Table 7.10.4: Assessment of impact magnitude on designated geological sites/features

Value / Sensitivity	Criteria
High	Large-scale permanent change to geological site/feature.
Medium	Modest permanent change to geological site/feature.
Low	Limited permanent change to geological site/feature. Temporary increase in erosion/degradation of the site/feature that is unlikely to affect the integrity of the geological site/feature in the long-term.
Very Low	Low risk of any temporary or permanent change to geological site/feature.

v. Assumptions and limitations

7.10.24 The baseline understanding of the geology underlying the Main Development Site is based on a combination of limited borehole sampling and published British Geological Society maps. Additional borehole sampling may therefore provide results which alter current assumptions on the superficial geology.

7.10.25 Agricultural land is assumed to have no anthropogenic contamination beyond the normal application of fertilisers and pesticides.

d) Potential impacts and effects

i. Construction

7.10.26 Potential risks from ground contamination within the land north of Sizewell B are considered to be low, assuming that appropriate personal protective equipment is worn by construction workers and that ground gas protection measures are incorporated into the proposed development, where appropriate.

7.10.27 The contamination risk associated with other land within the Main Development Site is considered to be very low as it is has not previously been developed.

7.10.28 There are potential risks to controlled waters, construction workers and vegetation associated with soil/spoil handling procedures, re-use of spoil to balance the earthworks, create construction platforms and bunds, and ultimately to restore the site in accordance with the proposed Landscape Strategy.

ii. Operation

7.10.29 The development will incorporate features to prevent ground contamination during the operational phase and the facility will be audited regularly in order to ensure that all pollution control measures are working effectively.

e) Potential mitigation

7.10.30 At this stage, no mitigation features are proposed beyond those embedded in the design of the proposed development. For example, the re-use of construction materials where they are suitable for use without pre-treatment and where they wouldn't cause harm to the environment.

f) Approach to cumulative assessment

i. Inter-relationships

7.10.31 Inter-relationships exist between this issue and groundwater, surface water, terrestrial ecology and ornithology, and landscape which all provide receptors which could potentially be impacted by ground contamination.

7.10.32 In addition there are links to coastal geomorphology and hydrodynamics as regards potential effects of the proposed development on geological sites/features.

7.10.33 These potential inter-relationships will be considered in the ES.

ii. Cumulative effects

7.10.34 There is potential for cumulative effects on geological sites/features located on the coast. The cumulative assessment will include consideration of relevant major developments that are permitted but not yet implemented and relevant submitted applications not yet determined.

7.11 Groundwater

a) Introduction

7.11.1 This section sets out the proposed scope and methodology for the groundwater assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.11.2 Work has been undertaken to establish groundwater conditions at the Main Development Site and to support the development of a conceptual model which describes the relationship between groundwater and the Sizewell Marshes SSSI and the Minsmere-Walberswick Heaths and Marshes SSSI.

7.11.3 Over 60 groundwater monitoring boreholes have been constructed to determine the baseline variation in groundwater levels. Non-radiochemical and radiochemical groundwater quality monitoring has been undertaken to define baseline conditions within the Main Development Site footprint. The information derived from monitoring undertaken to date has also been used to develop a predictive groundwater impact assessment model to provide a tool to assess the impacts of the proposed development on the groundwater environment, and closely related surface water environment within the Sizewell Marshes SSSI. The architecture and capability of the groundwater model have been subject to discussion with the Environment Agency and the modelling approach will be developed further to ensure a suitable basis for predictive assessment is available. The model will be informed by ongoing monitoring.

7.11.4 The groundwater studies which have been undertaken to date are summarised in **Table 7.11.1**.

Table 7.11.1: Summary of groundwater studies undertaken

Study	Scope of Study
Site investigations	Site investigation has been undertaken at the proposed Main Development site. These investigations have included construction of groundwater monitoring boreholes and soil and groundwater quality analysis of samples recovered from monitoring boreholes. Additional site investigations have also been initiated at locations with potential for winning material from within the temporary construction area and at proposed site options for a replacement wetland habitat.
Pumping tests	A pumping test was undertaken in the Red Crag Aquifer at the proposed Main Development Site during 2010 and 2011.
Groundwater quality monitoring	Groundwater quality monitoring comprised monthly sampling of 31 boreholes over the period December 2010 to October 2011.
Groundwater level monitoring	Groundwater level monitoring at 60 borehole locations was initiated in April 2011. Monitoring comprises monthly manual dips with continuous water level monitoring (data loggers) in selected boreholes.
Ground and surface water modelling	Development of a multi-layered ground and surface water model.

7.11.5 The locations of the groundwater monitoring points are shown on **Figure 7.11.1**.

c) Approach and methodology

i. Study area

7.11.6 The study area with respect to the Main Development Site is shown on **Figure 7.11.1** and includes the Minsmere-Walberswick Heaths and Marshes SSSI and the Sizewell Marshes SSSI. The study area also includes the outcrop (recharge area) of the Superficial Sands and Gravels and the Red Crag Formation (referred to as Crag).

ii. Baseline information

7.11.7 Baseline conditions have been determined through a programme of site investigation, ongoing groundwater level and quality monitoring and conceptual model development.

7.11.8 The geology beneath the Main Development Site is described in **Section 7.10** and summarised in **Table 7.10.1**. This knowledge is critical in supporting the baseline understanding for groundwater.

7.11.9 The Crag and the Chalk aquifers are classified as Principal Aquifers by the Environment Agency. The Lowestoft Sand Gravels and Beach deposits are classified as Secondary A aquifers. The deeper Chalk aquifer is separated from the Crag by the London Clay (see **Figure 7.11.2**) which provides a physical separation and aquiclude.

7.11.10 The Main Development Site is located on the Waveney and East Suffolk Chalk and Crag groundwater body. This groundwater body has been classified by the Environment Agency as being of Good Quantitative status but Poor Chemical status. The Poor Chemical status is attributed to impacts from agriculture as evidenced by elevated nitrates concentrations in groundwater.

7.11.11 The Crag and superficial aquifers support a number of licensed and private water supplies. The locations of these abstractions are shown on **Figure 7.11.3**. Environment Agency mapping (http://www.environment-agency.gov.uk/homeandleisure/37793.aspx) shows that there are no groundwater Source Protection Zones (SPZs) within the Main Development Site boundary. SPZs for two sources are located approximately 3km south-west from the Main Development Site. An inner SPZ (SPZ1) is located just outside of the Main Development Site boundary.

7.11.12 The Environment Agency East Suffolk Catchment Abstraction Management Strategy (Environment Agency, 2013) indicates that, in this area, the Environment Agency may consider applications for groundwater abstractions on a case-by-case basis dependent upon the scale of abstraction and the potential impact on surface water resources.

7.11.13 Groundwater level and quality monitoring has been undertaken for the Crag and overlying superficial deposits and has been focussed on understanding the groundwater conditions which influence the sustainability of the SSSIs (see **Figure 7.11.1**) in the near field of the Main Development Site area. Groundwater flow in the Crag is to the east and towards the coast with a component of groundwater

discharge to the Sizewell Marshes SSSI and the Minsmere-Walberswick Heaths and Marshes SSSI.

7.11.14 Groundwater quality monitoring indicates a transition from fresh calcium carbonate water to the west of the Main Development Site towards more saline waters at the coast and beneath the proposed development site. Groundwater below the Main Development Site cannot be used for potable supply due its high salinity. Nitrate concentrations in groundwater to the west of the Main Development Site exceed Drinking Water Standards and the area falls within a Nitrate Vulnerable Zone.

7.11.15 A west to east section through the Main Development Site is shown on **Figure 7.11.2** and this illustrates the relationship between the main groundwater aquifer units.

iii. Planned further survey/studies

7.11.16 Groundwater level monitoring will continue through 2014 to further define baseline conditions.

7.11.17 The data derived from groundwater monitoring (existing and ongoing) will be used to refine and calibrate the groundwater model that will be used to form the basis of a predictive impact assessment related to Main Development Site construction.

7.11.18 A study is also being undertaken to assess the feasibility of backfilling potential sites that could be used to win material from within the temporary construction area, with peat and alluvium arising from the construction excavations from the proposed development. This study will be informed by additional ground investigations (as detailed in **Table 7.11.1**) that have been undertaken in the first quarter of 2014.

iv. Assessment methodology

7.11.19 There is a wide range of legislation, policy and guidance which relates to the protection of groundwater resources. This is summarised in the Environment Agency's Groundwater Protection: Principles and Practice document (GP3). The main documents that will be referred to for the assessment are:

- Groundwater Protection: Principles and Practice (GP3) August 2013;
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2003;
- Environmental Permitting Regulations (England and Wales) 2010 (as amended);
- Environment Agency Pollution Prevention Guidelines;
- Environment Agency Anglian River Basin Management Plan (2010);
- The East Suffolk Catchment Abstraction Management Strategy (2013);
- Water Act 2003; and
- Water Resources Act 1991 as modified.

7.11.20 The assessment will consider the impacts and effects of the proposed Main Development Site construction and operational phases on the following resources and receptors:

- Resources:
  - Secondary A Superficial Aquifers (Sand and Gravels and Beach deposits);
  - Principal Crag Aquifer. The Chalk aquifer is considered not to be a risk due to the protection provided by the overlying London Clay; and
  - surface water bodies fed, in part, by groundwater.
- Receptors:
  - private and Environment Agency licensed groundwater abstractions; and
  - Minsmere-Walberswick Heaths and Marshes SSSI and Sizewell Marshes SSSI.

7.11.21 The Crag Principal Aquifer and Secondary A aquifers will be assessed according to the criteria given in **Table 7.11.2**.

Table 7.11.2: Guidelines for the assessment of groundwater receptor value and sensitivity

Value and sensitivity	Guideline
High	Principal Aquifer with public water supply abstractions. Site is within Inner or Outer Source Protection Zones.
Medium	Principal Aquifer with public water supply abstractions. Site is within a Catchment Source Protection Zone; or Secondary Aquifer with water supply abstractions. Site is within Inner or Outer Source Protection Zones.
Low	Secondary A Aquifer with water supply abstractions. Site is within a Catchment Source Protection Zone.
Very low	Secondary A/B Aquifer without abstractions in area of activity; or Unproductive strata.

7.11.22 The overall methodology for the assessment of impacts of the development on groundwater resources is set out in **Section 5** and **Tables 7.11.2** and **7.11.3**. The assessment will aim to establish:

- no deterioration in the status of groundwater and dependent water bodies (including SSSIs); and
- no exceedance of environmental water quality standards (e.g. Drinking Water Standards, Environmental Quality Standards (EQSs)) at relevant receptor locations.

Table 7.11.3: Guidelines used in the determination of magnitude of change for groundwater resources

Magnitude	Guideline
High	Major change to key groundwater regime characteristics to the extent that UK and European legislation is contravened. Deterioration in status of groundwater and/or

Magnitude	Guideline
	groundwater dependent water bodies (including SSSIs). Change in groundwater level, quality or available resource usefulness is chronic, permanent or prolonged beyond the activity causing the change, and irreversible. Permanent loss of aquifer as useful groundwater resource. Changes are spatially extensive beyond the area in which the effect may occur (e.g. drawdown into adjoining areas or contamination down gradient of site into adjoining areas).
Medium	Substantial change to key groundwater regime characteristics to the extent that UK and European legislation may be contravened. Groundwater quality may be affected permanently or at least for 10 years. Change in groundwater level, quality or available resource usefulness is prolonged more than two years beyond the activity causing the change, and only reversible after remediation activity. Permanent or long-term loss of aquifer as useful groundwater resource. Changes are spatially extensive beyond the area in which the effect may occur (e.g. drawdown into adjoining areas or contamination down gradient of site into adjoining areas).
Low	Noticeable but small changes in groundwater levels or quality for more than two years, or noticeable changes for more than six months but less than two years, or barely discernible changes for more than two years. Reversible without external action required. Changes confined largely to the area of effect only. No contravention of UK or European legislation.
Very low	Barely discernible changes in groundwater levels or quality for more than two years, or noticeable but small changes for more than six months but less than two years. Changes confined largely to the area of effect only and reversible without external action. Changes of lower magnitude than baseline seasonal changes. No contravention of UK or European legislation.

7.11.23 Changes in groundwater levels, groundwater flow and quality will be assessed in relation to the baseline conditions.

7.11.24 The assessment will be supported by the application of a groundwater model which will be used to assess the influence of site activities (e.g. construction of the cut-off wall) on groundwater levels, groundwater flow and groundwater discharges to surface water. Contaminant transport models (e.g. the Environment Agency ConSim model) will also be used to assess the impact on groundwater as a result of the mobilisation and/or leaching of contaminants during construction.

7.11.25 Groundwater contribution to potential flood risk issues is considered as part of the Flood Risk Assessment, however, the groundwater model will be used to assess whether below ground structures associated with the Main Development Site would result in a significant change to groundwater levels which might indicate an impact in terms of flood risk.

v. Assumptions and limitations

7.11.26 Groundwater monitoring data are available for the period 2011 to 2014. This comprehensive dataset will provide adequate baseline characterisation but will be

supplemented by reference to long-term monitoring undertaken by the Environment Agency and through application of the groundwater assessment model.

7.11.27 A regional scale groundwater model has been developed to undertake predictive assessment. The model will be refined to incorporate additional data sources including site investigation and ongoing monitoring data. This model will form the basis for assessment, and will be supplemented where necessary by appropriate, simpler models to resolve key questions.

7.11.28 The construction of the proposed development will require the construction of a cut-off wall in advance of bulk excavations and within which dewatering will take place. The models will be used to assess the effectiveness of this wall in restricting the influence of pumping on surrounding groundwater levels.

d) Potential impacts and effects

7.11.29 The development activities that would potentially impact groundwater are:

- construction dewatering;
- construction of a cut-off wall around the proposed power station footprint. This wall is currently proposed to extend down to the London Clay;
- building foundations and structures constructed below the water table;
- bridge construction across the Sizewell Marshes SSSI;
- changes in infiltration to groundwater resulting from changes to surface land use;
- excavation of soils from within the Main Development Site with the potential for mobilisation of contaminants;
- stockpiling of soils with the potential for leaching of contaminants; and
- potential for the leaching of contaminants from the backfilling of the proposed locations used to win fill material with peat and alluvium from the power station excavations.

7.11.30 The potential effects associated with these activities include changes in groundwater levels and flows, groundwater discharges to surface water, surface water flows to groundwater, infiltration to groundwater, and variation to groundwater and surface water quality relative to baseline conditions.

7.11.31 The proposed development activities will impact groundwater in differing ways. The construction of the cut-off wall is likely to raise groundwater levels upgradient of the wall. Areas of temporary and permanent hardstanding and buildings will reduce infiltration of precipitation to the ground with the potential to lower groundwater levels, but levels may be increased where surface water is routed to sustainable drainage systems. The application of the groundwater models will allow the combined effects on groundwater to be assessed.

7.11.32 The assessment would also address whether changes in groundwater infiltration and flow would influence the dilution and movement of any contaminants released as a result of site activities (e.g. leaching of contaminants from stockpiled material).

i. Construction

7.11.33 Dewatering for the construction of the proposed development has the potential for lowering groundwater levels with the risk of impacting the Sizewell Marshes SSSI and causing saline intrusion. A cut-off wall will be constructed around the excavation area which will limit the drawdown in groundwater levels. The wall may act as barrier to groundwater flow resulting in a rise in groundwater levels upgradient of the wall and a change in flow direction. Predictive groundwater flow models will be used to assess the influence of the cut-off wall on groundwater and to identify whether any changes in baseline groundwater conditions are likely to be significant.

7.11.34 Site investigations have shown that groundwater within the excavation area for the proposed power station is characterised by high salinity and the assessment will consider the volumes of water that will need to managed and discharged.

7.11.35 The impact of surface water management, via SuDS, on the groundwater resource would need to be assessed.

7.11.36 The development of Main Development Site would create areas of hard standing (e.g. car parks) that will reduce infiltration to the ground and increase surface water run-off. The change in infiltration will be assessed and the influence on groundwater levels and flow will be assessed using the groundwater models.

7.11.37 Construction activities (principally excavation of soils) may result in mobilisation of contaminants and a risk to groundwater. Investigations have been undertaken to characterise the materials to be excavated and therefore allow the risk to be assessed. The movement of any contaminants mobilised in the main excavation area will be limited by the cut-off wall and by dewatering.

7.11.38 The stockpiling of excavated materials may result in leaching of contaminants and a potential impact on groundwater. The potential impact on groundwater will be assessed based on information from soil testing undertaken as part of the investigations for the development (see **Table 7.11.1**).

7.11.39 An option that is currently being evaluated is to use peat and alluvium excavated from the proposed power station footprint as backfill to a potential site which will be excavated to source engineering fill. Leaching of this material may impact groundwater. A groundwater risk assessment has been initiated to assess any potential impacts and whether this option is environmentally acceptable.

ii. Operation

7.11.40 The main potential impacts associated with the operation of the proposed development relate to the influence of the cut-off wall installed during the construction phase on groundwater flow and the potential need to control (dewatering) groundwater levels within the wall. The impacts will be assessed using the groundwater models together with an assessment of management arrangements for the pumped water.

7.11.41 Infiltration to the ground will be reduced by buildings and areas of hardstanding and the change in infiltrations rates and impact on groundwater will be assessed using the groundwater models.

e) Potential mitigation

7.11.42 The impact of dewatering operations for the proposed construction excavations will be largely mitigated by the construction of a cut-off wall. This wall will have an influence on groundwater flow and levels and this, along with any associated mitigation to address this change, will be assessed using the groundwater models.

7.11.43 The excavation of Made Ground, peat and alluvium from the proposed power station construction area may result in the mobilisation of contaminants. This will be mitigated by containing the area within a cut-off wall and by controlled dewatering.

7.11.44 Buildings and areas of hard standing will reduce infiltration to the ground. The assessment will consider how this can be mitigated through the use of sustainable drainage systems where possible.

f) Approach to cumulative assessment

i. Inter-relationships

7.11.45 Groundwater impacts could have indirect effects on a number of environmental parameters. The key inter-relationships occur where changes to groundwater flows impact on ecologically sensitive receptors and designated sites (e.g. Sizewell Marshes SSSI and the Minsmere-Walberswick Heaths and Marshes SSSI).

7.11.46 For the Main Development Site, the following inter-relationships will be considered with surface water, terrestrial ecology and ornithology and flood risk (groundwater flooding).

ii. Cumulative effects

7.11.47 The Main Development Site in cumulation with other relevant plans or projects affecting the groundwater environment within a 5km radius could result in additive risks or impacts on groundwater and surface waters and receptors. Where appropriate the use of predictive groundwater models would allow any cumulative impacts to be identified and assessed.

7.12 Surface water

a) Introduction

7.12.1 This section sets out the proposed scope and methodology for the surface water assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development. This section does not give any consideration to flood risk, which is covered in **Section 2** and will be considered in a separate Flood Risk Assessment (FRA) which will cover both the Main Development Site and the off-site associated development sites.

b) Work undertaken to date

7.12.2 Initial studies have been undertaken to inform the consideration of surface water issues relevant to the Main Development Site and these will be further developed during the next phases of work. These are summarised in **Table 7.12.1**.

Table 7.12.1: Summary of work undertaken to date

Study	Scope of Study
Hydrogeological and hydrological study (2010)	Initial studies into the hydrogeological and hydrological behaviour of the area around the Main Development Site have been undertaken in order to provide information on likely long-term flows for rivers and marsh drains (see also **Section 7.11** (Groundwater)). Further development of these studies is underway and is being undertaken in consultation with the Environment Agency and other relevant stakeholders.
Water quality sampling (2010-2013)	Monthly water quality sampling was undertaken from January 2010 to January 2013 (total of 37 visits) for the purposes of establishing surface water quality conditions. The scope of the monitoring (spatial extent, frequency, testing suite etc.) was informed by relevant legislative drivers that include the Water Framework Directive (WFD) and through consultations with the Environment Agency, Natural England and the Suffolk Wildlife Trust. General physico-chemical parameters, such as dissolved oxygen, ammonia, pH and salinity were subject to field measurement or laboratory analysis as appropriate, together with laboratory analysis of microbiological and radiochemical parameters. Specific testing for Priority Substances as defined by the WFD was undertaken on six occasions to complete comprehensive baseline characterisation.
Production of Flood Risk Assessment Scoping Report (2014)	A Flood Risk Assessment Scoping Report is currently in production in order to provide technical details on the scope of the FRA.

7.12.3 The Environment Agency has funded work to model flows within the River Minsmere and Leiston Beck. Other models have been constructed to simulate the flow of groundwater and surface water into and through the Sizewell Marshes which will be used to inform the surface water chapter of the ES.

c) Approach and methodology

i. Study area

7.12.4 The geographical extent of the study area for surface water is shown in **Figure 7.12.1** and comprises the area within the Main Development Site, together with the

catchments of the watercourses draining into the area considered relevant to the Main Development Site.

ii. Baseline information

7.12.5 A number of watercourses are present within the study area but relatively few are located within the Main Development Site. Of particular importance is the area which falls within the Sizewell Marshes Site of Special Scientific Interest (SSSI). This area contains a series of interconnected drainage ditch systems, which can be generally grouped into two systems situated to the north-west and south-east of Sandy Lane. In addition, there are two small lakes within the Sizewell Marshes SSSI. Both support a dense coverage of reeds

7.12.6 The main input to the north-western ditch system is the consented discharge from Leiston sewage treatment works (both continuous and storm discharges). Surface runoff from Leiston produces a peak in discharge during rainfall. An additional input rises on Brick Kiln Farm and joins Leiston Beck immediately downstream of the sewage treatment works. Leiston Beck then crosses the north of the Sizewell Belts. Other, much smaller, ditches are maintained close to the level of the surrounding fields by sluices and pipe overflows.

7.12.7 The south-eastern ditch system rises to the south of the existing power station complex, near Sizewell village. The majority of flow follows a split channel that runs along the western boundary of the existing power stations.

7.12.8 The two systems join a few hundred metres north of the Sizewell B power station, and flow towards the coast around the foot of Goose Hill to the Minsmere Sluice, where they discharge to the sea. The network of ditches and watercourses draining the Minsmere to Walberswick Heaths and Marshes SSSI and SAC, and Minsmere-Walberswick SPA and Ramsar site join the Leiston Beck just upstream of the Minsmere Sluice.

7.12.9 **Figure 7.12.2** shows the inter-connected nature of the surface waters described above and illustrates important features, such as the ditch systems and Leiston Beck, and the assumed main drains in the context of the surface water catchment areas.

7.12.10 Of the surface waters in the study area, Water Framework Directive (WFD) water body descriptions are available from the Environment Agency for 'Sizewell Marshes' and for 'Leiston Beck and Minsmere Old River'. 'Leiston Beck and Minsmere Old River' is a 'heavily modified' water body and is assessed as being at 'high' status for all supporting water quality parameters, with the exception of phosphorous which is at 'good' and dissolved oxygen at 'moderate'. Supporting elements relating to hydromorphology are also classified as supporting 'good ecological potential'.

7.12.11 The small lake within the Sizewell Marshes SSSI is an artificial water body which is assessed as achieving 'good ecological potential'. There is, however, no water quality or hydromorphological information available within the description for Sizewell Marshes.

7.12.12 To supplement the Environment Agency's water quality information, a programme of water quality monitoring has been undertaken to better define baseline conditions. As set out in **Table 7.12.1**, the monitoring took place from 2010 to 2013 and covered

all watercourses within the Main Development Site. The water quality sampling sites are shown in **Figure 7.12.3**.

7.12.13 The monitoring results indicate moderate to poor water quality typical of lowland, coastal drainage ditches. Water quality at a number of monitoring sites exceeded relevant environmental standards (i.e. WFD Environmental Quality Standards) for a range of parameters, including ammonia, phosphorous, biochemical oxygen demand, dissolved iron, sulphate and suspended solids.

7.12.14 Low dissolved oxygen levels are noted as a particular feature across the entire study area, with all monitoring sites failing to achieve the Freshwater Fish Directive (Cyprinid Fish Category) Imperative Standard and falling below the WFD 'Poor' Status classification criteria. Consultation with the Environment Agency confirmed that low dissolved oxygen concentrations are a typical feature of surface water courses in the vicinity of the Suffolk Coastline. Radiochemical analysis has not shown elevated levels of radiochemical contamination beyond expected background levels (see **Section 7.17** which details the radiological assessment).

7.12.15 Additional water quality monitoring was undertaken to determine the baseline conditions for priority substances defined under the WFD. Results indicate that occurrences of priority substances are influenced by discharges from Leiston Sewage Treatment Works and road runoff. Specifically, the presence of tributyl tin and polyaromatic hydrocarbons are noted at the monitoring site to the south of existing power station complex, and are attributed to the fishing fleet located on the beach east of the monitoring site and vehicle exhaust particulates respectively (AMEC, 2013d).

iii. Planned further survey/studies

7.12.16 Initial studies into the hydrogeological and hydrological behaviour around the Main Development Site have been undertaken in order to provide information on likely long-term flows for rivers and marsh drains (see also **Section 7.11**). This has included conceptualisation of the processes operating in the area and their inclusion in numerical models, the updating of existing models in the light of new data and the recalibration of updated models (Vatnaskil, 2010). Further development of these studies is underway and is being undertaken in consultation with the Environment Agency and other relevant stakeholders.

7.12.17 A site drainage strategy for each phase of the Main Development Site is under development and this will inform the surface water and Flood Risk Assessments (see **Section 2.3**). A summary of planned studies is provided in **Table 7.12.2**.

Table 7.12.2: Summary of studies that will contribute to the development of the surface water impact assessment

Study	Scope of Study
Verification and validation of surface and ground water model	Collection of further information in order to validate the surface and ground water model as agreed with the Environment Agency.
Updates to the current surface water hydraulic model	The Flood Risk Assessment Scoping Report recommends that two models are combined in order to represent the complex drainage pathways of the Sizewell Belts and Minsmere Nature Reserve.

Study	Scope of Study
Surface water drainage strategy	A surface water drainage strategy is in preparation to inform both the surface water and flood risk elements of the proposals.
Flood Risk Assessment	Key information from the modelling described above will be used to develop a Flood Risk Assessment. This Flood Risk Assessment will be used to inform the surface water chapter.
Collection of flow and level data	Six temporary flow and level gauges were installed in December 2013. These will be in place for 12 months.

iv. Assessment methodology

7.12.18 The key legislation, policy and guidance documents in respect of hydrology and fresh water quality are set out below:

- Water Framework Directive 2000 (as amended) seeks to improve and integrate the management of water bodies in the UK and implements environmental standards for a number of substances;
- Environment Act 1995 (as amended) places a duty on the Environment Agency with respect to the conservation of natural beauty and sustainable development;
- The Environmental Permitting (England and Wales) Regulations, 2010 (as amended) has produced a single regulatory framework by streamlining and integrating waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation;
- National Planning Policy Framework 2012 on Water Supply, Wastewater and Water Quality;
- Planning Policy Statement PPS 25 (although PPS 25 has now been superseded, it is still considered useful and will therefore be considered)/National Planning Policy Framework; Development and Flood Risk (various years) which set out planning requirements that aim to ensure development would not result in increased flood risk including the use of Sustainable Drainage Systems (SuDS);
- Anglian River Basin Management Plan (Environment Agency, last modified January 2011) assigns ecological classifications and sets water quality targets to each water body within East Anglia to ensure that the environment is maintained and, if possible, improved; and
- The Suffolk Coastal District Local Plan (Suffolk Coastal District, 2013) sets out the emerging local planning policies for the Suffolk Coastal District.

7.12.19 There are also numerous best practice documents that provide guidance on ensuring that developments do not result in adverse hydrological, drainage and water quality impacts such as the Sustainable Drainage Systems Manual (CIRIA, 2007) and the Environment Agency Pollution Prevention Guidance (PPG) notes.

7.12.20 The methodology to be adopted for assessing the potential environmental impacts to surface waters is outlined in **Section 5**. In addition, specific information is provided below on the determination of resource value and sensitivity and impact magnitudes

for surface waters in particular. A separate WFD Compliance Assessment will be provided to support the ES (see **Section 2.3**).

Value and sensitivity

7.12.21 All of the surface water resources that have the potential to be impacted by the proposed development will be assigned a level of importance in accordance with the definitions set out in **Section 5** and with the surface water specific definitions given in **Table 7.12.3**. Conservative expert judgement will be used where a resource could be allocated to more than one value and sensitivity rating

Table 7.12.3: Proposed criteria to be used to determine the value and sensitivity of surface water resource

Value and sensitivity	Description
High	*Hydrology and drainage*: Controlled watercourses located in area of high social/community and economic value and considered of high amenity. Controlled watercourse identified is of UK or European value in terms of its hydrological status such as designated habitats and/or species are sensitive to change in hydrological regime. Watercourse identified as having no capacity to adapt to or recover from proposed form of change. *Water quality*: Water quality supports or contributes towards the designation of a feature of national or international importance. Very low capacity to accommodate change compared to baseline conditions. The water environment contributes to good salmonid and cyprinid fisheries. The watercourse may be used for any type of water abstraction including potable supply.
Medium	*Hydrology and drainage*: Controlled waters located in area of moderate social/community and economic value. Considered to be of medium amenity value. Controlled waters identified of moderate UK regional or local value in terms of hydrological status such that habitats/species are sensitive to change. Watercourse identified as having low capacity to accommodate proposed change. *Water quality*: Water quality supports high biodiversity but isn't designated. Watercourse has low capacity to accommodate change to water quality status. Environment considered to support coarse fisheries.
Low	*Hydrology and drainage*: Controlled waters located in area of no social/community and economic value. Considered to be of low amenity value. Controlled water is of moderate local value in terms of hydrological status. Watercourse identified as having moderate capacity to accommodate proposed form of change. *Water quality*: Watercourse has high capacity to accommodate change to water quality status for

Value and sensitivity	Description
	example as a result of its size, dilution availability. Baseline water quality status poor. Watercourse unlikely to support fisheries/fish populations.
Very low	*Hydrology and drainage*: Controlled waters located in area of no social/community and economic value. Considered to be of low amenity value. Controlled water is of low local value in terms of hydrological status. Watercourse identified is tolerant to proposed form of change. *Water quality*: Watercourse has high capacity to accommodate change to water quality status for example as a result of its size, dilution availability. Baseline water quality status poor/very polluted.

Magnitude

7.12.22 It is proposed that the assessment of the magnitude of impacts is based on the influence the proposed development would have on local surface water features and is considered in terms of high, medium, low and very low magnitude ratings.

7.12.23 All surface water impacts will be assigned a level of magnitude in accordance with the definitions provided in **Section 5** and with the surface water specific definitions given in **Table 7.12.4**.

7.12.24 Given the relatively long construction phase associated with the Main Development Site, it is considered appropriate to provide a project specific definition of what is meant by short-, medium- and long-term temporary impacts. These are defined as follows:

- temporary (short-term) are those construction phase impacts that would be experienced over a period of no more than 1-2 years;
- temporary (medium-term) are those construction phase impacts that would be experienced over a period of no more than 3-5 years; and
- temporary (long-term) are those construction phase impacts that would be experienced over a period of no more than 5 years.

Table 7.12.4: Proposed criteria to be used to determine the magnitude of the impact on surface waters

Magnitude	Description
High	*Hydrology and drainage*: Large change to key hydrological/hydraulic characteristics of the receiving water features to the extent that UK and European Legislation is contravened. Occurrence of change(s) is prolonged longer than would be expected over the baseline. Large spatial impact.

Magnitude	Description
	Leads to a permanent change in hydrological/hydraulic characteristics of the water body *Water quality*: Change to water quality of receiving water such as water quality change leads to permanent change and inability to meet Environmental Quality Standards.
Medium	*Hydrology and drainage*: Change to key hydrological/hydraulic characteristics of the receiving water features to the extent that UK and European Legislation may be contravened. Changes are limited in time to the duration over which they occur compared to the baseline. Large spatial impact. Leads to a long-term change in hydrological/hydraulic characteristics of the water body. *Water quality*: Change to water quality of receiving water such as water quality change leads to long term inability to meet Environmental Quality Standards.
Low	*Hydrology and drainage*: Noticeable but not necessarily large changes to hydrological/hydraulic characteristics of the receiving water. *Water quality*: Noticeable but not necessarily large changes to water quality. Activity unlikely to lead to long-term or permanent change to the receptor such that EQS' are compromised. Overall, baseline conditions are maintained.
Very Low	*Hydrology and drainage*: Occasional and small changes to hydrological/hydraulic characteristics of the receiving water. Impact occurs over very short timescales and spatial scales. *Water quality*: Although there may be a small impact, occurs over short timescales and unlikely to lead to long-term compromised of EQS.

7.12.25 The matrix for the assessment of effects, as outlined in **Section 5**, will be adopted and following the classification of an effect, a statement will then be made regarding whether the effect is significant or not significant. Major and moderate effects will be considered to be significant and minor and negligible effects will be considered to be not significant. If additional mitigation is proposed then the residual effect following additional mitigation will be assessed using the same methodology.

v. Assumptions and limitations

7.12.26 The following assumptions and limitations have been identified at this stage with respect to surface water:

- calculations to determine baseline water quality conditions will be derived from a limited number of sampling campaigns;
- the impact assessment will take into account those elements of the development site design relevant to surface water (e.g. provision of Water Management Zones

(WMZs)) before the determination of effect significance is made (as project design is not considered to be a form of additional mitigation for the purposes of this assessment);

- surface water discharge will be managed so it does not exceed the predetermined greenfield runoff rates in accordance with relevant guidance;
- suspended solid concentrations in water discharged to streams will be controlled as prescribed in a Site Preparation Drainage Design Discharge Conditionality Report; and
- Environmental Quality Standards prescribed for downstream designated WFD water bodies will be adopted for upstream watercourses for the purpose of the assessment.

d) Potential impacts and effects

7.12.27 This section outlines the potential impacts on surface hydrology and water quality within the Main Development Site and for any associated resources that may be indirectly impacted by changes to local watercourses (i.e. watercourses downstream of the site). However, it should be noted that these impacts have been identified using high level key design features for the management of runoff and foul water which have yet to be fully developed. Detailed surface water and foul water strategies will be available at later stages of the Project.

i. Construction

Hydrology

7.12.28 The following key elements of the construction works could impact on watercourse hydrology:

- creation of bare earth surfaces due to the stripping of topsoil and vegetation;
- realignment of existing ditches;
- changes to topography associated with site levelling, stock piling, deep excavations for example;
- construction of new access roads and temporary bridges;
- construction of semi-permeable and impermeable surfaces such as roads, site compounds areas, accommodation campus for example; and
- collection and discharge of foul water from construction compounds.

7.12.29 These activities could lead to an increase in surface water flows both through runoff volume and rate changes and any continuous discharges (such as those associated with treated effluent). An additional impact could be soil erosion associated with surface water runoff, which could lead to both blockages of existing water courses and a reduction of channel capacity if flows reduce enough to allow settlement of soil onto the channel bed.

7.12.30 In order to control surface water runoff at source, good practice measures will be adopted, where possible, to reduce the volume of surface water that will require collection. For the remaining flows, a temporary drainage system will be constructed to drain surface water runoff that does not impact on the wider hydrology of the area

(including downstream designated sites). A key design feature to control flows will be the use of WMZs to collect and attenuate the surface water runoff. These zones will also offer the potential for the settlement of any soil material. Foul water from offices and welfare facilities will be drained via a foul water drainage system and treated at temporary sewage treatment plants.

7.12.31 The temporary drainage system would remain operational until the land is restored to its current green-field state or until permanent site drainage and associated outfalls are commissioned. Provision will also be made for rainfall events that could exceed the normal design criteria for drainage systems, in order to reduce risks associated with inundation and potential failure of the water storage infrastructure.

Water Quality

7.12.32 During the construction phase, there is the potential for the generation of runoff from surfaces which have been exposed to hydrocarbon contamination from vehicle and equipment use. Additionally, a number of construction works will require the use of concrete pouring in situ, which could lead to concrete leachate in surface waters both from pours and during washout/delivery and cleaning of equipment. Accidental release of contaminants from the various construction activities is also a potential risk should watercourses be located nearby or surface water runoff washes contaminants into the watercourses. An additional impact is the potential for foul discharges to pollute watercourses either in an emergency or through poor levels of treatment.

7.12.33 As detailed for hydrology, the control measures to be put in place for the drainage system (SuDS and WMZs) will all be designed in order to provide attenuation and treatment. Oil interceptors will also be installed at sites where the risk of hydrocarbon contamination is high. For foul water, temporary treatment plants will be provided where required, to levels suitable for the receiving environment as determined by Environment Agency policy. In order to control and reduce the impact of accidental pollution spills as far as possible, Incident Control Plans will be developed in consultation with the regulators.

7.12.34 Overall, the control measures to be designed into the drainage system and for treatment of foul water will reduce risks to surface waters as far as possible. Further work will be undertaken to ensure all requirements and standards are met within the proposed drainage strategy and foul water management system, and hydraulic modelling will be undertaken to inform both the FRA and this topic.

ii. Operation

7.12.35 The Sizewell drain flows through an area of the Sizewell Belts which will be raised to create the development platform for the power station. It is intended that it will be realigned around the edge of the development platform which is likely to create a narrowing or pinch point through which both this and the existing Leiston Drain will need to flow. The use of hydraulic models will determine whether flows will be altered.

7.12.36 Additionally, new bridges to the development may create potential restrictions to flow in Leiston Drain and Sizewell Drain although the design would seek to avoid and reduce such effects. The use of hydraulic models will determine if the introduction of bridges and roads will alter flows in the area.

7.12.37 In terms of the management of surface water discharges from the Main Development Site, a drainage strategy is being developed in line with appropriate guidance.

e) Potential mitigation

7.12.38 A number of control measures will be included within the proposed design for the Main Development Site as detailed above. As a result, additional mitigation is not proposed at present, but the outcomes of the hydraulic modelling will confirm whether additional mitigation is required.

f) Approach to cumulative assessment

i. Inter-relationships

7.12.39 Surface water impacts could have indirect effects on a number of environmental and social parameters. The key inter-relationships occur where changes to surface water flows impact on ecologically sensitive parameters and designated sites.

7.12.40 For the Main Development Site, the following inter-relationships will be considered with groundwater, terrestrial ecology and ornithology, marine water quality (should surface water discharges to marine waters be required) and flood risk.

ii. Cumulative effects

7.12.41 The Main Development Site in cumulation with other relevant plans or projects affecting the surface water environment could pose additive risks or impacts on watercourses within the study area.

7.12.42 The cumulative assessment will include consideration of relevant major developments that are permitted but not yet implemented and submitted applications not yet determined.

7.13 Coastal geomorphology and hydrodynamics

a) Introduction

7.13.1 This section sets out the proposed scope and methodology for the coastal geomorphology and hydrodynamics assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.13.2 Extensive new observations and analyses have been undertaken to increase the understanding of the Sizewell coastal system:

- measurements of waves, currents and elevations in 2008, 2009 and 2013;
- high resolution bathymetric surveys of Sizewell-Dunwich Bank (2008/9) with further surveys in 2010, 2011 and 2012 to provide additional coverage, particularly in the nearshore zone;
- extensive sediment sampling and analyses for sediment transport trends;
- a comprehensive analysis of all available modern and historical datasets in order to examine the behaviour of shoreline change at Sizewell, including historical maps and charts (1837-present), orthorectified aerial photographs (1940-2012), beach topographic surveys (1985-2012), bathymetric profiling (1992-2007), swath bathymetry data (2007-2011) and LIDAR surveys (2008-2010);
- wave measurements over four years seaward of Sizewell-Dunwich Bank and access to 30 years of model hind cast data from a large area model;
- setup, calibration and validation of a high resolution unstructured grid (Telemac) tidal model (25m highest resolution) together with a coupled wave model (Tomawac) and sediment transport model (Sisyphe);
- production of scenarios for future potential geomorphologies (geoscenarios) of the Sizewell region using a facilitated expert panel approach. These geoscenarios will be used in future coastal process modelling work in which the consequences of each geo-scenario will be examined (see **iii. Planned further survey/studies**); and
- numerical modelling of the Sizewell B and C thermal plumes, including the effect of the different geoscenarios.

c) Approach and methodology

i. Study area

7.13.3 The spatial extent of the study area is shown in **Figure 7.13.1**. Most effects, such as changed wave climate due to the jetty, will be localised often to within a few tens of metres of the construction site and require high resolution modelling on a small scale. However, longshore sediment transport is a long-term process and acts over larger scales, typically the sediment cell. The modelling area covers the local sediment cell relevant to Sizewell and the cell to the south which is relevant to the observed net sediment transport southwards towards Orford Ness and the designated site at Shingle Street. The maximum possible extent of sediment resuspension resulting

from dredging or other construction-related activities was defined as the maximum spring tide excursion centred on the mid-point of the Main Development Site. The landward extent for coastal hydrodynamics assessment is Highest Astronomical Tide (HAT). The location of the cooling water infrastructure is subject to current engineering studies and the seaward extent of the study area was set at approximately 4km in order to allow flexibility in those studies.

7.13.4 The temporal extent of the surveys and for reuse of existing data is specific for each physical process. Most tidal variability is covered within one month; wave effects occur over many storms, whilst assessment of shore line variability and offshore sand banks requires much longer term scales of years to decades.

ii. Baseline information

7.13.5 The shoreline at Sizewell forms part of a longer 16km coastal bay defined by hard points at Southwold in the north and Thorpeness in the south. This bay has a classic coastal curvature, with a long southern arm, extending between Thorpeness and Dunwich aligned approximately north/south, and a shorter northern arm aligned approximately north-east/south-west. The concrete outfall to Minsmere Sluice (built in 1830) also acts as a groyne, resulting in shallow bays between the Sluice and the Blyth piers to the north, and between the Sluice and Thorpeness to the south. Hence the coast comprises two 'nested' very shallow bays within a larger bay, of which two erosion resistant points are man-made and one is natural.

Shoreline change

7.13.6 A century ago there were wide areas (several kilometres long) experiencing high rates of consistent erosion or accretion, whereas in recent years, shoreline change all around the Sizewell Bay coast has consisted of a fluctuating patchwork of erosion and accretion. In that more recent period, stretches of coastline with common behaviour have been typically only a few hundred metres wide, though some zones have been less than 50m or occasionally greater than 1km. The general patterns of shoreline change also appear to have been linked to variability in the inshore wave climate, longshore transport and offshore bathymetry (the morphology of the Sizewell-Dunwich Bank and bars). In particular, the very low rates of shoreline change around the Sizewell power stations have coincided with low wave energy and low longshore transport. Supply toward Thorpeness over recent decades is also considered to have been low. Thus, over periods of years to decades post 1925, the net transport can be considered to have been low and, in net terms, to the south.

7.13.7 Approximately 1.5km offshore from the coast is the Sizewell-Dunwich Bank. The bank represents a natural wave break preventing larger waves from propagating inshore and thus reducing erosion rates along this shoreline. As a result, the Bank forms an integral component of the shore defence and provides stability for the Sizewell coastal system. From the available bathymetric evidence the height and position of Sizewell-Dunwich Bank has varied over time, with the northern part migrating landwards and the southern end more anchored to the seabed at the Thorpeness headland outcrops of Coralline Crag. The northern (Dunwich) end of the bank system has been more variable in its position, height and width.

7.13.8 Whilst there has been significant short-term (storm driven) transport of sediment both to the north and south along the Southwold to Thorpeness shoreline since 1925, the

net volume of sediment moving to the south on a decadal scale has been relatively small. The wave field is considered to be a major driver of near shore sediment transport.

Tidal currents

7.13.9 The typical maximum flood tidal current speeds offshore of the Sizewell-Dunwich Bank were 1.1m/s on spring tides and 0.7m/s on neaps. However, inshore of the bank the speeds were slightly reduced with typical maximum spring tidal current speeds of 1.0m/s on spring tides and 0.6m/s on neaps. Slack water off Sizewell occurs approximately one hour after high water. There is a marked asymmetry in tidal current velocities over a tidal cycle, with stronger peak flood currents (southward) than ebb currents (northward). Tidal currents were measured in three observation campaigns, each of four weeks or longer, in 2008, 2009 and 2013 at the positions marked on **Figure 7.13.1**.

Tidal elevations

7.13.10 Class A tide gauges have been recording water level at Lowestoft since 1964 and Harwich since 1954.

iii. Planned further survey/studies

7.13.11 An X-band radar was installed in 2013 on the roof of the Sizewell A reactor building. The radar scans the nearshore region over a radius of up to 4km and measures waves, currents and meso-scale bathymetry sufficient to resolve the Sizewell Bank. The data will be used to track the movement of the shoreline and longshore bars in response to storm forcing.

7.13.12 Numerical modelling of shoreline change due to natural variability and the effect of structures such as the proposed jetty, beach landing facility and the existing Minsmere Sluice will be undertaken.

7.13.13 Numerical modelling of geoscenarios using coupled tide, sediment transport and wave models will also be undertaken. The nature and role of the Sizewell-Dunwich bank will be considered through a combined expert judgement and numerical modelling approach.

7.13.14 The Telemac suite of numerical models will be used to test the feasibility of each geoscenario and the effect each would have on nearshore processes. These scenarios include plausible worst cases for degree of effect on the coastline and upon the heat sink capacity for the Sizewell power stations.

iv. Assessment methodology

7.13.15 The assessment will consider impacts during the construction and operation of the Main Development Site, and potential effects on coastal geomorphology and hydrodynamics receptors and resources, as discussed in **Section d)**.

7.13.16 Particular regard will be given during the assessment and design development to relevant legislation and policies concerned with coastal geomorphology and coastal process, including:

European legislation

- EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC); and
- Marine Strategy Framework Directive (2008/56/EC).

National policy and legislation

- National Planning Policy Framework 2012;
- Marine and Coastal Access Act 2009; Coastal Protection Act 1949;
- Conservation of Habitats and Species Regulations 2010;
- Suffolk Shoreline Management Plan, SMP2 sub cell 3c. Zone 4 Dunwich Cliffs to Thorpeness; and
- Water Resources Act 1991 (Flood Defence Consent).

7.13.17 The magnitude of impacts would be determined on the basis of the spatial extent, reversibility, duration and likelihood of the impact, as well as the amount of change that would occur. The guidelines for assessing magnitude are shown in **Table 7.13.1**.

Table 7.13.1: Guidelines for the assessment of impact magnitude

Magnitude	Description
High	Entire study area affected (and potentially beyond), irreversible (e.g. outlasts operation), impact of long duration (e.g. 100+ years), certain to occur, change significantly above natural background including variability.
Medium	Majority of study area affected, reversible in the long-term (during operation), moderate-long duration (e.g. 10-100 years), likely to occur, change slightly above natural background including variability.
Low	Partial area affected (e.g. >20-50%), reversible in the medium-term (e.g. during construction phase), moderate duration (e.g. 6 months-10 years), will possibly occur, change discernable but similar to natural background including variability
Very low	Small area affected (e.g. 0-20%), reversible in the short-term (e.g. limited to the construction phase), very short duration (<6 months), unlikely to occur, change barely discernable.

7.13.18 The value/sensitivity of the receptors and resources would be determined on the basis of their conservation, economic or functional value and their capacity to accommodate the effect (i.e. their capacity for resistance and resilience). The guidelines for assessing value/sensitivity for the features are given in **Table 7.13.2.**

Table 7.13.2: Guidelines for the assessment of value/sensitivity

Value/sensitivity	Description
High	Value: high functional value (e.g. ecosystem feature dependent upon it), international conservation value, national/international socio-economic value. Sensitivity: no capacity for resistance, no capacity for resilience.
Medium	Value: moderate functional value (e.g. another feature partially dependent on it), national conservation value, national/regional socio-economic value. Sensitivity: low capacity for resistance, low capacity for resilience (e.g.

Value/sensitivity	Description
	recovery after 10yrs).
Low	Value: low functional value (e.g. limited connection to other ecosystem features), regional/local conservation value, local socio-economic value. Sensitivity: moderate capacity for resistance, moderate capacity for resilience (e.g. recovery after 5 years).
Very low	Value: very low functional value (e.g. no dependencies), no conservation value, no socio-economic value. Sensitivity: high capacity for resistance, high capacity for resilience (e.g. recovery after 1 year).

7.13.19 A combination of high resolution modelling and observations will be used to make the assessment of quantified change (e.g. changed wave stress resulting from the jetty) and whether it is within natural variability. Each modelling tool will be specific to the physical process of concern.

7.13.20 Effects would be determined based on impact magnitude (as per **Table 7.13.1**) and receptor/resource value/sensitivity (as per **Table 7.13.2**), using the matrix shown in **Table 5.3**. The definitions of major, moderate, minor and negligible effects for the coastal geomorphology and hydrodynamics assessment are provided in **Table 7.13.3**. Major and moderate effects would be considered to be significant, and minor and negligible effects would not considered to be significant.

Table 7.13.3: Definitions of effects

Effect	Description
Major	Very large or large changes to the coastal or sea bed geological features, which may alter the structure of the coastline or the sediment processes within it. Effects, both adverse and beneficial, that are likely to be important considerations at an international or national level because they contribute to achieving international/national objectives or are likely to result in exceedance of statutory objectives and/or breaches in legislation.
Moderate	Intermediate change in the coastal or sea bed geological features, which may alter the structure of the coastline or the sediment processes. Effects that are likely to be important considerations at a regional level, societal or with respect to environmental management processes.
Minor	Small change in coastal or sea bed features, with no discernible effects on other features or processes. These effects may be raised as local issues but are unlikely to be instrumental in the decision making process.
Negligible	No discernible change in the coastline or sediment processes. An effect that is likely to have a negligible or no influence, irrespective of other effects.

v. Assumptions and limitations

7.13.21 The assessment approach assumes that natural variability in the system and the future baseline in the absence of development can be adequately characterised.

7.13.22 No limitations that could affect the robustness of the assessment have been identified to date.

d) Potential impacts and effects

7.13.23 Elements of the Main Development Site that could have impacts on coastal geomorphology and hydrodynamics would be:

- construction and operation of cooling water infrastructure (including cooling water intake and outfall headworks on the seabed, and the outfall associated with a Fish Recovery and Return system);
- construction and operation of a beach landing facility to receive deliveries of AILs by sea throughout the power station's operational life;
- construction and operation of flood defence and coastal protection measures; and
- construction and operation of a jetty for the import/export of construction materials and AILs.

7.13.24 The receptors and resources that are of potential concern are:

- the Sizewell Bay shoreline (position, shape, beach profile and whether erosion or accretion is occurring);
- longshore sediment transport, primarily along the nearshore bars – the jetty and beach landing facility may affect sediment transport in the vicinity of the station and potentially further south on the Thorpeness frontage and ultimately to Orford Ness (although based upon the historic evidence from the Sizewell B beach landing facility operation, impacts at such spatial ranges are considered highly unlikely); and
- the geomorphology of the greater Sizewell Bay.

7.13.25 Timescales for effects on these receptors and resources might extend several years beyond the impacts occurring and monitoring and mitigation may be applied to address these effects.

i. Construction

7.13.26 The EIA would cover, but not necessarily be limited to, the following risks and effects upon coastal geomorphology and hydrodynamics associated with the construction stage of the Main Development Site.

7.13.27 Tidal climate, large scale hydrodynamics, and residual flow. None of the proposed developments during construction or operation will have a quantifiable effect on the tidal elevation or tidal current magnitudes at the site or effect the residual current circulation over the study area.

7.13.28 To enable the construction of the Main Development Site, a jetty would be required. This structure could potentially change the local onshore wave climate and hence change coastal erosion. This may also affect long shore sediment transport.

7.13.29 Scour due to the jetty and other elements of the marine and cross-shore infrastructure would be assessed. Dredging activities for the jetty and its navigation approach, should this prove necessary, would lead to changes in bathymetry and may alter sediment transport rates: e.g. nearshore infilling of dredged navigation channels would reduce downdrift sediment supply. Evidence from the construction of Sizewell B indicates that such effects were limited to within around 200m of the

Sizewell B site but may take several years to recover if there is no intervention (e.g. by beach recharge and/or use of dredged material to ensure supply is maintained). As the longshore transport rates are considered to be very low, alongshore effects would be spatially limited and could be readily monitored and mitigated. The fine material that would be discharged from dredging activity could potentially be relevant to water quality and marine ecology. Some of this material could be transported as far as a single tidal excursion but effects would become indiscernible from the background before that range.

7.13.30 The cooling water outfall and intake structures would be connected to the station by horizontal tunnels below the sea bed constructed with tunnel boring machines starting from a land based location within the Main Development Site. This is in contrast to the construction of Sizewell B where a cut and fill construction methodology, involving extensive dredging and backfilling operations on the seabed, was used for the construction of the cooling water culverts.

7.13.31 Vertical shafts would be drilled through the seabed to connect to the cooling water tunnels prior to the placement of the intake and outfall headworks. The fine material that might be mobilised through this activity would not affect the coastal geomorphology but could potentially be relevant to the local marine water quality and ecology. Some of this material could be transported as far as a single tidal excursion but effects would be expected to become indiscernible from the background level before that range.

ii. Operation

7.13.32 The EIA would cover, but not necessarily be limited to, the following risks and effects upon coastal geomorphology and hydrodynamics associated with the Sizewell C power station's operational stage.

7.13.33 There is the potential for localised scour associated with the intake and outfall structures and to a much lesser extent the smaller fish return and recovery system outfall.

7.13.34 In contrast to the situation at Sizewell B, the Main Development Site cooling water outfall (approximately 0.8 – 3km offshore, dependent upon the results of current engineering studies).

7.13.35 Dredging activities to secure the occasional access required during the operational life of the site to a beach landing facility would lead to changes in bathymetry and may alter sediment transport rates: e.g. nearshore infilling of dredged navigation channels would reduce downdrift sediment supply. Evidence from the construction of Sizewell B indicates that such effects were limited to within around 200m of the site but may take several years to recover if there is no intervention (e.g. by beach recharge and/or use of dredged material to ensure supply is maintained). As the longshore transport rates are considered to be very low, alongshore effects would be spatially limited and could be readily monitored and mitigated. The fine material that would be discharged from dredging activity could potentially be relevant to water quality, coastal geomorphology and marine ecology. Dredging activities may also lead to temporary changes in the exposure of the coastline.

7.13.36 A beach landing facility could over time be exposed and act as control point for sediment transport in a similar manner to the Minsmere Sluice.

e) Potential mitigation

7.13.37 Mitigation would comprise, but not necessarily be limited to, the following measures:

- the jetty and beach landing facility will be designed using the results of modelling tools to minimise, as far as possible, their impact on coastal processes;
- sediment bypassing, beach recycling and, if necessary, beach recharge are possible mitigation measures that might be required in association with the operations of a jetty and a beach landing facility; and
- scour protection would probably be employed for the intake and outfall structures.

f) Approach to cumulative assessment

i. Inter-relationships

7.13.38 With the exception of the receptors and resources described in **Section 7.13.d)**, most coastal processes are not receptors or resources in their own right and changes to coastal processes may have potential impacts on other receptors and resources, e.g. changes in suspended sediment level due to dredging may affect local water quality and marine ecology. The EIA will consider inter-relationships with marine water quality, marine ecology, terrestrial ecology and ornithology, flood risk and navigation.

ii. Cumulative effects

7.13.39 The other known relevant developments in the vicinity of the Main Development Site include the construction of the offshore Galloper Wind Farm.

7.13.40 Trenching activity associated with offshore Wind Farm export cables making landfall in the vicinity of Sizewell could cause disturbance to the longshore sediment transport processes, including increased turbidity. The effects would be localised and short lived.

7.14 Marine water quality and sediments

a) Introduction

7.14.1 This section sets out the proposed scope and methodology for the marine water quality and sediments assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.14.2 A water quality literature report was prepared for the Suffolk Coast and adjacent waterbody areas relevant to the site. A marine water quality monitoring programme was established off the Suffolk coast in the vicinity of Sizewell B power station from February 2010 to February 2011. Water samples were analysed for an extensive range of determinands. The detailed sampling plan has been discussed with the Environment Agency. The programme collected a few surface sediment samples from the area but a comprehensive chemical characterisation of the seabed sediments, including of core samples at sites that could be subject to construction disturbance, awaits a planned geotechnical survey in 2014.

7.14.3 In accordance with Environment Agency New Nuclear Build modelling guidelines, two different 3D hydrodynamic models of the Sizewell B discharge have been setup, calibrated and validated by independent contractors. The models were built using the GETM and Delft3D systems which have previously been successfully used for modelling of the proposed Hinkley Point C power station. The performance of the two Sizewell models has been independently assessed by Cefas. The models were then used to predict the thermal plumes from different cooling water configurations for Sizewell C (the Main Development Site) in combination with Sizewell B under different meteorological conditions. Annual runs with real meteorology have been undertaken. The impacts of the different geomorphological change scenarios on the predicted thermal plumes have been evaluated.

7.14.4 In support of future modelling of the planned cooling water chemical discharges at the Main Development Site, laboratory studies have been conducted to evaluate the degradation of chlorine-produced oxidants and the formation of chlorination byproducts in seawater collected from the vicinity of the Main Development Site. The Main Development Site has been designed to incorporate water treatment plant such that hydrazine would not be discharged from the cooling water outfall and it is not, therefore, necessary to undertake any studies on the effects of this chemical.

c) Approach and methodology

i. Study area

7.14.5 The Main Development Site is located immediately adjacent to the North Sea. The coastline near Sizewell B consists of a coarse beach of sand and gravel. The shore slopes down to a depth of 7 to 11m below chart datum. Approximately 1.5km offshore a bank exists. This feature is charted as two separate entities, Sizewell Bank and Dunwich Bank, although in reality it is a single, continuous feature aligned parallel to the shore and with minimum depths of less than 3m at its southern end. The Bank extends for approximately 8km from north to south and isolates the shallow

coastal channel from deeper water offshore of the bank where depths fall to below 15m. Analysis of historic bathymetric data from 1868 to present has indicated that the Bank is migrating shorewards, pivoting in a counter clockwise manner around the coralline crag outcrop at Thorpeness which appears to anchor the southern end of the Bank.

7.14.6 EDF Energy, on operational risk management grounds, has decided that the cooling water intakes of the Main Development Site should be located offshore of the Sizewell - Dunwich Bank at approximately 3km from the Main Development Site. Different locations for the Main Development Site cooling water outfalls are being modelled in order to predict:

- the extent of thermal plumes from Sizewell C only, and the plumes from Sizewell B and C together, compared to a modelled baseline without Sizewell B;
- the impact of the Sizewell C thermal plume on the operation of Sizewell B; and
- ecological impact from Sizewell C only, and Sizewell C together with Sizewell B, compared to a modelled baseline without Sizewell B.

7.14.7 Impacts from Sizewell C would be assessed compared to a baseline without Sizewell B in order to enable consideration of a future scenario when Sizewell B ceases to operate.

7.14.8 The north-south scope for the water quality baseline study was set to include the full tidal ellipse centred on the mid point of the Main Development Site i.e. approximately 9km north and 10km south. The location of the cooling water infrastructure is subject to current engineering studies and the seaward extent of the study area was set at approximately 4km offshore of the Main Development Site in order allow flexibility in those studies.

7.14.9 The boundary of the hydrodynamic models was set at a greater range of 20km north and south of the Main Development Site and 20km east. At this range the rate of change of bathymetry was sufficiently small to avoid numerical instabilities during model setup. The models used a curvilinear grid of variable resolution: 25m at the cooling water intake and outfall locations and 500m at the boundary.

ii. Baseline information

7.14.10 To assess the potential for impacts from future discharges from Sizewell C, water quality baseline information has been gathered through a desk study to identify the main literature on water quality in the vicinity of Sizewell B nuclear power station.

7.14.11 A spatial survey was conducted at 12 sampling stations in Sizewell Bay (see **Figure 7.14.1**). Sampling locations were centred on the cooling water outfall of Sizewell B (station 5). A tidal-cycle survey was carried out by sampling at hourly intervals at station 5 over an ebb/flood tidal cycle during spring tide conditions. A seasonal survey was also carried out with samples taken at stations 5 and 11 (near the centre of the study area approximately 4km offshore, i.e. offshore of the Sizewell – Dunwich Bank) to assess differences between onshore and offshore conditions on 21 occasions throughout the 12-month monitoring programme.

7.14.12 Sample locations were selected further north and south of the Sizewell B cooling water outfall along the tidal axis to examine changes in concentration as cooling

water dispersed from the outfall (stations 2 to 8). Two stations to the far north and two stations to the far south were also selected (stations 1, 9, 10 and 12) approximately 12km from the outfall to measure far-field concentrations outside of the tidal extent. Stations 1 and 9 were close to the coast and stations 10 and 12 were further offshore (2-4km).

7.14.13 Conductivity, temperature and depth sensor (CTD) profiles showed that the waters sampled were well mixed with regard to salinity. The temperature profiles indicated the presence of a thermally buoyant plume of water at the sea surface centred along the tidal stream from the Sizewell B outfall.

7.14.14 The water samples were analysed for a wide range of determinands but many chemical analyses gave negative results, indicating that the analytes were either absent or present at concentrations below the limits of detection. Few differences between results from inshore of Sizewell Bank (stations 1 to 9) and offshore (stations 10 to 12) were noted, with the exceptions of suspended solids and turbidity. The higher measurements of suspended solids and turbidity inshore of Sizewell Bank are likely to be related to the shallower water depth and local sediment resuspension.

7.14.15 Concentrations of dissolved copper, arsenic, zinc, mercury and cadmium exceeded environmental quality standard (EQS) levels on occasions. Some exceedance of the EQS concentrations for these metal and metalloid substances was detected at all stations except for stations 2 and 6. A small number of samples with concentrations in excess of their EQSs were recorded for some polycyclic aromatic hydrocarbons (PAHs), biphenyl and bis (2-ethylhexyl) phthalate (DEHP), though the majority of analyses for these compounds were negative. Exceedances of EQS concentrations for these organic compounds were detected at stations 1, 5, 9 and 12.

7.14.16 During the monitoring programme chlorine produced oxidants (expressed as total residual oxidant, TRO) were elevated at station 5 (the Sizewell B outfall) and the levels decreased further north and south from the outfall (stations 2 to 8). TRO levels were also elevated at the extreme north and south of the survey area (stations 1, 9 and 12) and further offshore at similar latitude to the outfall (station 11). The elevated TRO to the south (stations 9 and 12) was unexplained and may indicate a TRO source to the south or more likely limitations in the available analytical techniques in the presence of interfering substances. The data did not indicate that this elevation was associated with the Sizewell B discharge because of the lower levels observed between the outfall and the stations 9 and 12.

7.14.17 All measured radionuclide concentrations in seawater were very low and consistent with previous measurements by the Environment Agency.

7.14.18 The data from successive Environment Agency surveys of waterbodies of the East Suffolk Zone (ESZ) of the Anglian River Basin District (RBD) focus on metals in seawater and most observed concentrations of these have been low. Only in the case of cadmium was the EQS exceeded, for one location, but concentrations for both copper and zinc remained very close to their respective EQS. In the case of the latter two metals their use in boat antifouling paints may have been a contributory factor.

7.14.19 Nutrient concentrations for Suffolk rivers are known to be elevated in a number of cases but high turbidity is thought to prevent excess growth of phytoplankton and macroalgae in the case of the River Deben.

7.14.20 Baseline water temperature data are available for the Suffolk waterbody region. High frequency water temperature data are available from the Sizewell B cooling water inlet temperature sensors and these data have been used in the validation of the thermal performance of the hydrodynamic models.

7.14.21 Month long oceanographic measurement campaigns were established in 2008 and 2009 in the vicinity of the Sizewell B intakes and outfalls to provide independent calibration and validation data for the hydrodynamic models. This work included temperature measurements in the Sizewell B cooling water effluent surface plume.

7.14.22 Any development at the Main Development Site that may affect freshwater and/or estuarine and coastal water quality must be considered in relation to the WFD designations associated with the site which is located in East Suffolk Zone of the Anglian River Basin District. In this RBD, only 5% of rivers (by length) have met the requirements for good ecological status (GES) or good ecological potential (GEP). In total, 15% of all surface waters have been designated as artificial and 56% of all surface waters have been designated as heavily modified. None of the estuaries and transitional and coastal waters currently meet the requirements for GES or GEP. The Suffolk Coastal waterbody is designated as heavily modified due to coastal protection works and its current overall status is moderate; this waterbody is required to meet good ecological potential by 2015.

7.14.23 There are no identified Bathing Waters or Shellfish Waters in close proximity to the site. Sizewell is situated on an area of Suffolk coast covered by the Shoreline Management Plan 2 (SMP2) area which includes 10 transitional and coastal waterbodies.

iii. Planned further survey/studies

7.14.24 A literature report on water quality for Sizewell and adjacent waterbodies will be updated to include more recent studies and for comparison with the nearest available sediment contaminant data from the area around Sizewell. Additional monitoring data for water quality will also be acquired in 2014 to supplement the existing water quality data for the site. Sediment core samples will be obtained at the proposed locations of the jetty, beach landing facility, the cooling water intake and outfall headworks and in likely navigation channels. These samples will be analysed for a comprehensive range of determinands, including heavy metals, organics and radionuclides.

iv. Assessment methodology

7.14.25 The main legislation, policy and guidance that will provide the focus for the marine water quality assessment are:

European legislation

- EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC);

- EC Directive on the Conservation of Wild Birds (2009/147/EC);
- Water Framework Directive (2000/60EC);
- Marine Strategy Framework Directive (2008/56/EC);
- Priority Substances Directive (2008/105/EC);
- Dangerous Substance Directive (76/464/EEC);
- Urban Waste Water Treatment Directive (91/271/EEC); and
- Revised Bathing Waters Directive (2006/113/EC).

National legislation and policy

- Environmental Permitting (England and Wales) Regulations 2010; and
- Pollution Prevention and Control Act 1999.

Environment Agency guidance

- Cooling Water Options for the New Generation of Nuclear Power Stations in the UK (2010);
- Pollution Prevention Guidance Notes;
- Nuclear New Build – Guidance on Hydrodynamic Modelling Requirements (for cooling water discharges) (2011);
- Nuclear New Build – Guidance on Temperature Standards and Environmental permit Requirements (2011);
- Nuclear New Build – Guidance on Permitting Construction Phase Discharges (2011); and
- Nuclear New Build – Guidance on Permitting Non-nuclear Discharges (2011).

7.14.26 The proposed contaminant discharges from the Main Development Site during construction and operation will be assessed against the water quality baseline using the Environment Agency's H1 screening assessment methodology[5]. Any discharges of concern arising from screening will be assessed in detail against the relevant EQS where available (using the GETM hydrodynamic model of Sizewell where appropriate). The impact of the thermal plume on dissolved oxygen and unionised ammonia concentrations will also be assessed using the GETM model.

7.14.27 The GETM model will be used to identify the extent of potential areas of exceedance of thermal and chemical standards in areas designated under the Habitats Regulations and WFD.

[5] The H1 Assessment is a risk assessment screening methodology developed by the Environment Agency to be used by developers to identify discharges that are above natural background levels and that require more detailed impact assessment studies (e.g. involving the use of chemical discharge plume modelling).

7.14.28 The different scenarios to be modelled will be agreed in advance with the Environment Agency in order to ensure that they encompass the full range of the Environment Agency's concerns.

7.14.29 The magnitude of each impact would be determined on the basis of the spatial extent, reversibility, duration and likelihood of the impact, as well as the amount of change that would occur. The guidelines for assessing magnitude are shown in **Table 7.14.1**.

Table 7.14.1: Guidelines for the assessment of impact magnitude

Magnitude	Description
High	Entire study area affected (and potentially beyond), irreversible (e.g. outlasts operation), impact of long duration (e.g. 100+ years), impact certain or very likely to occur, change significantly above background levels.
Medium	Majority of study area affected, reversible in the long-term (during operation), moderate-long duration (e.g. 10-100 years), impact likely to occur, change slightly above background levels.
Low	Partial area affected (e.g. >20-50%), reversible in the medium-term (e.g. during construction phase), moderate duration (e.g. 6 months-10 years), impact would possibly occur, change discernable but equal to or below background levels.
Very low	Small area affected (e.g. 0-20%), reversible in the short-term (e.g. limited to site preparation), very short duration (<6 months), impact unlikely to occur, change barely discernable.

7.14.30 The assessment would consider impacts in terms of 'sensitivity' (in this context this will depend on whether formal quality standards exist or whether there are guidance values only) and magnitude (taking account of the extent of the area of exceedance and regulatory decisions on the area of acceptable mixing zones).

7.14.31 A hierarchical approach would be adopted to the criteria used as follows:

- where a substance has an EQS defined under the WFD, the EQS would be the standard against which the assessment is made;
- where there is no WFD EQS, the pre-WFD EQS is the standard against which the assessment will be made;
- where there is no EQS available then a probable no effect concentration (PNEC) would be used as the assessment criterion; and
- where there is neither an EQS nor PNEC available, comparison would be made to the baseline concentrations determined from the 2010/11 sampling programme.

7.14.32 The majority of environmental standards for marine water quality are those provided within the Directions for Transitional and Coastal (TRaC) Waters as determined for the WFD.

7.14.33 The value/sensitivity of the receptors and resources would be determined on the basis of their conservation, economic or functional value and their capacity to accommodate the impact (i.e. their capacity for resistance and resilience). The guidelines for assessing value/sensitivity for the features are given in **Table 7.14.2**.

Table 7.14.2: Guidelines for the assessment of value/sensitivity

Value/sensitivity	Description
High	Value: high functional value (e.g. contributes towards the designation of an internationally or nationally important feature, another ecosystem feature dependent on it), international/national conservation value. Sensitivity: The water quality of the resource has a very low capacity to accommodate any change to current water quality status, compared to baseline conditions, no capacity for resilience.
Medium	Value: moderate functional value (e.g. another feature partially dependent on it), regional conservation value. Sensitivity: The water quality of the resource supports high biodiversity and has low capacity to accommodate change to water quality status, low capacity for resilience (e.g. recovery after 10 years).
Low	Value: low functional value (e.g. limited connection to other ecosystem features), local conservation value. Sensitivity: The water quality of the resource has a high capacity to accommodate change to water quality status due, for example, to large relative size of the receiving water and capacity for dilution and flushing. Background concentrations of certain parameters already exist. Moderate capacity for resilience (e.g. recovery after 5 years).
Very low	Value: very low functional value (e.g. no dependencies), no conservation value. Sensitivity: Specific water quality conditions of the resource are likely to be able to tolerate proposed change with very little or no impact upon the baseline conditions detectable High capacity for resilience (e.g. recovery after 1 year).

7.14.34 No specific sediment receptors or resources have been identified as a part of this assessment because changes or disturbances to marine sediments may affect marine water quality status and potentially marine ecology. It is the consequential impacts on those receptors/resources that would be assessed in the EIA. For example, disturbance of bed sediments as a result of construction activities may cause the mobilisation of potential pollutants into the water column and an increase in suspended solid concentrations, with associated effects upon water quality status or marine ecology.

7.14.35 Effects will be determined based on the magnitude of impact (see **Table 7.14.1**) and sensitivity/value or resources and receptors (see **Table 7.14.2**) using the matrix set out in **Table 5.3**. Definition of major, moderate, minor and negligible effects for the purposes of the marine water quality and sediments assessment are provided in **Table 7.14.3**. Major and moderate effects would be considered to be significant, whereas minor and negligible effects would not.

Table 7.14.3: Definitions of effects

Effect	Description
Major	Very large or large changes to key characteristics of the water quality status of the receiving water feature, e.g. modelled as significant under the Environment Agency H1 assessment. Water quality status degraded to the extent that permanent

Effect	Description
	change and inability to meet (for example) EQS is likely.
Moderate	Intermediate changes to key characteristics of the water quality status taking account of the resource volume, mixing capacity, flow rate, etc. Water quality status likely to take considerable time to recover to baseline conditions.
Minor	Small changes to the water quality status of the receiving water feature. Activity not likely to alter local status to the extent that water quality characteristics change considerably or EQS are compromised.
Negligible	No discernible change in the water quality features above natural variability. An effect that is likely to have a negligible or no influence, irrespective of other effects.

v. Assumptions and limitations

7.14.36 There are no quantitative EU or UK EQS values for sediments. The only pertinent guidance for sediment quality is given for most of the EC Dangerous Substances Directive List 1 substances and is defined as 'standstill (no deterioration)'. In the absence of any quantified UK standards, common practice is to compare against two separate criteria sets:

- Cefas Guideline Action Levels for the disposal of dredged materials; and
- Canadian Sediment Quality Guidelines for the Protection of Aquatic Life.

7.14.37 The marine water quality baseline survey of Sizewell Bay was completed in 2010. It is considered that the results of this survey are representative of current conditions because there have been no significant alterations in anthropogenic inputs to the area since that date.

7.14.38 No limitations that could affect the robustness of the assessment have been identified to date.

d) Potential impacts

i. Construction

7.14.39 The EIA would include, but not necessarily be limited to, the following risks and impacts to marine water quality associated with the Main Development Site construction stage.

7.14.40 Impacts may include changes in water turbidity (cloudiness) and quality (contaminant mobilisation) and may occur due to the re-suspension of marine sediments into the water column during the construction of the cooling water intake and outfall vertical shafts and head structures, the fish recovery and return system and the temporary jetty.

7.14.41 Discharges to surface waters that enter the marine environment may include surface water drainage containing suspended sediment and contaminants and treated sewage effluent. All such discharges would have an appropriate level of treatment before discharge to the marine environment.

7.14.42 Potential changes may also occur to marine water quality as a result of chemicals that that are used in the commissioning of the Main Development Site.

ii. Operation

7.14.43 The EIA would include, but not necessarily be limited to, the following risks and impacts to marine water quality associated with the Main Development Site's operation stage.

7.14.44 Discharge of treated sewage effluent to sea would occur via the Main Development Site cooling water system.

7.14.45 The elevated temperature of the cooling water effluent would alter the thermal regime in the vicinity of the discharge point.

7.14.46 Potential changes may occur to marine water quality as a result of process chemicals that will be used in the operation of the Main Development Site and that are discharged in the cooling water effluent.

7.14.47 The occasional need to access the beach landing facility during the operational life of the power station may result in localised changes in water turbidity (cloudiness) and quality (contaminant mobilisation) due to the re-suspension of marine sediments into the water column from dredging operations and vessel movements.

e) Potential mitigation

7.14.48 Mitigation would comprise, but not necessarily be limited to, the following measures:

- A combination of 'embedded' environmentally sensitive design and best practice construction management measures would be implemented to avoid or minimise significant adverse effects during construction.
- Where potential exceedances of water quality parameters are identified, mitigation would primarily be achieved through the selection of appropriate embedded engineering design and construction methodologies and the application of best practice.
- Although there may be potential operational impacts as a result of the discharge of cooling water and possible use of various process chemicals, all discharges to the marine environment would be controlled through conditions of the environmental permits agreed with the Environment Agency.

f) Approach to cumulative assessment

i. Inter-relationships

7.14.49 Impacts relating to the discharge of thermal effluents and process chemicals are the subject of numerical hydrodynamic modelling studies. The models will permit a consideration of potential exceedances of existing water quality standards and the extent of relevant designated areas that might be affected. The EIA will consider inter-relationships with marine ecology and terrestrial ecology.

ii. Cumulative effects

7.14.50 Construction of the Galloper sub-station will necessitate the laying or trenching of two or more export cables on the seabed. In both instances, impacts may include changes in water turbidity (cloudiness) and quality (contaminant mobilisation) due to the re-suspension of marine sediments into the water column.

7.15 Marine ecology

a) Introduction

7.15.1 This section sets out the proposed scope and methodology for the marine ecology assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.15.2 A series of surveys was undertaken between 2008 and 2013, to characterise the baseline marine environment in the vicinity of the Main Development Site and within the wider zone of potential impact. A summary of the surveys completed to date is provided in **Table 7.15.1** and their spatial extents are shown in **Figure 7.15.1**.

Table 7.15.1: Characterisation studies completed to date

Study	Scope of study
Habitat mapping	Mapping of seabed morphology and associated marine biotopes based on sonar survey data, 2008 – 2012.
Intertidal	Survey of marine sediment-dwelling meio- and macroinvertebrates (endofauna) and surface sediments by core in 2011. Survey of salinity in saline lagoon at Minsmere in 2013.
Subtidal	Fish and surface invertebrates (epifauna) surveyed by beam and otter trawls and camera (for *Sabellaria* worms), 2008 – 2012; endofauna and surface sediments surveyed by grab, 2008 – 2012; phytoplankton (including nuisance algae) and zooplankton (including fish eggs and larvae) surveyed by Lund tube and Gulf IV/Pup sampler, variously 2008 – 2012; cetacean detection by acoustic C-POD device, 2011 – 2013.
Impingement and entrainment	Impingement sampling for fish and large invertebrates in Sizewell B, 2008 – 2013; entrainment sampling for zooplankton and postlarval fish in Sizewell B, 2011. Studies of entrainment effects (pressure, temperature and chlorination) on fish eggs/larvae and invertebrate species in the Entrainment Mimic Unit (EMU), 2012 - 2013. Species tested were: cod (*Gadhus morhua*), European plaice (*Pleuronectes platessa*), European seabass (*Dicentrarchus labrax*), European eel (*Anguilla anguilla*), lobster (*Homarus gammarus*), a copepod crustacean (*Acartia tonsa*), a mysid crustacean (*Neomysis integer*).
Fishing activity	Information gathered on gear types, vessel sizes, ports used and species caught, up to 2010.

c) Approach and methodology

i. Study area

7.15.3 The geographical extent of the marine ecology study area was determined by the potential zone of effect for the Main Development Site, by consideration of the physical processes that determine the ecology of the Greater Sizewell Bay area and by consideration of the regional context for commercial fisheries operating in the area.

7.15.4 The potential zone of effect was based on consideration of the two largest-scale potential impacts associated with the Main Development Site: sediment resuspension and transport resulting from construction of the jetty and cooling water infrastructure, and discharge of heated cooling water effluent during the Main Development Site operation. A worst-case plume extent was estimated using the annual 2°C mean excess temperature contour at the seabed using a validated General Estuarine Turbulence Model (GETM) of the in combination operation of Sizewell B and Sizewell C (assuming a Sizewell C cooling water outfall inshore of the Sizewell - Dunwich Bank). The extent of potential sediment resuspension was defined as a tidal ellipse centred on the mid-point of the Main Development Site. The zone of effect was bound by Dunwich to the north and Orfordness to the south, seaward of the Sizewell-Dunwich Bank to the east and mean high water springs to the west – the area known as the Greater Sizewell Bay.

7.15.5 The boundary of the study area for commercial fisheries was determined to be the International Council for the Exploration of the Sea (ICES) rectangles accounting for the local fishery (ICES rectangle 33F1) and the regional context (ICES rectangles 32F1, 32F2, 33F2, 34F1 and 34F2). The spatial extent of the study area (zone of effect and wider fisheries context, including spawning and nursery grounds) and biological sampling is shown in **Figure 7.15.1.**

ii. Baseline information

7.15.6 Greater Sizewell Bay contains moderate energy beaches, comprising a matrix of gravel and sand populated by patchy, low abundance invertebrate assemblages tolerant of the dynamic physical environment. The subtidal seabed is predominantly sand, with clay, mud, coarse sediment and bedrock. The epifauna that have been observed included free living and colonial taxa, with brittlestars (*Ophiura ophiura)* and crustaceans well represented. The endofauna was dominated by polychaetes and bivalves, with the catworm (*Nephtys* spp.) and the bivalves *Nucula nucleus* and *Nucula nitidosa* consistently present. Epifauna varied seasonally, but there were no clear patterns in the endofauna. Rossworm (*Sabellaria spinulosa*) occurred in the study area, though not consistently or in sufficient density to be classified as reefs.

7.15.7 Up to 62 phytoplankton taxa have been recorded in the area, including diatoms, dinoflagellates, microflagellates and, on occasion, cyanobacteria. The assemblages were dominated by diatoms and exhibited a characteristic spring bloom, with diversity increasing as the season progressed. Nuisance or harmful algal bloom species were present, though neither widely nor consistently. The invertebrate zooplankton was dominated by crustaceans, foraminiferans, bivalve and polychaete larvae and invertebrate eggs.

7.15.8 The fish assemblage surveyed around Sizewell was diverse. Dover sole (*Solea solea)* dominated the adult assemblage, with gobies (Gobidae spp.), whiting (*Merlangius merlangus)*, European plaice, thornback ray (*Raja clavata)*, Atlantic herring (*Clupea harengus)* and dab (*Limanda limanda)* also common. Herrings (Clupeidae), dab, Dover sole and gobies were also found locally as eggs and/or larvae, as were the pelagic species sprat (*Sprattus sprattus)* and anchovy (*Engraulis encrasicolus)*. Sprat, herring and whiting were impinged in Sizewell B in large numbers/biomass. European seabass was commonly impinged and its eggs also occurred locally, though adults were not particularly common in the wider waters.

7.15.9 Species of conservation priority occurring in the area included the European eel, cucumber smelt (*Osmerus eperlanus*), river lamprey (*Lampetra fluviatilis)*, Allis and Twaite shad (*Alosa alosa* and *A. fallax)*, cod, herring, whiting, plaice, Dover sole and tope (*Galeorhinus galeus)*.

7.15.10 Fish and shellfish fisheries operate in the area. There are several fishing ports and beach launching is practiced in some areas. Most inshore boats are <10m long and tend to use passive gear, such as fixed and drift nets, long-lines and pots. The number of boats fishing in the region has varied over the years, depending on environmental and economic factors.

7.15.11 One boat operates from Sizewell, mainly potting for European lobster and crabs (*Cancer pagurus, Carcinus maenas* and *Necora puber*), as well as whelk (*Buccinium undatum*). Sizewell is also within the principal drift net grounds for herring, sprat, bass, sole, mackerel (*Scomber scombrus*) and thornback ray. Other commercial fisheries along the Suffolk coast include bottom trawling for sole, brill (*Scophthalmus rhombus*), plaice, rays (Rajidae spp.), dab and flounder (*Pleuronectes flesus*), and for brown shrimp (*Crangon crangon*) in beam trawls, rod and line fishing for bass, mussel (Mytilus edulis) and Pacific oyster (*Crassostrea gigas*) harvesting and fyke netting for eels (*Anguilla anguilla*) in the estuaries.

7.15.12 Marine mammals have been found to be present in the study area. Dolphins do not regularly utilise the waters around Sizewell, though the presence of harbour porpoise (*Phocoena phocoena*) has occurred both inshore of the Sizewell-Dunwich Bank and further offshore.

iii. Planned further survey/studies

7.15.13 Further and ongoing studies will continue to examine rates of impingement of fish and invertebrates in the Sizewell B station, as well as phytoplankton, zooplankton, benthic invertebrate and fish populations in the vicinity of the Main Development Site. Supporting environmental variables will also be collected to furnish the required Water Framework Directive assessments, including chlorophyll a, salinity and temperature. Studies will characterise the marine food web links in the study area, including protected bird species (especially red throated diver (*Gavia stellata*), sandwich tern (*Sterna sandvicensis*) and little tern (*Sterna albifrons*)) and their marine prey. Studies to further characterise the area of coralline crag around Thorpeness will be undertaken using diver and, subject to technical feasibility which is currently being assessed, by high resolution acoustic surveys. The planned studies are summarised in **Table 7.15.2**.

Table 7.15.2: Planned marine ecology studies

Study	Scope of study
Intertidal	Further survey of salinity in the saline lagoon at Minsmere.
Subtidal	Fish and invertebrates in the vicinity of the Main Development Site by beam and otter trawls and grab; targeted survey of an area of coralline crag around Thorpeness, by either acoustics or diver survey; phytoplankton (including nuisance algae) and zooplankton (including fish eggs and larvae and gelatinous plankton) monthly. Desk/data study of seal distribution.
Impingement and	Impingement sampling for fish and invertebrates in Sizewell B. Studies of entrainment effects (pressure, temperature, chlorination)

Study	Scope of study
entrainment	on fish eggs/larvae and invertebrate species in the EMU, focussed on the different life stages of locally important or representative species.
Fishing activity	Further data on fishing activity, including updated fisheries statistics from the Marine Management Organisation.

iv. Assessment methodology

7.15.14 The main legislation, policy and guidance to be considered during the impact assessments would include:

International agreements/conventions

- the Ramsar Convention on Wetlands of International Importance 1975;
- the Convention on Biological Diversity 1992; and
- the Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR) 1992.

European legislation

- EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC);
- EC Directive on the Conservation of Wild Birds (2009/147/EC);
- the Water Framework Directive (2000/60EC); and
- the Marine Strategy Framework Directive (2008/56/EC).

National legislation and policy

- Salmon and Freshwater Fisheries Act 1975;
- the Wildlife and Countryside Act 1981;
- UK Biodiversity Action Plan 1994;
- National Planning Policy Framework 2012;
- Marine and Coastal Access Act 2009;
- East Inshore and Offshore Marine Plans 2014; and
- Eel Management Plans 2010.

7.15.15 The EIA would consider ecological features of conservation, socio-economic and functional importance, including features linked to terrestrial or freshwater resources (e.g. marine prey of protected bird species). A criteria-based matrix approach would be utilised, whereby the magnitude of impact for each construction and operational element would be set against the value/sensitivity of a feature in order to estimate the overall effect on the feature. Effect is defined here as the consequence of an impact on the ecological feature (with impact defined as changes resulting from an action). The basic premise that would be adopted is to compare impacts against natural variability in the ecological features including, where appropriate, predicted future

baselines in the absence of development but incorporating geomorphological change scenarios for the area.

7.15.16 The magnitude of the impact would be determined on the basis of the spatial extent, reversibility, duration and likelihood of the impact, as well as the amount of change that would occur. The guidelines for assessing magnitude are shown in **Table 7.15.3.**

Table 7.15.3: Guidelines for the assessment of impact magnitude

Magnitude	Description
High	Entire study area affected (and potentially beyond), irreversible (e.g. outlasts operation), impact of long duration (e.g. 100+ years), certain to occur, change significantly above background levels.
Medium	Majority of study area affected, reversible in the long-term (during operation), moderate-long duration (e.g. 10-100 years), likely to occur, change slightly above background levels.
Low	Partial area affected (e.g. >20-50%), reversible in the medium-term (e.g. during construction phase), moderate duration (e.g. 6 months-10 years), will possibly occur, change discernable but equal to or below background levels.
Very low	Small area affected (e.g. 0-20%), reversible in the short-term (e.g. limited to site preparation), very short duration (<6 months), unlikely to occur, change barely discernable.

7.15.17 The value/sensitivity of the receptors and resources would be determined on the basis of their conservation, economic or functional value and their capacity to accommodate the impact (i.e. their capacity for resistance and resilience). The guidelines for assessing value/sensitivity for the marine ecological features are given in **Table 7.15.4**.

Table 7.15.4: Guidelines for the assessment of value/sensitivity

Value/sensitivity	Description
High	Value: high functional value (e.g. another ecosystem feature dependent on it), international conservation value, national/international socio-economic value. Sensitivity: no capacity for resistance, no capacity for resilience.
Medium	Value: moderate functional value (e.g. another feature partially dependent on it), national conservation value, national/regional socio-economic value (e.g. commercial fishery). Sensitivity: low capacity for resistance, low capacity for resilience (e.g. recovery after 10 years).
Low	Value: low functional value (e.g. limited connection to other ecosystem features), regional/local conservation value, local socio-economic value (e.g. artisanal fishery). Sensitivity: moderate capacity for resistance, moderate capacity for resilience (e.g. recovery after 5 years).
Very low	Value: very low functional value (e.g. no dependencies), no conservation value, no socio-economic value. Sensitivity: high capacity for resistance, high capacity for resilience (e.g. recovery after 1 year).

7.15.18 Effects will be determined based on impact magnitude (see **Table 7.15.3**) and sensitivity/value of receptors and resources (see **Table 7.15.4**), using the matrix shown in **Table 5.3**. Explanations of the effect categories for the marine ecology assessment are provided in **Table 7.15.5**. Major and moderate effects would be considered to be significant; minor and negligible effects would not.

Table 7.15.5: Definitions of effects

Effect	Description
Major	Very large or large changes in individual ecological features, which may alter the structure or function of the overall marine ecosystem. Changes in highly protected or very valuable species or habitats. Effects, both adverse and beneficial, that are likely to be important considerations at an international or national level because they contribute to achieving international/national objectives or are likely to result in exceedance of statutory objectives and/or breaches of legislation.
Moderate	Intermediate change in individual ecological features that may or may not cause subtle changes in other ecosystem features. Changes in species or habitats of regional importance. Effects that are likely to be important considerations at a regional level, societally or with respect to environmental management processes.
Minor	Small change in ecological features, with no discernable effects on other ecosystem features. These effects may be raised as local issues but are unlikely to be instrumental in the decision making process.
Negligible	No discernable change in the ecological features. An effect that is likely to have a negligible or no influence, irrespective of other effects.

v. Assumptions and limitations

7.15.19 The assessment approach would assume that natural variability exists in the biological resources and, where appropriate, the future baseline in the absence of development can be adequately characterised.

7.15.20 No limitations that could affect the robustness of the assessment have been identified to date.

d) Potential impacts and effects

7.15.21 Elements of the proposed Main Development Site that could have effects on marine ecology resources would be:

- construction and operation of cooling water infrastructure (including cooling water tunnels extending out to sea, intake and outfall headworks on the seabed and the outfall associated with a fish recovery and return system);
- operation of the beach landing facility in order to receive deliveries of AILs by sea throughout the power station's operational life;
- construction and subsequent management of flood defence and coastal protection measures;
- construction and operation of a jetty for the import/export of construction materials and AILs (including vessel movements and any accidental chemical or fuel discharge);

- maintenance of any maritime exclusion zones around beach landing and offshore structures, during construction or operation; and
- land-based discharges such as surface water runoff from terrestrial groundworks and treated sewage discharges from the site.

7.15.22 Some effects may be short-term and others may be long-lasting, and this will be identified as part of the assessment.

i. Construction

7.15.23 The EIA would include, but not necessarily be limited to, the following potential impacts to marine ecology associated with the Main Development Site's construction stage.

7.15.24 Construction of the beach landing facility and cooling water infrastructure would cause sediment resuspension and localised habitat loss, potentially leading to smothering and/or behavioural effects in sensitive species. However, the species present would be expected to be adapted to the naturally turbid waters of Greater Sizewell Bay, although there may be some localised impacts close to the construction locations. Habitat loss would affect benthic species, although this would also be localised.

7.15.25 Construction noise could impact on invertebrates, fish and mammals, particularly if it occurs during sensitive periods (such as reproductive or migration seasons). Underwater noise impacts will be assessed in the marine ecology chapter of the ES as the marine environment is the location for the potentially affected species.

7.15.26 Chemical/organic matter discharges from terrestrial groundworks/sewage treatment and vessels (accidental spills) may have local impacts on receiving waters and organisms with limited movement control such as benthic species and phytoplankton.

7.15.27 The establishment of exclusion zones around the jetty and during construction of the seabed cooling water intake and outfall headworks and the Fish Recovery and Return outfall would limit inshore commercial fishery activities in these areas.

ii. Operation

7.15.28 The EIA would include, but not necessarily be limited to, the following potential impacts to marine ecology associated with the Main Development Site's operation stage.

7.15.29 The cooling water system of the Main Development Site would impinge and entrain fish and invertebrates. This could affect protected bird species such as the little tern and red throated diver that prey on pelagic fish.

7.15.30 Increases in mean water temperatures in Sizewell Bay could cause increases in nuisance phytoplankton (nuisance blooms), though the prevailing environmental conditions (e.g. high turbidity) may limit this to localised short-term effects or prevent bloom formation.

7.15.31 The thermo-chemical plume may have effects on sensitive species with limited movement control, although mobile species such as fish and cetaceans would be expected to avoid it unless it intersects with key migratory routes or nursery areas.

7.15.32 Dependent upon their location, the cooling water outfall structures may affect sediment transport in the area if they were to act as a hydraulic groyne. This could have consequent localised effects on sediment-dwelling organisms.

7.15.33 Any terrestrial discharges of organic matter/chemicals during operation can be expected to have similar effects to those occurring during construction.

7.15.34 Operations associated with the occasional use of the beach landing facility would cause sediment resuspension and localised habitat loss, potentially leading to smothering and/or behavioural effects in sensitive species. However, the species present are expected to be adapted to the naturally turbid inshore waters of Sizewell Bay.

7.15.35 Dependent upon their location, the seabed cooling water intake and outfall headworks, and Fish Recovery and Return outfall, could reduce areas of seabed available for inshore commercial fishery activities.

e) Potential mitigation

7.15.36 Mitigation would comprise, but not necessarily be limited to, the following measures:

- In accordance with Environment Agency guidance, the cooling water infrastructure design would incorporate low velocity side entry (LVSE) intakes and both acoustic fish deterrent (AFD) and fish recovery and return (FRR) systems. Through reducing the numbers of organisms entering the cooling water tunnels and returning to sea those that do enter the tunnels, these embedded systems can be expected to reduce mortality and thus mitigate effects on the wider populations.
- Any residual effects would be assessed on a species-specific basis with respect to the value of the feature (e.g. protected or commercially valuable fish species would be afforded greater consideration).
- Piling strategies, such as the choice of methodology, soft-start technology and, if necessary, seasonally-restricted activity could be adopted in order to limit underwater noise impacts on mammals and fish.

f) Approach to cumulative assessment

i. Inter-relationships

7.15.37 Noise effects could combine with sediment resuspension effects (e.g. smothering) in sensitive fish or invertebrate species exposed to the construction activities for the jetty or cooling water infrastructure. The cooling water discharge contains thermally and chemically modified water, so receiving waters would be subject to both impacts. Temperature effects may combine with chemical effects in sensitive marine species exposed to the plume. Any combined effects are more likely to be restricted to sensitive pelagic species in the immediate vicinity of the cooling water outfall, as the concentration of any discharged chemicals with distance from the outfall will reduce rapidly.

ii. Cumulative effects

7.15.38 Construction of the Galloper Wind Farm sub-station will necessitate a transport corridor across the foreshore and the laying or trenching of two or more export cables

on the seabed, potentially causing localised disturbance in terms of increased turbidity and localised habitat loss.

7.16 Navigation

a) Introduction

7.16.1 This section sets out the proposed scope and methodology for the navigation assessment of the Main Development Site. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with the proposed development.

b) Work undertaken to date

7.16.2 Work undertaken to date has entailed desk-based baseline data investigation to identify the principal shipping and navigational features in the study area, defined below. Data was collated from a variety of sources including vessel tracking Automatic Identification System (AIS) data, the Royal Yachting Association's (RYA) UK Coastal Atlas, the Marine Management Organisation's (MMO) UK fishing vessel lists, and other publicly available documents (for example, aggregate dredging statistical reports and offshore wind farm development application documents).

c) Approach and methodology

i. Study area

7.16.3 The study area covers the shoreline and open water within a 10 nautical mile (nm) (18.5km) radius of the Main Development Site (see **Figure 7.16.1**). This area encompasses the proposed offshore infrastructure for the Main Development Site (e.g. the jetty and the cooling water intake and outfall head structures) and will capture the relevant inshore and offshore routes used by commercial vessels and recreational craft.

7.16.4 A wider study area, to be defined through consultation and further study, extends further offshore to capture navigation and shipping activities associated with the plans and projects that may be relevant to the cumulative assessment (see **Section f)ii)** of this section), including offshore wind farm development and other commercial activity within the 12nm territorial sea limit.

ii. Baseline information

7.16.5 Navigation receptors include a range of commercial and recreational activities (and associated participants and economies) requiring the safe passage and access of vessels and craft within the study area.

7.16.6 Commercial navigation activity in the study area comprises various vessel movements and activities at varying distances offshore. Commercial shipping transiting the study area includes cargo vessels, passenger vessels (e.g. the Harwich–Esbjerg ferry route) and tankers using the principal east coast ports include the Medway ports (e.g. Sheerness and Chatham), London ports (e.g. Tilbury), Harwich Haven ports (e.g. Felixstowe, Harwich and Ipswich), and the Humber ports (e.g. Immingham) and Teesport. Vessels passing southwards through the study area also head for the Dover Strait and ports beyond.

7.16.7 Other commercial activity affecting navigation within the study area includes:

- dredging for aggregates in offshore waters, with vessels sailing to and from designated extraction areas situated inside and just beyond the 12nm territorial sea limit within the East Coast Region off Great Yarmouth/Lowestoft, the Thames Estuary Region off Orford and as far south as the Thames Estuary;
- fishing involving 41 vessels of over 10m in length generally fishing further offshore (e.g. beam trawling) and 247 vessels of less than 10m length generally fishing inshore (e.g. netting, potting, demersal trawling and long-lining) (based on the MMO's UK vessel lists for Lowestoft as the administrative port for vessels working between the River Thames Estuary and The Wash, dated 1 December 2013); and
- offshore wind farm development (e.g. Galloper, Greater Gabbard, and East Anglia One, Three and Four) generating various changes to navigation (such as in shipping routes) and additional movements (for example, plant and supplies associated with offshore wind farm construction, operation and maintenance activities).

7.16.8 Recreational navigation tends to be highly seasonal and generally restricted to daylight hours. It involves various activities and forms of watercraft, including:

- sea kayaking and canoeing and sailboarding in the creeks and minor rivers;
- dinghy and other small boat sailing (and training) in rivers and offshore up to about 15nm;
- cruising (both passage making and day sailing) under motor and sail between shore facilities; and
- personal watercraft use in inshore waters.

7.16.9 Recreation activity is based at a number of coastal locations to the north and south of the Main Development Site (i.e. marinas, clubs and training centres), and is particularly popular at locations south of the River Deben and on the River Blythe around Southwold and Walberswick.

7.16.10 The RYA's Coastal Atlas identifies two medium-use recreational sailing routes passing the Main Development Site: the Coastal Route North and the Long Distance Route North. The inshore route – the Coastal Route North – passes between Sizewell B's cooling water intake and outfall head structures and Sizewell Bank. The RYA has classed the coastal waters extending northwards from Aldeburgh and well beyond Sizewell and Southwold as a racing area.

iii. Planned further survey/studies

7.16.11 Additional baseline data on navigation, shipping and other vessel movements is being collected from existing available sources, including AIS data, RYA UK Coastal Atlas data, MMO fisheries sightings and satellite data, Crown Estate aggregate dredging data, Admiralty Charts and Sailing Directions data, Marine and Coastguard Agency (MCA) Search and Rescue (SAR) data, the Department for Transport (DfT) Marine Accident Investigation Branch (MAIB) and Royal National Lifeboat Institution (RNLI) maritime incident records, and meteorological and hydrodynamic data (wind, wave, tide, visibility data).

7.16.12 Subject to further consultation, including that undertaken to inform the scoping opinion, it is possible that surveys will be undertaken to record seasonal vessel

movements (summer and winter) in the local study area around the Main Development Site. These surveys will entail either AIS surveys or combined AIS and radar surveys, subject to consultation and agreement with the MCA.

7.16.13 The EIA process will be informed by a staged approach to studying navigation, as identified in **Table 7.16.1**.

Table 7.16.1: Staged approach to addressing navigation during the EIA process

Stage	Study	Description
1	Preliminary Hazard Assessment (PHA)	Desk-based study to review baseline navigation and vessel data availability (including AIS data) and to clarify the scope of work for surveys and Navigation Risk Assessment (NRA), informed by consultation with principal national and local consultees (e.g. MCA, Trinity House, RYA)..
2	Hazard Identification (HAZID) workshop	Structured round-table consultation with principal consultees to identify and agree risk scenarios and qualitatively assess hazards through expert opinion and local knowledge. The workshop's findings will be recorded and used to inform the NRA.
3	Navigation Risk Assessment (NRA)	Detailed assessment of agreed risk scenarios, including vessel-to-vessel collision risks and other collision risks (i.e. with seabed features or human infrastructure). Risks are quantified using dedicated software and assessed by combining a risk's consequence and frequency to determine whether it is unacceptable, As Low As Reasonably Practicable (ALARP) or unacceptable.

iv. Assessment methodology

7.16.14 The EIA will use an assessment methodology for navigation dependant on the risk or impact being considered. Both short-term and long-term effects on navigation receptors will be assessed.

7.16.15 Navigation impacts associated with collision risk will be assessed in line with the International Maritime Organisation's (IMO's) Formal Safety Assessment (FSA) process. This risk based approach entails expert judgement about the tolerability of risks that is typically agreed by a range of experts (e.g. during a HAZID workshop). The tolerability of collision risks will be assessed using matrices to plot a risk's consequence (i.e. scale of personal injury, equipment damage, environmental damage) (see **Table 7.16.3**) against its frequency (i.e. likelihood of occurrence) (see **Table 7.16.2**), taking into account the principle of As Low As Reasonably Practicable (ALARP). A risk that is neither negligibly low nor intolerably high will be reduced to a level that is ALARP using reasonable measures that are technically practicable and incurring costs that are not disproportionate to the benefits gained. Either side of ALARP, risks are intolerable or negligible (see **Table 7.16.4**).

7.16.16 Risks are assessed and put into one of the following categories:

- low risk – acceptable/tolerable (risk score of 1 to 6) and no risk control measures are required;
- moderate risk – tolerable (risk score of 7 to 15) and risk is ALARP; or

- high risk – unacceptable/intolerable (risk score of 16 to 25) and further risk reduction measures are required.

Table 7.16.2: Navigation risk frequency categories

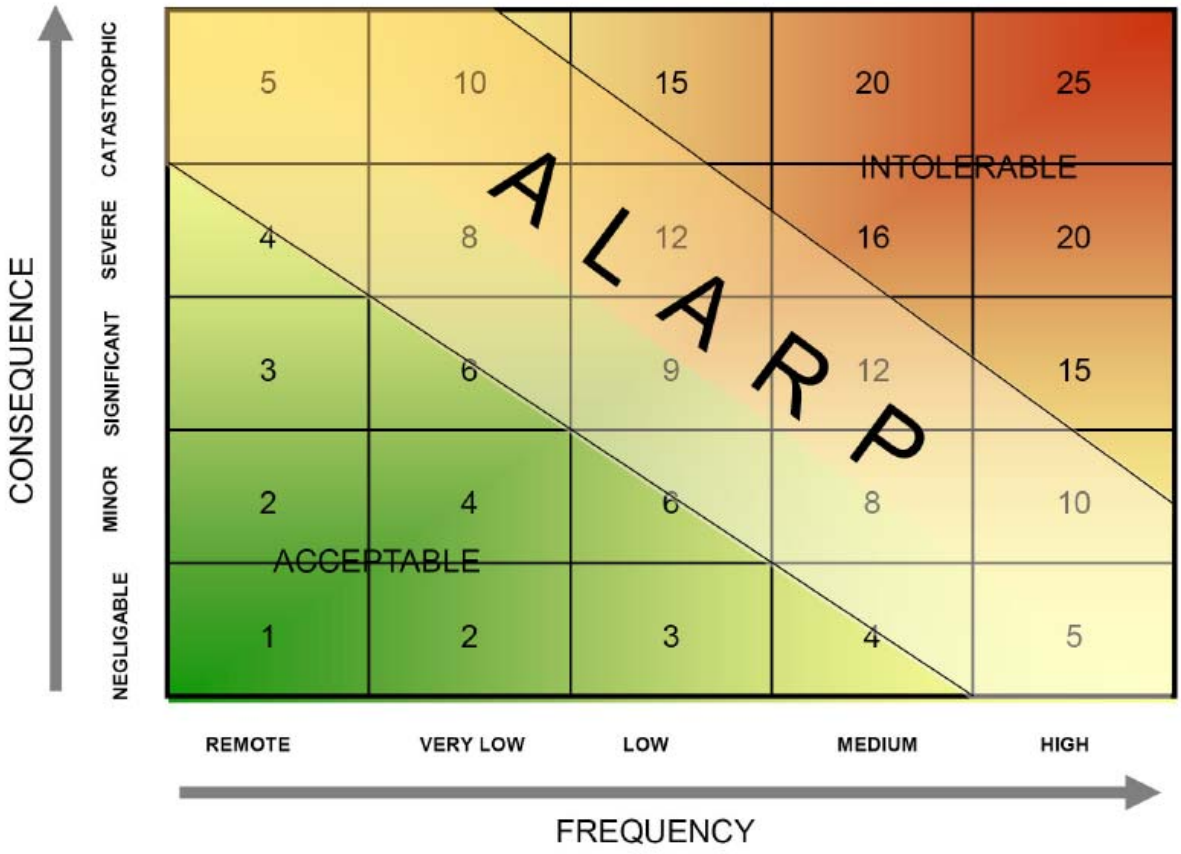
Category	Likelihood Ranking Number (LRN)	Frequency Definition	Frequency Band
High	5	Very likely to occur during activity	Yearly occurrence
Medium	4	Likely to occur during activity	1 occurrence per 1 to 10 years
Low	3	May occur during activity	1 occurrence per 10 to 100 years
Very low	2	Unlikely to occur during activity	1 occurrence per 100 to 10,000 years
Remote	1	Not expected to occur during activity	<1 occurrence per 10,000 years

Table 7.16.3: Navigation risk consequence categories

Category	Consequence Ranking Number (CRN)	Consequence Definition	Consequence Band
Catastrophic	5	Fatality, or severe personal injury, total plant loss, irreversible environmental damage.	People: More than one fatality. Property: >£10M. Environment: Tier 3 National assistance required. Business: >£10M International publicity.
Severe	4	Serious/moderate personal injury. Major/long -term equipment damage. Long-term environmental damage.	People: Serious injury or single fatality. Property: >£1M. Environment: Tier 2 Regional assistance required. Business: £1-£10M National publicity.
Significant	3	Minor/serious injury. Medium-term equipment and environmental damage.	People: Multiple moderate or single serious injury. Property: £100k-£1M. Environment: Tier 2 Limited external assistance required. Business: £100k-£1M Local publicity.
Minor	2	Minor personal injury. Minor/short-term equipment damage. Short-term environmental damage.	People: Slight injury(s). Property: £10k-£100k. Environment: Tier 1 Local assistance required. Business: £10k-£100k.
Negligible	1	Negligible personal injury/plant or equipment failure/environmental damage.	People: No injury. Property: <£10k.

Category	Consequence Ranking Number (CRN)	Consequence Definition	Consequence Band
			Environment: <£10k. Business: <£10k.

Table 7.16.4: Navigation risk assessment matrix



7.16.17 Effects will be determined based on impact consequence (see **Table 7.16.3**) and likelihood (susceptibility) of receptors (see **Table 7.16.2**), using the matrix shown in **Table 7.16.4**. Explanations of the effect categories are provided in **Table 7.16.5**. Major and moderate effects would be considered to be significant; minor and negligible effects would not.

Table 7.16.5: Definitions and descriptions of effects

Effect	Definition	Description
Major	Intolerable	Generally regarded as unacceptable whatever the level of benefit associated with the activity.
Moderate	Intolerable	Generally regarded as unacceptable whatever the level of benefit associated with the activity.
Minor	ALARP	Typical of the risks from activities which people are prepared to tolerate. There is however an expectation that these hazards are properly assessed, appropriate control measures are in place and that the residual risks / effects

Effect	Definition	Description
		are ALARP. (ALARP). These risks / effects require periodic review to investigate whether further controls are appropriate.
Negligible	Acceptable	Generally regarded as insignificant and adequately controlled. Nonetheless, the law still requires further risk / effect reductions if it is reasonably practicable. However, at these levels the opportunity for further risk/effect reduction is more limited.

7.16.18 The terminology used for the collision risk part of the navigation assessment can be aligned to the standard EIA terminology as shown in **Table 7.16.6**.

Table 7.16.6: Comparison of terminology for navigation collision risk assessment

Equivalent EIA effect and significance terminology	Collision risk assessment terminology
Major = significant	Intolerable = significant
Moderate = significant	Intolerable = significant
Minor = not significant	ALARP = not significant
Negligible = not significant	Acceptable = not significant

v. Assumptions and limitations

7.16.19 The assessment methodology inherently assumes that:

- awareness of navigation hazards can and will be raised, as appropriate, through standard measures such as Notices to Mariners, aids to navigation, etc.; and
- all marine activities will be undertaken in a competent manner, and all appropriate navigation information (e.g. Admiralty Charts) will be updated.

7.16.20 No limitations have been identified to date.

d) Potential impacts and effects

7.16.21 The assessment methodology will include a PHA, HAZID workshop and detailed NRA to inform the EIA process regarding a range of potential risks and impacts on the safe navigation and activity of commercial shipping and recreational craft during the Main Development Site's construction and operational phases.

ii. Construction

7.16.22 The EIA would cover, but not necessarily be limited to, the following risks and impacts to navigation associated with the Main Development Site construction stage:

- collision risk – commercial shipping and works vessels (e.g. jack-up platforms and vessels delivering construction materials);
- collision risk – recreational craft and works vessels;
- collision risk - commercial shipping and works structures (e.g. the jetty, cooling water intake and outfall head structures);

- collision risk – recreational craft and works structures;
- re-routing impact - commercial shipping (e.g. inshore vessel movements around temporary exclusion zones); and
- re-routing impact – recreational craft (e.g. inshore cruising routes around temporary exclusion zones).

iii. Operation

7.16.23 The EIA would cover, but not necessarily be limited to, the following risks and impacts to navigation associated with the operational stage of the proposed development:

- collision risk – commercial shipping and operational vessels (e.g. vessels using the beach landing facility);
- collision risk – recreational craft and operational vessels;
- collision risk - commercial shipping and operational structures;
- collision risk – recreational craft and operational structures;
- re-routing impact - commercial shipping (e.g. inshore vessel movements around operational structures, such as the cooling water intake and outfall head structures); and
- re-routing impact – recreational craft (e.g. inshore cruising routes around operational structures, such as the cooling water intake and outfall head structures).

e) Potential mitigation

7.16.24 Mitigation would comprise, but not necessarily be limited to, the following measures:

- a range of embedded mitigation measures (e.g. marks, lights and other aids to navigation);
- consent conditions (e.g. avoid works encroaching on any anchorages); and
- management measures during construction (e.g. Notice to Mariners, exclusion zones) and during operation (e.g. updating of nautical charts via the UK Hydrographic Office).

7.16.25 These measures would take into account the general navigation management measures identified by the MCA and RYA, specific lighting and marking measures to be specified by Trinity House, and additional measures identified through the navigation risk and impact assessment process.

f) Approach to cumulative assessment

i. Inter-relationships

7.16.26 Collision risks and re-routing impacts could have indirect effects on a number of environmental and social parameters. The key inter-relationships occur where the jetty and/or cooling water intake and outfall head structures' construction works and operations interfere with the navigation of vessels and, therefore, interfere with activities associated with the navigation of vessels.

7.16.27 For the Main Development Site, the following inter-relationships will be considered:

- the inter-relationship with commercial fishing and associated earnings from this activity if, for example, fishing activities become suspended and/or displaced to accommodate navigation requirements (e.g. exclusion zones) (see **Section 7.15**); and
- inter-relationships with recreation (particularly inshore cruising) if, for example, sailing routes become diverted to accommodate navigation requirements (see **Section 7.4**).

7.16.28 The scoping process has not identified any impacts on other receptors that could have indirect risks and impacts on navigation.

ii. Cumulative effects

7.16.29 The Sizewell C Project, in cumulation with other relevant plans or projects in the wider study area affecting the marine environment, could pose additive risks or impacts on navigation (e.g. increasing collision risks due to additional traffic movements and/or compressed sailing routes). A key project in this respect is anticipated to be the construction and operation of the offshore Galloper Wind Farm, including the laying of the seabed export cables that will come ashore at Sizewell, to the south of the Main Development Site. Due to the cumulative presence of works and vessel movements, it is anticipated that cumulative collision risks and re-routing impacts will be assessed where marine activities for the Sizewell C Project and Galloper Wind Farm development overlap in space and/or time. Other relevant permitted and/or implemented plans, programmes and projects will also be considered where scoped into the assessment.

7.17 Radiological

a) Introduction

7.17.1 The Sizewell C nuclear power station and associated radioactive waste management facilities will need to be permitted by the Environment Agency under Schedule 23 of the Environmental Permitting (England and Wales) Regulations, 2010 (as amended). This will authorise the operator to dispose of radioactive waste under specific limitations and conditions as specified in the environmental permit.

7.17.2 This section outlines the baseline conditions, proposed approach, methodology and assessment for the radiological impacts associated with potential radioactive discharges arising from the construction and operational phases of the Main Development Site. This includes radiological impacts from discharges of gaseous and liquid effluents to atmosphere and the marine environment respectively resulting from routine operations. There will not be any disposal of radioactive effluents to groundwater during construction or operation, therefore no radiological impact assessment on groundwater will be undertaken.

7.17.3 Whilst it addresses the radiological impacts associated with the transport of radioactive waste from the Main Development Site during the operational period, it does not address the management of solid radioactive waste or spent fuel which is described in **Section 3.8**.

7.17.4 In addition, the radiological impacts of decommissioning are assumed to be bounded by the routine operational activities and therefore not detailed further.

7.17.5 There are no radiological impacts expected with any of the off-site associated development sites. No radioactive disposals will take place from these locations during the construction or operation of either the Main Development Site or any of the off-site associated development sites.

7.17.6 Further information on the health implications associated with radiological impact of such permitted disposals will be addressed in the Health Impact Assessment.

b) Work undertaken to date

7.17.7 EDF Energy has undertaken surveys and monitoring programmes in order to obtain a more detailed understanding of the background radioactivity levels around the Sizewell C Main Development Site and of the potential implications of any planned radiological discharges. A summary of surveys and studies completed to date with respect to human and non-human radiological impacts is provided below:

- Desk study of data sources for background radioactivity levels: Background radioactivity data has been gathered. These data include a review of the most recent Environment Agency and the Foods Standards Agency 'Radioactivity In Food and the Environment' (RIFE) annual reports. These reports contain the results of radiological sampling and monitoring programmes of food and the environment in the UK.
- Radiological walkover survey: A survey, using instruments that can measure levels of radioactivity at and near the ground surface, was undertaken across the Sizewell C Main Development Site in 2010.

- Phase 2 intrusive radiological investigation: Radionuclide concentrations in shallow and deeper soils within the Sizewell C Main Development Site have been determined from soil sampling surveys which were completed in March 2011.
- Groundwater monitoring programme: Radionuclide concentrations in groundwater have been assessed. Six groundwater monitoring rounds were completed in October 2011.
- Surface water monitoring: Radionuclide concentrations in the surface freshwater features (ditches and streams) within the study area have been determined from 17 rounds of radiological sampling and in-situ radiological screening undertaken between January 2010 and May 2011, allowing potential seasonal variations to be assessed. Two further sampling campaigns took place in 2012.
- Marine water monitoring: Radionuclide concentrations in marine waters, in the North Sea in the vicinity of the Sizewell C Main Development Site, have been analysed from three sets of surveys of two locations between May 2010 and February 2011.These results have been compared to routine local Environment Agency monitoring.

7.17.8 In addition there has been preparatory work to support the radiological impact assessment from discharges on humans and non-human populations which will support both the environmental permitting and DCO process. This work included the following:

- Stack height sensitivity study, using the Atmospheric Dispersion Modelling System (ADMS), was performed to model the atmospheric dispersion of aerial discharges from Sizewell C UK EPR reactors.
- Evaluation of methodology and parameters for determining the effect of permitted radioactive discharges on the surrounding human population, including calculating realistic Candidates for the representative person doses to adult, child (10-year-old) and infant (one-year-old).
- Evaluation of methodology and parameters for determining the effect of permitted radioactive discharges from the proposed Sizewell C development, including assessment of impacts on habitats that are representative of the range of habitats in the locality of Sizewell (i.e. marine, freshwater, terrestrial, coastal and marshland).

c) Approach and methodology

i. Study area

7.17.9 The radiological assessment is limited to the construction and operation of the Sizewell C Main Development Site. This assessment does not address radiological impacts during decommissioning of Sizewell C. These impacts will be addressed under a separate EIA carried out under the specific legislative framework of the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999.

7.17.10 The study area includes the area around the Sizewell C Main Development Site where the impacts from the radiological discharges will be greatest. The internationally recognised basis for radiological assessment is built around the identification of “representative persons” who, by virtue of their location and habits

(such as dietary intake, occupation and activities), through environmental modelling are subject to the highest impacts. Therefore, by ensuring the protection of these "representative persons", protection of the public can be demonstrated. In addition, relevant sensitive habitats close to the Sizewell C Main Development Site are considered for the assessment of non-human biota to demonstrate the protection of the environment.

7.17.11 The assessment will include the calculation of radiological impacts associated with the transport of radioactive waste from the nuclear power station during the operational period.

ii. Baseline information

7.17.12 The historical and current permitted discharges from the Sizewell A and Sizewell B power stations as well as the historic impacts of atmospheric weapons testing, the Chernobyl accident and naturally occurring radioactivity all contribute to the background radioactivity levels around the Sizewell C Main Development Site.

7.17.13 EDF Energy has undertaken surveys and monitoring programmes in order to obtain a more detailed understanding of the background radioactivity levels around the Sizewell C Main Development Site and of the potential implications of any planned radiological discharges.

7.17.14 Baseline information is available from the Radioactivity in Food and the Environment (RIFE) reports which gather data across all nuclear sites and is administered by the relevant regulatory bodies including the Environment Agency and Foods Standards Agency.

Land quality results

7.17.15 The levels of radionuclides present in samples, collected by walkover surveys were generally consistent with background levels.

7.17.16 During 2010, soil samples were taken for radiochemical analysis. The comparison of radiochemical analysis results with adopted background activity and screening values indicated that the soil collected from the study area is consistent with background activity levels and that there is no evidence to indicate the presence of elevated levels of either anthropogenic or naturally occurring radionuclides.

Water quality results

7.17.17 The groundwater has been screened against drinking water standards. The radiochemical analysis results from the groundwater monitoring programme indicate that the groundwater is not contaminated with anthropogenic radionuclides and that the groundwater does not present a hazard to human health.

7.17.18 The radiochemical analysis results indicate that surface waters do not present a hazard to human health. The only anthropogenic radionuclide detected in any of the samples was caesium-137. This radionuclide was detected in a single sample at a level close to the limit of detection and significantly below its associated WHO guideline value.

7.17.19 The radionuclide results from analysis of marine waters indicate that radionuclide concentrations are very low, often below the limit of detection, and consistent with routine local Environment Agency radionuclide monitoring and considered to be at background levels.

7.17.20 The potential impact of mobilisation of any contaminated material into the water and air will be considered during the assessment. The potential impact of re-use, remediation or disposal of the material will also be examined.

iii. Planned further survey/studies

7.17.21 Further environmental monitoring surveys, including geotechnical surveys, are planned which will include reporting on relevant radiological parameters where appropriate. These are summarised below.

Land quality

7.17.22 A further site investigation on land quality and contamination is proposed to provide more data on targeted areas of interest (based on the 2010 – 2012 investigations), including parts of the Main Development Site that were not previously surveyed.

Marine water and sediment quality

7.17.23 Additional monitoring data for water quality will also be acquired in 2014 to supplement the existing water quality data for the site. Sediment core samples will be obtained at the proposed locations of the jetty, beach landing facility, the cooling water intake and outfall headworks and in likely navigation channels. These samples will be analysed for a comprehensive range of determinands including radionuclides.

Impact assessment studies

7.17.24 Studies confirming the stack height are expected to be completed in late 2014 to inform the radiological impact assessment.

7.17.25 The potential impact of mobilisation of the contaminated material into the water and air environments will be considered, therefore an assessment of the potential radiological impact on members of the public, including construction workers, will be undertaken based on site survey data as a result of activities during construction.

7.17.26 A radiological impact on the local population from the operation of Sizewell C will be evaluated by assessing the dose to a number of indicative representative persons. These representative persons comprise groups exposed to:

- atmospheric discharges and the impact on terrestrial pathways;
- aqueous discharges and the impact on marine pathways; and
- in-combination effects atmospheric and aqueous discharges.

7.17.27 In addition, radiological impact assessments using site-specific data will be undertaken to determine the following radiological impacts:

- annual doses to the most exposed members of the public from direct radiation exposure to the proposed radioactive waste stores;

- collective doses to the UK, European and world populations from routine releases of liquid and atmospheric discharges and representative 'per caput' doses (the latter refers essentially to the average dose to individuals within each of these large populations);
- potential doses to the representative person as a result of short-term operational atmospheric discharges; and
- doses due to potential build-up of radionuclides in the environment as a result of discharges during the whole of the proposed period of operation of Sizewell C.

7.17.28 An assessment of the radiological impact of gaseous and liquid effluent discharges on the environment and non-human biota will be undertaken.

iv. Assessment methodology

7.17.29 There is currently no statutory defined method for carrying out an assessment of radiological impacts for EIA. General guidelines are available in, for example, the Department of the Communities and Local Government, IEMA (2006) and from the Environment Agency. Using these guidelines, the approach adopted in the relevant chapter of the ES will be based on the following steps:

- Definition of the current baseline within and around the site.
- Undertake the radiological impact assessment – this covers the radiological impacts from the proposed development and assessment of these against recognised radiological protection standards for a specified range of human and non-human receptors. This process follows the regulatory guidance on the assessment of prospective public doses arising from authorised discharges of radioactive waste to the environment (Environment Agency, 2012) and includes the following steps:
  - identify/quantify source term;
  - model radionuclide transfer in the environment;
  - determine exposure pathways;
  - identify habits and data for exposure pathways;
  - determine candidates for the representative person from realistic combinations of habits;
  - estimate doses to the candidates for the representative person; and
  - determine the representative person.
  - Undertake Non-human species assessment covering a range of generic species plus some site-specific species selected on the basis of ecological surveys of the site for site specific representative habitats.
- Identify mitigation measures - this includes design and management controls which reduce the potential impact, and are consistent with the legal requirement to use Best Available Techniques (BAT) to ensure the radiological impact of radioactive effluent discharges and waste disposals are minimised and to reduce radiation doses to members of the public and workers to As Low As Reasonably Achievable (ALARA).

- Assess any residual impacts - undertaken following the implementation of any proposed mitigation measures.

7.17.30 The assessment of the representative person will be based on site specific factors and local habits data (where available) to determine representative persons on which the assessment will be completed. The assessment will use the maximum estimated discharges from two UK EPR reactors and associated facilities on the Sizewell C site informed by operating feedback from existing pressurised water reactors (PWR) of similar design and information provided in the Radioactive Substances Regulations (RSR) environmental permit application for Hinkley Point C and the Generic Design Assessment (GDA) for the UK EPR. The assessment of gaseous and liquid discharges includes the specific range of radionuclides, the subsequent movement of which through the environment (air, water, soil) and into the food chain is predicted using a range of industry-standard computer models.

7.17.31 The assessment of radiological impacts from construction activities will follow the methodology described in Methodology for Estimating the Doses to Members of the Public from the Future Use of Land Previously Contaminated with Radioactivity (Oatway and Mobbs, 2003), developed by the National Radiological Protection Board (now known as Public Health England).

7.17.32 The assessment of the radiological impact from discharge of gaseous and liquid effluents from operational activities will follow the guidance prepared by the UK environmental regulatory bodies (Environment Agency, 2012). The European Commission's PC-CREAM model will be used in the assessment of routine discharges to the environment and to calculate the impacts to members of the public using the methodology described in Methodology for Assessing the Radiological Consequences of Routine Releases of Radionuclides to the Environment (European Commission, 1995) and HPA-RPD-058 (Smith and Simmonds, 2009). Local site-specific parameters will be used where available. In the absence of site-specific data, data from nationally and internationally recognised sources will be applied.

7.17.33 EDF Energy proposes to use risk factors published by the International Commission of Radiological Protection (ICRP), which are the basis of those used by the UN International Atomic Energy Agency, the European Commission and regulatory bodies across the world, including those in the UK.

7.17.34 The habits of the representative persons that affect the radiological impact will be identified from published surveys of the local population and potential transport routes. In keeping with regulatory guidance (Environment Agency, 2012), three age groups will also be considered for each representative person. They are:

- infant;
- 10-year-old child; and
- adult.

7.17.35 If determined to be appropriate, an assessment of dose to the embryo and foetus will be undertaken.

7.17.36 The proposed criteria against which individual dose will be compared are presented in **Table 7.17.1.**

Table 7.17.1: Proposed dose assessment criteria

Dose	Source of the Dose Criterion used in the Assessment
1.0 mSv y^{-1}	1.0 mSv y^{-1} is the UK public dose limit as defined in the Ionising Radiations Regulations 1999. It includes all contributions from man-made sources but excludes medical or occupational exposure.
0.5 mSv y^{-1}	0.5 mSv y^{-1} is the site dose constraint to a member of the public from discharges from Sizewell A, Sizewell B and the proposed impacts from Sizewell C. The site constraint is defined in the Environmental Permitting Regulations (England and Wales) 2010 (as amended).
0.3 mSv y^{-1}	0.3 mSv y^{-1} is the source dose constraint for members of the public for a single power station and includes the contribution from discharges and direct radiation. The site constraint is defined in the Environmental Permitting Regulations (England and Wales) 2010 (as amended).
0.02 mSv y^{-1}	0.02 mSv y^{-1} is the screening value defined by the Environment Agency used in radiological assessments below which further detailed studies are not considered to be warranted.
0.01 mSv y^{-1}	0.01 mSv y^{-1} follows statutory guidance issued to the Environment Agency for England & Wales, below which regulators should not seek further reductions in public dose, provided the operator is using best available techniques to limit discharges.

7.17.37 There is no legal dose limit on collective doses. However, the International Atomic Energy Agency (IAEA) has presented a dose criterion of less than 1 man Sievert (mSv) per year of operation, below which doses are considered sufficiently low that doses arising from sources or practices may be exempted from regulatory control. This criterion is included in UK regulatory guidance.

7.17.38 Radiological impacts on non-human species, unlike those on humans, have no absolute regulatory or universal 'value'. This is because different non-human species or their habitats have different perceived values depending on, for example, their rarity, sensitivity or location. After estimating the level of significance from the doses there is therefore a need to consider these aspects of the species or habitat affected and draw a final conclusion on the magnitude of the radiological impact and its significance.

7.17.39 The International Commission for Radiological Protection (ICRP) Publication 91 describes a framework for assessing the impact of ionising radiation on non-human species. It sets out a systematic, risk-based approach, reiterated in the ICRP Publication 103 recommendations.

7.17.40 There are no specific UK regulations for the protection of non-human species from radiation sources. However, UK regulations are in place to enforce relevant European Directives in the UK, the principal UK regulations being The Conservation of Habitats and Species Regulations 2010. These implement the European Union (EU) Habitats Directive (1992) in the UK and require steps to maintain and restore to favourable conservation status the habitats and species of EU Community level interest.

7.17.41 Site-specific data from the ecological surveys carried out will be used as the basis for selecting the habitats and species of interest with respect to radiological impacts on

non-human species. This is to determine whether any adverse effects on radio-sensitive species are present.

7.17.42 The Environment Agency has concluded that it is unlikely there will be any significant effects in populations from ionising radiation at the chronic dose rates listed below:

- 40 µGray h^{-1} for terrestrial animal populations;
- 400 µGray h^{-1} for terrestrial plant populations;
- 400 µGray h^{-1} for populations of freshwater and coastal organisms; and
- 1,000 µGray h^{-1} for populations of organisms in the deep ocean.

7.17.43 EDF Energy recognises the regulatory screening level of 40 µGray h^{-1} for all non-human species as specified by the Environment Agency in its related guidance. The computer modelling code ERICA and associated radiological effects database FREDERICA are assessment tools for predicting the dose and effects on non-human species from radioactivity in the environment. Therefore, assessments falling below this screening level are assumed to cause no measurable harm to non-human species.

v. Assumptions and limitations

7.17.44 The UK has a strict regulatory framework to control routine discharges from nuclear power stations and direct radiation exposures to workers and the general public (radioactive waste is addressed in **Section 3.8**). The aim is to minimise potential health impacts and to ensure that radiation doses are well within internationally agreed limits, following the principles of ALARP through the application BAT.

7.17.45 Any new nuclear power station needs permission, under Schedule 23 of the Environmental Permitting (England and Wales) Regulations, 2010 (as amended), from the Environment Agency before making any discharges of radioactivity into the environment or disposals of radioactive waste. The site-specific radiological impact assessment is a key element underpinning the Radioactive Substances Regulation (RSR) permit.

7.17.46 The Environment Agency may only grant an RSR environmental permit for the disposal of radioactive wastes (including discharge of gaseous and liquid effluents) once an opinion has been provided by the European Commission under Article 37 of the EURATOM treaty.

7.17.47 It is expected that the radioactive discharges from commissioning of Sizewell C will be no greater than those during operation, therefore, for the purposes of this assessment it is assumed that the impacts from commissioning will be bounded by those for the operation of Sizewell C.

7.17.48 Furthermore, there are also supplementary provisions regulated by the Office for Nuclear Regulation, in particular the Nuclear Installations Act, 1965 (as amended), and the associated Nuclear Site Licence to control the accumulation of radioactive waste on a licensed site.

7.17.49 The Government and nuclear industry have an emergency preparedness framework in place to mitigate health effects in the unlikely event of major accidental releases of

radiation into the environment. This framework includes detailed site-specific emergency response and crisis management plans for each nuclear facility. The plans are tested regularly through site based emergency response exercises, some of which involve the Government and simulated media involvement, where the scope also extends to crisis management. The impacts associated with accidents are assessed as part of the site safety case and regulated by ONR under the Nuclear Site Licence.

d) Potential impacts and effects

i. Construction

7.17.50 While there will be no new radioactive materials generated during the construction phase for Sizewell C, there is the potential for contaminated soil to be discovered during ground preparation works. The results of the assessment are expected to indicate that any exposure would be very low. It is not expected that any specific measure would be needed during construction.

ii. Operation

7.17.51 The Environment Agency concluded its Generic Design Assessment (GDA) of the UK EPR in December 2012 and issued a Statement of Design Acceptability (SoDA) for the reactor design. This included an assessment of the radiological discharges and associated impacts for a generic site. This assessment confirmed that the impacts were well within the relevant regulatory limits and constraints.

7.17.52 Any site specific assessment, such as that required for Sizewell C is expected to be within the envelope established in the GDA. Site-specific assessments will be carried out for the Sizewell C Main Development Site, as it was during the planning and permitting process at Hinkley Point C, and this showed the site-specific assessment was well within the GDA envelope.

e) Potential mitigation

7.17.53 The Environment Agency is responsible for ensuring that new nuclear power station designs can meet high environmental standards and use the BAT to achieve this, as required by the OSPAR Convention. Through the GDA process, the Environment Agency ensured that designers consider this requirement at an early stage. This ensures that the most modern techniques to minimise radioactive waste discharges can be incorporated into the designs proposed. The application of BAT also ensures that discharges from new nuclear power stations constructed in the UK will not exceed the discharge levels from comparable nuclear power stations across the world.

7.17.54 The operations of the nuclear power station and associated facilities at Sizewell C will be regulated by the Environment Agency. The operator will need to be able to demonstrate the application of BAT to minimise the radioactive waste generated and the gaseous and liquid effluents discharged are kept As Low As Reasonably Achievable (ALARA). The impacts arising from the radioactive discharges must also be kept ALARA.

7.17.55 The environmental permit granted by the Environment Agency under Schedule 23 of the Environmental Permitting (England and Wales) Regulations 2010 (as amended),

will specify a number of conditions, as well as numerical discharge limits, with which the operator must comply. This includes requirements to ensure the monitoring of discharges applies BAT as well as the need to undertake monitoring of the environment. The results of the monitoring will be recorded and reported to the regulator in compliance with the conditions of the RSR environmental permit.

7.17.56 The radiological impacts from the construction and operation of Sizewell C are expected to be very low and well within the regulatory constraints and limits enforced by the Environment Agency. This is supported by the GDA assessment for a generic site which demonstrated that the radiological impacts were low. This is reinforced by the Hinkley Point C radiological impact assessment, which showed that the impacts were less than that presented in the GDA.

f) Approach to cumulative assessment

i. Inter-relationships

7.17.57 Potential effects from inter-relationships, as considered at this stage, include:

- effects on visual impact of stack height and dispersion of gaseous effluents; and
- results from additional environmental monitoring and surveillance programmes that could update the baseline information and inform the assessment of radiological impacts during construction.

ii. Cumulative effects

7.17.58 The assessment of impacts from radiological discharges to the atmosphere and the marine environment will be considered in-combination with operations at Sizewell A and Sizewell B and the cumulative effects presented. The assessment:

- is based on discharges at current permitted limits for Sizewell A and Sizewell B and will use the limits that will be proposed by EDF Energy for Sizewell C;
- assumes that discharges from Sizewell A and Sizewell B continue throughout the operation of Sizewell C and in parallel with the limits that will be proposed for the Sizewell C site. This is a conservative assumption, as Sizewell A is planned to be decommissioned over this time period. Sizewell A will be decommissioned into a quiescent state known as ‘care and maintenance’ and Sizewell B is planned to be shut down, defuelled and decommissioned; and
- assumes that the discharges from Sizewell B during decommissioning will not increase above their current permitted limits. Any increases that could arise are likely to be limited in time to address specific activities during the decommissioning programme to reduce the hazard on site to assist in achieving the site’s restoration. Any changes to the proposed limits at Sizewell B would be subject to regulatory review and approval.

7.17.59 The Environmental Permitting (England and Wales) Regulations 2010 (as amended), include dose constraints to ensure the impacts of neighbouring sites are considered in the radiological assessment. Therefore, the Sizewell A and B power stations will also be taken into account for site dose calculations and to inform an assessment of in-combination effects.

8. EIA – OFF-SITE ASSOCIATED DEVELOPMENT

8.1 Introduction

8.1.1 To support the construction and/or operation of Sizewell C, EDF Energy would also need to use additional land for associated development. Since Stage 1 consultation EDF Energy has progressed in its consideration of the potential off-site associated development sites and, where a lead option has been identified, these are considered in this section. The lead sites are the likely, but not definite, associated development sites that EDF Energy has identified for further consultation and which are being taken forward for further assessment. For off-site associated development where a lead site has not been identified, all options have been considered in this section and will be taken forward for further assessment.

8.1.2 The EIA for the off-site associated development will consider:

- future baseline in the absence of development;
- construction of the off-site associated development;
- operation of the off-site associated development; and
- post-operation of the off-site associated development.

8.1.3 This section sets out the proposed scope and methodology for the assessment of the off-site associated development sites. This has been informed by an outline description of the environmental baseline conditions, along with a preliminary view of the key issues likely to be associated with each development.

8.1.4 The following environmental topics have not been discussed within this section for the following reasons:

- socio-economics and transport – have been dealt with as project-wide topics for the purposes of EIA Scoping;
- marine historic environment, coastal geomorphology and hydrodynamics, marine water quality and sediments, marine ecology and navigation – as these are marine-based topics it is unlikely that there will be any impact from the terrestrial based developments. For this reason they have been scoped out of the off-site associated development section. Flooding has been addressed within the surface water sections; and
- radiological – any potential impacts relate to the proposed Sizewell C nuclear power station and are therefore centralised around the Main Development Site. Given that radiological impacts will not be associated with off-site associated development sites, this topic has been scoped out of the off-site associated development section.

8.2 Northern park and ride

a) Description of the off-site associated development site

8.2.1 The park and ride site located at Darsham (see **Figure 8.2.1**) is approximately 28ha in area and is a triangular-shaped site located to the north of Darsham Station, with the A12 to the east and the railway line to the west. The site entrance is located approximately 1.3km north of the A12/B1122 junction and is well positioned for the A144 further to the north. As detailed within the Stage 1 consultation, land requirements for park and ride facilities have been estimated based on the following:

- car parking areas with up to approximately 1,000 spaces per site;
- bus terminus and parking, including shelters;
- perimeter security fencing and lighting;
- welfare building including toilets, drivers rest room, and security and administration offices;
- on-site soil storage pending site restoration once Sizewell C is built; and
- external areas including roadways, footways, landscaping and drainage.

8.2.2 Additionally, the possibility of co-locating an induction centre for construction workers and a postal consolidation facility, either within the northern or southern park and ride, is being considered.

b) Site and surrounding environmental conditions

8.2.3 The site is located to the west of the village of Darsham. Its western boundary is defined by the main line railway between Saxmundham and Halesworth (Darsham Station is located immediately to the south of the site). The eastern boundary is defined in part by the A12 and the boundary vegetation/fencing around properties/farm buildings along the A12. The northern boundary is defined by Willow Marsh Lane.

8.2.4 Ordnance Survey maps indicate that there may be up to 15 ponds present within 500m of the site. Nine statutory designated sites are located within 5km of the proposed location of the northern park and ride, these are: Minsmere-Walberswick (SPA and Ramsar, 3.4km east); Minsmere to Walberswick Heaths and Marshes (SAC and SSSI, 3.4km east), and Dew's Pond (SAC and SSSI, 1.7km north-west). A third SSSI, Potton Hall Fields is located 4.2km to the east and two NNR are located 4.8km (Westleton Heath) and 4.5km (Suffolk Coast) north-east. Darsham Marshes, a Suffolk Wildlife Trust reserve, is also located approximately 1km south.

8.2.5 The site is located outside the area designated as the Suffolk Coast and Heaths AONB, which is approximately 3.5km to the east. The site is also outside the designated SLA, which is a retained SCDC policy. The SLA occupies the valley of the Minsmere River approximately 1km to the south of the site.

8.2.6 The site is located in the Ancient estate claylands landscape character type which is described in the Suffolk County Landscape Character Assessment. The Ancient estate claylands landscape is characterised by arable land use, with fields interspersed with deciduous copses. A more organic pattern of hedged pastoral

fields and tree belts is generally associated with the Rolling estate claylands landscape character type which occupies the rolling valley sides of the Minsmere river to the south of the site. Settlement across the claylands consists of occasional villages and dispersed hamlets and farmsteads. Larger settlements, such as Yoxford and Darsham occupy valley locations within the Rolling estate claylands landscape.

8.2.7 An initial desk-based study has identified that there are a number of PRoW, including a north-south aligned footpath to the west linking Willow Marsh Lane to Yoxford; to the south of the site linking Darsham Station with Westleton Road; to the east a number of footpaths around Priory Farm and around the village of Darsham; and to the north a number of footpaths between Willow Marsh Lane and the A144. There are no PRoW within the proposed site boundary. Located on the southern edge of the south-western edge of the study area is the A1120, which is designated as a tourist route.

8.2.8 There are no Scheduled Monuments or Listed Buildings within the red line boundary. There are a number of Grade II Listed Buildings within the Darsham Conservation Area, as well as the Grade I Listed Darsham Church and Grade II* Listed Darsham House.

8.2.9 There is currently no baseline noise data available for this site although it is apparent that noise levels within the study area are generally high along the road corridor due to existing road traffic on the A12. Monitoring data for NO_2 has been collected in background locations and along key nearby transport routes (e.g. A12) to support the proposed development and data has also been collected by SCDC.

8.2.10 The soils are slowly permeable, seasonally waterlogged fine loams and clays over clayey sub-soil (ALC grade 3 undifferentiated and 4). There are no statutory or non-statutory geological sites within 500m of the site. There is no known on-site contamination risk, although a nearby petrol filling station is a potential source of off-site contamination. The area is underlain by the Lowerstoft Diamicton (boulder clay) which overlies the Lowestoft sand and gravels (Secondary Superficial aquifer) and the Crag (Principal Aquifer). The park and ride site does not lie within a Source Protection Zone. A licensed groundwater abstraction is located on the southern edge of the site.

8.2.11 There are no statutory designations within the site but there is a small watercourse located approximately 250m to the south-west, which flows into the Minsmere Old River, 1,250m downstream. The Minsmere Old River forms part of the WFD water body 'Leiston Beck and Minsmere Old River', which is heavily modified. The River Yox is also located 160m to the south-east of the site.

8.2.12 **Figure 8.2.1** illustrates the key environmental constraints for the northern park and ride.

c) Planned further studies/surveys

8.2.13 **Table 8.1** summarises the potential studies/surveys that are proposed for the northern park and ride site.

Table 8.1: Northern park and ride – planned further studies/surveys

Environmental topic	Planned further studies/surveys
Terrestrial ecology and ornithology	• An extended Phase 1 habitat and protected species survey. • Surveys to determine presence or absence of great crested newts. • Survey to assess the potential for bats to roost in the adjacent woodland.
Landscape and visual	• Views and visibility: ZTV modelling for northern park and ride. • Carry out assessment based on agreed methodology, study area and viewpoints. • Baseline landscape/character: review and update landscape baseline for the park and ride site for agreed study area. • Develop design principles for the northern park and ride site and develop masterplan and mitigation strategy to assist in the integration of the development and reduction of significant adverse effects.
Amenity and recreation	• Baseline recreation and amenity research will be undertaken including field survey and desk top analysis including the identification of: o cycle routes and their use; o the extent and use of PRoW and Permissive paths; and o preparation of principles for construction phase based on those developed for the northern park and ride.
Terrestrial historic environment	• Following completion of the desk study it is anticipated that staged archaeological investigation will be carried out across the site. This would comprise geophysical survey followed by a programme of trial trenching to confirm the presence/absence of archaeological remains, establish the nature, date and extent of any archaeological remains within the site boundary and inform proposals for mitigation to be agreed with SCCAS and English Heritage for inclusion in the ES. • Site visits to identify offsite heritage assets where settings assessment will be required will be carried out in conjunction with English Heritage and local authority Conservation Officers, if required.
Noise and vibration	• A baseline survey is planned for this site to be carried out in Q2 of 2014. Monitoring locations are as identified in **Figure 8.2.2**. Below shows a list of planned monitoring locations in the vicinity of this site: o PRN1 – Close to Willow Marsh Cottage (north of the site). To assess local noise impact from northern park and ride; o PRN2 – A location to the east of the site. To assess local noise impact from northern park and ride on dwellings on the A12; and o PRN3 – Darsham (south of the site). To assess local noise impact from northern park and ride on dwelling to the south of the site on east of the A12.
Air quality	• No further surveys (as part of either the construction or operation phase assessment) are planned for the northern park and ride, due to the availability of existing data.
Soils and agriculture	• Soil survey in accordance with standard ALC methodology.
Geology and land quality	• Phase 1 ground contamination desk study and potential intrusive investigation subject to the findings of the desk study.
Groundwater	• No further specific groundwater work is planned, however the geological and hydrogeological understanding will be updated based on any geotechnical investigations for the site including information on depth to

Environmental topic	Planned further studies/surveys
	groundwater.
Surface water	• No further surface water survey is proposed.

d) Assessment methodology

8.2.14 The approach to assessment and methodology to be undertaken in relation to the northern park and ride site is the same as that for the Main Development Site. See **Section 7** for details.

e) Potential impacts and effects

8.2.15 **Table 8.2** details the potential impacts that may give rise to environmental effects. These are based on the current known baseline conditions, which are subject to further studies/surveys outlined in **Table 8.1**. Where it is considered that effects are unlikely, prior to applying mitigation, these have been identified and scoped out, where applicable.

8.2.16 An assessment of the potential impacts and effects during the post-operational phase of the park and ride facility will be assessed within the ES.

Table 8.2: Northern park and ride – potential impacts and effects

Environmental topic	Potential impacts and effects
Terrestrial ecology and ornithology	**Construction of the off-site associated development** • Potential loss of habitat features suitable for use by great crested newts, such as hedgerows and other field boundaries. • Potential disturbance from noise and lighting to birds, bats roosts in trees and woodland area; and potential minor loss of foraging habitat. • Potential diffuse pollution from surface water runoff affecting the Minsmere River and Darsham Marshes. **Operation of the off-site associated development** • Noise and lighting disturbance to roosting and foraging bat species. • Water quantity and quality issues from the site affecting Minsmere River and Darsham Marshes.
Landscape and visual	**Construction of the off-site associated development** • Disturbance from construction activities and the movement of vehicles and plant. • Changes to the existing environment due to removal of vegetation and introduction of new features including soil storage areas, vegetation, infrastructure and buildings. • Visual impact arising from construction lighting at night, causing potential disturbance. **Operation of the off-site associated development** • Changes to the landscape and views due to transport infrastructure and introduction of new landscape features, structures and ancillary features. • Change in traffic movement along the road network during operation. • Visual impact arising from operational lighting at night, causing potential disturbance.

Environmental topic	Potential impacts and effects
Amenity and recreation	**Construction of the off-site associated development** • Changes to baseline views and disturbance of nearby PRoW resulting from construction activities, increased traffic movement, construction noise, dust and other emissions. • Disturbance to amenity and recreation assets and public open space within the study area from a range of activities, including construction noise, traffic noise, dust and other emissions and visual disturbance. **Operation of the off-site associated development** • Diminished enjoyment of PRoW in the vicinity of the development resulting from general site activity, traffic, noise, dust and other emissions and views to the development.
Terrestrial historic environment	**Construction of the off-site associated development** • The nature and extent of buried archaeological remains across the construction site has not yet been determined, although there is the potential for the permanent loss of buried archaeological remains during construction. • There is the potential for temporary impacts to the settings of designated heritage assets in the vicinity of the construction site. **Operation of the off-site associated development** • There is the potential for impacts to the settings of designated heritage assets in the vicinity of the site during operation.
Noise and vibration	**Construction of the off-site associated development** • Occupiers of nearby dwellings and other sensitive receptors may experience noise impacts during construction of the park and ride sites. **Operation of the off-site associated development** • There is generally likely to be minimal noise and vibration impact at this site during the operational phase due to the anticipated relatively high noise levels from the existing A12 and the propagation distances between noise sources and most receptors. However, some impacts are possible at the closest receptors (i.e. nearby residential receptors) and these may need some mitigation, such as screening.
Air quality	**Construction of the off-site associated development** • Dust impacts during the construction phase will be assessed by providing a qualitative assessment of the potential sources and effects, together with a risk assessment to identify those receptors most at risk. **Operation of the off-site associated development** • There may be adverse effects for transport routes to and from the northern park and ride site. These effects will be considered further as part of the assessment.
Soils and agriculture	• Development of this site may result in soil damage/loss of fertility but with appropriate soil handling procedures significant impacts are unlikely.
Geology and land quality	• Potential contamination from the nearby petrol filling station, and any other potential sources of contamination, will be identified in the risk assessment
Groundwater	• Development of this site may result in some disturbance of soils, but as this is a greenfield site the risk of any impacts to groundwater quality are low. Construction of areas of hardstanding (car parking) have the potential to reduce infiltration to groundwater, but as the area is underlain by boulder clay, the magnitude of any change in infiltration is likely to be very low. Therefore it is proposed that a detailed assessment is not necessary.

Environmental topic	Potential impacts and effects
Surface water	• Given the control measures that will be in place and that watercourses are not located in close proximity the site, it is proposed that the northern park and ride site is scoped out of requiring any further assessment in relation to surface water impacts.

f) Potential mitigation measures

8.2.17 The majority of the potential mitigation measures, detailed in **Table 8.3**, comprise embedded mitigation, which could be incorporated into the design of the northern park and ride site to reduce likely impacts and effects. These mitigation measures will be further developed and will be subject to consultation. Additional mitigation measures will also form part of the ongoing assessment and will be described within the ES.

Table 8.3: Northern park and ride – potential mitigation measures

Environmental topic	Potential mitigation measures
Terrestrial ecology and ornithology	• Retain existing woodland and protection of any bat roost trees. • Minimise light spill into woodland. • Landscape Strategy to consider incorporating suitable habitats for any impacted species, as appropriate.
Landscape and visual	• Optimise land use to reduce/mitigate significant adverse landscape and visual effects where reasonably practicable. • Design and treatment of structures and associated infrastructure, including lighting, access and fencing, to minimise significant adverse landscape and visual effects including at night. • Retain existing screening landscape features where reasonably practicable and promote appropriate new landscape design (planting and landform) to mitigate significant adverse landscape and visual effects of the proposed development.
Amenity and recreation	• Orchestration of Rights of Way closures and diversions, where practicable, and provision of a comprehensive construction phase masterplan. • Re-establishment of former PRoW and realignment of Permissive paths where practicable and establish recreation areas as part of the EDF Energy Estate Landscape Strategy. • Plan the construction and operational phases of the development to optimise land use to reduce/mitigate recreation and amenity effects where reasonably practicable.
Terrestrial historic environment	• For buried archaeological remains and palaeoenvironmental deposits mitigation would usually entail preservation in-situ or, where this would not be feasible, preservation by record to mitigate any significant adverse effects from construction. • Any significant effects on the settings of heritage assets would usually be mitigated through sensitive design, landscape planting or screening. Where this would not be feasible, enhancements to the asset or its immediate setting may be considered.
Noise and vibration	• Some local acoustic screening or planting could be introduced where necessary in line with the Landscape Strategy.

Environmental topic	Potential mitigation measures
Air quality	• Construction dust would be controlled through the implementation of standard dust management techniques. • The need for road traffic air quality mitigation would be considered for the Main Development Site and off-site associated development as a whole.
Soils and agriculture	• Use of appropriate soil handling procedures.
Geology and land quality	• To be considered subject to the proposed risk assessment.
Groundwater	• Mitigation of any spills or leaks will be in accordance with the Environment Agency Pollution Prevention Guidelines.
Surface water	• Since the site has been scoped out from requiring further assessment, mitigation is not required.

g) Approach to inter-relationships and cumulative assessment

8.2.18 Each environmental topic has outlined the approach to inter-relationships and cumulative assessment within the Main Development Site in respect of the relevant topic (see **Section 7**). The same process will apply to the northern park and ride site.

8.3 Southern park and ride

a) Description of the off-site associated development site

8.3.1 The park and ride site at Wickham Market (see **Figure 8.3.1**) is located north-east of Wickham Market between the A12 and B1078/B1116. The site comprises three areas: an indicative Wickham Market site (approximately 20.47ha) and additional land identified for potential development (approximately 22.84ha). The indicative Wickham Market site has the B1078/B1116 to the west and the A12 carriageway to the south. The site also includes the land between the A12 slip road and the A12 dual carriageway. The additional land for potential development is located immediately adjacent and to the east of the Wickham Market site. This site would occupy a smaller area then is currently identified. Both distinct areas are defined by field boundaries and two wooded copses to their eastern and northern boundaries.

8.3.2 Similar to the northern park and ride site, land requirements for facilities have been estimated based on the following:

- car parking areas with up to approximately 1,000 spaces per site;
- bus terminus and parking, including shelters;
- perimeter security fencing and lighting;
- welfare building including toilets, drivers rest room, and security and administration offices;
- on-site soil storage pending site restoration once Sizewell C is built; and
- external areas including roadways, footways, landscaping and drainage.

8.3.3 Additionally, the possibility of co-locating an induction centre for construction workers and a postal consolidation facility – either within the northern or southern park and ride - is being considered.

b) Site and surrounding environmental conditions

8.3.4 The closest private residential properties are located to the west of the site at Ash View, some 100m away on the main road and Glevering Lodge, approximately 180m to the west. These dwellings benefit from existing tree screening.

8.3.5 The River Deben is located approximately 400m to the west. No statutory designated sites were found to be located within 5km of the proposed location. The site is located outside the area designated as the Suffolk Coast and Heaths AONB which is approximately 5km to the south-east. The site is also outside the designated SLA. The SLA occupies land immediately to the south and west of the site and to the north and east, at a distance of approximately 1.5km. There is a pond within the site boundary which could support ecologically sensitive species.

8.3.6 The site is located in the Plateau estate farmlands landscape character type which is described in the Suffolk County Landscape Character Assessment. The westernmost portion of the site lies partially within the adjacent Rolling estate claylands landscape character type. The Plateau estate farmlands landscape character type is described as gently rolling or flat plateau formed from a mixture of glacial deposits. Arable farmland predominates with grassland confined to parklands

and occasional paddocks. Woodland cover is scattered, mostly in the form of rectangular plantations and coverts. Settlement across the Plateau estate farmland consists of dispersed hamlets and farmsteads and the town of Wickham Market.

8.3.7 An initial desk based study has identified there are a number of PRoW, including footpaths and bridleways to the north, south, east and west of the site, with a number in close proximity to the southern site boundary and within the River Deben floodplain, and between the indicative Wickham Market site and additional land identified for potential development. There is a bridleway crossing the northern fields which passes a disused pit before heading north-west towards the B1116. There are no areas of Open Access Land within the study area.

8.3.8 The Roman settlement of Hacheston was the subject of geophysical survey and large area excavations in 1973-4 prior to construction of the A12 Wickham Market bypass (Blagg et. al, 2004). It appears to consist of a road and circular buildings, enclosed by ditches and a palisade. During the latter first century AD, a gravel road line was laid out and insubstantial rectangular buildings were constructed alongside it. This basic layout continues throughout the Roman period, with a droveway and partial field enclosures recorded to the south. Pottery kilns dating from the latter first and mid-third centuries AD were uncovered on the site in the 1960s and 1970s (Blagg et. al, 2004). The 2013 geophysical survey recorded a series of linear anomalies, presumably representing fields and enclosures, sub-circular anomalies possibly representing structures and two sides of a sub-rectangular enclosure which could be the remains of a Roman marching camp.

8.3.9 There is currently no baseline noise data available for this site but it is evident that noise from the A12 is high in the vicinity of the site. Monitoring data for NO_2 has been collected in background locations and along key nearby transport routes (e.g. A12) and data has also been collected by SCDC.

8.3.10 The soils are deep, well drained loams over slowly permeable sub-soils and are classified as ALC grade 3 (undifferentiated). There are no designated geological sites within 500m of the site or any known sources of ground contamination.

8.3.11 The indicative Wickham Market site is underlain by the Lowestoft sand and gravels (Secondary Superficial aquifer) and the additional land for potential development is underlain by the Lowerstoft Diamicton (boulder clay). These superficial deposits overlie the Crag (Principal Aquifer). The park and ride site lies within an outer Source Protection Zone (SPZ2), although the abstraction is located approximately 2km to the south-south-east. The nearest licensed groundwater abstraction is located on the eastern edge of the park and ride area.

8.3.12 **Figure 8.3.1** illustrates the key environmental constraints for the southern park and ride site.

c) Planned further studies/surveys

8.3.13 **Table 8.4** summarises the potential studies/surveys that are still required for the southern park and ride site.

Table 8.4: Southern park and ride – planned further studies/surveys

Environmental topic	Planned further studies/surveys
Terrestrial ecology and ornithology	• An extended Phase 1 habitat and protected species survey. • Surveys to determine presence or absence of great crested newts. • Survey to assess the potential for bats to roost in the shelterbelt woodland present.
Landscape and visual	• Views and visibility: ZTV modelling for the southern park and ride site development proposals. • Carry out assessment based on agreed methodology, study area and viewpoints. • Baseline landscape/ character: Review and update landscape baseline for the southern park and ride site for agreed study area. • Develop design principles for southern park and ride site and develop masterplan and mitigation strategy to assist in the integration of the development and reduction of significant adverse effects.
Amenity and recreation	• Baseline recreation and amenity research will be undertaken including field survey and desk top analysis including the identification of: o cycle routes and their use; o the extent and use of PRoW and Permissive paths; o preparation of principles for construction phase based on those developed for Main Development Site; and o preparation of initial diversion strategy related to temporary works (construction phase) masterplanning.
Terrestrial historic environment	• Further desk studies and additional geophysical survey to update and expand the existing baseline are currently being undertaken; and • A programme of trial trenching will be agreed with SCCAS to confirm the presence/absence of archaeological remains, establish the nature, date and extent of archaeological remains within the site boundaries and inform proposals for mitigation to be agreed with SCCAS and English Heritage for inclusion in the ES.
Noise and vibration	• A baseline survey is planned for this site to be carried out in Q2 of 2014. Monitoring sites are as identified by **Figure 8.3.2**. Below shows a list of planned monitoring locations: o PRS1 – To assess local noise impact from the southern park and ride at dwellings to the south of Hasketon. o PRS2 – Close to The Lodge. To assess local noise impact from the southern park and ride site. o PRS3 – Close to Ash View. To assess local noise impact from the southern park and ride site.
Air quality	• No further surveys (as part of either the construction or operation phase assessment) are planned for the southern park and ride site, due to the availability of existing data.
Soils and agriculture	• Soil survey in accordance with standard ALC methodology.
Geology and land quality	• Phase 1 ground contamination desk study and potential intrusive investigation subject to the findings of the desk study.
Groundwater	• No further specific groundwater work is planned. However the geological and hydrogeological understanding will be updated based on any

Environmental topic	Planned further studies/surveys
	geotechnical investigations for the site including information on depth to groundwater.
Surface water	• No further surface water survey is proposed.

d) Assessment methodology

8.3.14 The approach to assessment and methodology to be undertaken in relation to the southern park and ride site is the same as that for the Main Development Site. (See **Section 7** for details).

e) Potential impacts and effects

8.3.15 **Table 8.5** details the potential impacts that may give rise to environmental effects. These are based on the current known baseline conditions, which are subject to further studies/surveys outlined in **Table 8.4**. Where it is considered that effects are unlikely, prior to applying mitigation, these have been identified and scoped out, where applicable.

8.3.16 An assessment of the potential impacts and effects during the post-operation phase of the southern park and ride site will be assessed within the ES.

Table 8.5: Southern park and ride – potential impacts and effects

Environmental topic	Potential impacts and effects
Terrestrial ecology and ornithology	**Construction of the off-site associated development** • Potential loss of habitat features (such as hedgerows) suitable for use by great crested newts and habitat features for ground-nesting birds. • Potential disturbance to roosting bats from noise and lighting. • Diffuse pollution from surface water runoff affecting the River Deben. **Operation of the off-site associated development** • Noise and lighting disturbance to roosting and foraging bat species; and • Increased surface water discharge to the River Deben.
Landscape and visual	**Construction of the off-site associated development** • Disturbance from construction activities and the movement of vehicles and plant. • Changes to the existing environment due to removal of vegetation and introduction of new features including soil storage areas, vegetation, infrastructure and buildings. • Visual impact arising from construction lighting at night, causing potential disturbance. **Operation of the off-site associated development** • Changes to the landscape and views due to transport infrastructure and introduction of new landscape features, structures and ancillary features. • Change in traffic movement along the road network during operation. • Visual impact arising from operational lighting at night, causing potential disturbance.
Amenity and	**Construction of the off-site associated development**

Environmental topic	Potential impacts and effects
recreation	• Changes to baseline views and disturbance of nearby PRoW resulting from construction activities, increased traffic movement, construction noise, dust and other emissions. • Disturbance to amenity and recreation assets and public open space within the study area from a range of activities, including construction noise, traffic noise, dust and other emissions and visual disturbance. • Possible closure or diversion of PRoW. **Operation of the off-site associated development** • Diminished enjoyment of PRoW in the vicinity of the development resulting from general site activity, traffic, noise, dust and other emissions and views to the development.
Terrestrial historic environment	**Construction of the off-site associated development** • The nature and extent of buried archaeological remains across the construction site has not yet been determined, although there is the potential for the permanent loss of buried archaeological remains during construction. **Operation of the off-site associated development** • Owing to the site location, topography and proposed layout there are unlikely to be any adverse impacts to the settings of designated heritage assets in the vicinity of the southern park and ride site.
Noise and vibration	**Construction of the off-site associated development** • Occupiers of nearby dwellings and other sensitive receptors may experience noise impacts during construction of the park and rides. **Operation of the off-site associated development** • There is likely to be minimal noise and vibration impact at this site during the operation phase due to the relatively high noise levels from the existing road; the distance of nearby dwellings to the site and local topography which will attenuate noise significantly.
Air quality	**Construction of the off-site associated development** • Dust impacts during the construction phase will be assessed by providing a qualitative assessment of the potential sources and effects, together with a risk assessment to identify those receptors most at risk. **Operation of the off-site associated development** • There may be adverse effects for transport routes to and from the park and ride site. These effects will be considered further as part of the assessment.
Soils and agriculture	• Development of this site may result in soil damage/loss of fertility but with appropriate soil handling procedures significant impacts are unlikely.
Geology and land quality	• There are no known contamination risks, however, any other potential sources of contamination will be identified in the risk assessment.
Groundwater	• Development of the site would result in some disturbance of soils and the construction of areas of hardstanding (car parking) with the potential to reduce infiltration to groundwater. • The assessment will consider whether any changes in infiltration are significant and whether surface water drainage from hardstanding areas could represent a risk to groundwater resources.
Surface water	• Given the controls that will be in place and that, for the southern park and ride site, watercourses are not located in close proximity, it is proposed that this site is scoped out of requiring any further assessment in relation to surface water impacts.

f) Potential mitigation measures

8.3.17 The majority of the potential mitigation measures, detailed in **Table 8.6**, comprise embedded mitigation, which could be incorporated into the design of the southern park and ride site to reduce likely impacts and effects. These mitigation measures will be further developed and will be subject to consultation. Additional mitigation measures will also form part of the ongoing assessment and will be described in the ES.

Table 8.6: Southern park and ride – potential mitigation measures

Environmental topic	Potential mitigation measures
Terrestrial ecology and ornithology	• Minimisation of light spill into shelterbelt woodland. • Pollution prevention and control measures during construction and attenuation of surface water during operation. • Additional landscape planting providing suitable foraging habitat for great crested newts and bats.
Landscape and visual	• Mitigation proposals are likely to include the following measures: o plan the construction and operational phases of the proposed southern park and ride site development to optimise land use to reduce/mitigate significant adverse landscape and visual effects where reasonably practicable; o design and treatment of structures and associated infrastructure, including lighting, access and fencing, to minimise landscape and visual effects including at night; and o retain existing screening landscape features where reasonably practicable and promote appropriate new landscape design (planting and landform) to mitigate significant adverse landscape and visual effects of the proposed development.
Amenity and recreation	• Orchestration of Rights of Way closures and diversions, where practicable, and provision of a comprehensive construction phase masterplan. • Re-establishment of former PRoW and realignment of Permissive paths where practicable and establish recreation areas as part of the EDF Energy Estate Landscape Strategy. • Plan the construction and operational phases of the development to optimise land use to reduce/mitigate recreation and amenity effects where reasonably practicable.
Terrestrial historic environment	• For buried archaeological remains and palaeoenvironmental deposits mitigation would usually entail preservation in-situ or, where this would not be feasible, preservation by record to mitigate any adverse effects from construction. • Any significant effects on the settings of heritage assets would usually be mitigated through sensitive design, landscape planting or screening. Where this would not be feasible, enhancements to the asset or its immediate setting may be considered.
Noise and vibration	• Some local acoustic screening or planting could be introduced where necessary in line with the Landscape Strategy.
Air quality	• Construction dust would be controlled through the implementation of standard dust management techniques; and • The need for road traffic air quality mitigation would be considered as for the

Environmental topic	Potential mitigation measures
	Main Development Site and off-site associated development as a whole.
Soils and agriculture	• Use of appropriate soil handling procedures.
Geology and land quality	• To be considered subject to the proposed risk assessment.
Groundwater	• The assessment will consider the decrease in recharge and mitigation through the management of surface water runoff including the use of sustainable drainage systems. The risk to groundwater quality from any surface water drainage will also be assessed. • Mitigation of any spills or leaks will be in accordance with the Environment Agency Pollution Prevention Guidelines.
Surface water	• Since the site has been scoped out from requiring further assessment, mitigation is not required.

g) Approach to inter-relationships and cumulative assessment

8.3.18 Each environmental topic has outlined the approach to inter-relationships and cumulative assessment within the Main Development Site in respect of the relevant topic (see **Section 7**). This same process will apply to the southern park and ride site.

8.4 Rail line extension

a) Description of the off-site associated development site

i. Blue and green route options

8.4.1 Either the blue or green route options (see **Figure 8.4.1**) would provide a temporary extension of the Saxmundham to Lesiton branch rail line into the construction area.

8.4.2 The blue route spurs off the existing Saxmundham-Leiston branch line shortly after the Westhouse level crossing. Travelling north it crosses Abbey Lane and then Harrow Lane, running along open countryside in the area of the former airfield. The route then turns east running to the north of Hill Farm, the remains of Leiston Abbey and the Pro Corda music school. After crossing the B1122 the route runs to the south of EDF Energy's lead site for the campus accommodation, to the north of Upper Abbey farm buildings and into the proposed construction area.

8.4.3 The green route spurs off the existing Saxmundham-Leiston branch line shortly after the Saxmundham Road level crossing. Travelling north it crosses Buckleswood Road and then traverses open countryside to the north of Leiston and to the south of Abbey Lane and the remains of Leiston Abbey. After crossing Abbey Road the route enters the proposed construction area to the north of Lovers Lane and in the vicinity of the Fiscal Policy woodland.

8.4.4 For both the blue and green route, there would be around five freight trains per day delivering materials during the peak phase of the construction phase of the Main Development Site, which is equivalent to ten train movements per day.

ii. New freight terminal and freight laydown area option

8.4.5 A new rail terminal north of King George's Avenue (see **Figure 8.4.1**) is being considered. This would be located on land to the north east of Leiston industrial estate, which is included within the Main Development Site construction area. It would be used for unloading and storing rail freight for onward delivery to the Main Development Site. This location would avoid the use of the level crossing on King George's Avenue and the land may be used as a temporary area for freight storage, pre-fabrication and laydown during the construction phase, irrespective of whether it becomes the location for a new rail head.

b) Site and surrounding environmental conditions

8.4.6 The rail options pass in close proximity to Sizewell Marshes SSSI. Eight statutory designated sites are located within 5km of the proposed rail routes, these are as follows: Minsmere-Walberswick (SPA, SAC and SSSI located 1.3km north east), the Sandlings (SPA and SSSI located 2.1km to the south). Two further SSSIs are located within 5km of the, Sizewell Marshes SSSI, (415m to the east) and Leiston-Aldeburgh SSSI (2km to the south). A single NNR, Westleton Heath is located 4.9km to the north.

8.4.7 The blue and green route options lie partially within the Suffolk Coast and Heaths AONB. The blue route also extends into an area defined as the Suffolk Heritage Coast and designated as Special Landscape Area. Both routes extend across two principal landscape character types described in the Suffolk County Landscape

Character Assessment; the Ancient estate claylands and the Estate sandlands. The Ancient estate claylands is described as being characterised by arable land use, with fields interspersed with deciduous copses with a settlement pattern of occasional villages and numerous dispersed hamlets and farmsteads. The Estate sandlands is described as a gently rolling plateau of freely-draining sandy soils with arable land uses, plantation woodlands and a sparse settlement pattern. The freight terminal option is located outside the Suffolk Coast and Heaths AONB, Suffolk Heritage Coast and area designated as a SLA. It is located within the Estate sandlands.

8.4.8 Both the blue and green route options cross a number of PRoW, including the Sandlings Walk and Suffolk Coastal Path long distance paths. Permissive routes include those around Goose Hill and Kenton Hills. A limited number of areas of Open Access Land occur beyond the rail line extensions and within the study area(s), including Leiston Common to the south and Theberton Woods to the north.

8.4.9 There are no Scheduled Monuments or Listed Buildings within the rail route boundaries. The green option would pass close to a number of designated heritage assets including Leiston House, a Grade II* Listed building, Fisher's Farm House, a Grade II Listed Building, and Leiston Abbey, which is both a Scheduled Monument and a Grade I Listed Building with associated Grade II buildings. Cropmark features, of possible prehistoric date, have been identified in the fields to the north-east of Buckleswood Road and to the north of Fiscal Policy woodland. Surface scatters of Romano-British and medieval pottery and metal detector finds, including a Bronze Age sword hilt fragment and Roman coins, have been recovered from the fields along the route.

8.4.10 The blue route would pass to the north of Hill Farm, a Grade II Listed Building, which dates originally from the 16th/17th century, passing approximately 250m to the north of the curtilage of Leiston Abbey and would pass close to Abbey Cottage and Upper Abbey Farmhouse, which are both Grade II Listed, and the 18th century Grade II Listed barn. Further to the east, the blue route coincides with an earthwork mound of uncertain origin, variously recorded as a possible prehistoric barrow or a landscape feature/folly mound of late 18th or 19th century date, in the corner of woodland adjacent to Abbey Road.

8.4.11 There is currently no baseline noise data available for the rail routes. Monitoring data has previously been gathered for SO_2 within the area, including at Leiston Railhead and NO_2 data has also been collected in background locations and along key transport routes (e.g. A12).

8.4.12 The blue and green route options are mainly underlain by the Lowerstoft Diamicton (boulder clay) along their western and central sections and by the Lowestoft Sand and Gravels (Secondary Superficial Aquifer) in the east. The new rail terminal and freight laydown area is underlain by boulder clay and sand gravels. These superficial deposits overlie the Crag (Principal Aquifer). The rail line extensions and the new rail terminal area do not cross a Source Protection Zone.

8.4.13 There are no watercourses located within or adjacent to the option for a new rail terminal and freight laydown area or the green route. The blue route is located close to the Hundred River. This is a designated WFD heavily modified water body, which is currently considered to have 'poor' ecological potential.

8.4.14 **Figure 8.4.1** illustrates the key environmental constraints for the rail line extension options.

c) Planned further studies/surveys

8.4.15 EDF Energy is progressing more detailed design work on the rail route options both within and outside the construction area. This includes consideration of how any affected areas of the highway network and public footpaths will be crossed, which in turn has implications for the precise horizontal and vertical alignment adopted and the associated land take. In addition to the land take required for the rail route itself there is likely to be some requirement for storage of surplus earthworks adjacent to the routes in some locations – again the precise extent and location of these is subject to further work. EDF Energy will publish more detailed proposals in this area as part of consultation.

8.4.16 In addition to the above, **Table 8.7** summarises the other potential studies/surveys that are still required for the Rail line extension options.

Table 8.7: Rail line extension options – planned further studies/surveys

Environmental topic	Planned further studies/surveys
Terrestrial ecology and ornithology	• An extended Phase 1 habitat and protected species survey. • Surveys to determine presence or absence of great crested newts. • Survey to assess the potential for bats to roost in the woodland blocks and to forage/commute along the hedgerows present. • Surveys to determine the presence or absence of reptiles (most likely to be slow worm and common lizard). • Breeding bird surveys to assess the importance of the habitats affected for nesting and foraging bird species.
Landscape and visual	• Views and visibility: ZTV modelling for the selected rail route option development proposals. • Carry out assessment based on agreed methodology, study area and viewpoints. • Baseline landscape/ character: Review and update landscape baseline for the selected rail route option for agreed study area. • Develop design principles for the selected rail route option and develop mitigation strategy to assist in the integration of the development and reduction of adverse effects.
Amenity and recreation	• Baseline recreation and amenity research will be undertaken including field survey and desk top analysis including the identification of: o cycle routes and their use; o the extent and use of PRoW and Permissive paths; o user surveys for PRoW and recreational assets (to utilise information gathered as part of the Main Development Site); o preparation of principles for construction phase based on those developed for the rail extension options; and o preparation of initial diversion strategy related to temporary works (construction phase) masterplanning.
Terrestrial historic environment	• Following completion of the DBA, it is proposed that staged archaeological investigation will be carried out across the preferred option. This would comprise a geophysical survey followed by a programme of trial trenching

Environmental topic	Planned further studies/surveys
	to confirm the presence/absence of archaeological remains, establish the nature, date and extent of any archaeological remains within the site boundary and inform proposals for mitigation to be agreed with SCCAS and English Heritage for inclusion in the ES.
Noise and vibration	• A baseline survey is planned for this site to be carried out in Q2 2014. Monitoring sites are as identified by **Figure 7.7.4** (as part of the Main Development Site noise survey plan)
Air quality	• No further surveys (as part of either the construction or operation phase assessment) are planned for the rail line extension options, due to the availability of existing data.
Soils and agriculture	• Soil survey to be undertaken in accordance with standard ALC methodology.
Geology and land quality	• Phase 1 ground contamination desk study and potential intrusive investigation subject to the findings of the desk study.
Groundwater	• No further specific groundwater work is planned, however the geological and groundwater understanding will be updated based on any geotechnical investigations.
Surface water	• No further survey is proposed for the green route and rail terminal options. • The requirement for further studies for the blue route option will be reviewed as scheme design and consultation progresses.

d) Assessment methodology

8.4.17 The approach to assessment and methodology to be undertaken in relation to the rail line extension options is the same as that for the Main Development Site (see **Section 7** for details).

e) Potential impacts and effects

8.4.18 **Table 8.8** details the potential impacts that may give rise to environmental effects. These are based on the current known baseline conditions, which are subject to further studies/surveys outlined in **Table 8.7**. Where it is considered that effects are unlikely, prior to applying mitigation, these have been identified and scoped out, where applicable.

8.4.19 An assessment of the potential impacts and effects during the post-operation phase of the rail line extension will be assessed within the ES.

Table 8.8: Rail line extension options – potential impacts and effects

Environmental topic	Potential impacts and effects
Terrestrial ecology and ornithology	**Construction of the off-site associated development** • Potential habitat loss and fragmentation for a variety of species. • Potential loss of trees suitable for roosting bats and/or nesting birds. • Possible severance of bat commuting routes (especially for barbastelle bats).

Environmental topic	Potential impacts and effects
	• Diffuse pollution from surface water runoff affecting Sizewell Marshes SSSI. **Operation of the off-site associated development** • Noise disturbance to birds and roosting bats and continued severance of bat commuting routes (especially for barbastelle bats).
Landscape and visual	**Construction of the off-site associated development** • Disturbance from construction activities and the movement of vehicles and plant. • Changes to the existing environment due to removal of vegetation and introduction of new features including soil storage areas, vegetation, infrastructure and buildings. • Visual impact arising from construction lighting at night, causing potential disturbance. **Operation of the off-site associated development** • Changes to the landscape and views due to transport infrastructure and introduction of new landscape features, structures and ancillary features. • Increase in rail traffic movement during operation. • Visual impact arising from operational lighting at night, causing potential disturbance.
Amenity and recreation	**Construction of the off-site associated development** • Disturbance and diversion of nearby PRoW resulting from construction activities including increased traffic movement, construction noise, dust and other emissions, and visual disturbance. • Disturbance to amenity and recreation assets within the study area and public open space from a range of activities, including construction noise, traffic noise, dust and other emissions, and visual disturbance. **Operation of the off-site associated development** • Diminished enjoyment of PRoW in the vicinity of the development resulting from general site activity, traffic noise, dust and other emissions and views to the development.
Terrestrial historic environment	**Construction of the off-site associated development** • The nature and extent of buried archaeological remains has not yet been determined. However, there is the potential for the permanent loss of buried archaeological remains during construction. • There is the potential for temporary impacts to the settings of designated heritage assets in the vicinity of the green and blue routes. **Operation of the off-site associated development** • There is the potential for impacts to the settings of designated heritage assets in the vicinity of the green and blue routes.
Noise and vibration	**Construction of the off-site associated development** • Occupiers of nearby dwellings and other sensitive receptors may experience noise impacts during construction. Vibration impacts may be noticeable in close proximity to the rail line during the construction phase but would be unlikely to pose a risk of damage to structures, even at the closest receptors. **Operation of the off-site associated development** • Operation of rail routes and rail heads has the potential to cause adverse impacts on sensitive receptors in close proximity, although only for a relatively short duration as the trains travel to and from site.

Environmental topic	Potential impacts and effects
	• Vibration impacts may be noticeable in close proximity to the rail line during the operation phase but would be unlikely to pose a risk of damage to structures, even at the closest receptors.
Air quality	**Construction of the off-site associated development** • Dust impacts during the construction phase will be assessed by providing a qualitative assessment of the potential sources and effects, together with a risk assessment to identify those receptors most at risk. • Additional road traffic visiting the rail head during construction has the potential to adversely affect air quality at receptors within 200m of transport routes used. **Operation of the off-site associated development** • The operation of rail traffic and stationary locomotives have the potential to affect nearby sensitive receptors (e.g. residential properties) within 30m. • Additional road traffic visiting the rail head during operation has the potential to adversely affect air quality at receptors within 200m of transport routes used.
Soils and agriculture	• Development may result in soil damage/loss of fertility.
Geology and land quality	• There are no known contamination risks, however, any other potential sources of contamination will be identified in the risk assessment.
Groundwater	• The construction of the rail lines is unlikely to impact on groundwater and, therefore, will not be considered in detail as part of the assessment. • Development of the new rail terminal and freight laydown area may result in some disturbance of soils, but as this is a greenfield site the risk of any impacts to groundwater quality are low. Construction of buildings and areas of hardstanding have the potential to reduce infiltration to groundwater, but as the area is partly underlain by boulder clay, the magnitude of any change in infiltration is likely to be low. Therefore it is proposed that no further assessment is necessary.
Surface water	For both the green route and new rail terminal options, watercourses are not located in close proximity to the proposals. It is therefore proposed that these two options are scoped out of requiring any further assessment in relation to surface water impacts. In relation to the blue route, the potential impacts and effects include: **Construction of the off-site associated development** • Given the location of blue route across the upper reaches of the Hundred River, the creation of embankments and culverting could impact on surface water runoff during construction. Additionally, runoff could increase the potential for pollution associated with soil erosion and accidental spills of hydrocarbon or construction materials or post-operation activities. **Operation of the off-site associated development** • During operation, it is proposed that a drainage system will be installed to collect surface water runoff during storm conditions which will be discharged to local watercourses. The impact of culverting sections of watercourses will also need to be considered.

f) Potential mitigation measures

8.4.20 The majority of the potential mitigation measures detailed in **Table 8.9** comprise embedded mitigation, which could be incorporated into the design of the rail extension options to reduce likely impacts and effects. These mitigation measures will be further developed and will be subject to consultation. Additional mitigation measures will also form part of the ongoing assessment and will be described within the ES.

Table 8.9: Rail line extension – potential mitigation measures

Environmental topic	Potential mitigation measures
Terrestrial ecology and ornithology	• Keeping rail routes to a minimum width to reduce habitat loss and fragmentation. • Ensuring that important bat commuting routes are maintained across the line and wider construction area. • Pollution prevention and control measures during construction.
Landscape and visual	• Plan the construction and operational phases of the selected rail route option development to optimise land use to reduce/mitigate significant adverse landscape and visual effects where reasonably practicable. • Design and treatment of infrastructure, including lighting, access and fencing, to minimise landscape and visual effects including at night. • Retain existing screening landscape features where reasonably practicable and promote appropriate new landscape design (planting and landform) to mitigate significant adverse landscape and visual effects of the proposed development. • Establish new planting and landform at the earliest reasonable opportunity.
Amenity and recreation	• Orchestration of Rights of Way closures and diversions, where practicable, and provision of a comprehensive construction phase masterplan. • Re-establishment of former PRoW and realignment of Permissive paths where practicable and establish recreation areas as part of the EDF Energy Estate Landscape Strategy. • Plan the construction and operational phases of the development to optimise land use to reduce/mitigate recreation and amenity effects where reasonably practicable.
Terrestrial historic environment	• For buried archaeological remains mitigation would usually entail preservation in-situ or, where this would not be feasible, preservation by record to mitigate any significant adverse effects from construction. • Significant adverse effects on the settings of heritage assets would usually be mitigated through sensitive design, landscape planting or screening. Where this would not be feasible, enhancements to the asset or its immediate setting may be considered to offset the overall impact. • The need for further specific assessment work on Leiston Abbey, for example, to inform any mitigation planting, will be discussed and agreed with English Heritage.
Noise and vibration	• This will depend on which option is selected. Options include various mitigation measures (dependent on circumstances) and physical screening, where necessary and feasible.
Air quality	• Construction dust would be controlled through the implementation of standard dust management techniques. • No other specific mitigation for road traffic or rail traffic is anticipated to be required.

Environmental topic	Potential mitigation measures
Soils and agriculture	• Use of appropriate soil handling procedures.
Geology and land quality	• To be considered subject to the proposed risk assessment.
Groundwater	• The assessment will consider the decrease in recharge and mitigation through the management of surface water runoff. The risk to groundwater quality from any surface water drainage will also be assessed. • Mitigation of any spills or leaks will be in accordance with the Environment Agency Pollution Prevention Guidelines.
Surface water	• Control measures will be built into the construction process which will require consideration of the drainage implications of the works during the construction of the railway line, and removal of any potential risks associated with hydrocarbon contamination from vehicles and accidental spillages. • Impacts associated with operational effects such as changes to hydrology and drainage will be considered further within the FRA which will inform any further mitigation measures required.

g) Approach to inter-relationships and cumulative assessment

8.4.21 Each environmental topic has outlined the approach to inter-relationships and cumulative assessment within the Main Development Site in respect of the relevant topic (see **Section 7**). This same process will apply to the rail extension options.

8.5 A12 improvement – Farnham Bend

a) Description of the off-site associated development site

8.5.1 Preliminary findings set out in Stage 1 consultation identified the likely requirement for options to mitigate the impact of the Main Development Site traffic on the narrow bend at Farnham. Three possible permanent solutions (see **Figure 8.5.1**) were identified including:

- a Farnham bypass;
- road widening at Farnham Bend; and
- HGV traffic controls at Farnham Bend.

i. Farnham bypass

8.5.2 The Farnham bypass would be located north of Farnham village. It would be approximately 1km in length and comprise a single-lane carriageway in each direction. At the southern end of the route it would adjoin the existing A12 close to Stratford St Andrew and at the northern end it would adjoin the existing A12 north of Farnham.

ii. Road widening at Farnham Bend

8.5.3 The road widening at Farnham Bend would require the demolition of a single Grade II Listed property at the Farnham Bend to allow for carriageway widening and an amended junction with the A12.

iii. HGV traffic controls at Farnham Bend

8.5.4 The HGV traffic controls would involve the use of an automated traffic control monitoring system to detect oncoming HGVs and prevent two passing through Farnham Bend at the same time.

b) Site and surrounding environmental conditions

8.5.5 The surrounding landscape supports 15 - 20 ponds within 500m. Nine statutory designated sites are located within 5km of the proposed location of the Farnham bypass, these are as follows: Alde-Ore Estuary (SPA, SAC, SSSI and Ramsar located 4.3km south-east), the Sandlings (SPA and SSSI, located 3.3km to the south). An additional four SSSI site are within 5km; Gromford Meadow (2.7km to the south-east); Snape Warren (4.6km to the south-east); Iken Wood (4.8km to the south-east) and Blaxhall Heath (3.3km to the south). Seven non-statutory designated CWS are located within 2km of the proposed location of the Farnham bypass, these are; Benhall Churchyard (1.5km northeast); Great Wood (2km west); Manor Farm Meadows (1.6km east); Denney's Grove (2km north-west); Farnham Churchyard (350m south); Foxburrow Wood (875m south) and Great Glemham Wood (2km north-west).

8.5.6 Farnham is not located within the Suffolk Coast and Heaths AONB, which lies approximately 3km to the south-east at its nearest point. It does, however, lie within an area designated as an SLA. Farnham village is located at the junction of two landscape character types mapped and described in the Suffolk County Landscape Character Assessment; the Rolling estate sandlands and Valley meadowlands. The

Rolling estate sandlands are described as a landscape of rolling river terraces with tree belts and plantations throughout. The adjacent lower lying Valley meadowlands landscape occupies the valley of the River Alde and is characterised by cattle grazed pastures and occasional fields converted to arable production.

8.5.7 An initial desk-based study has identified there are a number of PRoW, the largest concentration being to the south of the A12 and east of Farnham. The majority of the Rights of Way are pedestrian links. There are no areas of Open Access Land.

8.5.8 There are a number of Grade II Listed Buildings, including the Old Post Office, within Farnham, as well as the Grade II* Listed Church of St Mary. Farnham is not a designated conservation area.

8.5.9 There is currently no baseline noise data available for this site. However, it is known that noise levels at dwellings facing directly onto the A12 are high due to road traffic. Monitoring data for NO_2 has been collected in background locations and along key nearby transport routes (e.g. A12) and data has also been collected by SCDC.

8.5.10 The route of the A12 improvement is underlain by river alluvium and by the Crag (Principal Aquifer). The route does not cross a Source Protection Zone and there are no licensed abstractions within 200m of the road.

8.5.11 Farnham bypass would run through agricultural land to the north-west of the Street Farm, parts of which are in the flood plain. The route would also cross the River Alde and various drainage ditches. The other options do no cross any watercourses.

8.5.12 **Figure 8.5.1** illustrates the key environmental constraints for the A12 improvement options.

c) Planned further studies/surveys

8.5.13 Of the Farnham bend options presented, it is considered that the bypass could represent the most substantial in terms of new development and thus also in terms of potential environmental impacts/effects and requirements for mitigation. Therefore, much of the comment in this section focuses on the bypass option although all options have been considered.

8.5.14 It should be noted that the alignment shown for the bypass is indicative and further work would be required to establish the alignment of the bypass in more detail along with any associated junction arrangements for connecting the bypass to the A12. This work would need to take account of and mitigate for any significant adverse effects and environmental issues arising from the design, as well as establishing more precisely the permanent land take and the land required during construction.

8.5.15 In addition to the above, **Table 8.10** summarises the other potential studies/surveys that are still required for the A12 improvement options.

Table 8.10: A12 improvement options – planned further studies/surveys

Environmental topic	Planned further studies/surveys
Terrestrial ecology and	• An extended Phase 1 habitat and protected species survey. • Surveys to determine presence or absence of great crested newts.

Environmental topic	Planned further studies/surveys
ornithology	• Surveys to determine presence or absence of water voles on the River Alde and the network of ditches. • Surveys to determine the presence or absence of holts or lying-up sites used by otters on the River Alde and the network of ditches. • Surveys to establish if riparian trees support roosting bat species and how important the proposed route corridor is for foraging and commuting bat species. • Breeding bird surveys to assess the importance of the habitats affected for nesting bird species.
Landscape and visual	• Views and visibility: ZTV modelling for the selected A12 improvement options. • Carry out assessment based on agreed methodology, study area and viewpoints. • Baseline landscape/character: Review and update landscape baseline for the selected A12 improvement option for agreed study area. • Develop design principles for the selected A12 improvement option and develop masterplan and mitigation strategy to assist in the integration of the development and reduction of significant adverse effects.
Amenity and recreation	• Baseline recreation and amenity research will be undertaken including field survey and desk top analysis including the identification of: o cycle routes and their use; o the extent and use of PRoW and Permissive paths; o preparation of Principles for construction phase based on those developed for the A12 improvement options; and o preparation of initial diversion strategy related to temporary works (construction phase) masterplanning.
Terrestrial historic environment	• Following completion of the desk study and depending on the option chosen, it is anticipated that staged archaeological investigation will be carried out across the proposed bypass route. This would comprise geophysical survey followed by a programme of trial trenching to confirm the presence/absence of archaeological remains, establish the nature, date and extent of any archaeological remains within the site boundary and inform proposals for mitigation to be agreed with SCCAS and English Heritage and included in the ES. • Should the road widening option be chosen, the need for and scope of any additional assessment and recording of the Grade II Listed Old Post Office building will be discussed with the relevant Conservation Officer and English Heritage.
Noise and vibration	• A baseline survey is planned to be carried out in Q2 2014. Monitoring sites are as identified by **Figure 8.5.2** and the list below shows a list of planned monitoring locations. o FB1 – Farnham west. To assess impact of noise from road traffic to the dwellings and leisure uses. o FB2 – Farnham east. To assess the impact of road traffic on the existing A12 to assist with verifying noise modelling. o FB3 – Farnham south. To assess the impact noise levels from road traffic on the A12/or any bypass to the south of Farnham.
Air quality	• No further surveys (as part of either the construction or operation phase assessment) are planned for the Farnham area, due to the availability of existing data.

Environmental topic	Planned further studies/surveys
Soils and agriculture	• Soil survey in accordance with standard ALC methodology.
Geology and land quality	• Phase 1 ground contamination desk study and potential intrusive investigation subject to the findings of the desk study.
Groundwater	• No further specific groundwater work is planned, however the geological and hydrogeological understanding will be updated based on any geotechnical investigations for the A12 improvement.
Surface water	• There is an Environmental Agency flow gauge located close to the proposed bypass site that will be used to inform the impact assessment. • Detailed flood modelling and analysis would be required to help inform the alignment and design of any bypass of Farnham.

d) Assessment methodology

8.5.16 The approach to assessment and methodology to be undertaken in relation to the A12 improvement options is the same as that for the Main Development Site (see **Section 7** for details).

e) Potential impacts and effects

8.5.17 **Table 8.11** details the potential impacts that may give rise to environmental effects. These are based on the current known baseline conditions, which are subject to further studies/surveys outlined in **Table 8.10**. Where it is considered that effects are unlikely, prior to applying mitigation, these have been identified and scoped out, where applicable.

Table 8.11: A12 improvement options – potential impacts and effects

Environmental topic	Potential impacts and effects
Terrestrial ecology and ornithology	**Construction of the off-site associated development** • Potential habitat loss and fragmentation. • Potential severance of key bat foraging and commuting routes. • Loss of trees suitable for roosting bats or disturbance from traffic noise and lighting to roosts in retained trees. • Potential disturbance to otters using holts or lying-up sites in the vicinity of the proposed route. • Potential loss of habitat suitable for use by water voles. • Diffuse pollution from surface water runoff affecting the River Alde and, potentially, the Alde – Ore Estuary SAC downstream. **Operation of the off-site associated development** • Potential road mortality for otters if they cannot pass under bridges and culverts during high river flows. • Noise and lighting disturbance to roosting and foraging bat species. • Incidental mortality to bat species forced to cross the road due to severance of commuting and foraging routes. • Increased surface water discharge to the River Alde.

Environmental topic	Potential impacts and effects
Landscape and visual	**Construction of the off-site associated development** • Disturbance from construction activities and the movement of vehicles and plant. • Changes to the existing environment due to removal of vegetation and introduction of new features including soil storage areas, vegetation, infrastructure and buildings. • Visual impact arising from construction lighting at night, causing potential disturbance. **Operation of the off-site associated development** • Changes to the landscape and views due to transport infrastructure and introduction of new landscape features, structures and ancillary features. • Increases of and changes in traffic movement along the road network during operation. • Visual impact arising from operational lighting at night, causing potential disturbance.
Amenity and recreation	**Construction of the off-site associated development** • Disturbance and potential diversion of nearby PRoW resulting from construction activities including increased traffic movement, construction noise, dust and other emissions, and visual disturbance . • Disturbance to amenity and recreation assets and public open space within the study area from a range of activities, including construction noise, traffic noise, dust and other emissions and visual disturbance. **Operation of the off-site associated development** • Diminished enjoyment of PRoW in the vicinity of the development resulting from general site activity, traffic, noise, dust and other emissions and views to the development.
Terrestrial historic environment	**Construction of the off-site associated development** • The nature and extent of buried archaeological remains across the bypass site has not yet been determined. However, there is the potential for the permanent loss of buried archaeological remains during construction. • Should the road widening option be chosen, there would be a direct impact on the Old Post Office, a Grade II Listed building. • There is also the potential for the setting of designated heritage assets in the vicinity of the site to be temporarily affected. • Installation of HGV traffic signals is not expected to cause impacts on heritage assets. **Operation of the off-site associated development** • There is the potential for the settings of designated heritage assets in the vicinity of the sites to be affected.
Noise and vibration	**Construction of the off-site associated development** • Occupiers of nearby dwellings and other sensitive receptors may experience noise impacts during construction of the bypass. • There may also be construction noise impacts associated with the option of road widening through Farnham but for a short duration. • Installation of HGV traffic signals is not expected to cause noise impacts. **Operation of the off-site associated development** • If the bypass option was progressed, noise and vibration levels for dwellings which will be bypassed by this scheme are likely to be significantly reduced and the impacts are likely to be beneficial. There will, however, be a potential increase in noise levels to some dwellings to the

Environmental topic	Potential impacts and effects
	west of the site and to the rear of some receptors to the south east of the bypass. • The road widening option would reduce the potential for traffic congestion at peak times, but would not remove traffic from the village of Farnham. Properties along the A12 in the village would therefore not benefit from reductions in traffic noise as they would with a bypass. • The HGV traffic control option would have no beneficial effect on traffic flow through the village of Farnham and could exacerbate congestion and associated noise impacts.
Air quality	**Construction of the off-site associated development** • Dust impacts during the construction phase will be assessed by providing a qualitative assessment of the potential sources and effects, together with a risk assessment to identify those receptors most at risk. • Due to the nature of any construction works at Farnham there may also be temporary adverse effects associated with changes in traffic flow. Traffic management may be required to minimise these temporary air quality effects. **Operation of the off-site associated development** • The operation of the Farnham Bend improvements has the potential to permanently improve air quality in locations which will be adjacent to reduced traffic flows, or have traffic flows relocated to locations further away. Some locations may also be subject to a permanent deterioration in air quality, for example, if traffic is moved closer to other properties.
Soils and agriculture	• Development of the bypass may result in soil damage/loss of fertility.
Geology and land quality	• There are no known contamination risks, however, any other potential sources of contamination will be identified in the risk assessment.
Groundwater	• Construction of the bypass would result in some disturbance of soils and a decrease in infiltration to groundwater along the line of the road and the need to manage surface water runoff. The assessment will consider whether the changes in infiltration to groundwater are significant and whether surface water drainage from the road could represent a risk to groundwater resources.
Surface water	**Construction of the off-site associated development** • The potential requirement to construct the bypass over the River Alde could lead to changes in hydrology and the potential for pollution associated with surface runoff from construction activities and accidental spills. The other two options, however, are unlikely to impact on surface water and therefore have been scoped out from requiring any further assessment. **Operation of the off-site associated development** • There could be permanent changes to the hydrology of the River Alde and vehicle use of the road could lead to run-off containing pollutants.

f) Potential mitigation measures

8.5.18 The majority of the potential mitigation measures detailed in **Table 8.12** comprise embedded mitigation, which could be incorporated into the design of the A12 improvement options to reduce likely impacts and effects. These mitigation measures will be further developed and will be subject to consultation. Additional mitigation measures will also form part of the ongoing assessment and will be described within the ES.

Table 8.12: A12 improvement options – potential mitigation measures

Environmental topic	Potential mitigation measures
Terrestrial ecology and ornithology	• Keeping land take to a minimum to reduce habitat loss and fragmentation. • Design of lighting, bridges and culverts to enable bats, birds, otters and water voles to continue to use the River Alde corridor for commuting and foraging. • Pollution prevention and control measures during construction, and treatment and attenuation of surface water during operation.
Landscape and visual	• Plan the construction and operational phases of the selected A12 improvement option development to optimise land use to reduce/mitigate significant adverse landscape and visual effects where reasonably practicable. • Design and treatment of infrastructure, including lighting and fencing, to minimise landscape and visual effects including at night. • Retain existing screening landscape features where reasonably practicable and promote appropriate new landscape design (planting and landform) to mitigate significant adverse landscape and visual effects of the proposed development. • Establish new planting and landform at the earliest reasonable opportunity.
Amenity and recreation	• Orchestration of Rights of Way closures and diversions, where practicable, and provision of a comprehensive construction phase masterplan. • Re-establishment of former PRoW and realignment of Permissive paths where practicable and establish recreation areas as part of the EDF Energy Estate Landscape Strategy. • Plan the construction and operational phases of the development to optimise land use to reduce/mitigate recreation and amenity effects where reasonably practicable.
Terrestrial historic environment	• For buried archaeological (bypass option) remains mitigation would usually entail preservation in-situ or, where this would not be feasible, preservation by record to mitigate any significant adverse effects from construction. • Permanent significant effects on the Grade II Listed Old Post Office could be mitigated through a programme of detailed building recording to be agreed with the relevant Conservation Officer and English Heritage. • Potential significant effects on the settings of heritage assets would usually be mitigated through sensitive design, landscape planting or screening. Where this would not be feasible, enhancements to the asset or its immediate setting may be considered to offset the overall impact.
Noise and vibration	• If the bypass option is progressed, additional mitigation options would include sound absorbent road surface, speed limiting and screening where necessary and technically feasible.
Air quality	• Construction dust would be controlled through the implementation of standard dust management techniques. • Disruption due to traffic during construction would be mitigated by a traffic management plan. • Precise mitigation measures, if required, would depend on the findings of the air quality assessment.
Soils and agriculture	• Use of appropriate soil handling procedures would be applied.
Geology and land quality	• To be considered subject to the proposed risk assessment.
Groundwater	• The assessment will consider the decrease in recharge and mitigation

Environmental topic	Potential mitigation measures
	through the management of surface water runoff. The risk to groundwater quality from any surface water drainage will also be assessed. • Mitigation of any spills or leaks will be in accordance with the Environment Agency Pollution Prevention Guidelines.
Surface water	• Control measures will be built into the construction process, which will require consideration of the drainage implications of the works during both the construction and operation of the bypass, and removal of any potential risks associated with hydrocarbon contamination from vehicles and accidental spillages. • Impacts associated with operational effects such as changes to hydrology and drainage will be considered further within the FRA which will inform any further mitigation measures required.

g) Approach to inter-relationships and cumulative assessment

8.5.19 Each environmental topic has outlined the approach to inter-relationships and cumulative assessment within the Main Development Site in respect of the relevant topic (see **Section 7**). This same process will apply to the A12 improvement – Farnham Bend options.

8.6 Visitor Centre

a) Description of the off-site associated development site

8.6.1 The Visitor Centre would be a joint facility with Sizewell B, replacing the existing Visitor Centre associated with the existing station. The Visitor Centre would comprise predominantly exhibition space, galleries and service areas able to accommodate the expected volume of visitors, including school parties. Dedicated parking and access to the facility would also be required.

8.6.2 EDF Energy has developed its siting options for the Visitor Centre since Stage 1 and potential siting options being considered (see **Figure 8.6.1**) are:

- a site at Coronation Wood which could be used to serve both construction and operational phases of the proposed development;
- a two-phased siting approach involving the temporary use of land either east of Leiston or within Leiston town (for the construction phase only) and a site at Goose Hill (within the Main Development Site construction area) which would be constructed after completion of the power station.

8.6.3 The Visitor Centre options at Coronation Wood and Goose Hill are within the Main Development Site boundary and, therefore, have already been considered within **Sections 6 and 7.** For the purpose of this section, only the options to the east and within Leiston town have been discussed further.

b) Site and surrounding environmental conditions

8.6.4 There are up to twelve statutory designated sites in close proximity, these are: Minsmere-Walberswick (SPA, SAC, SSSI and Ramsar), Alde-Ore Estuary (SPA, SAC, SSSI and Ramsar SPA), Sandlings (SPA and SSSI). Additional SSSIs include Sizewell Marshes, Leiston-Aldeburgh and Round Hill Pit.

8.6.5 Visitor Centre options within and to the east of Leiston are outside both the Suffolk Coast and Heaths AONB and Suffolk Heritage Coast. None of the options are located within or immediately adjacent to areas designated as SLA.

8.6.6 The Visitor Centre to the east of Leiston is located within the Estate sandlands landscape character type described in the Suffolk County Landscape Character Assessment. The Estate sandlands is described as a gently rolling plateaux of freely-draining sandy soils with arable land uses, plantation woodlands and a sparse settlement pattern.

8.6.7 There are a number of PRoW which pass through the town and within the study area. A limited number of areas of Open Access Land occur beyond the Leiston Visitor Centre options, including land at Sizewell Common and much of the Walks and Aldringham Common. Sizewell Common is also registered as Common Land.

8.6.8 There are no Scheduled Monuments or Listed Buildings. There is also no baseline noise data available at any of the sites under consideration. Baseline air quality information is available for A-road (e.g. A12) and B-road (e.g. B1122) routes near to the Visitor Centre options.

8.6.9 The Visitor Centre options are located in an area underlain by Lowestoft Sand and Gravels (Secondary Superficial Aquifer) and the Lowerstoft Diamicton (Boulder Clay). These superficial deposits overlie the Crag (Principal Aquifer). East of Leiston, the site lies outside of a Source Protection Zone, but there are two licensed abstractions located at the edge of the search area.

8.6.10 **Figure 8.6.1** illustrates the key environmental constraints for all of the Visitor Centre site options. A location to the east of Leiston is represented by Visitor Centre Option 2B and the site within Leiston town is represented by Option 2C.

c) Planned further studies/surveys

8.6.11 **Table 8.13** summarises the potential studies/surveys that are still required for the Visitor Centre options.

Table 8.13: Visitor Centre options – planned further studies/surveys

Environmental topic	Planned further studies/surveys
Terrestrial ecology and ornithology	• An extended Phase 1 habitat and protected species survey. • Survey work to establish if woodland trees are suitable for roosting bat species. Activity surveys for barbastelle bats. • Great crested newt surveys of any ponds within 500m of each site. • Breeding bird surveys of any suitable vegetation.
Landscape and visual	• Views and visibility: ZTV modelling for the preferred Visitor Centre options. • Carry out assessment based on agreed methodology, study area and viewpoints. • Baseline landscape/character: Review and update landscape baseline for the preferred Visitor Centre option for agreed study area. • Develop design principles for the preferred Visitor Centre and develop masterplan and mitigation strategy to assist in the integration of the development and reduction of adverse effects.
Amenity and recreation	• Baseline recreation and amenity research will be undertaken, including field survey, during week-days and weekends, and desk top analysis including the identification of: o cycle routes and their use; o the extent and use of PRoW and Permissive paths; o user surveys for PRoW and recreational assets (to utilise information gathered as part of the Main Development Site); o preparation of principles for construction phase based on those developed for the Visitor Centre options; and o preparation of initial diversion strategy related to temporary works (construction phase) masterplanning.
Terrestrial historic environment	• Following completion of the desk study it is anticipated that staged archaeological investigation will be carried out across the site. This would comprise geophysical surveys followed by a programme of trial trenching to confirm the presence/absence of archaeological remains, establish the nature, date and extent of any archaeological remains within the site boundary and inform proposals for mitigation to be agreed with SCCAS and English Heritage for inclusion in the ES.
Noise and vibration	• A baseline survey would be carried out once a preferred site has been selected, if noise has the potential to have an impact in the vicinity of the

Environmental topic	Planned further studies/surveys
	chosen site.
Air quality	• No further studies or surveys are proposed (for either construction or operation impacts), due to the low air quality risks anticipated to be associated with the Visitor Centre.
Soils and agriculture	• A thorough review will be undertaken of published literature and web-based information to help characterise baseline conditions. In addition to the information sources already consulted, this will include agri-environment schemes and other relevant records held by Defra, for example animal burial pits, records of noxious weeds and the most recent national census of agriculture and horticulture. • Consultations will also be held with landowners and land managers in order to understand farming and land-management practices and issues material to the EIA. • Further studies/surveys will be undertaken as detailed within the Main Development Site, **Section 7.9**.
Geology and land quality	• A thorough review will be undertaken of published literature and web-based information to help characterise baseline conditions. • Further studies/surveys will be undertaken as detailed within the Main Development Site, **Section 7.10**.
Groundwater	• No further specific groundwater work is planned, however the geological and hydrogeological understanding will be updated based on any geotechnical investigations for the proposed sites.
Surface water	• The requirement for further studies will be reviewed as scheme design and consultation progresses.

d) Assessment methodology

8.6.12 The approach to assessment and methodology to be undertaken in relation to the Visitor Centre options is the same as that for the Main Development Site (see **Section 7** for details).

e) Potential impacts and effects

8.6.13 **Table 8.14** details the potential impacts that may give rise to environmental effects. These are based on the current known baseline conditions, which are subject to further studies/surveys outlined in **Table 8.13**. Where it is considered that effects are unlikely, prior to applying mitigation, these have been identified and scoped out, where applicable.

8.6.14 An assessment of the potential impacts and effects during the post-operation phase (for the temporary Visitor Centre, should it be progressed) will be assessed within the ES.

Table 8.14: Visitor Centre options - potential impacts and effects

Environmental topic	Potential impacts and effects
Terrestrial ecology and	**Construction of the off-site associated development** • Potential habitat loss.

Environmental topic	Potential impacts and effects
ornithology	• Potential loss of trees suitable for roosting bats, and/or disturbance from noise and lighting to roosts in retained trees. **Operation of the off-site associated development** • Noise and lighting disturbance to roosting and foraging bat species. • Disturbance to adjacent habitats and species by visitors.
Landscape and visual	**Construction of the off-site associated development** • Disturbance from construction activities and the movement of vehicles and plant. • Changes to the existing environment due to removal of vegetation and introduction of new features including soil storage areas, vegetation, infrastructure and buildings. • Lighting from construction activities at night causing potential disturbance. **Operation of the off-site associated development** • Permanent changes to the landscape and views through the introduction of new structures/landscape features and ancillary features. • Potential disturbance from lighting of structures at night.
Amenity and recreation	**Construction of the off-site associated development** • Disturbance of nearby PRoW resulting from construction activities, including increased traffic movement, construction noise, dust and other emissions and visual disturbance. • Disturbance to amenity and recreation assets and public open space within the study area from a range of activities, including construction noise, traffic noise, dust and other emissions and visual disturbance. **Operation of the off-site associated development** • Diminished enjoyment of PRoW in the vicinity of the development resulting from general site activity, traffic, noise, dust and other emissions and views to the development.
Terrestrial historic environment	**Construction of the off-site associated development** • The nature and extent of buried archaeological remains across the construction site has not yet been determined, although there is the potential for the permanent loss of buried archaeological remains during construction. • There is the potential for temporary impacts to the settings of designated heritage assets in the vicinity of the construction site. **Operation of the off-site associated development** • There is the potential for impacts to the settings of designated heritage assets in the vicinity of the site during operation.
Noise and vibration	• It is not expected that there would be significant impacts from any of the proposed sites in the context of the wider Sizewell C build.
Air quality	**Construction of the off-site associated development** • Dust impacts during the construction phase will be assessed by providing a qualitative assessment of the potential sources and effects, together with a risk assessment to identify those receptors most at risk. **Operation of the off-site associated development** • Small anticipated changes in traffic and combustion point sources are expected with the Visitor Centre.
Soils and agriculture	• The options to the east of Leiston and within Leiston town include both agricultural and brownfield sites.
Geology and	• The options to the east of Leiston and within Leiston town include both

Environmental topic	Potential impacts and effects
land quality	agricultural and brownfield sites.
Groundwater	• Construction will result in some disturbance of soils and the facilities and associated car parking will result in a decrease in infiltration to groundwater and the need to manage surface water runoff. The assessment will consider whether any changes in infiltration are significant and whether surface water drainage from hardstanding areas could represent a risk to groundwater resources. Part of the sites to the east of, and within, Leiston lie within an urban area and therefore the assessment will address the risk to groundwater quality from the disturbance of soils.
Surface water	• The potential requirement to create a non-permeable surface could impact on surface water runoff to the adjacent designated sites both during construction and operation. Additionally, runoff during construction and the post-operation phase could increase the potential for pollution associated with soil erosion and accidental spills of hydrocarbon or construction materials.

f) Potential mitigation measures

8.6.15 The majority of the potential mitigation measures detailed in **Table 8.15** comprise embedded mitigation, which could be incorporated into the design of the Visitor Centre sites to reduce likely impacts and effects. These mitigation measures will be further developed and will be subject to consultation. Additional mitigation measures will also form part of the ongoing assessment and will be described within the ES.

Table 8.15: Visitor Centre options – potential mitigation measures

Environmental topic	Potential mitigation measures
Terrestrial ecology and ornithology	• At this stage, it is not possible to be precise about what mitigation measures will be required. However, on the basis of the information currently known about the site, mitigation measures are likely to include: o design of lighting to enable bats to continue to use the local environs for commuting and foraging; o pollution prevention and control measures during construction; and o management of visitors to avoid trampling of adjacent habitats.
Landscape and visual	• Plan the construction and operational phases of the selected Visitor Centre option development to optimise land use to reduce/mitigate significant adverse landscape and visual effects where reasonably practicable. • Design and treatment of facilities and infrastructure, including lighting, access and fencing, to minimise landscape and visual effects including at night. • Retain existing screening landscape features where reasonably practicable and promote appropriate new landscape design (planting and landform) to mitigate significant adverse landscape and visual effects of the proposed development. • Establish new planting and landform at the earliest reasonable opportunity if appropriate.
Amenity and recreation	• Plan the construction and operational phases of the development to optimise land use to reduce/mitigate recreation and amenity effects where reasonably practicable.

Environmental topic	Potential mitigation measures
Terrestrial historic environment	• For buried archaeological remains and palaeoenvironmental deposits mitigation would usually entail preservation in-situ or, where this would not be feasible, preservation by record to mitigate any significant adverse effects from construction. • Any significant effects on the settings of heritage assets would usually be mitigated through sensitive design, landscape planting or screening. Where this would not be feasible, enhancements to the asset or its immediate setting may be considered.
Noise and vibration	• Standard mitigation techniques, such as selection of quiet plant and screening to car park areas, could be used if found to be necessary.
Air quality	• Construction dust would be controlled through the implementation of standard dust management techniques. • No other specific operational mitigation for road traffic or heating plant is anticipated to be required.
Soils and agriculture	• For areas of land that will be restored to agricultural use, appropriate measures will be taken to reduce impacts on soil quality. This will be enabled through appropriate soil handling (for example in relation to soil stripping, stockpiling and tracking by vehicles). Detailed arrangements will be developed in consultation with relevant stakeholders and in line with established soil management principles such as the Defra code of practice "Protecting Our Water, Soil and Air (Defra, 2013) and set out in a Soil Management Plan. • The Soil Management Plan will also address soils to be used for non-agricultural purposes for example habitat creation.
Geology and land quality	• At this stage, no mitigation features are proposed beyond those embedded in the design of the proposed development. For example, the re-use of construction materials where they are suitable for use without pre-treatment and where they wouldn't cause harm to the environment.
Groundwater	• The assessment will consider the decrease in recharge and mitigation through the management of surface water runoff including the use of sustainable drainage systems. The risk to groundwater quality from any surface water drainage to ground will also be assessed. • Mitigation of any spills or leaks will be in accordance with the Environment Agency Pollution Prevention Guidelines.
Surface water	• Control measures will be built into the construction methodology in order to reduce any increase in surface water runoff, risk of pollution and accidental spills. In addition, Incident Control Plans will be in place.

g) Approach to inter-relationships and cumulative assessment

8.6.16 Each environmental topic has outlined the approach to inter-relationships and cumulative assessment within the Main Development Site in respect of the relevant topic (see **Section 7**). This same process will apply to the Visitor Centre options.

9. SUMMARY

9.1 EIA Scoping Report Summary

9.1.1 This EIA Scoping Report accompanies a written request to the Planning Inspectorate for a Scoping Opinion, in accordance with the EIA Regulations. The report sets out the proposed scope, approach and methodologies to be adopted and key matters to be considered in the EIA.

9.1.2 The Scoping Opinion will set out what information the Planning Inspectorate considers should be included in the ES for Sizewell C. EDF Energy will consider the Scoping Opinion in its preparation of the ES to be submitted to support the application for development consent. The ES will include all required information as defined by Schedule 4 of the EIA Regulations.

9.1.3 EDF Energy is continuing to consult on its emerging proposals for Sizewell C. A second stage of consultation is proposed in 2014. Feedback received will help inform further consultation on EDF Energy's preferred proposals. This will provide more detailed information in relation to the technical and environmental considerations of the proposed development.

9.2 Indicative Proposed ES Structure

9.2.1 At this stage, an indicative outline structure for the proposed ES is set out below:

- Volume 1: Introduction
- Volume 2: Project-wide Considerations (socio-economics and transport)
- Volume 3: Sizewell C Main Development Site – to include all relevant topics (as outlined in this report)
- Volumes 4 – 8: Off-site associated development (to include all relevant topics):
  - Volume 4: Northern park and ride
  - Volume 5: Southern park and ride
  - Volume 6: Rail line extension
  - Volume 7: A12 Improvement – Farnham Bend
  - Volume 8: Visitor Centre (if temporary options are taken forward)
- Volume 9: Cumulative assessment

9.2.2 In addition, a non-technical summary of the ES will be provided in support of the application.

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GLOSSARY

Term	Definition
Agricultural Land Classification (ALC)	A classification of agricultural land in England and Wales according to its quality and agricultural versatility. The classifications range from Grade 1 (the best and most versatile), through Grades 2, 3a, 3b, 3c and 4, down to Grade 5 (the least versatile).
Alongshore Transport	Movement parallel to the coastline.
Anchorage	An area off the coast that is suitable for a vessel to anchor.
Annex I Habitats	Habitats listed in Annex I of the Conservation of Habitats and Species Regulations 2010 (SI 2010/490) (as amended).
Anthropogenic	Man-made.
Appropriate Assessment (AA)	A process required by the Habitats Directive 92/43/EEC to avoid adverse effects of plans, programmes and projects on Natura 2000 sites and thereby maintain the integrity of the Natura 2000 network and its features.
Area of Outstanding Natural Beauty (AONB)	AONBs were formally designated under the National Parks and Access to the Countryside Act 1949 to protect areas of the countryside of high scenic quality that cannot be selected for National Park status due to their lack of opportunities for outdoor recreation (an essential objective of National Parks). Further information on AONBs can be found at www.aonb.org.uk
Bathing Water Directive Quality Standards	The microbial standards for water quality at popular beaches and inland bathing sites.
Bathymetric	Related to topography of the seabed.
Bathymetry	The 'topography' of the seabed.
Berth	A designated location where a vessel may be moored.
Biodiversity Action Plan (BAP)	An agreed plan for a habitat or species, which forms part of the UK's commitment to biodiversity. For further information consult the BAP website: www.ukbap.org.uk
Birds Directive	European Community Directive 2009/147/EC (which codified Directive 79/409/EEC) on the conservation of wild birds. In the UK the Directive is implemented via the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Habitats and Species Regulations 2010 (SI 2010/490) (as amended).
Bivalve	Marine or freshwater mollusc whose body is enclosed between two shells hinged together by a ligament on the dorsal side of the body.
British Energy (BE)	British Energy delisted from the London Stock Exchange on 3 February 2009 and is now part of EDF Energy.
Cetaceans	Marine mammals, such as dolphins and porpoises.
Conservation Areas	Designated areas of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance.
Contaminated Land	Land where there may be a presence on site of a noxious substance, which may give rise to a hazard.
Conventional Island	Turbine halls and electrical buildings forming part of the UK EPR.
County Wildlife Site (CWS)	Areas identified and selected for their local nature conservation value.

Term	Definition
Cross-shore	On or across the shore.
Cumulative effects	Incremental effects that result from the accumulation of a number of individual effects, either caused by the development (intra-project effects) or by other reasonably foreseeable developments which would be under construction at the same time as Sizewell C or built later (inter-project effects).
Decibel (dB)	A unit specifying the logarithm of the ratio between the value of a quantity and a reference value (usually used in the measurement of power and intensity). For sound pressure level the reference quantity is 20μPa, which is the threshold of normal hearing (0 dB). 140 dB is the threshold of pain.
Diamicton	Glacial till.
Disturbance	A perturbation in the system (either biological, e.g. predation or physical, e.g. storms) which alters the nature of the biological community.
Drift nets	Drift netting is a fishing technique where nets, called drift nets, are allowed to float freely at the surface.
EDF Energy Estate	Land owned by EDF Energy in the Sizewell area.
Effect	The consequence of an impact. For example, a change in the perception of a local landscape character.
Embedded mitigation	Mitigation which is incorporated into the design of the proposed development to reduce likely impacts and effects. These mitigation measures will be further developed and will be subject to consultation and agreement.
English Heritage	A Government Agency which promotes conservation and understanding of the historic environment, advises Government on the selection of listed buildings and scheduled monuments for protection and provides grant aid for the maintenance of historic buildings and monuments
Entrainment	Term used to describe the passage of marine organisms small enough to go through the cooling water screens through the power station cooling water circuit and then discharged to sea.
Environment Agency	A Government Agency responsible for matters relating to contaminated land, waste management, surface water drainage and discharges, flood risk management and water quality and has responsibility for ensuring that new nuclear power station designs meet high environmental standards and use the Best Available Techniques (BAT) to achieve this.
Environmental Impact Assessment	Generically, a process for predicting the effects of a proposed development on the environment that informs decision-makers in relation to planning permissions, consents, licences and other statutory approvals, as required by European Union Directive 2011/92/EU (which codified Directive 85/337/EEC) (the EIA Directive).
EIA Scoping Report	A scoping report is usually produced at an early stage in the EIA process and should contain sufficient information to support a developer's request to a regulator for a scoping opinion.
Environmental Statement	The document reporting the process and outcomes of the EIA.
Fauna	Animals.
Future baseline	The situation that would occur in the absence of the proposed development. Predicted impacts are compared against this theoretical scenario. It is typically based upon extrapolating the current baseline forward using technical knowledge of changes which may occur.
Geological Disposal Facility	Disposal underground at a depth of more than about 200 metres (also called "deep geological disposal"). The depth is chosen so as to provide a barrier against the escape of radioactivity and protect the waste from disturbance. This disposal method is appropriate for

Term	Definition
	high level and intermediate level wastes.
Geomorphology	The scientific study of landforms and the processes that shape them through an understanding of landform history and dynamics (in particular their nature, origin, processes of development and material composition).
Gravity Model	Developed to estimate where non-home-based workers would choose to live and where home-based workers would travel from.
Gross Value Added (GVA)	Gross Value Added measures the value of goods and services produced in a geographical area, industry or economic sector. It is a measure of economic productivity, calculated by valuing the amount of goods and services that have been produced, less the cost of all inputs and raw materials that are directly attributable to that production.
Groundwater	Water occurring below ground in natural formations (typically rocks, gravels and sands).
Habitats Directive	The Habitats Directive (more formally known as Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora) is a European Union Directive adopted in 1992 as a response to the Berne Convention. It is one of the EU's two directives in relation to wildlife and nature conservation (the other being the Birds Directive). It aims to protect over 200 habitats and approximately 1,000 animal and plant species listed in the Directive's Annexes. Annex I covers habitats, Annex II covers species requiring designation of special areas of conservation, Annex III covers the criteria for selecting sites eligible for identification as sites of community importance and designation as special areas of conservation, Annex IV covers species in need of strict protection and Annex V covers species whose taking from the wild can be restricted by European law. These are species and habitats which are considered to be of European interest, following criteria given in the Directive. The Directive led to the setting up of a network of Special Areas of Conservation which, together with the existing Special Protection Areas, form a network of protected sites across the European Union called Natura 2000.
Habitat Regulations Assessment	An assessment to determine compliance of a plan or project with the Habitats Directive (94/43/EEC) and Conservation of Habitats and Species Regulations 2010 (as amended).
Health and Safety Executive (HSE)	A non-departmental public body, which is responsible for the encouragement, regulation and enforcement of workplace health, safety and welfare, and for research into occupational risks in England and Wales and Scotland.
Impact	The change resulting from an action. For example, a new bypass development and the local landscape as the sensitive environmental resource. Here an impact (the change arising from the development's progression) could be the permanent loss of mature trees and hedgerows.
Impingement	Term used to refer to the fish and other marine species becoming trapped on cooling water intake screens.
Informal recreation	Leisure activities which are not undertaken on a formal, organised basis and are generally carried out by individuals or small groups on an intermittent basis with a minimal requirement for supporting facilities.
Inter-relationship	Occurs between individual environmental effects of the proposed development and has the potential to combine together with one another at receptors and lead to significant effects. For example, the combined effect of noise, vibration and dust on a single receptor.
Intertidal	The area of shore between the highest and lowest tides.
Ionising radiation	Radiation, such as alpha, beta, gamma and x-rays, capable of inducing certain changes and effects in materials of living tissues.
Landscaping	A general term used for the means by which, where appropriate, development is made to fit visually into its surroundings by control of siting and layout and use of trees, shrubs or grass (soft landscaping) and/or fences, walls or paving (hard landscaping).
LiDAR	Light Detection and Ranging – a device used to measure distance to, or other properties of, a target.

Term	Definition
Listed Buildings	Buildings and structures which have been identified by the Secretary of State for Culture, Media and Sport as being of special architectural or historic interest and whose protection and maintenance are the subject of special legislation. Their curtilage and setting is also protected. Listed Building consent is required before any works can be carried out on a listed building.
Longlines	Longline fishing is a commercial fishing technique that uses a long line with baited hooks attached at intervals by means of branch lines.
Main Development Site	The site of the proposed nuclear power station development (the Main Development Site) and construction areas. The permanent features within the Sizewell C development will include: two UK EPRs comprising reactor buildings and associated buildings; turbine halls and electrical buildings; cooling water pumphouses and associated buildings; an Operational Service Centre; fuel and waste storage facilities; external plant including storage tanks; internal roads; ancillary, office and storage facilities; drainage and sewerage infrastructure and a National Grid 400kV Substation and one additional National Grid pylon and removal of an existing pylon. In addition to the permanent development, the following would be sited away from the main station platform: cooling water infrastructure; an access road to join the B1122 and related junction improvements; a bridge connecting the power station to the new access road to the north, car parking, ancillary buildings and helipad; flood defence and coastal protection measures; a beach landing facility to receive deliveries of abnormal indivisible loads by sea, a Simulator Building/Training Centre, options for a Visitor Centre and landscaping.
Marine environment	Anything below the mean high water mark.
Mitigation	Measures recommended through the EIA process and applied through the regulatory approvals process to avoid, reduce or, where appropriate, to offset significant adverse effects on the environment
Morphology	Shape or form.
Natural England	A Government Agency that promotes the conservation of England's wildlife and natural features and is responsible for designating National Nature Reserves, identifying Sites of Special Scientific Interest and for advising a wide range of bodies and individuals including the Government on matters affecting nature conservation.
National Nature Reserve (NNR)	National Nature Reserves are defined under the National Parks and Access to the Countryside Act 1949 and the Wildlife and Countryside Act 1981 (as amended) as land primarily for nature conservation, Such a purpose covers the study, research and preservation of flora, fauna and sites with special geological or physiographical features. The NNRs were established to protect the most important areas of wildlife habitat and geological formations in Britain and as places for scientific research. All NNRs are nationally important and are best examples of a particular habitat/ecosystem.
National Grid	National Grid runs and operates the high voltage electric power transmission network in Great Britain, connecting power stations and major sub-stations and ensuring that electricity generated anywhere in Great Britain can be used to satisfy demand elsewhere.
Nearshore	Located close to the shore.
Nuclear Island	Reactor buildings and associated buildings forming part of the UK EPR.
Off-site associated development	Temporary development which is associated with a Nationally Significant Infrastructure Project (NSIP), as defined by the Planning Act 2008 (as amended). For the Sizewell C Project, this will include: two park and ride sites (north lead site: Darsham, south lead site: Wickham Market); an accommodation campus (lead site: development site campus); rail extension for freight and/or a new rail terminal and freight laydown area north of King George's Avenue, Leiston; improvements to the A12 at Farnham Bend (options include: a Farnham Bypass, road widening at Farnham Bend or HGV traffic controls at Farnham Bend) and a Visitor Centre (temporary options on land east of Leiston or in Leiston town for use

Term	Definition
	during construction. The Visitor Centre options at Coronation Wood (for use during both the construction and operational phases) and Goose Hill (operational phase only) are within the Main Development Site boundary).
On-site associated development	On-site associated development comprises temporary development within the Sizewell C Main Development Site, which includes the following: construction working areas: laydown areas, workshops, storage and offices; temporary structures, including concrete batching plant; management of spoil/stockpile arrangements, including potential sourcing on-site of construction fill materials; temporary bridge between the power station and adjacent construction areas; a temporary jetty for the transport of bulk construction materials, equipment and AILs by sea; options for a temporary rail extension options into the construction site; works areas on the foreshore for the installation of flood defence and coastal protection measures; construction roads, fencing, lighting and security features; site access arrangements and coach, lorry and car parking; and a development site accommodation campus.
Ordnance Datum (Newlyn) (OD)	The UK reference point for height.
Passive gear	An umbrella term for all fishing methods with static fishing gear in the water, such as lobster pots.
Piling	The installation of bored and driven piles and the effecting of ground treatments by vibratory dynamic and other methods of ground stabilisation.
Plankton	Organisms suspended in the water column and incapable of moving against water currents.
Potable water	Drinking water.
Pressurised Water Reactor (PWR)	A type of nuclear power reactor.
Principal Aquifer	Layers of rock or deposits with high permeability that provide a high level of groundwater storage.
Public access	Permitted use of land by members of the public. Access can be allowed by a variety of means including: public rights of way (e.g. footpath, bridleway, byway); Acts of Parliament; the granting of conditional access by landowners (e.g. National Trust); custom or tradition.
Public Rights of Way (PRoW)	These are designated 'highways' under the Countryside and Rights of Way (CRoW) Act 2000, which the public can use at anytime.
Radionuclide	Any man-made or natural element which emits radiation in the form of alpha or beta particles, or as gamma rays.
Ramsar Site	The Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat (1971) imposes a requirement on the UK Government to promote the wise use of wetlands and to protect wetlands of international importance. This includes the designation of certain areas as Ramsar Sites, where their importance for nature conservation (especially with respect to waterfowl) and environmental sustainability meet certain criteria. Further information can be found on the RAMSAR convention on wetlands website: www.ramsar.org
Receptor	Used to refer to human beings that may be affected by changes arising due to the development and the socio-economic systems on which they depend. These can be reflected individually or collectively. For example resident, employees, communities.
Resources	Defined as bio-physical features or items of 'environmental capital'. For example, species and their habitats, aquifers, access routes and community facilities.
Secondary Aquifer	Layers of rock or deposits providing lower levels of groundwater storage than a Principal Aquifer.
Scheduled Monument	A feature of national, historical or archaeological importance, either above or below the ground, which is included in the schedule of monuments as identified by the Secretary of State. Not all nationally important archaeological remains are scheduled and sites of lesser

Term	Definition
	importance may still merit protection.
Shoreline Management Plan (SMP)	A non-statutory plan produced to provide sustainable coastal defence policies (to prevent erosion by the sea and flooding of low-lying coastal land) and to set objectives for the future management of the shoreline. They are prepared by the Environment Agency and maritime local authorities, acting individually or as part of coastal defence groups.
Site of Special Scientific Interest (SSSI)	An area designated as being of special interest by reason of any of its flora, fauna or geological or physiographical features. SSSIs are designated by Natural England under the Wildlife and Countryside Act 1981 (as amended) and the Countryside and Rights of Way Act 2000.
Source Protection Zones (SPZ)	Defined by the Environment Agency, these zones show the risk of contamination from any activities that might cause pollution in the area.
Spatial scope	An area over which a significant change to the environment may occur.
Special Area of Conservation (SAC)	A site designated via the European Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC)) (i.e. the Habitats Directive) to protect rare and endangered habitats and species at a European level. Together with SPAs they form a network of European sites known as Natura 2000.
Special Protection Area (SPA)	Designated under Article 4 of the European Directive on the Conservation of Wild Birds (2009/147/EC) (i.e. the Birds Directive) to protect the habitats of threatened and migratory birds.
Subtidal	Areas below water at all states of tide.
Suffolk Heritage Coast	Areas of coast that are managed to conserve their natural beauty and, where appropriate, to improve accessibility for visitors.
Surface water	Terrestrial water bodies that are found above ground level, such as lakes, rivers and ditches, and including fresh and inland brackish water.
Temporary scope	Is the timeframe over which the environmental impact assessment is undertaken.
Trammel net	A fishing net with three layers of netting that is used to entangle fish or crustaceans.
UK EPR	The third generation Pressurised Water Reactor design. It has been designed and developed mainly in France and Germany. In Europe this reactor design was called the European Pressurised Reactor and the international name of this reactor is Evolutionary Power Reactor, but is now referred to as EPR.
Water Framework Directive (WFD)	European Community Directive (2000/60/EC) on integrated river basin management. The WFD sets out environmental objectives for water status based on: ecological and chemical parameters; common monitoring and assessment strategies; arrangements for river basin administration and planning; and a programme of measures in order to meet the objectives. For further detail consult the European Commission website: http://europa.eu.int
Waterfowl	Wading birds and wildfowl.
Zone of Influence	The maximum geographical area around the Main Development Site and off-site associated development where there is a potential for impacts to occur.
Zone of Theoretical Visibility	The likely (or theoretical) extent of visibility of a development, usually shown on a map.

ABBREVIATIONS

Abbreviation	Term
AA	Appropriate Assessment
ACT	Archaeological Conservation Team
AILs	Abnormal Indivisible Loads
ALC	Agricultural Land Classification
AONB	Area of Outstanding Natural Beauty
AOD	Above Ordnance Datum
BAP	Biodiversity Action Plan
CRoW	Countryside and Rights of Way Act 2000
CWS	County Wildlife Site
dB	Decibels
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
DTI	Department of Trade and Industry
EDF	Electricité de France
ECITB	Engineering Construction Industry Training Board
EIA	Environmental Impact Assessment
EQS	Environmental Quality Standards
ES	Environmental Statement
GDA	Generic Design Assessment
GVA	Gross Value Added
Ha	Hectare
HRA	Habitats Regulations Assessment
HSE	Health and Safety Executive
ITIS	Integrated Transport Information System
km	Kilometre
km^2	Kilometres squared
LCA	Landscape Character Area
LVIA	Landscape and Visual Impact Assessment
MMO	Marine Management Organisation
mSv	Millisievert
MW	Megawatt
NCA	National Character Area
NCN	National Cycle Network
NNR	National Nature Reserve
OD	Ordnance Datum

Abbreviation	Term
PRoW	Public Rights of Way
PWR	Pressurised Water Reactor
RCN	Regional Cycle Network
RIFE	Radioactivity In Food and the Environment
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SLA	Special Landscape Area
SMP	Shoreline Management Plan
SPA	Special Protection Area
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
UK	United Kingdom
WFD	Water Framework Directive

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